Mathematics
For Rwandan Schools

Senior 1
Teacher's Guide

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Contents

1.1 Organization of the book

This teacher's guide is organised into two main sections. **Part 1** is the general introduction section detailing pedagogical issues. **Part 2** is the main topics area. It gives the details of the expected learning units as organised in the learner's book. The main elements of Part 2 are:

- **Topic area page** - detailing the various **sub-topic areas** and the units covered under the topic area.

- **Unit heading** – this is accompanied by some text in the learner's book to motivate the learners. In addition, the total number of lessons per unit is given.

- **Key Unit Competence:** This is the competence, which will be achieved once students have met all the learning objectives in the unit.

- Outline of **main sections** in the unit – is a quick summary of the subtopics covered under the unit.

- **Learning Objectives:** The content in this area is broken down into three categories of learning objectives, that is, knowledge and understanding; skills; attitudes and values.
    - *Knowledge and understanding:* As in the existing curriculum, knowledge and understanding is very important.
    - *Skills:* It is through the skills that students apply their learning and engage in higher order thinking. These skills relate to the upper levels of Bloom's taxonomy and they lead to deep rather than surface learning.
    - *Attitudes and values:* Truly engaging with the learning requires appropriate attitudes and values that relate to the unit.

- **Links to other subjects:** It is important for learners to gain an understanding of the interconnections between different subjects so that learning in each subject is reinforced across the curriculum. This platform does exactly that. It prepares the teacher to pass this information to the learners so that they are aware!

- **Assessment Criteria:** This is meant to evaluate whether learners have succeeded in achieving the Key Unit Competence(s) intended. This section will help the teacher in assessing whether the unit objectives have been met.

- **Background information:** This is the introduction part of the unit. It aims at giving insights to the teacher on the subject matter.

- **Additional information for the teacher:** This section gives more information than what the syllabus recommends for purposes of preparing the teacher to answer tough questions from learners.
- **Learning Activities:** These are given per lesson and have these sub-sections:
  - Lesson titles.
  - Specific objectives of the lesson
  - Materials and learning resources.
  - Teaching methodology.
  - Suggested teaching/learning approach.
  - Generic competencies covered.
  - Cross-cutting issues covered.
  - Special needs and multi-ability learning.
  - Formative assessment.
  - Extended exercises/activities for fastlearners and remedial (reinforcement) exercises/ activities for slow learners.
  - Answers to self-evaluation exercises.

These are repeated across all lessons until the end of the unit followed by the answers or tips on the test your competence questions at the end of every unit.

1.2 The Structure of the syllabus

Mathematics subject is taught and learned in both at O-level as a **core subject**. At every grade, the syllabus is structured in **Topic Areas**, and then further broken down into **Units**. The units have the following elements:

- Unit is aligned with the Number of Lessons.
- Each Unit has a Key Unit Competency whose achievement is pursued by all teaching and learning activities undertaken by both the teacher and the learners.
- Each Unit Key Competency is broken into three types of Learning Objectives as follows:
  - *Type I:* Learning Objectives relating to knowledge and understanding. These are associated with Lower Order Thinking Skills or **LOTS**.
  - *Type II* and *Type III:* These learning objectives relate to acquisition of skills, Attitudes and Values. They are associated with Higher Order Thinking Skills or **HOTS**. – These learning objectives are actually considered to be the ones targeted by the present reviewed syllabus.
- Each unit has a content area which indicates the scope of coverage of what a teacher should teach and learner should learn in line with stated learning objectives.
- Each Unit suggests Learning Activities that are expected to engage learners in an interactive learning process as much as possible (learner-centered and participatory approach).
- Finally, each unit is linked to other

subjects, its assessment criteria and the materials (or Resources) that are expected to be used in teaching and learning process.

In all, the syllabus of mathematics syllabus for ordinary level Senior 1 has five Topic Areas namely:

Algebra, metric measurements (money), proportional reasoning, geometry statistics and probability.

The topic areas are subdivided into 9 units namely:

1. Sets of Numbers.
2. Linear Functions, Equations And Inequalities.
3. Percentage,Discount, Profit And Loss.
4. Ratio And Proportions.
5. Points,Lines And Angles.
6. Solids.
7. Statistics.
8. Probability.

1.3 Background Information on new curriculum

The aim of a competence-based curriculum is to develop in the learners competences that will enable them interact with the environment in more practcal ways.

It is against this background that the Mathematics syllabus for O level was reviewed to ensure that it is responsive to the needs of the learner with a shift from knowledge-based learning to competence-based learning.

Competence-based learning refers to systems of instruction, assessment, grading, and academic reporting that are based on students demonstrating that they have acquired and learned the prerequisite knowledge, skills and attitudes as they progress through their education. Apart from being integrative, the newly revised syllabus guides the interaction between the teacher and the learner in the learning process. It further puts greater emphasis on skills a learner should acquire during each unit of learning. As a competency-based syllabus, it elaborates on the three aspects of **knowledge, skills** and **attitudes** in mathematics.

1.4 Rationale of Teaching and Learning Mathematics

Mathematics and Society

Mathematics plays an important role in society through abstraction and logic, counting, calculation, measurement, systematic study of shapes and motion. It is also used in natural sciences, engineering, medicine, finance, and social sciences. The applied like statistics and probability play an important role in game theory, in the national census process, in scientific research, etc. In addition, some cross-cutting issues such as financial awareness are incorporated into some of the mathematical units to improve social and economic welfare in Rwanda society.

Mathematics is key to the Rwandan education ambition of developing a knowledge-based and technology-led economy since it provide to learners all

required knowledge and skills to be used in different learning areas. Therefore, Mathematics is an important subject as it supports other subjects. This new curriculum will address gaps in the current Rwanda Education system that lacks of appropriate skills and attitudes provided by the current education system.

1.5 Types of Competences and their acquisition

Competencies are statements of the characteristics that students should demonstrate which indicate they are prepared and have the ability to perform independently in professional practice. The two types of competencies envisaged in this curriculum are **basic** and **generic** competences.

(a) Basic competences

Basic competences are addressed in the stated broad subject competences and in objectives highlighted year on year basis and in each of units of learning. They include:

Literacy

- Reading a variety of texts accurately and quickly.
- Expressing ideas, messages and events through writing legible texts in good hand-writing with correctly spelt words.
- Communicating ideas effectively through speaking using correct phonetics of words.
- Listening carefully for understanding and seeking clarification when necessary.

Numeracy

- Computing accurately using the four mathematical operations.
- Manipulating numbers, mathematical symbols, quantities, shapes, and figures to accomplish a task involving calculations, measurements, and estimations.
- Use numerical patterns and relationships to solve problems related to everyday activities like commercial context and financial management.
- Interpreting basic statistical data using tables, diagrams, charts, and graphs.

ICT and digital competences

- Locating, extracting, recording and interpreting information from various sources.
- Assessing, retrieving and exchanging information via internet or cell phones.
- Using cell phones and internet for leisure and for money transactions.
- Using computer keyboard and mouse to write and store information.
- Using information and communication technologies to enhance learning and teaching (all subjects).

Citizenship and national identity

- Relating the impact of historical events on past and present national and cultural identity.

- Understanding the historical and cultural roots of Rwandan society and how the local infrastructure functions in relation to the global environment.
- Demonstrating respect for cultural identities and expressing the role of the national language in social and cultural context.
- Advocating for the historical, cultural and geographical heritage of the nation within the global dimension.
- Showing national consciousness, a strong sense of belonging and patriotic spirit.
- Advocating for a harmonious and cohesive society and working with people from diverse cultural backgrounds.

Entrepreneurship and business development
- Applying entrepreneurial attitudes and approaches to challenges and opportunities in school and in life.
- Understanding the obligations of the different parties involved in employment.
- Planning and managing micro projects and small and medium enterprises.
- Creation of employment and keeping proper books of accounts.
- Risk-taking in business ventures and in other initiatives.
- Evaluating resources needed for a business.

Science and technology
- Apply scientific skills to solve practical problems encountered in everyday life including efficient and effective performance of a given task.
- Develop a sense of curiosity, inquisitiveness and research to explain theories, hypotheses and natural phenomena.
- Reason deductively and inductively in a logical way.
- Use experimentation to draw appropriate conclusions.

(b) Generic competences
The generic competencies are competences that must be emphasized and reflected in the learning process. They are briefly described below and teachers must ensure that learners are engaged in tasks that help them to acquire the competences.

1. **Critical thinking and problem solving skills:** The acquisition of such skills will help learners to think maginatively, innovatively and broadly and be able to evaluate and find solutions to problems encountered in their surroundings.

2. **Creativity and innovation:**
   The acquisition of such these skills will help learners to take initiatives and use imagination beyond knowledge provided in classroom to generate new ideas and construct new concepts.

3. **Research skills:** This will help learners to find answers to ques-

tions based on existing information and concepts and use it to explain phenomena from gathered information.

4. **Communication in official languages:**
Teachers, irrespective of being language teachers should e n s u r e the proper use of the language of instruction by learners (which is English at O- level). The teachers should communicate clearly and confidently and convey ideas effectively through s p o k e n and written English by applying appropriate grammar and relevant vocabulary.

5. **Cooperation, inter-personal management and life skills:**
This will help the learner to cooperate in a team in whatever task assigned and to practice positive ethical moral values and while respecting rights, feelings and views of others. Perform practical activities related to environmental conservation and protection. Advocate for personal, family and community health, hygiene and nutrition and responding creatively to a variety of challenges encountered in life.

6. **Lifelong learning:** The acquisition of such skills will help learners to update knowledge and skills with minimum external support. The learners will be able to cope with evolution of knowledge advances for personal fulfillment in areas that are relevant to their improvement and development.

Broad mathematics competences

During and at the end of learning process, the learner can:

1. Use correctly specific symbolism of the fundamental concepts in Mathematics.

2. Develop clear, logical, creative, and coherent thinking.

3. Apply acquired knowledge in Mathematics in solving problems encountered in everyday life.

4. Use the acquired concepts for easy adaptation in the study of other subjects.

5. Deduce correctly a given situation from a picture and / or a well-drawn out basic mathematical concepts and use them correctly in daily life situations.

6. Read and interpret a graph.

7. Use acquired mathematical skills to develop work spirit, team work, self-confidence and time management without supervision.

8. Use ICT tools to explore Mathematics (examples: calculators, computers, mathematical software).

Mathematics and developing competences

The national policy documents based on national aspirations identify some 'basic Competencies' alongside the 'Generic

Competencies' that will develop higher order thinking skills and help student learn subject content and promote application of acquired knowledge and skills. Through observations, constructions, hand-on, using symbols, applying, and generalizing mathematical ideas and presentation of information during the learning process, the learner will not only develop deductive and inductive skills but also acquire cooperation and communication, critical thinking and problem solving skills. This will be realized when learners make presentations leading to inferences and conclusions at the end of learning unit. This will be achieved through learner group work and cooperative learning that in turn will promote interpersonal relations and teamwork.

The acquired knowledge in learning Mathematics should develop a responsible citizen who adapts to scientific reasoning and attitudes and develops confidence in reasoning independently. The learner should show concern of individual attitudes, environmental protection and comply with the scientific method of reasoning. The scientific method should be applied with the necessary rig or, intellectual honesty to promote critical thinking while systematically pursuing the line of thought.

1.6 Cross-cutting issues to be infused during learning

These emerging issues need to be incorporated in the learning process.

Each of the cross-cutting issues has its own important programme of learning reflecting key national priorities. This learning is integrated into the syllabuses of subjects across the curriculum rather than each issue having a dedicated timetable slot of its own. Because of this integration, the learning activities in the units of subjects across the curriculum incorporate all the learning associated with the cross-cutting issues.The eight cross-cutting issues are:

g. *Peace and Values Education*

> The need for Peace and Values Education in the curriculum is obvious. Peace is clearly critical for society to flourish and for every individual to focus on personal achievement and his or her contribution to the success of the nation. Values education forms a key element of the strategy for ensuring young people recognize the importance of contributing to society, working for peace and harmony and being committed to avoiding conflict.

h. *Financial Education*

> Financial education makes a strong contribution to the wider aims of education. It makes learning relevant to real life situations. It aims at a comprehensive financial education program as a precondition for achieving financial inclusion target and improves the financial capability of Rwan-

dans. Financial education has a key role of not only improving knowledge of personal but also transforming this knowledge into action. It provides the tools for sound money management practices on earnings, spending, saving, borrowing and investing. Financial education enables people to take appropriate financial services both formal and informal that are available to them and encourages financial behaviours that enhance their overall economic well-being.

i. *Standardization Culture*

Standardisation Culture develops learners' understanding of the importance of standards as a pillar of economic development and in the practices, activities, and lifestyle of the citizens. It is intended that the adoption of standardization culture should have an impact upon health improvement, economic growth, industrialization, trade, and general welfare of the people. While education is the foundation and strength of our nation, standards are one of the key pillars of sustainable economic development.

j. *Genocide Studies*

Genocide Studies provides young people with an understanding of the circumstances leading to the genocide and the remarkable story of recovery and re-establishing national unity. Genocide Studies helps learners to comprehend the role of every individual in ensuring nothing of the sort ever happens again.

The intent of a cross-cutting curriculum around the topic of genocide is to fight against genocide, genocide denial, and genocide ideology; and to equip students with a more fundamental and comprehensive understanding of the genocide, thereby preventing further human rights violations in the future and enabling Rwanda's population of young people to more competently and thoughtfully enter the workforce. So, it needs to be emphasized.

k. *Environment and sustainability*

The growing awareness of the impact of the human race on the environment has led to recognition of the need to ensure our young people understand the importance of sustainability as they grow up and become responsible for the world around them. Hence, Environment and Sustainability is a very important cross-cutting issue. Learners need basic knowledge from the

natural sciences, social sciences, and humanities to understand and interpret principles of sustainability. They also need skills and attitudes that will enable them in their everyday life to address the environment and climate change issue and to have a sustainable livelihood.

l. *Gender education*

There is a strong moral imperative to accord every individual their basic human rights and gender inequality results in women and girls being treated less favourably than men. A strongly negative impact of unequal treatment, which affects the nation as a whole, is the fact that it results in women being held back and their talents and abilities not being fully realised. With a good understanding of the principles of Gender Equality, it is intended that future generations will ensure that the potential of the whole population is realised.

m. *Comprehensive sexuality education (HIV/AIDS, STI, Family planning, Gender equality and reproductive health)*

Comprehensive sexuality education, which is age appropriate, gender sensitive and life skills based can provide young people with the knowledge and skills to make informed decisions about their sexuality and life style. Preparing children and young people for the transition to adulthood has been one of humanity's greatest challenges with human sexuality and relationships at its core. Few young people receive adequate preparations for their sexual lives. This leaves them potentially vulnerable to coercion, abuse and exploitation. Unintended pregnancy and sexually transmitted infections (STIs) including HIV/AIDS. Many young people approach adulthood faced with conflicting and confusing messages about sexuality and gender. This is often exacerbated by embarrassment, silence, disapproval and open discussion of sexual matters by adults (parents, teachers) at very time when it is most needed.

Comprehensive sexuality education supports a rights- based approach in which values such as respect, acceptance tolerance, equality, empathy and reciprocity are inextricably linked to universally agreed human rights. A clear message concerning these dangers and how they can be avoided, from right across the curriculum, is

the best way to ensure that young people understand the risks and know how to stay healthy.

n. *Inclusive Education*

Inclusive education involves ensuring all learners are engaged in education and that they are welcomed by other students so that everyone can achieve their potential. Inclusive practice embraces every individual regardless of gender or ability including those with learning difficulties and disabilities. The almost focus of inclusive curriculum is on ensuring participation in education of learners with different learning styles and other difficulties. To be successful, it entails a range of issues including teacher's positive attitudes, adapting the learning resources, differentiation of teaching and learning methods and working together. Overall, the benefits of an inclusive curriculum extend to all learners.

1.7 Special needs education and inclusivity

All Rwandans have the right to access education regardless of their different needs. The underpinnings of this provision would naturally hold that all citizens benefit from the same menu of educational programs. The possibility of this assumption is the focus of special needs education. The critical issue is that we have persons/ learners who are very different in their ways of living and learning as opposed to the majority. The difference can either be emotional, physical, sensory and intellectual learning challenges traditionally known as mental retardation. These learners equally have the right to benefit from the free and compulsory basic education in the nearby ordinary/mainstream schools. Therefore, the schools' role is to enrol them and set strategies to provide relevant education to them. The teacher therefore is requested to consider each learner's needs during teaching and learning process. Assessment strategies and conditions should also be standardised to the needs of these learners. Also, ensure that you include learners with special educational needs in classroom activities as much as possible.

The special needs children can fall in any of the following common categories:

- Physical difficulties
- Visual difficulties
- Hearing difficulties
- Mental difficulties
- Genocide traumatized learners

The teacher should identify such cases and help facilitate the affected learners learning. For example, learners with visual and hearing difficulties should sit near the teacher's table for easy supervision and assistance. The following are some suggestions on how to support special needs children in your class.

(a) Learners with physical difficulties

In this group of learners, the affected areas are normally some body parts, especially the limbs. There may be partial or total loss of use of the limbs. In case the legs are affected, the learners will need assistance during activities that involve movement. This could be during a nature walk and other activities that learners have to stand for some reason. The teacher should organize for the learner's ease of movement around. The learner should also be given time to catch up with the others.

In case the hands are affected, the learners should be given more time to finish their work. In both cases, the learners should not be pressurized to do things that can cause injury or ridicule.

(b) Learners with visual difficulties

These learners normally have problems with their eyesight. They should sit in a position where they are able to see the chalkboard without straining

Note: The learner could be longsighted or short sighted.

The material to be observed should be brought to appropriate position where the learners can be able to see. The magnifying lens can be used where necessary. The teacher should use large diagrams, charts and labels. In some cases, the learners can be allowed to touch and feel whatever they are looking at. Other learners can assist by reading aloud. The lighting system in the classroom can also be improved.

The teacher should read aloud most of the things he/she writes on the chalkboard.

(c) Learners with hearing difficulties

The affected part in this case is the ear. The learner should have **hearing aids**. The teacher should use as many visual aids as possible. They should also project their voice and always talk while facing the learners. Use of gestures and signs while talking helps the learner figure out what the teacher is saying as well.

(d) Learners with speech difficulties

A common example in a normal class is the **stammerer**. They always speak with many difficulties. The teacher should be patient with them and encourage such learners to express themselves in their own way. Such learners should be given more written exercises.

(e) Learners with mental difficulties

The teacher should try to identify the nature and level of the mental difficulty. Learners with mental difficulties should then be given special assistance and attention at an individual level. They can be given special tests or assessments. In general, all the learners with difficulties should be reinforced promptly. This encourages and motivates them. The teacher and the rest of the class should never ridicule learners with any of the difficulties. Note that generally, people with any kind of disability can be very sensitive to any kind of negative

comments or criticism.

*Remind them that '**Disability is not inability**'.*

The teacher should avoid giving privileges where the learners do not deserve them. Treat them fairly but not with undue favours. In extreme cases, it can be recommended for the learners to join a special school.

(f) Genocide traumatized learners

Studies have shown that learners from families that were affected by genocide suffer post-traumatic stress disorder (PTSD). As such, they need to be treated as a special case. As a teacher, you need to be careful when dealing with such learners. In addition, the teacher needs to be in control especially when the topic under discussion touches on genocide issues. Any language that may elicit emotional reactions from learners either by fellow learners or by the teacher him or herself should be avoided.

2.1 Important attitudes in learning Mathematics

(a) In learners

There are certain useful attitudes, which the teacher should help develop in the learners as they carry out investigations in Mathematics. Mathematics as a problem solving discipline is expected to make an impact on a learner's general behaviour.

The nature of the scientific method demands learners to be honest with themselves as they record results and make unbiased conclusions. They should be aware of the danger involved in generalising out of limited information. They should be open-minded and able to distinguish between propaganda and truth.

Some of the attitudes that learners should develop include:

- **Responsibility** – A learner should be responsible enough to effect tasks apportioned and take good care of apparatus during and after an investigation.
- **Cooperation** – Learners will often be working in groups while carrying out investigations and need therefore to cooperate with all other members of the group.
- **Curiosity** – Learners should have a curious attitude as they observe things and events around them. This is the first step towards solving a problem.

- **Self-confidence** – Learners should have the will to attempt to solve a problem. The feeling of self-confidence can be strengthened in young learners if they experience many small successes that win approval and encouragement from the teacher. The problems that learners attempt to solve should not be so difficult that they lead to frustration.
- **Honesty** – As they make observations, record, analyse results and draw conclusions.
- **Patience** – Learners should be patient for the results of an experiment that may take time to manifest.
- **Practical approach** to problem solving. Learners should seek answers to their questions and problems by carrying out investigations wherever possible.

(b) In Teachers

A good teacher should make the following capabilities:

- Engage students in variety of learning activities.
- Apply appropriate teaching and assessment methods.
- Adjust instructions to the level of the learner.
- Creativity and innovation.

- Makes connections/relations with other subjects.
- Show a high level of knowledge of the content.
- Develop effective discipline skills manage adequately the classroom
- Good communicator.
- Guide and counsellor.
- Passion for children teaching and learning.

2.2 Philosophy of teaching Mathematics

In the teaching of Mathematics, two definite approaches or techniques have been used. The first is the **passive traditional** approach where the teacher is the central figure around whom all other things revolve. In this setup, the teacher talks and issues command. The learners sit and listen. The teacher treats the learners like an 'empty pot' waiting for information to be poured into it. A small amount may enter, some will stay in while the rest evaporates. This teacher-centred approach **has no place** in our schools today. In the second approach, which we call the dynamic or **activity-oriented** approach and which is being advocated for, the learners are active participants in the learning process. They are the doers and the materials and apparatus they work with are the tellers. The teacher's role is that of a guide and facilitator in the learning process. Mathematics is a practical subject and learners understand it best by doing.

(a) Learner's role in learning Mathematics

Learning takes place only when the learner has internally digested and assimilated the material to be learnt. As such, learning is a highly personal and individual process. It therefore means that a learner must be actively engaged in the learning exercise.

For active participation in learning, the learner must:

a. Develop the curiosity, powers of observation and enquiry by exploring the local environment.

b. Raise questions about what is observed.

c. Suggest solutions to those questions and carry out investigations to search for answers.

d. Manipulate a variety of materials in search of patterns and relationships while looking for solutions to problems.

The competence-based approach considers the learning process to involve the construction of meaning by learners. Simply, it emphasizes the need for children to think about mathematical activity in order to make sense of and understand the mathematics concepts being introduced. In this new dispensation, learners are in the driver's seat, which implies they will construct their knowledge by posing questions, planning investigation, conducting their own experiments, analysing and communicating results. More specifically, when engaging in inquiry, learners will describe objects and events,

ask questions, construct explanations, test those explanations against current knowledge, and communicate their ideas to others. By so doing, the learners will take ownership of the learning process.

Learners' activities are indicated against each learning unit reflecting their appropriate engagement in the learning process. Even though they do not necessarily take place simultaneously in each and every Mathematics lesson and for all levels, over time learners get involved in the following activities:

- Observing and where possible, handling and manipulating real objects.
- Pursuing questions which they have identified as their own even if introduced by the teacher;
- Taking part in planning investigations with appropriate controls to answer specific questions.
- Using and developing skills of gathering data directly by observation or measurement and by using secondary sources.
- Using and developing skills of organizing and interpreting data, reasoning, proposing explanations, making predictions based on what they think or find out.
- Working collaboratively with others, communicating their own ideas and considering others' ideas.
- Expressing themselves using appropriate mathematical terms and representations in writing and talk.
- Engaging in lively public discussions

in defense of their work and explanations.
- Applying their learning in real-life contexts.
- Reflecting self-critically about the processes and outcomes of their inquiries.

During this reciprocal interaction, what learners will acquire is not only content knowledge, but a number of skills including how to approach a problem, identify important resources, design and carry out hands-on investigations, analyze and interpret data, and, perhaps most importantly, recognize when they have answered the question or solved the problem.

(b) Teacher's role in learning and teaching

The teacher is one of the most important resources in the classroom. The teacher's role is central to the successful implementation of the learning programme in the school. The role of the teacher will remain critical however, instead of being the "sage on the stage", the teacher will rather be **"the guide on the side"** who acts as facilitator in a variety of ways which include:

- Encouraging and accepting student autonomy and initiative.
- Using raw data and primary sources, along with manipulative, interactive, and physical materials.
- Using cognitive terminology such as classify, analyse, predict, and create when framing tasks.
- Allowing student responses to

drive lessons, shift instructional strategies, and alter content.

- Familiarizing themselves with students' understandings of concepts before sharing their own understandings of those concepts.
- Encouraging students to engage in dialogue, both with the teacher and one another.
- Engaging students in experiences that pose contradictions to their initial hypotheses and then encouraging discussion.
- Providing time for students to construct relationships and create metaphors.
- Nurturing students' natural curiosity.
- Organising the classroom to create a suitable learning environment.
- Preparing appropriate materials for learning activities.
- Motivating learners to make them ready for learning.
- Coordinate learners' activities so that the desired objectives can be achieved.
- Assessing learners' activities and suggest solutions to their problems.
- Assist learners to consolidate their activities by summarising the key points learnt.

From time to time, the teacher should interact with the learners individually or in groups to diagnose their weaknesses and frustrations, appraise their efforts, imagination and excitement. This will assist and guide them in the task of learning. The teacher must make an effort to teach learners how to team up but still have each learner directly involved in working with materials, consulting with the teacher and with fellow learners. Remember that whatever you do during the class, the interests of the learner remain paramount! Therefore the teacher should allow and encourage the learners to:

- Explore their local environment.
- Ask questions about things and events.
- Make observations.
- Perform simple investigations research and experiments to seek answers to their questions.
- Talk to each other and to the other learners about their experiences, interests, problems, successes and even frustrations.
- Play and make models of things that interest them.

There is no doubt that scientific knowledge is increasing at such a rapid rate that it is impossible for any teacher to teach, or any child to learn, all the information available on any particular topic, within the time allocated. As an alternative, we should take on a strategy that is practical and time saving. It involves equipping the learners with skills, which they can use to find out information, and solutions to problems in Mathematics and in their daily lives. We therefore advocate the teaching of Mathematics as a process, combined with providing basic Mathematical facts, which are appropriate in content to the age and stage of mental development

of children under your charge. The mathematical skills that the teacher must endeavor to introduce and promote in his /her learners include:

observing, comparing, classifying (sorting), recording, predicting, experimenting, measuring, controlling variables, collecting data, recognizing patterns and relationships, analysing and interpreting data, making conclusions (inferring) and communicating.

These skills, used in conjunction with the introduction of basic mathematical facts will form a firm foundation that learners can build more as they learn both inside and outside of school.

Education at school is about children learning. The process of organizing learners' learning to achieve the aims and objectives of the curriculum involves bringing together the needs and characteristics of the learners. To do this, the skills, knowledge and experience of the teacher are all required within a given situation.

2.3 Teaching resources

These refer to things that the teacher requires during the teaching process. They include:

- The classroom.
- Textbooks.
- Wall charts and wall maps.
- Materials and apparatus.
- Various tools and equipment.
- Mathematical models.
- Resource persons.
- Social facilities such as health centres, other learning institutions, community organisations, etc.
- Enterprises such as agricultural farms, industries, among others.

(a) Classroom as a learning environment

Classroom generally refers to the place where learning takes place. Learners learn from everything that happens around them, such as the things that they hear, see, touch, taste, smell and play with. It is therefore important for the teacher to make his classroom an attractive and stimulating environment. This can be done by:

- Carefully arranging the furniture and desks.
- Putting up learning and teaching aids on the walls. Examples are wall charts or pictures or photographs.
- Displaying models.
- Providing objects for play for example toys.
- Having a display corner in the classroom where learners display their work.
- Securing a storage area.

The materials in the classroom should get the learners thinking and asking questions about what is around them and encourage them to do worthwhile activities.

Classroom organization

A well organised classroom is an asset to good Mathematics teaching but there is no one correct style to suit all classrooms and situations. However, the teacher should consider the following factors when organising the classroom:

a. Furniture should be well arranged so as to allow free movement of learners and the teacher.

b. Set a corner for storing materials so as not to obstruct learners or distract them.

c. The number of learners in the class and their ages.

d. Learners should be reasonably spread out so that they do not interfere with one another's activities.

e. The series of lessons or activities going on for a number of days or weeks such as individual or group work or whole class.

f. Classroom itself, that is, positions of windows, doors such that learners face the lighted areas of the room.

g. Personal preferences. But these should be in the interest of the learners especially where you normally stand, you should be able to communicate with all learners, and also have a general view of all learners in the class.

Grouping learners for learning

Most of the Mathematical activities are carried out in groups and therefore the teacher should place 2 or 3 desks against each other and then have a group of learners sitting around those desks.

In certain activities, the teacher may wish to carry out a demonstration. In this case, the learners should be sitting or standing in a semicircle, or arranged around an empty shape of letter "U" such that each learner can see what the teacher is doing clearly and without obstruction or pushing. If the learners are involved in individual work, each learner can work on the floor or on the desk or a portion of the desk if they are sharing. In this case, they need not face each other.

Grouping learners for learning has increasingly become popular in recent years. Infact, the shift from knowledge-based to competence curriculum will make grouping the norm in the teaching process. Grouping learners can be informed by one or all of the following:

a. Similar ability grouping.

b. Mixed ability grouping.

c. Similar interests grouping.

d. Needs grouping.

e. Friendship grouping.

f. Sex grouping.

Grouping learners in a mathematics class has several advantages that includes:

a. The individual learner's progress and needs can easily be observed.

b. The teacher-learner relationship is enhanced.

c. A teacher can easily attend to the needs and problems of a small group.

d. Materials that were inadequate for individual work can now easily be shared.

e. Learners can learn from one another.

f. Cooperation among learners can easily be developed.

g. Many learners accept correction from the teacher more readily and without feeling humiliated when they are in a small group rather than the whole class.

h. Learners' creativity, responsibility and leadership skills can easily be developed.

i. Learners can work at their own pace.

The type of "grouping" that a teacher may choose depends on:

a. The topic or task to be tackled.

b. The materials available.

c. Ability of learners in the class (fast, average, slow).

However, the teacher must be flexible enough to adjust or change his/her type of grouping to cope with new situations.

There is no fixed number of learners that a group must have. This again will be dictated by such factors as the task to be done, the materials, characteristics of learners in your class, size and the space available. However, groups should on average have between **four to five learners**. You can also resort to pair work depending on the nature of the content being taught at the time.

There is no one method or approach to teaching that is appropriate to all lessons. A teacher should, therefore, choose wisely the method to use or a combination of methods depending on the nature of the topic or subtopic at hand.

(b) Apparatus and materials

For learners to study mathematics through the activity method, a number of materials and apparatus are required. The important role played by materials in learning has been felt for centuries. This is noted for instance in the old Chinese proverb that says:

- *What I hear I forget*
- *When I see I remember*
- *When I do I understand*

Since Mathematics is largely a practical subject, materials help the teacher to convey his/ her points, information or develop skills, simply and clearly, and to achieve desired results much faster.

Most of the materials that a teacher requires for Mathematical activities and calculations can be collected from the local environment.

Many others can be improvised while some will have to be purchased. Whether collected, improvised or purchased, there are certain materials that are valuable to have around almost all the time. These include:

- **Tools:** *Knife, hammer, chisel, screwdriver, saw, magnifiers, machetes, strings, cloth, scissors, paper glue etc.*
- **Containers:** *Tins, gourds, bottles, coconut shells, jars, shells, calabashes a cartons etc.*
- **Powders:** *Salt, sugar, flour, soap, powder, ash etc.*
- **Liquids:** *Water, kerosene, methylated spirit, used engine oil, cooking oil, ink etc.*

- **Colors:** *for example, from flowers, leaves roots and stems, charcoal and chalk.*
- **Soils:** *Clay, loam, sand and gravel.*

Others include pieces of wood and sticks of various sizes, wires, ropes, nails, pins, thorns, grass stalks, growing plants like peas, beans, maize, seeds and cuttings of various plants.

The teacher should organise a place within the school for the proper storage of mathematical materials and in labelled boxes.

Encourage learners to collect and bring as many materials and apparatus to the school as they can. This will continuously replenish your materials and apparatus collection.

Improvisation

If each learner is to have, a chance of experimenting, cheap resources must be made available. Expensive, complicated apparatus may not always be available in most schools. Such sophisticated equipment made by commercial manufacturers are usually expensive and majority of schools cannot afford them. The teacher is therefore advised to improvise using locally available materials as much as possible.

Timing of topics and the local weather pattern

The collection of mathematical data in handling topics like probability and statistics are done at particular specific weather condition than at other times. For example, when collecting data on different makes of vehicles that pass through a particular route, the weather and other physical conditions must be put constant and into consideration for accuracy and to avoid biasness. Certain insects appear only during the dry weather while others emerge with the onset of the rains. Nature walks and visits are best done when the weather is sunny and dry. The teacher should therefore think ahead while making the scheme of work so that the prevailing weather pattern is considered. This will ensure that suitable activities for learning mathematics are planned for with the weather in mind.

However, a good scheme of work should be sufficiently flexible to cope with unexpected situations and can be altered or modified to suit certain circumstances.

(c) Mathematical Kit

A Mathematical kit is a special box containing materials, apparatus, and equipment necessary to conduct any mathematical operations and the performance of specific tasks. The content of the mathematical kit depends on the curriculum requirements per level. Most Mathematical kits are commercially available and target particular levels of learners. However, the teacher is encouraged to come up with a kit based on the specific unit and syllabus requirements.

Some of the materials within a mathematical kit includes:
- Dice
- Playing cards
- Blackboard; - ruler, Set square,

Divider, Compass
- Meter rule
- Calculator
- Number cards etc.

Mathematical set

It is important for every learner to have a mathematical set containing at least; protractor, compass, set squares, rulers, divider, pencil, sharpener and eraser. The learner needs these materials especially during mathematical and geometrical constructions.

(e) Resource persons

A resource person refers to anybody with better knowledge on a given topic area. Examples include health practitioners such as doctors, nurses and laboratory technologists, agricultural extension officers, environmental specialists among others. Depending on the topic under discussion, the teacher can organize to invite a resource person in that area to talk to learners about the topic. The learners should be encouraged to ask as many questions as possible to help clarify areas where they have problems.

(f) Models

A model refers to a three-dimensional representation of an object and is usually much smaller than the object. Several models are available commercially in shops. Examples include model of the heart, skin, lungs, eye, and ears, among others. These can be purchased by schools for use during mathematical operations.

2.5 Teaching methods

There is a variety of possible ways in which a teacher can help the learners to learn. These include :

(a) Direct exposition

(b) Discovery or practical activity

(c) Group, class or pair discussion

(d) Project method

(e) Educational visit/ field trips

(f) Teacher demonstration

(g) Experimentation/ Research

The particular technique that a teacher may choose to use is influenced by several factors such as:
- The particular group of learners in the class.
- The skills, attitudes and knowledge to be learned.
- Learning and teaching aids available. The local environment.
- The teacher's personal preference.
- The prevailing weather.
- The requirements of mathematical syllabus.

(a) Direct exposition

This is the traditional way of teaching whereby the teacher explains something while the learners listen. After the teacher has finished, the learners may ask questions. However, remember that in competence-based curriculum, this technique should be used very minimally.

(b) Guided Discovery

In this technique, the teacher encourages learners to find out answers to problems by themselves. The teacher does this by:

- Giving learners specific tasks to do.
- Giving learners materials to work with.
- Asking structured or guided questions that lead learners to the desired outcome.

Sometimes learners are given a problem to solve and then left to work in an open-ended manner until they find out for themselves.

With the introduction of the new curriculum, this is the preferred method of teaching.

(c) Group or class discussion or pair work

In this technique, the teacher and learners interact through question and answer sessions most of the time. The teacher carefully selects his questions so that learners are prompted to think and express their ideas freely, but along a desired line of thought. Discussion method should take learners from known to unknown in a logical sequence; and works well with small groups of learners. The disadvantage of this method is that some learners maybe shy or afraid to air their opinions freely in front of the teacher or their peers. This may give them more confident learners a chance to dominate the others. However, the method should be embraced as it intends to eliminate the lack of confidence in learners. Further, it is hoped that it will help improve interpersonal and communication skills in learners.

(d) Project method

In this approach, the teacher organizes and guides a group of learners or the whole class to undertake a comprehensive study of something in real life over a period of time such as a week or several weeks.

Learners using the project method of studying encounter real life problems which cannot be realistically brought into a normal classroom situation. A project captures learners' enthusiasm, stimulates their initiative and encourages independent enquiry. The teacher, using the project method, must ensure that the learners understand the problem to be solved and then provides them with the necessary materials and guidance to enable them carry out the study.

Disadvantages

If a project is not closely supervised, learners easily get distracted and therefore lose track of the main objective of their study. Studying by the project method does not work well with learners who have little or no initiative.

(e) Educational visits and trips/ nature walks

This is a lesson conducted outside the school compound during which a teacher and the learners visit a place relevant to their topic of study. An educational visit/nature walk enables learners to view their surroundings with a broader outlook that cannot be acquired in a classroom setting. It also allows them to learn practically through first-hand experience. In all "educational visit/ nature walk lessons", learners are likely to be highly motivated and the teacher

should exploit this in ensuring effective learning. However, educational visits are time consuming and require a lot of prior preparation for them to succeed. They can also be expensive to undertake especially when learners have to travel far from the school.

(f) Demonstration lessons

In a demonstration, the teacher shows the learners an experiment, an activity or a procedure to be followed when investigating or explaining a particular problem. The learners gather around the teacher where each learner can observe what the teacher is doing. It is necessary to involve the learners in a demonstration, for example by:

- Asking a few learners to assist you in setting up the activity.
- Requesting them to make observations.
- Asking them questions as you progress with the demonstration.

This will help to prevent the demonstration from becoming too teacher-centred.

When is a demonstration necessary?

A teacher may have to use a demonstration, for example when:

- The experiment/procedure is too advanced for learners to perform.
- The experiment/ procedure is dangerous.
- The apparatus and materials involved are delicate for learners to handle.
- Apparatus and equipment are too few.

2.6 Planning to teach

The two most important documents in planning to teach are the schemes of work and the lesson plan.

(a) Schemes of work

A scheme of work is a collection of related topics and subtopics drawn from the syllabus and organized into lessons week by week for every term. It is also a forecast or plan that shows details under these sub-headings:

- Week
- Key unit competency
- Lesson
- Learning objectives
- Learning resources and reference materials
- Teaching methods and techniques
- Observations/self-evaluation
- Comments from school director (DOS)

In addition, the schemes of work shows the day when a specific lesson will be taught and how long it is intended to take. The following is a sample of the scheme of work.

Week - refers to the week in the term e.g. 1, 2, 3, etc.

Key unit competency
- Gives the competence learners are expected to achieve at the end of the unit.

SAMPLE SCHEME OF WORK

Academic Year: 2016   **Term: 1 School: Town School Kigali**

Subject: Mathematics   **Teacher's Name: Class: Senior 1**

Week	Key unit competences	Lessons	Learning objectives	Resource and reference	Teaching methods and techniques	Observations/ evaluation (including proposed dates assessment)
1	To be able to collect, to represent and to interpret quantitative discrete data appropriate to a question or problem	Lessons 1 and 2 Types of Data	Learners should be able to • Define the term statistics • Name and identify types of data	Learner's book activities 1 to 5	Group activity, guided discovery, individual work given as home work	
		Lesson 3 and 4 collecting and organizing data	Learners should be able to • Use different methods to collect information. • Determine suitability and accuracy of each method	Learner's text book, electronic materials, dictionaries	Group activities , teacher guided discussions, class discussions, individual work given as homework	
		Lesson 5	Learners should be able to • Make a frequency distribution table using tally marks	Learner's text book	Group activities, examples, demonstrations, individual work done as homework	
2		Lesson 6 Measures of central tendency	Learners should be able to • Define arithmetic mean, the mode, median • Calculate the arithmetic mean	Learner's book, dictionaries, access to internet	Group activity, demonstration, class discussion, examples, individual class work based on Ex. 8.1	
		Lesson 7 Measures of central tendency	Learners should be able to • Define the mode. • Define the median, • Identify the median and mode • Calculate the median	Learner's text book	Class activities and discussions, examples and demonstration, homework, individual work	
		Lesson 8 and 9 quartiles	Learners should be able to • Define quartiles • Identify quartiles • Determine quartiles. • Determine interquartile range	Learner's book internet dictionaries (English and Mathematics)	Group activity, examples, demonstrations, discussions, h/work and classwork using exercise 8.8	
		Lesson 10 statistical graphs	Learners should be able to • Define a pictogram • Describe a rank order list • Draw a pictogram, • Interpret a pictogram	Learner's book	Group activity, examples, demonstrations, class discussions	
		Lesson 11: pie chart	Learners should be able to • Define a pie chart • Accurately construct a pie chart • Interpret a pie chart	Learner's book	Group activities, examples, demonstrations, individual work, h/ work, exercise 8.5 in the learner's book questions 1 to 7	
		Lesson 12 Bar Chart	Learners should be able to • Define bar chart • Construct a bar chart • Interpret a bar graph		Group activities, examples and demonstration, class discussions, exercise 8.5 questions 8 to 11	

Lesson- refers to the lesson being taught in that week e.g. lesson 1, 2, 3 and 4, etc. This shows which a single is and which is a double lesson.

Date - the day when the lesson will be taught.

Sub-topic- a subset of the topic which is a smaller component of the unit e.g. under the topic plants, one could have 'parts of a plant' as a sub-topic.

Objective- what learners are expected to achieve at the end of the lesson.

Learning resources - any materials that will be used by the learner and the teacher for learning and teaching.

References - books or other materials that will be consulted or used in the teaching process. Books that learners will use should also be shown here; indicating the actual pages.

Observations/self-evaluation- this should be a brief report on the progress of the lesson planned in the scheme of work. Such reports could include 'taught as planned'. 'Not taught due to abrupt visit by Country Director of Education.' 'Children did not follow the lesson, it will be repeated on... (Specific date).

Comments from director of school – space left for comments by the school director.

(b) Lesson plan

A lesson plan is a detailed outline of how the teacher intends to carry out a specific lesson.

Important sub-headings of a Lesson Plan

1. Administrative details
Date………… Subject……….
Class………….
Time…………. Roll…........

2. Unit title
The name of the unit as in the syllabus.

3. Key unit competence
This is/are the competence(s) that the learner is expected to achieve at the end of the unit.

4. Lesson title
The content area to be taught in the lesson**.**

5. Instructional Objectives
These represent what the teacher anticipates learners to achieve by the end of the lesson. Objectives should be clear and specific. They should also be stated in behavioural terms, that is, in a way that the outcome can be seen, displayed or measured. In mathematics, one should distinguish between knowledge, skill and attitude objectives.

6. Learning/teaching resources
Any materials and apparatus that the learners and the teacher will use during the lesson.

7. References
Any resources consulted or used by the teacher to prepare the lesson as well

SAMPLE LESSON PLAN

Term	Date	Subject	Class	Unit No.	Lesson No.	Duration	Class size
I		Mathematics	S1	3	I of	40 mins	40

Type of special educational needs to be catered for in this lesson and number of learners in each category	Out of a class size of 40, one of the learners is physically challenged in the hands i.e her hands are disabled hence she is not able to write well.
Unit title:	Statistics (ungrouped data)
Key unit competence	To be able to collect, to represent and to interpret quantitative discrete data appropriate to a question or problem
Title of the lesson	Types of statistical data
Instructional objectives	Through group discussions, the learners should be able to correctly • Define the term statistics correctly • Identify and describe types of data precisely.
Plan for this class inside/outside	Both inside and outside classroom i.e in school library Work in groups
Learning materials for all learners	English/Mathematical dictionaries, access to internet, access to school library, learner's text book
References	Learner's text book

Timing for each step	Description of teaching and learning activities		Generic competences and cross cutting issues to be addressed in this lesson
	Through group discussion and refernce materials, learners to define the term statistics, and data; and identify four types of data namely quantatitive, qualitative, discrete and continous data		
	Teacher activities	**Learner activities**	
Introduction (5 minutes)	Guiding learners to carry out activity 8.1 on what is statistics Clarifying learner's responses to help them understand the definition of statistics more clearly.	Carry out the task in the activities 8.1 participate in the discussions and answer questions in the activities	Research and communication, reporting , will be enhanced as the learners research, and present their findings as required in the two activities.
Development of the lesson (30 min)	Organising learners into groups of 5 Guiding learners on how to do activities 8.2, 8.3 and 8.4 on types of data as described in the Student's book page 1 and 2. Facilitates the discussion in the activities asking probing questions about the activities Harmonizing the learners presentations and making clarifications in order to make the understand the difference between quantitative and qualitative data.	Reading and following instructions in activities 8.2, 8.3 and 8.4 on types of data Answering the questions in the activities and the probing questions asked by the teacher.	Critical thinking and problem solving skills will be enhanced as learners do activity 8.4 on analysing the given data Inclusivity, harmony, tolerance and humility will be enhanced as the learners work together in the activities. The learner with physically challenged hands to be given other tasks in the group discussion other than recording e.g chairing the discussion.
Conclusion (3 min)	Teacher summarizes main teaching points, highlights key points of the lesson, gives practice exercises on identification of types of data. Fast learners can be assigned a research activity to identify more types of data	Learners ask question for further clarification and information then take notes	Communication and writing skills will be enhanced as learners answer questions and take notes.
Teacher self evaluation	Teacher to evaluate him/herself on whether the lesson objectives have been met and act accordingly.		

as any books that the learners will use during the lesson.

8. Introduction

This is the start of the lesson. The teacher should motivate the learners by creating learning situations that interest learners e.g. posing a problem, telling an amusing but relevant story or episode, showing an object or picture that arouse their interest. The introduction should link what the learners have already learnt with what they are going to learn.

9. Presentation/lesson development

This should mainly include the activities that learners and the teacher will perform in order to achieve the stated objectives; as well as the questions that learners will answer as they do the various activities.

It is convenient to distinguish between the learners' and teacher's activities under two columns.

10. Summary/conclusion: (Consolidation)

This is the step in which the lesson activities are tied up or consolidated to emphazise the main points, summarize the lessons or make conclusions. The summary should correspond to the objectives stated for that lesson.

11. Comments/self-evaluation:

Teacher should write remarks on whether the objectives were achieved or not and what he or she intends to do to improve on the weak points noted during the lesson.

This teacher's book has been written to help you guide learners to learn mathematics in the most enjoyable and captivating manner. You are reminded to always arouse the curiosity of learners as you teach. Some things that you may do before you go for a lesson include:

- Go through the expected learning outcomes – this should help guide the manner of teaching.
- Read through the unit for the lesson in advance to get an overview of the content required.
- Form a mental picture of the teaching situation and the ways in which you will interact with learners when dealing with the suggested activities.
- Collect the materials that will be needed during the lesson in advance.
- In some cases, try out the suggested activities/experiments in advance to avoid embarrassments like - the experiment failing to work during the lesson.

Remember: The suggested teaching activities in this book are just a guide. You may not need to follow them to the letter! Feel free to incorporate other innovative teaching methods that will help in delivering the intended content optimally.

Assessment is the process of evaluating the teaching and learning processes through collecting and interpreting evidence of individual learner's progress in learning and to make a judgment about a learner's achievements measured against defined standards. Assessment is an integral part of the teaching and learning processes. In the new competence-based curriculum assessment must also be competence-based; whereby a learner is given a complex situation related to his/her everyday life and asked to try to overcome the situation by applying what he/she learned.

3.1 Types of assessment

The two types of assessment that will be employed in the new curriculum is **formative** and **summative** assessment.

(a) Formative and continuous assessment (assessment for learning)

Formative or continuous assessment involves formal and informal methods used by schools to check whether learning is taking place. When a teacher is planning his/her lesson, he/she should establish criteria for performance and behaviour changes at the beginning of a unit. Then at the of end of every unit, the teacher should ensure that all the learners have mastered the stated key unit competencies basing on the criteria stated, before going to the next unit. The teacher will assess how well each learner masters both the subject matter and the

generic competencies described in the syllabus and from this, the teacher will gain a picture of the all-round progress of the learner. The teacher will use one or a combination of the following:

- Observation to judge the extend of skills acquisition
- Written tests
- Oral questions
- Project work
- Attitude change – this can be done by asking probing questions and checking body language as learners respond to the questions.

(i) Written tests

Under this, learners are given questions or tasks and are required to respond in writing. Examples of written tests are: short answer type questions, structured type questions, filling blanks, multiple choice questions, true-false questions and matching items.

(ii) Practical work or Activity

In this category, learners are required to perform a task or solve a problem practically. The teacher then assesses the finished work by looking at the materials used, procedures followed, whether it works or not or whether it is finished. He or she then awards marks accordingly.

(iii) Observation

This involves the teacher observing learners as they perform a practical task to assess acquisition of skills and attitude

change. The teacher checks ability of the learner to measure, classify, communicate findings, etc. He or she also assesses the learner's curiosity, patience, team and co-operation spirit among others.

(iv) Oral questions or interviews

Asking learners questions which require a verbal response such as naming parts of human body, a system or short explanations of a process such as digestion can also be used to assess a learner's level of competence.

(v) Drawing

This involves asking learners to draw something they have observed or learnt about. They can also collect data and draw graphs and interpret the graph and give conclusions. This helps to assess their skill in communication through recording.

(vi) Project work

In a project, learners undertake a comprehensive study of something in real life over a period of time such as several weeks or even months after which they present a report. In project work, let learners begin from planning stage (come up with a schedule of events), execute the plan, analyse the results and look back (reflect on the challenges encountered during the project and come up with solutions to those challenges (problem-solving skills).

A teacher can use one or several of these assessment methods depending on the subtopic being studied or the purpose for which assessment is required.

When should the teacher assess learning progress?

The teacher should decide whether to assess learners at the end of the lesson or at any other appropriate time when enough content has been covered. The general criteria to use to gauge learner achievement in the various generic competency areas is given in the table below.

Name of Learner	COMM	I&C	CT	RS	LL	PS	C&I
A	Red	Blue	Yellow	Blue	Red	Green	Yellow
B	Yellow	Red	Blue	Yellow	Blue	Red	Blue
C	Green	Blue	Red	Yellow	Blue	Red	Yellow
D	Yellow	Green	Yellow	Red	Yellow	Yellow	Green
E	Red	Blue	Yellow	Blue	Yellow	Red	Blue
F	Blue	Yellow	Red	Yellow	Blue	Green	Red
G	Yellow	Green	Blue	Yellow	Red	Blue	Green

KEY: Red – Poor

Blue – Average

Green – Good

Yellow – Excellent

COMM – Communication in English

I & C – Interpersonal skills & Co-operation

CT – Critical Thinking

RS – Research Skills

LL – Life long skills

PS – Problems solving skills

C &I – Creativity & Innovation

Allocate marks for each colour and calculate the marks that the learner has attained. Grade the learners based on how they have scored here and in the various tests given to assess skills acquisition and attitude change.

b) Summative assessment (assessment of learning)

When assessment is used to record a judgment of a competence or performance of the learner, it serves a summative purpose. Summative assessment gives a picture of a learner's competence or progress at any specific moment. The main purpose of summative assessment is to evaluate whether learning objectives have been achieved and to use the results for the ranking or grading of learners, for deciding on progression, for selection into the next level of education and for certification. This assessment should have an integrative aspect whereby a student must be able to show mastery of all competencies.

It can be internal school based assessment or external assessment in the form of national examinations. School based summative assessment should take place once at the end of each term and once at the end of the year. School summative assessment average scores for each subject will be weighted and included in the final national examinations grade. School based assessment average grade will contribute a certain percentage as teachers gain more experience and confidence in assessment techniques and in the third year of the implementation of the new curriculum it will contribute 10% of the final grade, but will be progressively increased. Districts will be supported to continue their initiative to organize a common test per class for all the schools to evaluate the performance and the achievement level of learners in individual schools. External summative assessment will be done at the end of P6.

Item writing in summative assessment

Before developing a question paper, a plan or specification of what is to be tested or examined must be elaborated to show the units or topics to be tested on, the number of questions in each level of Bloom's taxonomy and the marks allocation for each question. In a competency based curriculum, questions from higher levels of Bloom's taxonomy should be given more weight than those from knowledge and comprehension level.

Before developing a question paper, the item writer must ensure that the test or examination questions are tailored towards competency based assessment by doing the following:

- Identify topic areas to be tested on from the subject syllabus.
- Outline subject matter content to be considered as the basis for the test.
- Identify learning outcomes to be measured by the test.
- Prepare a table of specifications.
- Ensure that the verbs used in the formulation of questions do not require memorization or recall answers only but testing broad competencies as stated in the syllabus.

Structure and format of the examination

There will be one paper in Mathematics at the end of Secondary 3. The paper will be composed by two sections, where the first section will be composed

with short answer items or items with short calculations which include the questions testing for knowledge and understanding, investigation of patterns, quick calculations and applications of Mathematics in real life situations.

The second section will be composed with long answer items or answers with simple demonstrations, constructions, calculations, simple analysis , interpretation and explanations.
The items for the second section will emphasize on the mastering of Mathematics facts, the understanding of Mathematics concepts and its applications in real life situations. In this section, the assessment will find out not only what skills and facts have been mastered, but also how well learners understand the process of solving a mathematical problem and whether they can link the application of what they have learned to the context or to the real life situation. The Time required for the paper is three hours (3 hrs).

The following topic areas have to be assessed: algebra; metric measurements (money & its application); proportional reasoning; geometry; statistics and probability. Topic areas with more weight will have more emphasis in the second section where learners should have the right to choose to answer 3 items out of 5.

3.2 Record Keeping

This is gathering facts and evidence from assessment instruments and using them to judge the student's performance by assigning an indicator against the set criteria or standard. Whatever assessment procedures used shall generate data in the form of scores which will be carefully be recorded and stored in a portfolio because they will contribute for remedial actions, for alternative instructional strategy and feed back to the learner and to the parents to check the learning progress and to advice accordingly or to the final assessment of the students.

This portfolio is a folder (or binder or even a digital collection) containing the student's work as well as the student's evaluation of the strengths and weaknesses of the work. Portfolios reflect not only work produced (such as papers and assignments), but also it is a record of the activities undertaken over time as part of student learning. Besides, it will serve as a verification tool for each learner that he/she attended the whole learning before he/she undergoes the summative assessment for the subject.

3.4 Reporting to parents

The wider range of learning in the new curriculum means that it is necessary to think again about how to share learners' progress with parents. A single mark is not sufficient to convey the different expectations of learning, which are in the learning objectives. The most helpful reporting is to share what students are doing well and where they need to improve.

CONTENT MAP

	Unit 1: Sets	Unit 2: Sets of Numbers	Unit 3: Algebra	Unit 4: Percentage, Discount, Loss and Profit	Unit 5: Ratio and Proportion
Number of periods	30	36	36	12	12
Introduction	The use of sets and Venn diagrams in relations to representing situations and solving problems.	Operations to explore properties of sets of numbers and their relationships.	Algebra and meaning of linear functions, equations, inequalities, the number line and its link to the Cartesian axes.	To solve problems that involving calculating percentage, discount, profit and loss and other financial calculations.	To be able to solve problems involving ratio and proportion. Expressing ratios into their simplest forms and identification of direct and indirect proportions.
Classroom organization	• Whole class orientation • Group work then individual work as appropriate.	• Whole class orientation • Group work • Individual work • Pair work	• Group work then individual work as appropriate. • Whole class orientation	• Individual work • Pair work • Whole class orientation • Group work	• Individual work • Pair work • Whole class orientation
Equipment Required	• Access to the internet • Cards • Writing materials.	• Text books • Manila paper • Calculators	• Writing materials including graph/square paper or books • Access to internet	• Coins, bills, receipt papers, Electronic materials, ATM cards.	• Calculators • Electronic materials
Activities	Activities on: • Pair/group activities on sets and Venn diagrams. • The class act out various Venn diagrams with rules for sets. • In pairs explore relations between sets define domain and range, create mappings. • In groups, investigate when inverse relations are possible and identify the criteria.	Activities on: • Group discussions on the identification of sets of numbers and the relationships between them. • Illustrate different set of numbers on a number line. • Show that irrational numbers cannot be expressed exactly as a decimal.	Activities on: • Pair /group activities on graphs of linear function. • Creation of number line using rational numbers. • Marking inequalities on number lines. • Identification of points on the Cartesian plane. • Investigate gradients of lines y = mx + c drawn on the plane. • Relate m and c in y = mx + c to the gradient of line and the y-intercept. • Solving simple equations and inequalities.	Activities on: • Groups research and discussion on the use of percentages in business, household and personal finance – prepare a poster. • Individually, determine the best value for money with different discount arrangements. • In pairs, solving problems involving simple interest, discount, profit and loss	Activities on: • In groups, solving problems involving direct and inverse proportion, ratios and sharing adjust recipe amounts for different numbers of people. • In pairs, match different representations of ratios and proportions including simplestform. • In pairs, solve problems in practical contexts involving direct and indirect proportion using tables of values and graphs

Competences practices	• Drawing Venn diagrams and using them to solve various questions on sets. • Identification of different types of relations between sets. • Represent relations between sets as mappings and graphs. • Using sets and relations to solve problems • Problem solving • Teamwork • Communication skills	• Carry out mathematical operations on sets of numbers. • Work systematically to determine the operational properties of sets of numbers • Operations and properties on sets of numbers and relationships between sets of numbers.	• Drawing and naming vertical and horizontal lines. • Marking and naming points, defining and identifying gradient of a line. • Drawing graph of a linear function. • Distinguish between an equations and an identity. • Solving equation and inequalities. • Forming equations and inequalities in one unknown.	• Use percentages to calculate discount, commission, profit, loss, interest, taxes. • Solve problems involving: - Discount - Commission - Profit and loss - Loans and savings - Tax and insurance	• Comparing quantities using proportions. • Sharing quantities in a given proportion/ratio • Applying ratio and unequal sharing to solve given problems. • Solving real life problems involving direct and indirect proportion using tables and graphs • Interpreting ratio and proportions in practical contexts.
Language practiced	• Presentation of experimental findings, observation and results. • Writing observations. • Solving mathematical problems. • Discussion in groups.	• Writing observations. • Solving mathematical problems. • Discussion in groups. • Presentation of experimental findings, observation and results.	• Group discussions, presentation of activity findings, writing and reporting activity findings, an opportunity to improve both written and spoken language.	• Presentation of experimental findings, observation and results. • Writing observations • Solving mathematical problems. • Discussion in groups.	• Writing observations. • Solving mathematical problems. • Discussion in groups. • Presentation of experimental findings, observation and results.
Vocabulary acquisition	• New terminologies in sets through research	• New terminologies in sets of numbers.	• Opportunity to distinguish between dependent and independent, master words often used in inequalities such as at least, at most, not more than etc. • Relate the words gradient and slope inclination.	• New terminologies such as percentage, loss, profit, insurance and loans.	• New terminologies in ratio and proportions e.g direct and indirect proportions.

Numeracy	• Drawing the Venn diagrams and using them to manipulate and solve mathematical problems in decision-making.
	• Categorising values within a set to subsets.
		• Convert between decimal and fraction representations of rational numbers.
		• Determine the hierarchy of sets of numbers and explain relationship with operations
		• Working systematically to determine the operation properties of sets of numbers.
			• Drawing and using number line.
			• Drawing and naming vertical and horizontal lines, including the Cartesian axes.
			• Drawing linear graphs.
			• Determine gradient of any line.
			• Forming and solving linear equations.
			• Forming and solving linear inequalities.
				• Calculating discount, commission, profit and loss, simple interest, tax.
				• Solve problems involving
				  • - Discount
				  • - Commission
				  • - Profit and loss
				  • - Loans and savings
				  • - Tax and insurance
					• Solving problems involving direct and inverse proportion, ratios and sharing adjust recipe amount for different number of people.

Study skills	• Exploring relations between sets define domain and range, create mappings.
	• Illustrating sets using a Cartesian plane and showing its elements in terms of ordered pairs.
		• Exploring addition, subtraction, multiplying and divide pairs of natural numbers.
		• Construction of a Venn diagram to illustrate the relationship between two or more sets of numbers.
		• Solving questions involving sets of numbers.
			• Drawing and interpreting graphs.
			• Solving equations and inequalities
			• Forming and solving equations and inequalities to model practical life situations.
				• Monetary calculations in dealing with
				  • -Percentages
				  • -Discount
				  • -Commission
				  • -Profit and loss
				  • -Loans and savings (simple interest only)
				  • - Tax and insurance
					• Solving problems involving ratios and proportions.
					• Forming and solving direct and indirect proportional relationships in practical contexts.

Revision	• Revision exercises provided (exercises and unit test)	• Revision exercises provided (exercises and unit test)	• Left to the discretion of the teacher according to his/her class response.	• Revision exercises provided (exercises and unit test)	• Revision exercises provided (exercises and unit test)

Assessment	• A formative assessment of solving sets of numbers with the use of the Venn diagram. • Using sets to group and classify values according to given conditions. • Represent relations between sets as mappings and graphs.	• A formative assessment of solving sets of numbers. • Decimal representation of rational numbers and determine why the decimal is terminating or recurring.	• Draw and interpret graphs of linear functions and inequalities, interpret such graphs, application in real life. • Solve linear equations and inequalities. • Continuous process with reference to required competences.	• A formative assessment the performance and calculation of profits, losses, and other monetary calculations.	• A formative assessment of performing mathematical problems involving proportion and ratios.
Learning outcomes	• Appreciate how sets, Venn diagrams and relations can be used to represent situations mathematically. • Solving sets in a Cartesian plane. • Represent relations between sets as mappings and graphs. • Use sets and relations to solve problems	• Appreciate that rational numberscan be represented exactly as a fraction or a decimal that may terminate or recur. • Appreciate that the number line is incomplete without the irrationals that cannot be written exactly as a decimal. • Explain the relationships between sets of numbers, and rational and irrational numbers.	• Drawing accurate graphs on the cartesian plane. • Interpretation of graphs correctly. • Distinguishing and linking linear functions equations and inequalities. • Interpreting solutions of equations and inequalities. • Application to real life problems.	• Appreciate the role of money in our life. • Be honest in managing and using money. • Appreciate that saving and investing money can increase its value. • Appreciate the importance of paying taxes	• Appreciate the importance of multiplication when working with ratio and proportion.

	Unit 6: Points, Lines and Angles	Unit 7: Solids	Unit 8: Statistics	Unit 9: Probability
Number of periods	36	24	24	6
Introduction	Construction of mathematical arguments using the angle properties of parallel lines.	Selecting and using appropriate formulae to find the surface area and volume of solids.	Statistics, collection and organization of statistical data, interpretation of data suitable and unsuitable statistical methods.	Determining the probability of an event happening using equally likely events or experiment.
Classroom organization	• Whole class orientation, organized group work, pair work and individual method.	• Group work then individual work as appropriate. • Whole class orientation	• Whole class orientation, organized group work, pair work and individual method.	• Group work then individual work as appropriate. • Whole class orientation
Equipment required	• Manila papers, geometrical instruments, Electronic materials.	• Solid figures for practical work, paper, scissors, glue, calculators, oranges.	• Paper and pen including graph papers/books • Mathematical instruments • English and mathematical dictionaries • Access to internet	• Dice, coins, playing cards, graph paper
Activities	Activities in: • Presentations of research and activities findings through group reports. • Analysis and conclusions from group findings.	Activities in: • Research for recommended activities. • Presentations of research and activities findings through group reports. • Analysis and conclusions from group findings.	Activities in: • Group discussions on activities suggested in the pupil's book. • Research for recommended activities. • Presentations of research and activities findings through group reports. • Analysis and conclusions from group findings.	Activities in: • Presentations of research and activities findings through group reports. • Analysis and conclusions from group findings.
Competences practices	• Research methods – findings, analysis and reporting. • Ability to team work effectively. • Communication skills	• Ability to team work effectively. • Communication skills. • Data collection methods, organization and presentation of data.	• Data collection methods, organization and presentation of data. • Research methods – findings, analysis and reporting. • Ability to team work effectively. • Communication skills.	• Research methods – findings, analysis and reporting. • Ability to team work effectively. • Communication skills

Vocabulary acquisition	• New terminology through research e.g point, arrow	• New terminology through in the topic research.	• New statistical terminology through research.	• New probability terminologies through research.
Numeracy	• Illustration of angles at different points in diagrams. • Construction and calculations of angles.	• Illustration of the volume as the space occupied by a solid. • Distinguishing between surface area and volume and know the correct units. • Calculation of surface area and volume of solids.	• Statistical analysis, graphical representation, manipulation of statistical problems, graphical interpretation and decision-making.	• Analysis of probability of equally likely outcomes through experiments like tossing a coin or dice. • Estimation of probabilities where experimental data is required.
Study skills	• Drawing and calculating angles at different points. • Construction and measurements of different angles. • Constructing mathematical arguments using angle properties of parallel lines and shapes.	• Choosing and using suitable methods for calculating and manipulating the area and volumes of different solids. • Conversion of different values and units of volume and surface area measurements to other units of measurements.	• Choosing and using suitable methods for the required processes. • Drawing graphs. • Reading and interpreting graphs accurately, making useful decision correct manipulation of statistical data in problem solving.	• Performing experiments like tossing a coin or dice. • Determining correct outcomes of the experiment.
Revision	• Revision exercises provided (exercises and unit test).	• Revision exercises provided (exercises and unit test).	• Decision left to the discretion of the teacher according to his/her class.	• Revision exercises provided (exercises and unit test).
Assessment	• This assessment to be based on the required competences as stated above.	• A formative assessment of solving sets of numbers.	• This assessment to be based on the required competences as stated above.	• A formative assessment of solving sets of numbers.
Learning outcomes	• Appreciate the need to give reasons when developing solutions to missing angle problems. • Value a variety of different approaches to reach same conclusion. • Solving problems involving angles, lines and points.	• Appreciating the difference between surface area and volume and recognize solids in the environment. • Understanding the capacities and surface areas of different solids. • Solving problems involving solids.	• Understanding the meaning of statistics. • Understanding statistical methods of collecting, organizing and presentation of data. • Drawing and interpreting data, drawing conclusions from these processes. • Solving problems involving statistics.	• Appreciating that the chance of an event happening is given by its probability which is number between 0(impossible) and 1 (certain). • Distinguish when an experiment is necessary to find a probability and that more data improves the estimate.

Algebra

SETS

Student's Book pages 1 - 36. (30 Lessons)

Key unit competence

By the end of this unit, the learner should be able to use sets, Venn diagrams and relations to represent situations and solve problems.

Learning objectives

Knowledge and understanding

- Define and give examples of sets.
- Indicate what a specified region in a Venn diagram represents, using connecting words (and, or, not) or set notation.
- Show how sets are used in representing given information.
- Observe a contextual problem that involves sets, record the solution using set notation, and give explanations.
- Demonstrate algebraic and graphical reasoning through the study of relations.
- Identify different types of relations between sets.

Skills

- Use sets to group and classify according to given conditions.
- Use Venn diagrams to represent information.
- Find intersection, union, complement, difference, and symmetrical difference on sets.
- Represent relations between sets as mappings and graphs.
- Use sets and relations to solve problems.

Attitudes and values

- Appreciate how sets, Venn diagrams, and relations can be used to represent situations Mathematically

Generic competences addresses in this unit

- Communication skills
- Critical thinking

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- Problem solving

- Research/ innovation

- Cooperation, interpersonal management and life skills.

Links to other subjects

- Any subject where classification is important (e.g. biology, geography, physics, financial education).

Cross cutting issues addressed in this unit

- Inclusive education

- Financial education

- Genocide studies

- Peace, gender and values

- Standardization of culture

- Comprehensive and sexuality education

- Hiv and aIDS

Background information

Sets is the first unit in this book. It is one of the areas in which learners can pick up a lot of interest to study mathematics. It deals with visible and tangible things which learners are able to observe with their eyes. In the field of manufacturing, products are packed in form of set so that pricing is done easily. Since it is a practical unit, learners could be taken to the library or nearby local market to see how items are organized in the shelves.

Suggested teaching/ learning activities

Introduction to set concepts

(1 lesson)

By the end of this section, the learners should be able to define the term sets and be able to list some examples of sets.

Materials: box of chalk, packet of sweets, some exercise books.

Teaching guidelines 1.1

- Organize the class into groups. You should make them know that they need a group secretary who should write down their points and present their findings to the class after the discussion.

- Ask the groups to do Activity 1.1 given in the Student's book 1 i.e. to list items at their homes that form sets and to name the sets listed followed by Activity 1.2.

- Let the groups present their findings in a class discussion through their secretaries, and allow other members of the class to point out omissions or errors in the facts presented.

- Summarise the presentation by also talking about set notation and how important it is to put sets in their notations. Use Activity 1.3 to emphasize on set notation. Learners sometimes find it difficult to use set notation. This is best explained in student's book.

This activity will promote:

- Leadership and organization skills,
- Listening/speaking skills among other competencies.

Membership of a set

(2 lessons)

Materials: empty bottles,cups, books

Teaching guidelines 1.2

- On individual bases ask them to do activity 1.4 in student's book in learners book which talks about listing down sets of four legged domestic animals and whether a cow and a lion is members of the set listed or not.

- Ensure that every member of the group is actively participating so that learning takes place to all the students.

- When the activity is done, listen as different learners report their findings. Verify their findings and emphasize the key points and correct possible errors that arise from the discussion.

- After the discussion with the class, help them to realise the use of symbol $\in$ for " is a member of" and the symbol $\notin$ for 'is not a member of".

- Allow the students to attempt exercise 1.1 in student's book from numbers 1 to 4 as you move round the class checking as they work. This helps you to identify those students

with problems and be able to help them.

- When all is done, you conclude the lesson by correcting where they have gone wrong.

Number of members in a set

(1 lesson)

By the end of this lesson, the learner should be able to count the number of members in a given set.

Materials: empty bottles of water.

Teaching guidelines 1.3

- Organize the class to do activity 1.5 on individual bases given in the student's book i.e. to count the number of students in their class, and the elements in set A as given in the pupils book .

- When they are done with the activity 1.5, lead discussion so that each student is given a chance to represent their findings.

- Use this as platform to clear confusion on some students whose presentation are not adequate.

- Use the symbol $n(A)$ to mean number of members of set A.

- Guide the through example 1.1 to 1.5 given in student's book.

- Ask them to do the remaining questions of exercise 1.1 given in student's book.

- This activity promote research, communication, critical thinking, and problem solving.

Subset of a set

(2 lesson)

By the end of this lesson learners should be able to list all the subsets of a given set.

Material Beads

Teaching guidelines 1.4

- Pair up the students in the class to do activity 1.6 in pupil's book i.e. to discuss the number of subsets in a given set.

- Invite one of the members of the pairs to present what they have discussed as the rest of the learners are observing and pointing out mistakes during the presentation.

- Students often find the fact that set A is a subset of itself difficult and the convention that empty set is a subset of a set.

- Use the opportunity to emphasis that number of subsets is given by the formula 2n. Where n is the number of elements in a set.

- Let the Learners also discuss activity 1.7 of learner's book and present their findings.

- The activity talks about **HIV, Gonorrhea, syphilis which are sexual transmitted infection.** This is the right time to tell the learners to stay away from sex to avoid the spread of sexually transmitted infections (STIs).

- Guide the learners through a discussion given in the students book to emphasize on how to find the number of subset in a set.

- Led them through examples 1.6 to 1.9 given in the student's book.

- Ask them to do exercise 1.2 given in the student's book.

Subsets of numbers

(2 lessons)

By the of the lesson, the learner should be able to mention that even numbers, odd numbers and prime numbers are subsets of natural numbers .

Teaching guidelines 1.5

- Organise the class in groups to do activity 1.8 in learner's book which talks about natural, odd, even and prime numbers.

- Guide the groups to choose a secretary to record down findings of the discussion this should take at least 10 minutes.

- Lead a discussion so that each group is given opportunity to present their findings in front of the class as you note down mistakes made by them.

- Let the learners try first two questions of Exercise 1.3.

- Conclude the lesson by correcting the mistakes made by learners.

Venn diagram

(1 lesson)

By the end of the lesson, learners should be able to put elements in Venn diagram and use Venn diagram to solve problems.

Teaching guidelines 1.6

- Ask individual learners to do Activity 1.9 in students book.

- You should be able to tell the learners the different shapes of Venn diagrams. Use example 1.10 to emphasis on the circular one. It is not drawn by compass but it is drawn freely by hand in an oval shape.

Intersection of sets

- By the end the lesson, the learner should be able to identify common elements that exists between sets and be able to represent them on a Venn diagram.

Teaching guidelines 1.7

(1 lesson)

- On individual basis, as the learners to do activity 1.10 on pupils book that talks about identifying common element. As they do the activity, ask one of them to write down their finding which he or she will present after the discussion to the rest of the class.

- As the learners present their finding, give chance for the rest of the class to ask the presenter for clarification.

- Conclude the discussion by mentioning the symbol ∩ stands for intersection of sets. Proceed and do the example in the book to consolidate the point.

"Remember intersection is like two roads which meet at appoint and intersection of two or more sets is where they meet that is they have common elements."

Remind the learners that common elements are not repeated in the Venn diagram as you enter them in their varies regions.

- Take them through examples given in the student's book.

- Put a lot of emphasis on listing elements from the Venn diagram to individual set. The intersections are repeated when writing.

- Again allow the students in groups of three to do activity 1.11 in student's book. This activity will trigger the student to identifying common elements in the given intersection of sets.

- After 5 minutes students should present their findings via group leaders. This help them to get the intersection of the elements.

- Lead them through a discussion given in the student's book.

- Continue to do some of the examples to drive the point home.

- Give the students to do exercise 1.4 from numbers 1 to 5 as you move round correcting and marking them. For those who finish before time ask them to continue to do number 6.

- This activity will promote the following competence: Leadership

skill, self-confidence, critical thinking problem solving.

Union of sets

(2 lessons)

By the end of the lesson, learners should be able to combine two or more sets together to form one set called the union.

Teaching guidelines 1.8

- Organise the class to do activity 1.12 in student's book.
- Conduct a discussion so that you can come up with the meaning of union which says joining sets together.
- Use that opportunity to explain the meaning of union of sets.
- Proceed to do examples in the learner's book.
- Pick one student to come and do one of the examples on the board. This helps to measure whether they have understood the concept.
- Thereafter learners should attempt activity 1.13 and examples 1.15 and 1.16 should be explained.
- Give exercise 1.5 and correct the students for any mistake.
- These activities will promote:Critical thinking , research problem solving.

Universal set

(1 lesson)

- By the end the lesson, the learner should be able to define universal sets and represnt its subsets in a Venn diagram.

Teaching guidelines 1.9

- Pair up learners to do Activity 1.14 i.e to write all the subset of people in a school.
- Guide the learners through the Activity and let each pair present their findings to the whole class.
- Lead the through a whole class discussion to clarify some of the mistake made during the activity by learners.
- Conclude the disussion by guiding them through a discussion given in the Student's book.
- Guide the learners through examples 1.17 and 1.18 given in Student's book to emphasize about universal sets.

Complement of sets

(2 lessons)

By the end of the lesson, learners should be in position to identify elements of a set which do not belong to the other sets.

Teaching guidelines 1.10

- Organise the class in pairs to do activity 1.15 which prompts the learners to find out the complementary events. Lead a discussion so that the groups are given chance to present their findings. Correct the errors which learners can make in their findings.

- Use the opportunity to explain the symbols for complementary events.
- Guide the learners through Examples 1.19 to 1.21 given in student's book.
- Prompt the learners to do exercise 1.6 in the student's book.
- Correct ant errors made by the learners in their exercises.

Simple and symmetric differences of sets

(1 lesson)

By the end of the lesson, learners should be in position to identify the difference between two sets.

Teaching guideline 1.11

- Organise the learners in pairs to do activity 1.16.
- Lead a discussion but make sure you involve more students in the discussion and do some examples to help the students to understand better the concept of the difference in sets.
- Guide learners through example 1.22 to emphasize on difference of sets.
- Conclude the lesson by summarizing the important points.
- Use the opportunity to explain to learners how they should avoid creating differences with other individuals in order to live happily in a society.

Other special sets

(2 lessons)

By the end of the lesson, the learners should be able to explain empty and disjointed sets.

Teaching guidelines 1.12

- Organise learners into groups of three.
- Ask them to do Activity 1.17 given in student's book.
- Guide them through a discussion on their findings and the one given in the student's book.
- Let them proceed to activity 1.18 in the student's book.
- Engage them in a discussion given in the student's book.
- Give the more examples on the chalkboard to understand empty and disjoint sets.
- Ask them to do exercise 1.7 in the student's book.

Comparison of sets

(2 lessons)

By the end of the lesson, the learners should be able to explain and solve questions on equivalent and equal sets.

Teaching guidelines 1.13

- Pair up learners to do activity 1.19 given in student's book.
- Allow learners to discuss between them and present their findings to

the whole class.

- Guide them in their presentation by identifying errors and correcting them.
- Lead learners through a discussion given in Student's book and the example on equivalent sets.
- Ask them to proceed to Activity1.20 on their own.
- Guide them on a discussion about equal sets.
- Ask them to do Exercise 1.8 given in the student's book.
- Mark learner's work and guide them appropriately to understand equivalent and equal sets.

General problems in sets using venn diagram

(2 lessons)

By the end of the lesson, the learners should be able to apply Venn diagrams to solve some practical problems involving sets.

Teaching guidelines 1.14

- Guide the learners through examples 1.24, 1.25 and 1.26 for the students in the student's book.
- Make sure you give sufficient explanation by asking whether the learners have understood.
- Prompt the learners to do first 6 questions of Exercise 1.9 in the student's book. Move around the class correcting the mistakes the

learners would have made.

- Use the opportunity to tell the learners the importance of planting Trees and cleaning the environment basing on question 9 of exercise 1.9.
- Give the remaining questions as homework for the learners.

Relations and functions

(2 lessons)

By the end of the lesson, learners should be able to list some biological relation, mathematical relation and be able to put this relation in a Papygram.

Teaching guidelines 1.15

- Organize the class to do activity 1.21 in the student's book on individual bases and move round to guide them as they do it.
- Let them discuss so that each student is given some time to say something on his or finding.
- Let them find out the properties of relation from reference book and internet.
- Guide them through a discussion on each properties mentioned on their discussion i.e. reflexive, symmetric, transitive and antisymmetric.
- Lead them in a discussion given in the student's book.
- This discussion should lead you to the introduction of **Papygram.** As you try to use relation in a Papygram, make sure that the

students understand this relation very well for example " is a factor of" is very much confusing because a number is a factor of itself.

- Emphasise that each relation is different from the other and how it is represented on a Papygram matters a lot.

- When this concept is understood, continue to give the learners to do activity 1.22.

- Guide the learners through examples 1.28 to 1.30 given in student's book.

- Prompt learners to do Exercise 1.10 on pages 23 – 24 in learner's book.

- Correct exercises and identify the errors which students have.

- Once you are satisfied that learners have understood the properties of relation, proceed to a discussion of terms that are used to express a relation given in the Student's book.

- Guide them through examples 1.31 and 1.32 on chalkboard. Let them do exercise 1.11.

Mapping

(1 lesson)

By the end of this lesson, learners should be able to identify the type of mapping, be able to use the domain to get the value of the range with the given relation and be able to draw graph of relations.

Teaching guidelines 1.16

- Prompt the learners to do activity 1.23 on individual basis in student's book.

- Lead a discussion with class which should remind them about relation using arrow diagrams and Papygram to show the connection between the members of a set and their images.

- Types of mapping are not easy to differentiate especially one to many and many to many. Therefore be very careful in explaining them. Make sure you exhaust learners with explanation until when they all understand.

- Ask them to do Exercise 1.12 given in the student's book.

Graphs of relations

(2 lessons)

Materials: graph papers. Pencils manila papers

Teaching guidelines 1.17

- Organise the class and individually, let the learners do activity 1.27 in learners book page 28.

- When drawing graphs, ensure that learners have graph papers and move around the class to guide them.

- Use orders pairs to describe the type of mapping.

- When drawing the graph, emphasize on proper use of scales for both y-axis and x-axis.

- The range should be on the vertical axis and the domain should be on the horizontal axis.

- In working with the students, bring issues about relations between opposite sexes, families and relatives. Tell them to be careful to avoid wasting their precious time in relationships when they are still students.

- Let the Students do exercise 1.13 in the student's book. Guide them to plot the graphs and correct their mistakes.

- Use the opportunity to tell learners that many to many sexual relationships of opposite sexes can expose someone at a risk of contracting HIV/AIDS.

- This section creates self-awareness, self-confidence and leadership skills.

Functions

(1 lesson)

By the end of the lesson, learners should be able to write functions in their notation and be able to solve problems with functions.

Teaching guidelines 1.18

- Organise the class in group of three allow them to do activity 1.28 in the student's book.

- Give time to each group secretary to present their discussion and allow other members of the class to contribute on the presentation.

- Use this time to tell them the notation of a function and to emphasis that functions are one to one mapping and many to one mapping because

an object has on one image. This point can be understood by you doing at least an example from the learners book.

- Ask the learners to do exercise 1.14 from number 1 to 4 and move round to help those who need help and an extra numbers to the quick learner's number 5 and 6.

- Give other numbers as homework.

- Conclude the lesson by summarizing important point.

Inverse of a function

(2 lessons)

By the end of the lesson learners should be able to change functions into their inverse and map them using arrow diagrams.

Teaching guidelines 1.19

- Tell the learners to do activities 1.29 and 1.30 in student's book on individual bases.

- Lead a discussion so that each learner can have chance to speak out what he or she has done on the activity.

- Use this time to correct them and show them the notation of inverse $f^{-1}(x)$ by doing some examples given in the student's book on the chalkboard.

- Allow them to try exercise 1.15 from numbers 1 to 10 and move round to mark and correct for those who have failed. The quick learners to continue to do numbers 11 and 12.

- This exercise will promote in students the skill of critical thinking self-confidence, student's book research, problem solving and among others.

Composite functions

(2 lessons)

By the end of the lesson, the learners should be able to combine two or more function together to form one.

Teaching guidelines 1.20

- Guide the learners to do activity 1.31 in the student's book.
- Lead a discussion that will help the learners to understand how to combine functions together. Do not forget to emphasis that the function fg(x) is not the same as gf(x).
- Let the learners present their findings.
- Do examples 1.43 and 1.44 and explain the concepts fully.
- Ask the learners to do questions 1 to 6 of exercise 1.16 in the student's book.
- Correct any mistake made by students and guide them.
- Give the rest of the questions from the exercise as homework.
- Summarise the lesson by emphasizing important facts.
- Take the learners through the unit summary given in the student's book and let them attempt all questions in the Unit Test 1.

This lesson will promote research skills, leadership skill, and critical thinking communication skills among other competences.

ANSWERS
Exercise 1.1 (Pages 3–5)

1. a) N={0, 1, 2, 3, ...}
   b) Define P to represent set of squares of natural numbers
      P={0, 1, 4, 9, ...}
   c) X= {2, 4, 6, 8, 10, 12, 14}
   d) X= {-1, 1}   e) X= {14}
2. a) {4} $\subset$ Even numbers
   b) -5 $\notin$ Counting Numbers
   c) 3 $\notin$ Even numbers
   d) {5,6} $\not\subset$ Even Numbers
   e) 7 $\in$ Odd numbers
   f) {6, 7, 8} $\subset$ Counting Numbers
3. a) A set of even numbers
   b) A set of counting numbers
   c) A set of odds numbers
   d) A set of positive numbers
4. a) Set of capital cities of East African countries; 6 elements
   b) Set of vowels
      5 elements
   c) Set of even numbers up to 10
      5 elements
   d) Set of days in a week
      7 elements
5. a) {Red, Orange, Yellow, Green, Blue, Indigo, Violet}
      7 elements
   b) {Green, yellow, Blue}
      3 elements
   c) {Uganda, DRC, Tanzania, Burundi}
      4 elements

d) Depends on the name of the head teacher

6. a) True   b) False
   c) False   d) True
   e) False   f) False

7. a) April $\in$ Months of a year
   b) A $\in$ {Vowels}
   c) 3 $\in$ {Prime numbers}
   d) 4 $\in$ {square numbers}
   e) K $\in$ {letters of Alphabet}
   f) HIV $\in$ {sexually transmitted diseases}

8. a) $5 \in A$ b) $5 \notin B$
   c) $5 \in C$ d) $6 \in B$
   e) $13 \notin B$ f) $9 \notin C$
   g) $2 \notin A$ h) $17 \notin A$

9. a) 28 or 29
   b) 3   c)   30
   d) 4
   e) 2

Exercise 1.2 (Page 6)

1. { } or ϕ, {x}, {y}, {z}, {x,y}
{y, z}, {z, x}, {x, y, z}

2. {} or ϕ, {a}, {3}, {1}, {2},
{a, 3}, {a,1}, {a, 2}, {3,1}, {3,2}, {1, 2}
{a, 1, 2, }, {a, 3, 1, 2}, {a, 3, 1}, {a, 3, 2},
{3, 1, 2}

3. 7 elements   4. 6 elements

Exercise 1.3 (Page 7)

1. (a) {lion} {hyena} {leopard}
{lion, hyena} { }
{lion, leopard}
{hyena, leopard}
{lion, hyena, leopard}

(b) 8 subsets

2. (a) { }, {cassava}, {potato}, {maize}, {pumpkin}, {cassava, potato}, {cassava, maize}, {cassava, pumpkin}, {cassava, potato, maize}, {cassava, potato, pumpkin} {potato, maize, pumpkin}, {potato, maize}, {potato, pumpkin}, {maize, pumpkin}, {cassava, maize, pumpkin} {cassava, potato, maize, pumpkin}

b) 16 subsets

3. a) { }, {u}, {v}, {w}, {x},
{y}, {u, v}, {u, w}, {u, x}, {u, y}
{v, w}, {v, x}, {v, y}…{u, v, w, x, y, z}

b) 32 subsets

4. a) i)   E = {2,4,6,…………..,48}
    ii)   P = {2,3,5,7,11,13,…,47}
    iii) D = {1, 3, 5, 7, 9,… 49}

b) i) $E \subset N$ ii) $P \subset N$
    iii) $D \subset N$

c) E = 16777216
   P = 8192
   D = 33554432

5. a) i) A = {3, 12, 15} 8 subsets
    ii) B = {2, 3, 5, 7, 11} 32 subsets
    iii) C = {3, 5, 7, 11, 15} 32 subsets

b) i) A = {5, 10, 15, 20, 25, 30, 35, 40}
      256 subsets
    ii) B = {15, 30}   4 subsets
    iii) C = {20, 40}   4 subsets

Exercise 1.4 (Page 10)

1.   a) {1,2}   b) {2,3}
      c) {2,5}   d) { }

e) { 2 }　　f) { 5 }

2. a) A ∩ B
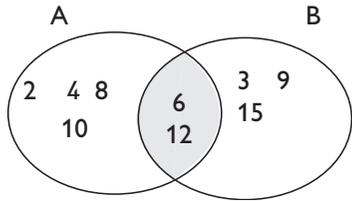
b) A ∩ C
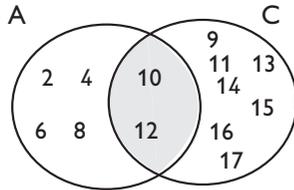
c) B ∩ C
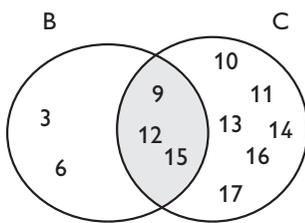
d) A ∩ B ∩ C
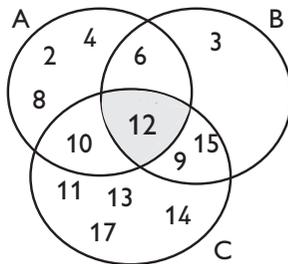
3. (a) P ∩ Q = {h, g, d, e, f}
   (b) R ∩ Q = {d, e, f, i, j}

4.
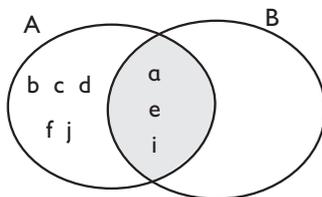
5. M = { a, p, r, s, t, u}
   N = {t, u, v, w, x, y, z}
   M∩ N= {t, u}

6. a) D= { 2, 4,6,10, 11, 13, 14}
      E= {2, 4, 14, 15, 20, 22}
      F= {11, 14, 23, 24, 25}

   b) i) D∩ E= {2, 4, 14}
      ii) D∩ F= {11, 14}
      iii) E∩ F= {14}
      iv) D∩ E∩ F= {14}

Exercise 1.5 (Page 12)

1. a) {a, b, c, d, e, i, o}
   b) {a, b, e, d, f, i, o}
   c) {a, b, c, d, e, f, i, o}
   d) {a, b, c, d, e, f, g}
   e) { a, b, d, e, f, g, i, o}
   f) {a, b, d, e, f, g}

2. a) {-1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16, 18, 20}
   b) {stool, chair, table, bed, beans, lemon}

3. a)
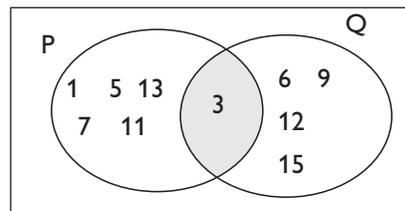
   n(p) = 6
   n(q) = 5
   n(P ∪ Q) = 10
   n(P ∪ Q)-n(P) +n(Q) = 9

b)
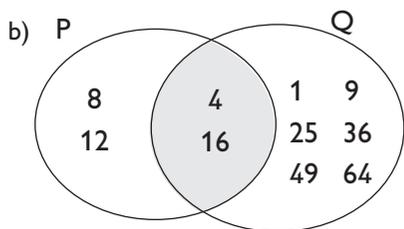
$$n(P) = 4$$
$$n(Q) = 8$$
$$n(P \cup Q) = 10$$
$$n(P \cup Q) - n(P) + n(Q) = 14$$

c)
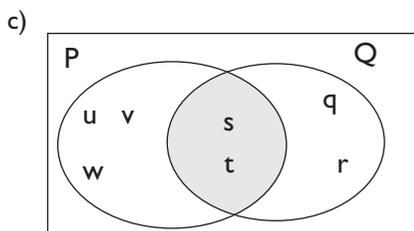
$$n(P) = 5$$
$$n(Q) = 4$$
$$n(P \cup Q) = 7$$
$$n(P \cup Q) - n(P) + n(Q) = 6$$
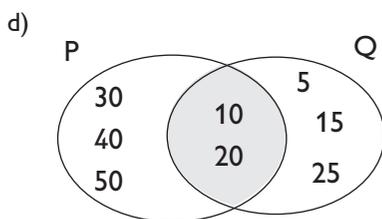
d)

$$n(P) = 5$$
$$n(Q) = 5$$
$$n(P \cup Q) = 8$$
$$n(P \cup Q) - n(P) + n(Q) = 8$$

4. {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

$$n(M \cup N) = 10$$

Exercise 1.6 (Page 15)

1. a) {n, f, g, h, i, j, l}
   b) {   }
2. {3, 5}
3. i)   { }
   ii) {1, 3, 5, 7, 9, 11, 13, 15}
4. i)   {7, 9, 11, 13}
   ii) { 3, 5, 7, 9, 11, 13}

iii) {3, 5}
iv) { }
v) { 7 }
vi) { 3, 5, 9, 11, 13}

5. a) A' = {−2, −1, 1, 3, 4}
   b) $A \cup \varepsilon$ = { −3, 0, 2}
   c) $A \cup \varepsilon$ = {−3, −2, −1, 0, 1, 2, 3, 4}
   d) $A \cup A'$ = {−3, −2, −1, 0, 1, 2, 3, 4}
6. a) $P \cap A$ = {2, 4, 6, 8, 10}
   b) $P \cap B$ = { 4, 8}
   c) $P \cap E$ = {20, 22, 24, 26, 28, 30}
   d) $P \cap D$ = {12}
   e) $P \cap E'$ = { }
7. a) $A \cap A'$ = {1, 2, 4, 5, 6, 9, 10}
   b) $A \cap A'$ = {   }
   c) $A \cup A'$ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
8. a) (i) $n(\varepsilon)$ = 27
       (ii) $n(V')$ = 22
   b) 31
9. a) {4} $\in$ even numbers
   b) −5 $\notin$ counting numbers
   c) 3 $\notin$ even numbers
   d) {5, 9} $\subset$ odd numbers
   e) 7 $\in$ odd numbers
   f) {6, 7, 8} $\in$ counting numbers

Exercise 1.7 (Pages 16-17)

1. a) { 1, 3, 5, 6}
   b) {7, 8}
   c) $P \triangle Q$ = {1, 3, 5, 6, 7, 8}
2. a) A − B {Tomatoes, Green pepper}
   b) B − A {Rice, Potatoes}
   c) $A \triangle B$ = {tomatoes, green pepper, rice, potatoes}
3. a) { 3, 4}
   b) { }
4. a) { 1, 3, 5}   b) {6, 8, 10}
   c) {2, 6, 10}   d) {12, 16}
   e) {1, 2, 3, 5}   f) { 8, 12, 16}

Exercise 1. 8 (Page 18)

1. Equivalent Sets 2. Equal sets
3. Neither equivalent nor equal sets
4. Equal Sets
5. Neither equivalent nor equal sets
6. Equal sets

Exercise 1. 9 (Pages 19–20)

1. 11 do not play any
2. 10 play both
3. a) 15   b) 125   c) 0
4. a)
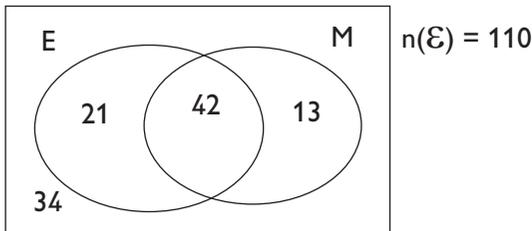
b) 76   c) 42   d) 13

5. a)
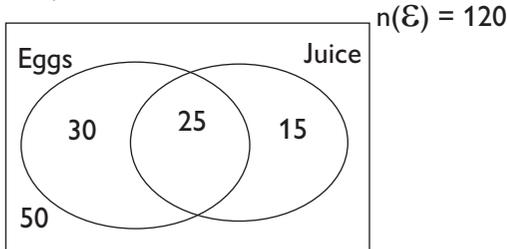
b) 50

6. 27 read both
7. a)
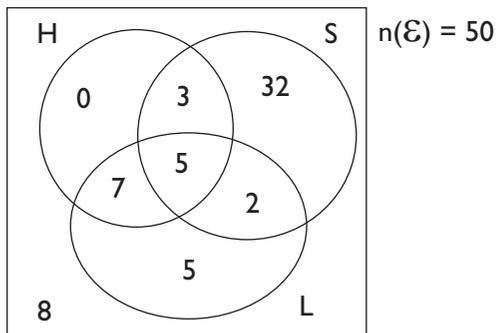
b) 0   c) 23   d) 8

8.
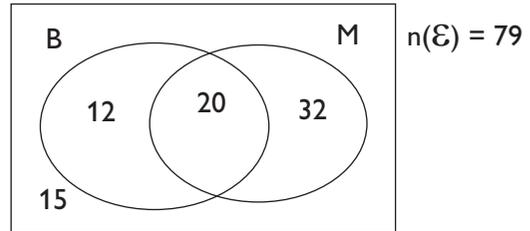
a) 20   b) 12   c) 32

9.
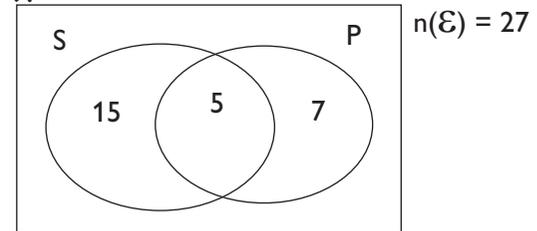
Number of students is 27.

10.
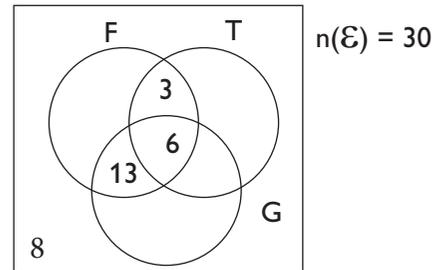
8 students did not participate in any of the sports

Exercise 1.10 (Pages 23-24)

1.
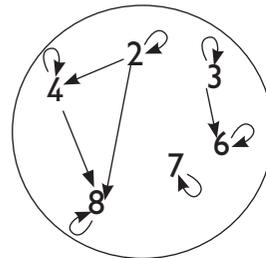
2.
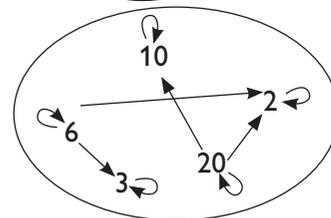
A(E) = 30°

3.
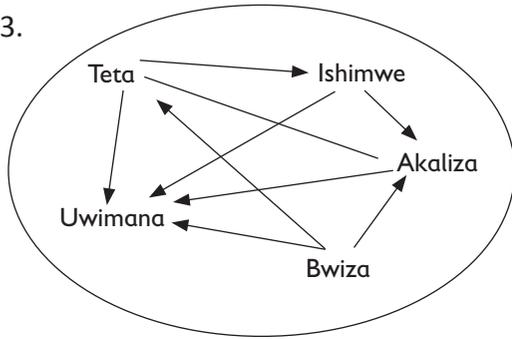
4. "Is a square of"

5. a)
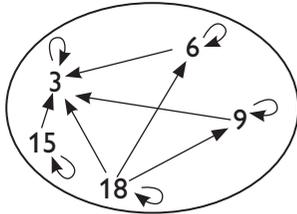
Is a multiple of

b)
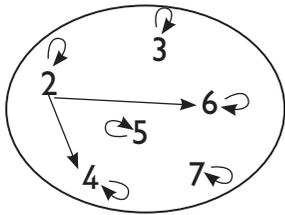
Is a factor of

c)
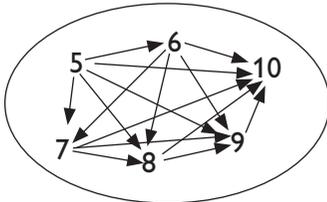
Is less than

6. (a) Symmetric

  (b) Transitive

 (c) Symmetric

  (d) Antisymmetric

Exercise 1.11 (Page 25)

1. a) A x B = {{a, 2}, {a, 3}, {b, 2}, {b, 3}}

  b) C x F = {{m, 5}, {m, 6}, {m, 7},
            {n, 5}, {n, 6}, {n, 7}}

  c) D x E = {{p, 1), {p, 2}, {p, 3},
            {q, 1}, {q, 2}, {q, 3},
            {r, 1}, {r, 2}, {r, 2}}

2. R = {(a, b) ∈ A x B | b = 2a}

Exercise 1.12 (Pages 27-28)

1. a) {4, 8, 12, 16, 20}

  b)
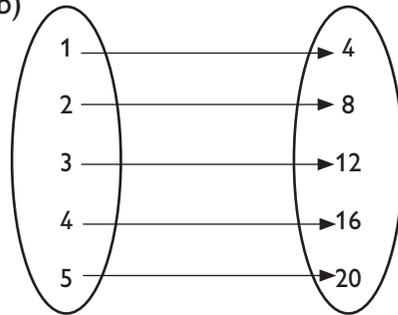
2. a) { 16, 19, 22, 25, 28}

  b)
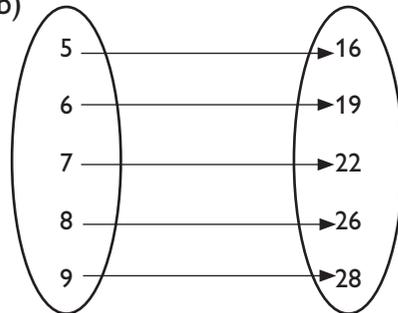
  c) One-to-one

3.
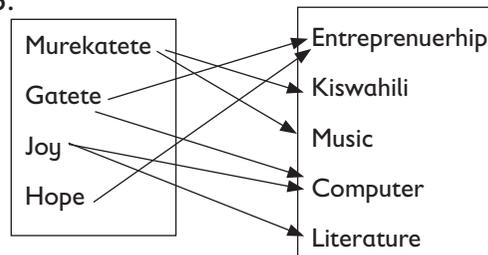
One-to-many

4.
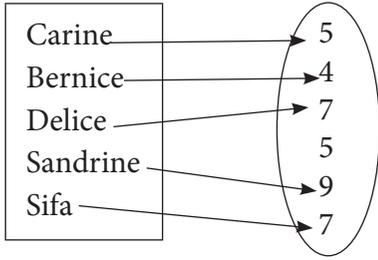

One-to- one

## Exercise 1.13 (Pages 29-30)

1. B = { 0, 2, 4, 6, 8}

c)
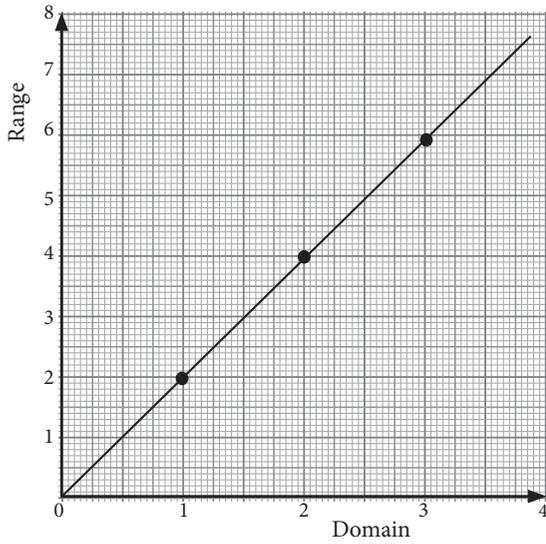
2. a) Q = {1, 2, 3, 4, 5}
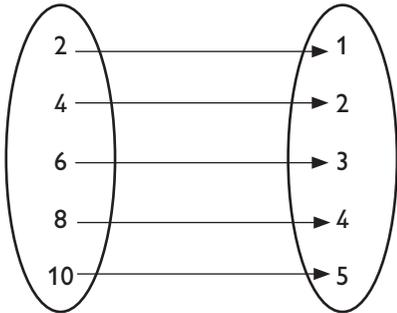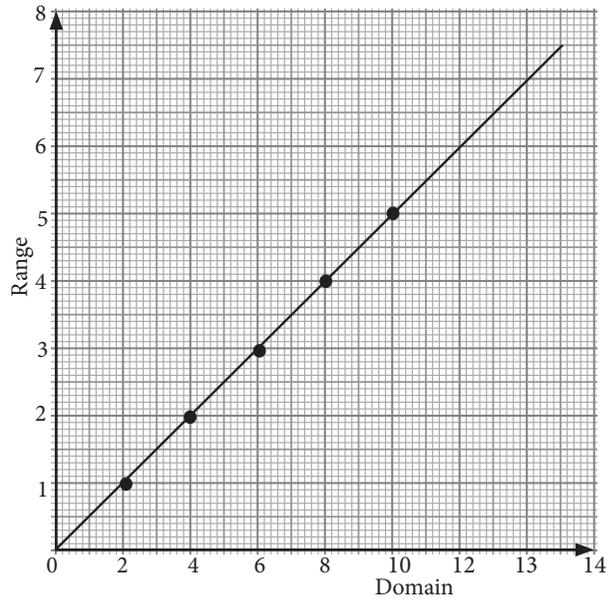


3. a) Range = { 0, 3, 6, 9, 12, 15}

b)   Range = { 1, 3, 5, 7, 9, 11}
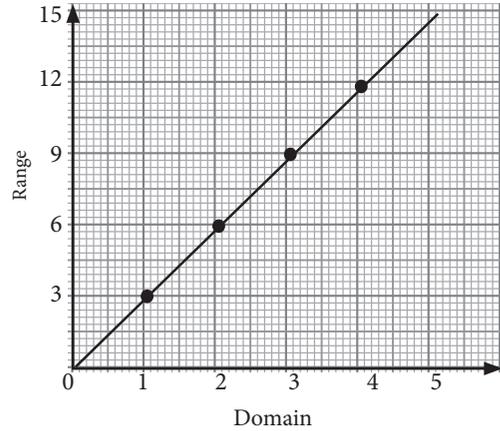
c)   Range = { –2, 1, 4, 7, 10, 13}
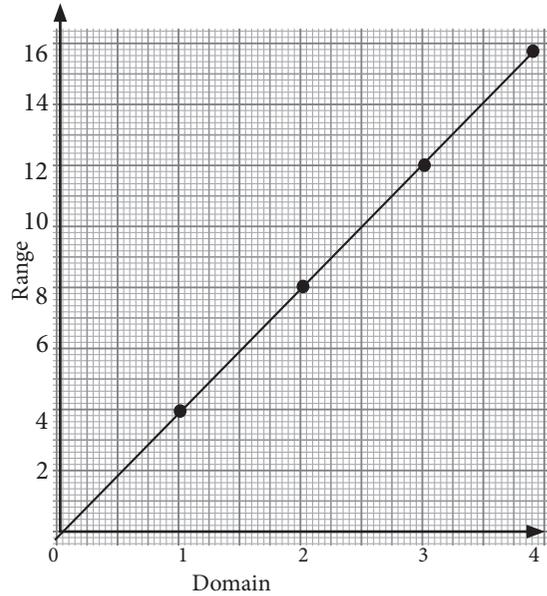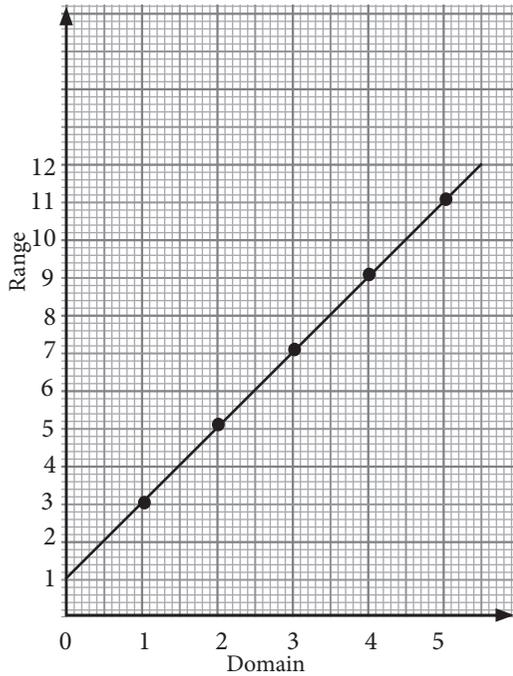
4.   Range = { 0, 4, 8, 12, 16}

5.   Domain = {$^-$3, $^-$2, $^-$1, 0, 1, 2, 3}
Range = {0, 1, 4, 9}
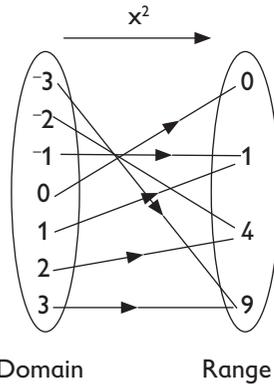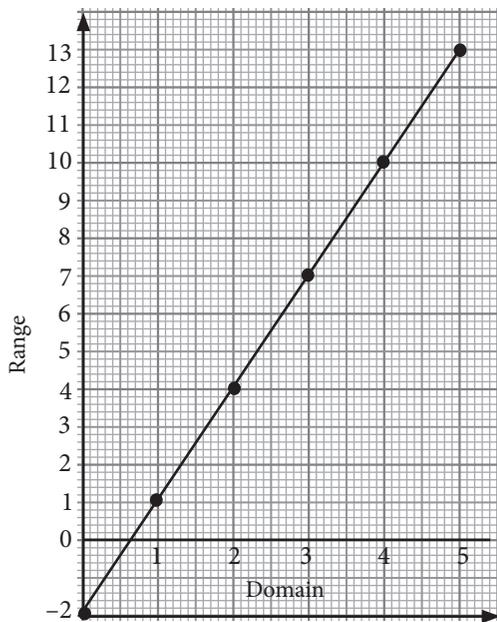
6.   a)   (1,1), (2,4), (3,9), (4, 16), (5, 25), (6, 36), (7, 49), (8, 64), (9, 81), (10, 100)

b)   (1, 6), (2, 7), (3, 8), (4, 9), (5, 10), (6, 11), (7, 12), (8, 13), (9, 14), (10, 15)

c)   (1, -2), (2, -1), (3, 0), (4, 1), (5, 2), (6, 3), (7, 4), (8, 5), (9, 6), (10, 7)

Exercise 1.14 (Page 31)

1.   14   2.   10   3.   17
4.   a) -11   b) -3   c)   1

5. a) 17   b) $\dfrac{-1}{3}$ c) $\dfrac{-17}{7}$

6. b = 2

7. c = 8   g (4) = 41

8. a) a = 12   b) -12

9. {3, 6, 9, 12, 15}

10. {3, 2, 1, 0, -1}

11. b = 3

12. a) a = -2   b) -1   c) -21
    d) -3   e) -28

Exercise 1.15 (Page 33)

1. x + 6

2. x − 2

3. $\dfrac{x - 3}{2}$

4. $\dfrac{x + 1}{3}$

5. $\sqrt{x - 2}$

6. $\sqrt{\dfrac{x + 1}{3}}$

7. $\dfrac{x}{2}$

8. $\dfrac{\sqrt{-x + 4}}{9}$

9. 2x

10. $\sqrt{3x + 3}$

11. x

12. $\dfrac{1}{x}$

Exercise 1.16 (Page 34)

1. a) 4x − 2   b) 4x − 8

2. a) 6x + 7   b) 6x + 3

3. a) 3xz   b) 3xz

4. a) 2x + 6   b) 2x − 5
   c) $2x^2 - 4$ d) $x^2 + 2x$

5. a) 3x + 1   b) 3x + 3   c) 9

6. a) $4x^2 + 1$ b) $2x^2 + 2$
   c) 10   d) 17

7. ±1

8. 6x + 3

9. 2x + 9

10. a) $6x^2 - 38$, 6x-3
    b) $36x^2 - 36x + 5$

11. $9x^2 + 6x + 1$

12. $4x^2 - 20x + 25$

Unit Test 1 (Pages 35 - 36)

1. a) Monday ∈ {days of the week}

   b) {2, 4, 6, 8} ⊂ {Even numbers}

   c) {lion, cheetah, cat} ⊂ {cat family}

   d) {−2, −8, −0} ⊄ {natural numbers}

   e) {cow, dog, hyena} ⊄ {Domestic animals}

2. (a) A = {2, 4, 6, 8, 10, 12, 14, 16, 18}

   (b) B = {1, 3, 5, 7, 9, 11, 13, 15, 17, 19}

   (c) C = {2, 5, 7, 11, 13, 17, 19}

   (d) D = {4, 8, 12, 16}

   (e) {3, 6, 9, 12, 15, 18}

3. (a) B ∩ C = {0}
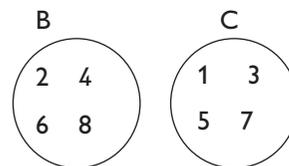
   (b) A ∩ C = {1, 3, 5}
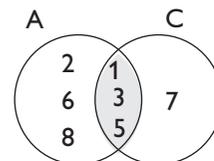
   (c) A ∩ B = {2, 6, 8}
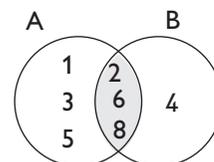
(d)   B ∪ C = {1, 2, 3, 4, 5, 6, 7, 8}
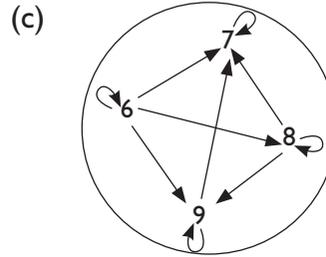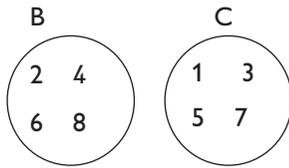
(e)   A ∪ B = {1, 2, 3, 4, 5, 6, 7, 8}
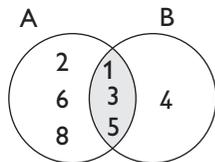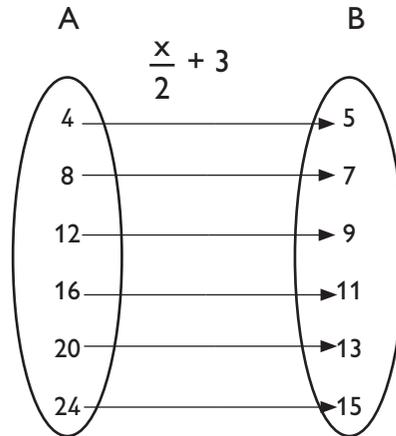
4.   a)   A = {a, e, i, o, u}

 b)   B = {a, b, c, d, e}

 c)   A ∪ B = {a, b, c, d, e, i, o, u}

 d)   A ∩ B = {a, e}

 e)   B − A = {b, c, d}

 f)   A − B = {i, o, u}

5.
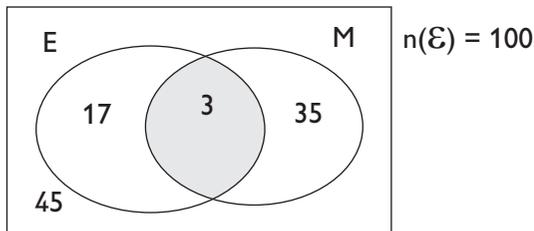
 (a)   45   (b)   58   (c)   52

6.   (a)   12   (b)   0

7.

(a)   (b)

(c)

8.   a)   B = {5, 7, 9, 11, 13, 15}
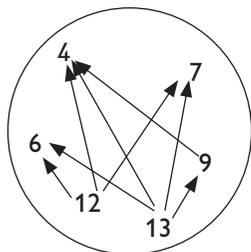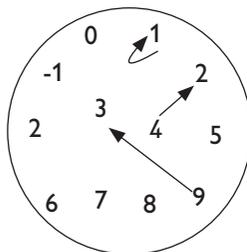
 b)   (4, 5), (8, 7), (12, 9), (16, 11), (20, 13), (24, 15)

d)
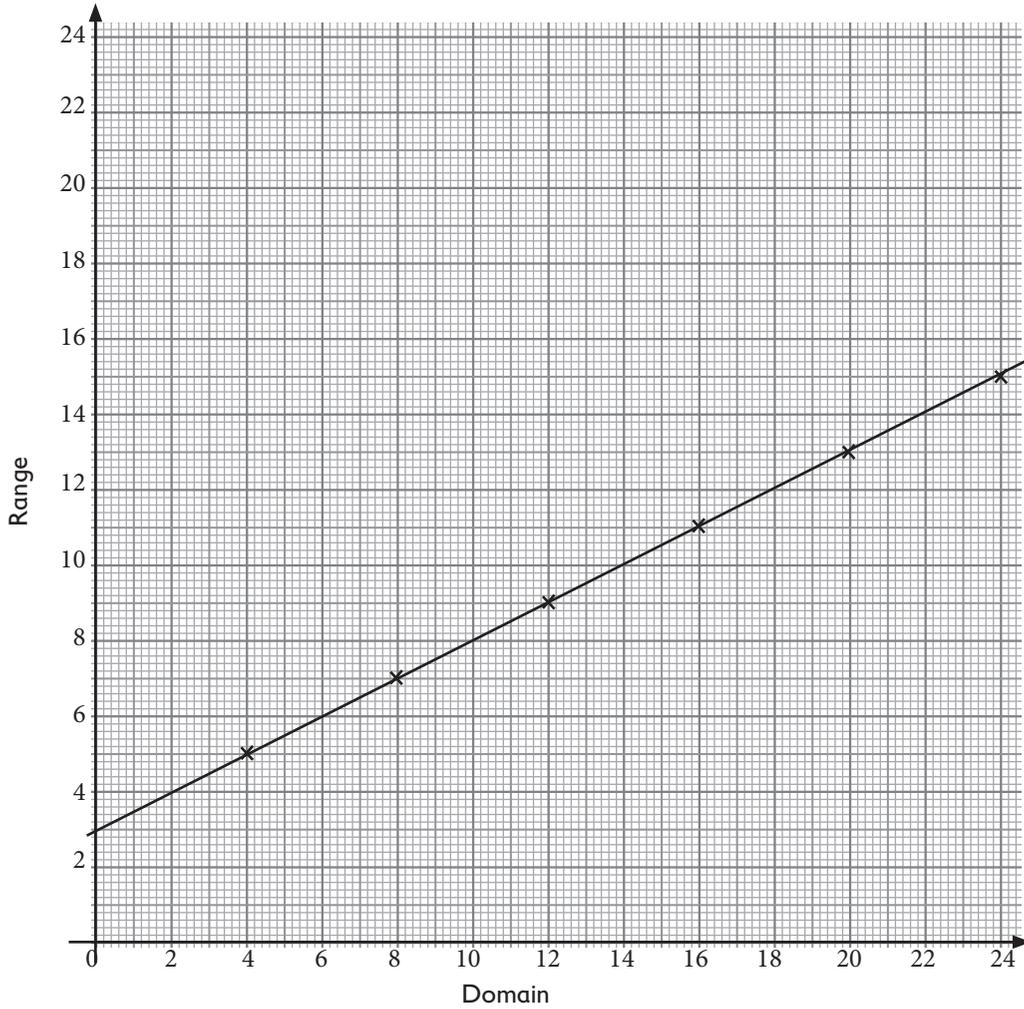
9. (a) 31   (b) 7   (c) 199

10. (a) $f^{-1}(x) = x - 3$

(b) $f^{-1}(x) = \dfrac{-1}{3} \pm \sqrt{\dfrac{3x + 4}{9}}$

(c) $f^{-1}(x) = \sqrt{\dfrac{x - 1}{2}}$

(c) $f^{-1}(x) = \dfrac{x + 5}{6}$

11. (a) $fg(x) = 10x - 10$

(b) $gf(x) = 10x - 2$

Algebra

SETS OF NUMBERS

Student's Book pages 37 - 63 (36 Lessons)

Key unit competence

By the end of this unit, learners should be able to use operations to explore properties of sets of numbers and their relations.

Learning objectives

Knowledge and understanding
- Identify sets of numbers (natural, integer, rational and real) and know the relationships between them.
- Illustrate different set of numbers on a number line.
- Show that irrational numbers cannot be expressed exactly as a decimal.

Skills
- Carry out mathematical operations on sets of numbers.
- Work systematically to determine the operation properties of sets of numbers.
- Determine the hierarchy of sets of numbers and explain its relationship with operations.

- Convert between decimal and fraction representations of rational numbers.

Attitudes and values
- Appreciate that rational numbers can be represented exactly as a fraction or a decimal which may terminate or recur.
- Appreciate that the number line is incomplete without the irrationals which cannot be written exactly as a decimal.

Generic competences addressed in this unit
- Critical thinking
- Problem solving
- Communication skills
- Research skills
- Creativity & innovation

- Co-operation, interpersonal management and life skills
- Lifelong skills

Links to other subjects

- It is linked with biology, English, Computer Science, Physics, Finance, Geography, Chemistry, Economics, Accounting, Construction, etc.

Cross cutting issues addressed in this unit

- Genocide studies
- HIV/AIDS awareness

Assessment criteria

- Use operations to explore properties of sets of numbers and their relationships.

Background information

Sets of numbers form an important part of mathematics. The purpose of sets is to house a collection of related objects. They are important everywhere in mathematics because every field of mathematics uses or refers to sets in some way. They are important for building more complex mathematical structure.

We use sets of numbers when counting objects. They find their applications in everyday life. If you don't count, you don't count!!

Every branch of mathematics is based on sets of numbers where we deal with integers,

Because of its very general or abstract nature, set theory has many applications in other branches of mathematics. In the branch called analysis, of which differential and integral calculus are important parts, an understanding of limit points and what is meant by the continuity of a function are based on set theory. The algebraic treatment of set operations leads to Boolean algebra, in which the operations of intersection, union, and difference are interpreted as corresponding to the logical operations "and," "or," and "not," respectively. Boolean algebra in turn is used extensively in the design of digital electronic circuitry, such as that found in calculators and personal computers. Set theory provides the basis of topology, the study of sets together with the properties of various collections of subsets.

Suggested teaching/ learning activities

- In groups, add, subtract, multiply, and divide pairs of natural numbers. For which of these operation(s) is the answer always/sometimes/never a natural number.
- Repeat for integers, rational numbers, and real numbers.
- Individually, construct a Venn diagram to illustrate the relationship between two or more sets of numbers.
- In pairs, investigate the decimal representation of rational numbers and determine why the decimal is terminating or recurring.

- Now lead the learners through activity 2.1 given in the Student's book.

Sets of natural numbers

(2 lessons)

By the end of this section the learners should be able to understand what natural numbers are and its elements.

  The learners should also be able to write numbers in words.

Information to the teacher

Learners in primary level were introduced to different counting techniques in mathematics. They were exposed to multiplication, addition, subtraction and division of numbers.

They were also exposed to writing of some numbers in words.

Ask the learners whether they can still recall.

Materials: Reference materials including books, Manila paper, and calculators.

Preparation

A day before this lesson, ask all the students to come with calculators to assist them in multiplications, addition, subtraction, division.

Teaching guidelines 2.1

- Organize the class into pairs. Prompt them to realise that one of the two must work as the secretary to record the findings.

- Ask the pairs to do Activity 2.2 given in the Student's book i.e. to write the given numbers in words.

- Let the pairs present their findings in a class discussion through their secretaries, and allow other members of the class to point out omissions or errors in the facts presented.

- Summarise their presentation by helping the learners to understand the meaning of natural numbers. Let the learners understand more about place values.

- Lead the learners through the discussion given in learner's book.

- Guide them through Examples 2.1 and 2.2 in student's book.

- This activity will promote in the learner:

- Leadership and organization skills.

- Communication skills among other competences.

Subset of natural numbers

(4 lessons)

By the end of this section, the learner should be able to understand all different subsets of natural numbers. These include, square numbers, prime numbers, odd numbers, even numbers, to mention but a few.

Learners should also learn how to obtain square roots, greatest common factors.

Information to the teacher

Learners have learnt about the natural numbers and can list them.

Materials: Reference textbooks, calculators

Preparation

Ask learners to ensure they carry along their scientific calculators.

Ensure that all the learners have access to the learner's book.

Teaching guidelines 2.2

- Organize the learners into groups of three to do activity 2.3 given in the student book i.e. to find subset of even, odd and prime numbers.

- Each group should have a secretary to record their findings.

- Ask the secretaries to present their findings and let the whole class participate in elimination of any error arising.

- Guide the whole class about different subsets of natural numbers.

- Guide the learners through Examples 2.3 and 2.4 given in student's book.

- Ask the learners to do question 1 to 4 of exercise 2.1 given in the student's book.

- By checking their work, give more guidance to slow learners while quick learners can proceed with their exercises.

This unit will promote Leadership skills and communication skills among other competences.

Operations on natural numbers

(3 lessons)

By the end of this section, learners should be able to master all mathematical operations of addition, subtraction, multiplication and division.

Information to teacher

Before working on operations, remind the learners how they were exposed to addition, multiplication, subtraction and division in their primary level. Also, remind the learners of the daily activities where operations on natural numbers occur. This will make it easy for them to understand this section fully.

Materials: Reference materials including books and calculators.

Preparation

A day before this lesson, remind the learners to bring along with them their electronic calculators.

Teaching guidelines 2.3

- Organise the learners in pairs to do Activities 2.4 to 2.7 in the Student's book i.e. to do different operations on the numbers provided in the activity.

- Ensure that every learner has a partner and that both partners are active and know what they are looking for. When the activity is done, listen as different learners report their findings.

- Verify their findings and conclusions; emphasize the key points and correct possible erroneous conclusions, guided by the discussion and the definitions given on the student's book.

- Help the learners by doing examples 2.5, 2.6, 2.7 and 2.8 in student's book.

- Ask the learners to do first 4 questions of exercise 2.2. Identify quick learners and slow learners.

- As quick learners proceed with the rest of the exercise and later slow learners. The slow learners should be helped to understand more on the concepts.

- Activities 2.4 to 2.7 promotes communication and leadership skills. It also promotes self-confidence among the learners in other competences.

The set and subsets of integers (z)

(5 lessons)

By the end of this section, the learner should be able to understand all integers and how they can work upon in their applications.

Materials: Reference textbooks, calculators

Information to the teacher
Make learners to understand that in primary, they were introduced to negative and positive numbers. This can assist them in understanding integers quickly.

Preparation
A day before this section, learners should be instructed to carry along their electronic calculators.

Teaching guidelines 2.4
- Organize the learners into groups of three to do activity 2.8 given in the student book. Guide them through Activity 2.9 i.e using number lines to perform given operation.

- Each group should have a secretary to record their findings.

- Ask the secretaries to present their findings and let the whole class participate in elimination of any error arising.

- Guide them through examples 2.9. Ask them to do Activity 2.10 given in student's book. Guide them through example 2.10. Let learners do Excercise 2.3.

Operations on Integers

(4 lessons)

By the end of this section learners should be able to add, subtract, multiply and divide integers.

Teaching guidelines 2.5
- Organize learners into groups of two to do Activity 2.11 i.e additional of integers.

- Guide the whole class by using more examples 2.11, 2.12, 2.13 and 2.14 given in student's book.

- Ask the learners to do questions of exercise 2.4 given in the student's

book. By checking their work, give more guidance to slow learners.

- Proceed to other operations like subtraction, multiplication and division of integers using number lines where necessary.
- Guide them through Activities and examples given on each of them.
- Let the learners do exercises 2.5, 2.6 and 2.7 in the students book. Check their workings and help slow learners to catch up by offering more explanation while quick learners can do complicated questions like number 2 of the exercise 2.5.

This section will promote Leadership skills and communication skills among other competences.

Fractional numbers (Rational numbers)

(7 lessons)

By the end of this section, the learner should be able to understand all rational numbers and their properties and how they can worked upon in their operations like addition, subtraction, division, multiplication, converting rational numbers to decimals, converting decimals to rational numbers, and difference between recurring and non-recurring decimals.

Materials: Reference textbooks, calculators

Information to the teacher

Make learners to understand that in primary, they were to fractions especially in addition, multiplications, subtractions and division. This can assist them in understanding rational numbers quickly.

Preparation

A day before this section, learners should be instructed to carry along their electronic calculators.

Teaching guidelines 2.6

- Organize the learners into pairs to do activity 2.15 given in the student book i.e. learners should be able to state the fractions.
- Each learner should have a partner and they should all be active where one of them should work as the secretary to record their findings.
- Ask the secretaries to present their findings and let the whole class participate in elimination of any error arising.
- Guide the whole class by using more explanation and making the students getting the meaning of rational numbers.
- Guide the learners through Activity 2.16 i.e additional and subtraction of fractions. Lead them through Examples 2.22 and 2.23.
- Proceed to Activity 2.17 i.e multiplication and division of fractions.
- Guide them through Examples 2.24 to 2.27 given in student's book.
- Using the same groups, ask learners to do Activity 2.18 in student's book i.e. mixed operations on fractions.
- Guide them through example 2.28.
- Let the learners do question 1 and 2 of exercise 2.8 in student's book page 52.

- Use the opportunity to check their work. Identify the quick learners and slow learners in the process. Help slow learners by giving them explanation, let quick learners do question 3 of the same exercise which looks somehow complicated.

- Take the learners through Activity 2.19 and the discussing thereafter on Irrational numbers before proceeding to decimals.

Decimals

(4 lessons)

By the end of this section, the learners should be able to convert fractions into decimals and the operation of decimals.

Materials: Reference books, calculators.

Informations to the teacher.

Learners have interacted with decimal numbers in primary. Start with the basics on decimals to introduce the lesson.

Preparations

A day before the lesson, learners should be instructed to carry along their elctronic calculators.

Teaching guidelines 2.7

- In pairs, assign learners to do Activity 2.20 in the student's book.

- Guide them through the activity to enable them understand decimal fraction, decimal point and mixed decimals.

- Let them proceed to Activity 2.21.

- Guide them through example 2.29.

- Ask the learners to do question 1 of Excercise 2.9. Use this quetion to identify the challeges the

learner have while carrying out decimal operation and guide them appropriately.

- Let them proceed with other questions of excercise 2.9.

- Guide the learners through a discussion of Activities 2.22 to 2.25 and Examples 2.30 to 2.35 given in the student's book.

- Ask them to do Excercises 2.10, 2.11, 2.12, and 2.13. Mark learner's work and guide them appropriately to understand the operation of decimals.

The set of real numbers

(2 lessons)

By the end of this section, the learner should be able to understand all irrational numbers and their properties and how they can worked upon in their operations like addition, subtraction, division, multiplication.

Materials: Reference textbooks, calculators

Information to the teacher

Make learners to understand that in primary, they were to exposed to finding square roots of direct numbers like 4, 9, 16 etc. But the learners cannot estimate the square root of a number like 12.

Preparation

A day before this section, learners should be instructed to carry along their electronic calculators.

Teaching guidelines 2.8

- Organize the learners into groups of 3 to do activity 2.26 given in the student's book i.e. learners should be able to state the results in 3 decimal places. They should use their calculators.

- Each group should have a secretary to record the results and they should all be active.

- Ask the secretaries to present their findings and let the whole class participate in elimination of any error arising.

- Guide the whole class by using more explanation and making the students getting the meaning of irrational numbers.

- Use the opportunity to explain that irrational numbers have no direct roots and cannot be expressed as fractions.

- Use the opportunity to explain how the square root of a number like 12 can be estimated.

- Guide them through Example 2.36.

- Ask learners to do Excercise 2.14 given in student's book.

- Lead learners through unit summary and let them do all questions in the Unit Test 2.

This section will promote Leadership skills and communication skills among other competences.

Answers

Exercise 2.1 (Pages 40 - 41)

1. a) Two hundred and thirty four.

   b) Sixty eight thousand nine hundred and one.

   c) Forty one millions three hundred and forty three thousand, two hundred and nine.

   d) Eight thousand six hundred and thirty one.

   e) Three billions ninety five millions five hundred and forty two thousand one hundred and twenty.

   f) Two millions thirty one thousand four hundred and one.

2. a) 821   b) 65 532

   c) 92 854   d) 5 053 000

   e) 1 037 000 402

   f) 240, 004

3. a) {2, 4, 6, 8, 10,… 50}

   b) {1, 3, 5, 7, 9, ... 49}

   c) {2, 3, 5, 7, 11,… 49}

4. a) {4, 8, 16}

   b) {1, 11, 25, 49, 53, 75}

   c) {11, 53}
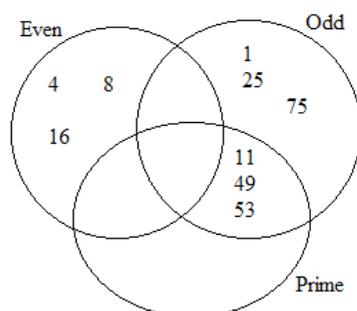
Exercise 2.2 (Pages 43-44)

1. a) 1 000   b) 158   c) 125
   d) 21 733   e) 13 940

2) a) 231   b) 60 600
   c) 3 031   d) 2972

3) a) 586 – 234=252.
   b) 1 554 – 289=1 265
   c) 4 456 – 3 587 = 869
   d) 85 457– 6 382 = 79 075

4. a) 24 000   b) 10 500
   c) 25 600   d) 165 968

5. a) 161   b) 117   c) 78   d) 864

6. a) 68.667   (3 decimal places)
   b) 31.968   (3 decimal places)
   c) 1 414   d) 68 496

7. 59, 250 kg

8. 85 140 students

9. 46

10. 106 boards, 1 246 m

Exercise 2.3 (Page 46)

1.

2.

a)

b)
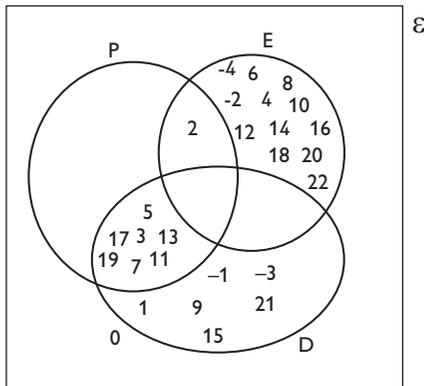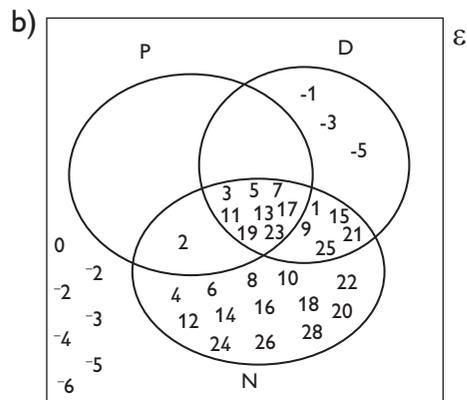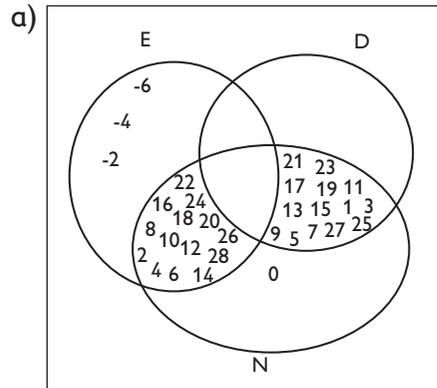
3. a) i) {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}

   ii) {-4, -2, 2, 4, 6, 8, 10, 12, 14}

   iii) {1, 2, 3, 5, 7, 11, 13}

   b) {-3, -1, 0, 1, 2, 3, 4, 5 , 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}

Exercise 2.4 (Page 47)

1.   -9

2.   +4

3.   0

4.   +3

5.   +1

6.   +10

7.   -9
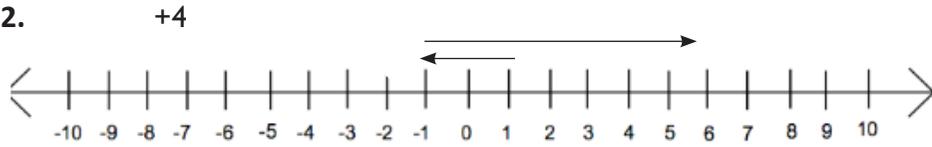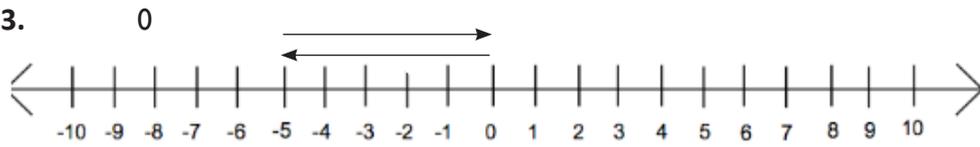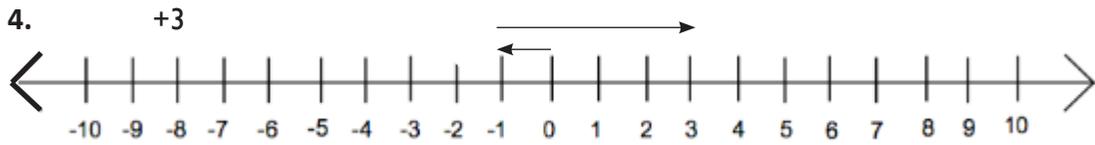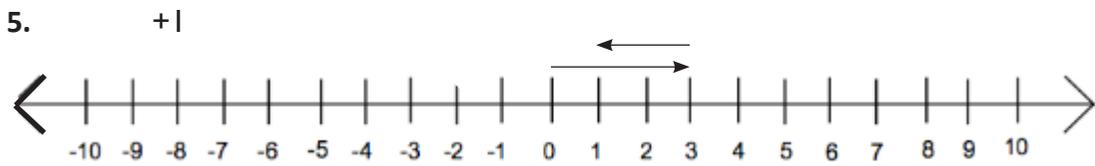
8. +5

9. -9
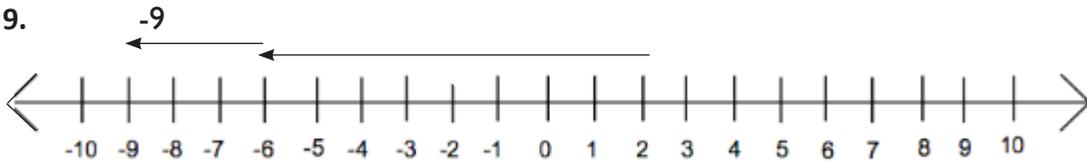
Exercise 2.5 (Page 48)

1. a) -1   b) -10   c) 2
   d) 1   e) 11   f) 2
   g) 4   h) 4   i) 8
   j) -18   k) -13

2. a) 21°C   b) -5°C   c) -20°C
   d) – 4°C   e) 21°C

Exercise 2.6 (Page 48)

1. -10   2. 100
3. -60   4. 30
5. -36   6. 30
7. -64   8. 30
9. 36   10. -100

Exercise 2.7 (Page 49)

1. a) 4   b) -5   c) -6.33…
   d) 8   e) -4   f) 10

2. a) 50   b) -60

Exercise 2.8 (Page 52)

1. a) $\dfrac{7}{12}$ b) $\dfrac{3}{5}$ c) $\dfrac{77}{45}$

   d) $\dfrac{29}{6}$ e) $\dfrac{163}{35}$

2. a) $\dfrac{1}{12}$ b) $\dfrac{11}{20}$ c) $\dfrac{17}{24}$

   d) $\dfrac{19}{20}$ e) $\dfrac{71}{24}$

3. a) $\dfrac{3}{8}$ b) $\dfrac{2}{9}$ c) 2

   d) $\dfrac{5}{8}$ e) $\dfrac{5}{4}$ f) 20

4. a) 3   b) $\dfrac{280}{27}$ c) 24

   d) $\dfrac{4}{3}$ e) $\dfrac{7}{3}$

5. a) $\dfrac{7}{3}$ b) $\dfrac{37}{16}$ c) $\dfrac{4}{5}$

   d) $\dfrac{125}{22}$ e) $\dfrac{9}{20}$

Exercise 2.9 (Page 55)

1. a) 9.3   b) 8.3   c) 9.97
   d) 205.439   e) 156.461   f) 1.74427

2. a) 6   b)4.3   c) 6.85
   d) -0.65   e) 1.939   f) 2.263

3. a) 1.77   b) 78.12   c) 7.51
   d) 361.3   e) 1.255
   f) 17.18

4. 4.75

5. 148.5

6. 318.14 m

Exercise 2.10 (Page 56)

1. a) 1.05   b) 216.63
   c) 172.8   d) 0.6816
   e) 0.19065   f) 0.00008
2. a) 0.0851   b) 0.0851   c) 0.851
3. a) 0.3   b) 60   c) 598.3
4. 73.5 cm^2
5. 8.96 Ohms

Exercise 2.11 (Page 57)

1. a) 0.13   b) 0.00294
   c) 0.003675   d) 3.9
   e) 0.009   f) 5.9
2. a) 0.00681   b) 0.0002   c) 1.187
3. 95 books
4. 30 minutes
5. 0.75 cm

Exercise 2.12 (Page 58)

1. a) 25.35   b) 0.2
   c) 6.48   d) -0.892
   d) 0.89504   f) 5
2. 0.267
3. 154 pieces
4. 39 cans, 99.92 litres
5. 11cm, 2.75 cm

Exercise 2.13 (Page 60)

1. a) 0.375   b) 0.889   c)0.143
   d) 0.4444   e) 0.583   f) 1.429
   g) 1.25   h)1.3

2. a) $\dfrac{1}{5}$ b) $\dfrac{31}{50}$ c) $\dfrac{3}{250}$

   d) $\dfrac{1}{1000}$ e) $\dfrac{7}{5}$ f) $\dfrac{6}{5}$

3. a) $\dfrac{5}{9}$ b) $\dfrac{72}{99}$ c) $\dfrac{13}{99}$

   d) $\dfrac{717}{999}$ e) $\dfrac{12}{99}$ f) $\dfrac{486}{999}$

   g) $\dfrac{8088}{9999}$ h) $\dfrac{112}{99}$

Exercise 2.14 (Page 61)

1. a) 2.44   b) 2.828   c) 2.44   d) 3.162   e) 5.099   f) 8.544   g) 10.149
2. a)
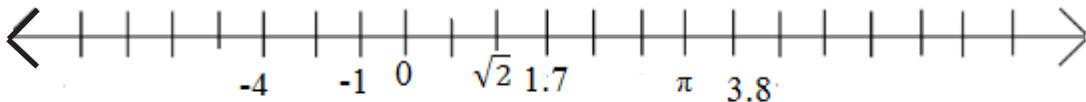
   b)
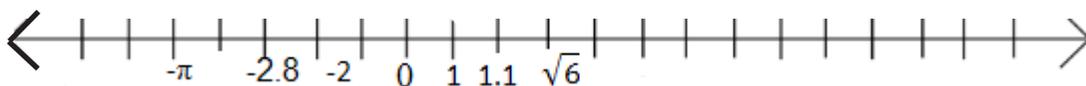
3. a) 1.03527
    b) 3.146264
    c) 0.317837
    d) 3.863703
    e) 0.717439

4.
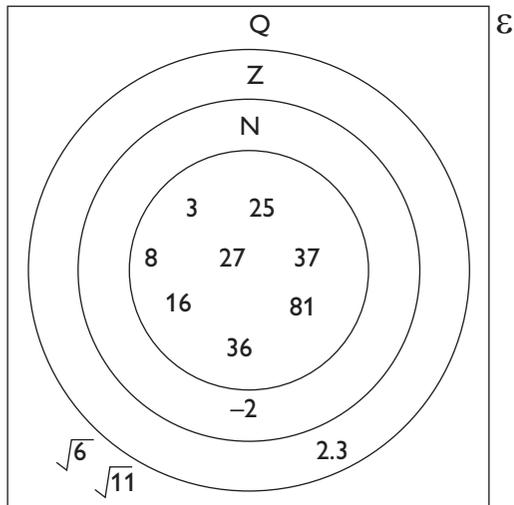
Z= {-2, 3, 8, 16, 25, 27, 36, 37, 81...}
N= {3, 8, 16, 25, 27, 36, 37, 81...}
Q= {2.3...,}

Unit Test 2 (Page 63)

1. P = {2, 5, 7, 11, 13, 17, 19, 23, 29}

2. (a) +2
    (b) −7

3. (a)
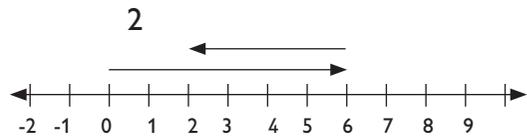
(b)

(c)
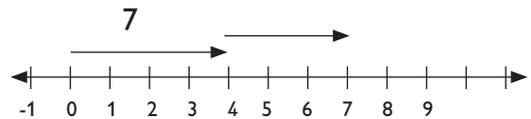
4. (a) $\dfrac{ab}{c}$ (b) −6y   (c) −6

5. (a) 65   (b) $\dfrac{27}{6}$ (c) −32

    (d) 9

6. (a) $\dfrac{83}{30}$ (b) $\dfrac{167}{72}$

    (c) 901.075   (d) −63.549

    (e) −12416.59

Algebra

LINEAR FUNCTIONS, EQUATIONS AND INEQUALITIES

Student's Book pages 64 - 104. (36 Lessons)

Key unit competence

By the end of this unit, the learner should be able to represent and interpret graphs of linear functions and apply them in real life situations. Solve linear equations and inequalities, appreciate the importance of checking their solution, and represent the solution.

Learning objectives

Knowledge and understanding

- Define a linear function and recognize its graph.
- Illustrate that the linear function is written in the form.

  $y = mx + c$, c is the y-intercept, m is a measure of steepness and the solution of the equation.

  $0 = mx + c$, is the x-intercept

- Explain what is meant by the solution of a linear equation and inequality.

Skills

- Plot linear functions on the Cartesian plane.
- Interpret the graph of a linear function linking the parameters of the function with the features of the graph, including intercepts and steepness.

- Solve linear equations representing the solution graphically.
- Solve linear inequalities in one unknown representing the solution on a number line.
- Check solutions to equations and inequalities by substituting into one side of the original equation.
- Use linear functions, equations and inequalities to model situations and solve problems.

Attitudes and values

Appreciate the importance of checking the solution when solving an equation or inequality and represent on a graph (equation only) and number line

Generic competences addressed in this unit

The following are basic competences addressed in this unit.

- Critical thinking
- Problem solving
- Communication skills
- Research skills
- Cooperation, interpersonal relationship
- Creativity and innovation.

Links to other subjects

- Linear functions, equations and inequalities arise in science and economics.

Cross cutting issues addressed in this unit

- Inclusive education
- Financial education
- Environment and sustainability

Assessment criteria

- Can represent and interpret graphs of linear functions and apply them in real life situations. Solve linear equations and inequalities appreciate the importance of checking their solution, and represent the solution.

Background information

Algebra is the branch of Mathematics that uses symbols including letters to represent unknown quantities. In classical algebra, symbols such as x and y represent ordinary numbers and the central part of the subject is the study of algebraic equations. Algebra obeys commutative and associative laws that hold in arithmetic. It is not a highly practical subject but is useful in geometry especially when proving various things about geometrical figures.

Suggested teaching/learning activities

Linear functions

(1 lesson)

By the end of this section, the learner should be able to;

- Define linear function comprehensively.
- Give examples of linear function.

Information to the teacher

This is a new topic to the learners. They are not familiar with the Cartesian plane and therefore cannot represent linear functions graphically. So start them off with a review of points on the number line.

Materials

Mathematics and English dictionaries, electronic equipment to access internet.

Preparation

Ensure that the required materials are available.

Teaching guidelines 3.3

- Organize the class to work in pairs. Ask the groups to do activity 3.1 in the student's book i.e. to research and discuss the meaning of linear functions.

- Let the groups present their findings comparing with other groups findings.
- Summarize their presentations and help them draw conclusions. Verify the learners' findings.
- Explain to them that representing linear functions graphically will come later when they have learned about the Cartesian plane and coordinates.

The number line

(1 lesson)

By the end of this section, the learner should be able to;

- Graph numbers on a number line
- interpret a number line

Information to the teacher

The learners are already with number line from primary school, thus activity 3.2 in the student's book is meant to help the learners recall the basic facts.

Teaching guidelines 3.2

- Prepare the learners to do activity 3.2 in pairs.
- Ask the learners to do the activity 3.2 as you move around supervising their work, and helping those who may need help.
- Allow presentations and thereafter explain the concepts with the help of examples provided.
- Involve them in a formative assessment.

Position of a point on a plane surface

(2 lessons)

By the end of this section, the learners should be able to;

- Distinguish between a row and a column.
- Appreciate the importance of order in describing a specific point.
- Appreciate the need for reference point and direction.

Information to the teacher

Let this activity 3.3 be a class discussion lead by you.

Materials

A measuring tape

Teaching guidelines 3.3

- Prepare your class for a discussion based on the plan desks in the student's book.
- Guide the learners through the questions based on fig. 3.2 up to the point where the shaded desk described fully as being in position (4,5).
- Ensure that the learners distinguish between rows and columns in fig. 3.2; emphasize the importance of reference point and direction.
- Summarize the discussion by listing down the conclusions.
- Ask the learners to describe their own desks with reference to an agreed wall. This discussion provides

a good introduction to the Cartesian plane and coordinates.

- Summarize the activity on the board and have the learners do the same in their books.

Drawing and labelling axes

(2 lessons)

By the end of this section, learners should be able to;

- Draw a pair of number lines intersecting at 0.
- Draw other vertical and horizontal lines on the same graph.
- Describe vertical and horizontal lines with reference to the two number lines and the reference point 0.

Information to the teacher
The text under vertical and horizontal lines in the student's book is ideal for a class discussion. I suggest you discuss it with the whole class.

Materials
- Graph or square papers
- Colored chalk
- Square board
- Measuring tape

Teaching guidelines 3.4
- Prepare the class for a group discussion involving the whole class.
- Copy fig. 3.4 on the board including point D. Ask the learners to do the same in their graph books.

- With reference to fig. 3.4 on the board guide the class through the explanation under the subheading "drawing and labeling axes without making reference to x and y. Just call them vertical and horizontal axes or number lines.
- Emphasize the importance of order and direction when locating a point i.e. the horizontal distance corners first followed by the vertical.
- You may identify some desks in the class and locate them in fig. 3.4. Remember to use the correct distances and the scale.
- The discussion should include the interpretation of the number line in fig. 3.5 in the Student's book.
- In fig. 3.5 the vertical and horizontal number lines extend to both positive and negative directions on the chalk board, copy fig. 3.5 and ask your learners to do the same. The Exercise of describing the lines l_1, to l_9 with reference to the axes, should be done by the students individually.
- Ask the learners to do Activity 3.4 in student's book.
- As the class works, move round checking to ensure that they are doing the correct thing.
- Summarize the activity by verifying their findings.
- Decide on a method to verify that their responses to all the questions are correct.

- Guide them through the activity and let them do Exercise 3.1.
- After this activity, the class should be ready to proceed to Cartesian plane and coordinates.

The Cartesian plane

(2 lessons)

By the end of this section, the learners should be able to;

- Identify the vertical and horizontal axes as the x and y axes.
- Plot points on a Cartesian plane.
- Read coordinates of points on the Cartesian plane.

Materials
Squared chalkboard

Graph paper/books

Teaching guidelines 3.5
- Organize the learners into pairs to do activity 3.5 in the Student's book.
- Ask the groups to do the activity.
- Ensure that the groups have an appropriate pair of axes and that they measure correct distances from the axes and are using a correct scale.
- When done, let the learners present their findings by explaining the procedure they used to arrive at their conclusion.
- Summarize their activity demonstrating a few correct positions. Ensure that the concept is mastered and well understood.

- Ask the learners to read and state the coordinates of the points marked on the graph in fig.3.8 and guide the learners through the highlights just before Exercise 3.2.
- Ask learners to do questions 1 and 2 Exercise 3.2 as you move round the room verifying the working. Let those who are through with questions 1 and 2 continue to questions 3-5 of same Exercise. If they do not complete the work, let them do it as part of homework.

Plotting points

By the end of this section, the learner should be able to;

- Choose an appropriate scale.
- Plot a given set of points.
- Use a given scale to plot points.

Materials
Squared chalk board

Graph books or papers

Teaching guidelines 3.6
- Organize the learners in pairs to do activity 3.7 in the student's book.
- Briefly guide them on the choice and use of good scale.
- Ask the learners to do activity 3.7. As the activity continues, move round checking on the choice of scale and the procedure of plotting, ensuring that the points they choose to plot are assorted i.e. both positive and negative, and mixed.

- When done comment on learners' performance according to your observation as they were working.
- Take the class through examples 3.1 and 3.2.
- Ask them to do question 1 of Exercise 3.3 as move round the class checking that the work is going on well and if need be helping those may experience challenge.
- If satisfied let them move on to questions 2-5 of same Exercise. The fast quick learners may continue working on other questions.

Linear graphs

(2 lessons)

By the end of this section, the learner should be able to;

- Identify and draw graphs of linear functions of the form y=k, x=c where c and k are constants.
- Identify and draw graphs of linear functions of the form y=mx+c.
- Make table of values of linear functions in two variables and distinguish between dependent and independent variables.
- Interpret linear graphs.

Information to the teacher

Discuss the introduction to linear graphs as discussed in the student's book before asking them to work on activity 3.8 in the student's book.

Materials

Graph/paper/book.

Squared chalkboard, colored chalk.

Teaching guidelines 3.7

- Organize the class in pairs to do activity 3.8 in the student's book.
- Tell them to first do the activity individually and then discuss with them the results.
- Move round the class as they work, verifying that they are working well and that their results are correct.
- Using the function y=2x+3, ask the learners to find the values of y for x: $0 \leq x \leq 6$ and tabulate the results as in Table 3.1.
- Write the corresponding values of x and y in the coordinate form and plot them on the Cartesian plane.
- At the end of the activity, summarize their results emphasizing the need for table of values.
- Ask them individually to do activity 3.9 in the student's book to familiarize themselves with the terms variable, dependent and independent variables. Briefly discuss the result as summarized in the student's book after the activity.
- Now ask the learners to do Exercise 3.4 individually.

The y and x-intercept

(2 lessons)

By the end of this section, the learners should be able to;

- Identify and distinguish between the x and the y intercepts in a graph.
- State the coordinates of the intercepts.
- Rearrange a linear function in the form y = mx +c and x = my +k and use them to find the x and y intercepts.

Materials

A squared chalkboard,colored chalk.

Graph or squared /graph book

Teaching guidelines 3.8

- Organize the class to do activity 3.10 in the student's book.
- Ask the learners to do the activity individually i.e. make tables of values, write down the coordinates, choose an appropriate scale and draw the graphs.
- Verify, see accuracy as the learners work and help where necessary.
- Let them discuss their results and present to the class. Encourage the learners to demonstrate their work on the board so that others can visualize their argument.
- Summarize their results and conclusions as discussed in the student's book that follow the activity.
- Now ask the class to pair up and do activity 3.11 in the student's book.
- Let the learners fill table 3.4 as homework to consolidate what they have learned.
- Ask them to do Exercise 3.5.

The gradient of a straight line

(2 lessons)

By the end of this section, the learners should be able to:

- Define gradient of a straight line.
- Determine gradient using any two points on a line.

Materials

- Graph papers/books.
- Squared chalkboard.

Teaching guidelines 3.9

- Organize the class to work through activity 3.12 to determine gradient of a line.
- Ask the groups to do activity 3.12 in the student's book.
- When done let the groups present their findings in a class discussion.
- Encourage the groups to demonstrate their findings on the board, allowing others contribute in case of errors or omissions.
- Summarize their presentations by helping the learners to understand the accurate definition of gradient, explaining the difference between positive and negative gradients.
- Now, allow the learners to do activity 3.13 individually as a follow up of activity 3.14. Take them through Example 3.4. Ask the learners to do question 1 of exercise 3.6 in the student's book. As they work you go round verifying their findings and

helping those who need help. When satisfied let them go on to questions 2-5.

Gradient and y-intercept

(2 lessons)

By the end of this section, the learners should be able to;

- To express any linear equation in two variables x and y in the form y = mx +c.
- Identify the gradient and the y intercept of such as line.
- Express a linear equation in the form x = ky+c to determine the x intercept.

Teaching guidelines 3.10

- Organize the learners to work in pairs to do activity 3.15 in the student's book.
- Move round the class as the students work, checking and verifying that they understand what they are doing.
- Summarize the class findings and conclusions as in the student's book immediately after the activity 3.15.
- Take the learners through Example 3.5.
- Let them do activity 3.16.
- Now take the class through example 3.6 in the student's book. Ask the learners to do Exercise 3.7.

Linear Equations

(2 lessons)

By the end of this section, the learners should be able to;

- Find gradient of a horizontal line.
- Explain why the gradient of a vertical line is undefined.

Information to the teacher
Ensure that the learners recall the properties of zero in the basic arithmetic operations.

Materials
Graphs papers/books

Teaching guidelines 3.11

- Guide the learners through a discussion given in the Student's book.
- Ask them to do Exercise 3.8 in the student's book. Mark student's work and guide them appropriately.

Solving linear Equations

(1 lesson)

By the end of this section, the learners should be able to;

- Distinguish between an equation and an expression.
- Distinguish between a conditional equation and an identity.

Information to the teacher
Explain to the learners the meaning of equivalent equations and the meaning of solution.

Teaching guidelines 3.12

- Organize the class to work in groups of two to do activity 3.17 to determine equivalent equations and solution set of an equation.

- Ask the groups to do the activity 3.17, in the students book.

- When the activity is over, let the groups do presentations in class discussion.

- Ensure that all participate actively.

- Summarize their presentations as you verify the accuracy of their work and emphasizing the basic rules as in the student's book.

- Lead the learners through a discussion on their findings and the one given in student's book.

- Ask them to do excercise 3.8 given in student's book.

- Take the class through Examples 3.7 and 3.8. Ask them to do Exercise 3.9 in the student's book.

Solving equations by balancing method

(2 lessons)

By the end of this section, the learners should be able to solve linear equations by balancing method.

Materials

Quantities that have different masses i.e. 1 kg, ½ kg, 2 kg etc

At least a pair of weighing scales, computers, Mathematics/English dictionaries.

Preparations

If the school does not have weighing scales for small quantities, you borrow one from a shop nearest to your school.

Teaching guidelines 3.13

- Organize the class into groups to do activity 3.18 in the student's book to find the meaning of balancing method of solving linear equations.

- Ask the students to do the activity.

- When the activity is done, ask the groups to present their finding in class discussion. Listen to their presentation as you verify their findings and guide them in describing the method.

- Guide the class through Examples 3.9 and 3.10 and 3.11.

- Ask students to do Exercise 3.10 question 1. When you are satisfied with the working on the accuracy let them continue to questions 2-4 of the same Exercise. Those who work faster may continue to question 5.

Linear equations involving fractions

(2 lessons)

By the end of this section, the learners should be able to;

- Find the L.C.M of a set of numbers.

- Use of LCM to remove the denominators of fractions in a given equation.

- Solve linear equations involving fractions.

Teaching guidelines 3.14

- Organize the class into pairs to do activity 3.19 to find LCM of a given set of number.
- Ask the groups to do the activity in the student's book.
- At the end of the activity, ask the groups to present their finding in class discussion through the group secretary.
- Listen to their presentation in order to help those who need help and to verify the accuracy of their findings.
- Take the class through example 3.12 and then ask them to do question 1 Exercise 3.11 as you move round checking the method and accuracy of their work. If they are okay, let them continue to questions 2-4.

Equations involving brackets

(2 lessons)

By the end of this section, the learners should be able to;

- Remove brackets and simplify expressions or equations.
- Solve equations involving brackets.
- Insert brackets when necessary.

Information to the teacher

Remind your class the basic truths about multiplication and division of positive and negative numbers.

Teaching guidelines 3.15

- Organize the class to work in groups of two three to do activity 3.20 in the student's book.
- Ask the groups to do activity 3.20 to remove brackets in this activity.
- At the end of the activity, ask the students to present their findings in class discussion through the secretary.
- Allow other members of the class to point out omissions and errors in the facts presented.
- Summarize their presentation by helping the learners to understand the significance of a negative number or sign before a bracket. Discuss the observations following immediately after the activity 3.20.
- Take the learners through Examples 3.13 to 3.15. Ask the learners to do question 1 to 3 of Exercise 3.12. Continue to questions 4 to 10 after questions 1-3. Give the rest of Exercise 3.12 as homework and for practice.

Forming and solving linear equations

(2 lessons)

By the end of this section, the learners should be able to;

- Choose an appropriate letter to represent the unknown quantity.
- Form equations that satisfy given conditions or constraints.

- Solve the equations and answer the question.

Teaching guidelines 3.16

- Organize the class to work in groups to do activity 3.21 in the student's book to form and solve linear equations.
- Ensure that the groups discuss the choice of the variables used and what it represents.
- When done, listen to different groups present their reports, verifying their accuracy. Emphasize the key points and correct possible erroneous conclusions.
- Summarize their presentations comparing them with the argument presented in the student's book.
- Take the class through examples 3.16 to 3.19. Ask the learners to do question 1 to 3 of Exercise 3.13. As you move round the classroom to inspect how they are doing. If satisfied with the work, let the class go on to questions 3 to 7. For fast workers who finishes before time, let them go on to questions 8 to 10.

Inequalities

(1 lesson)

By the end of this section, the learners should be able to;

- Define the word inequalities in words.
- Use inequality symbols accurately.

- Represent simple inequalities on a number line.
- Accurately interpret a given number line.

Information to the teacher

The learners were introduced to simple inequalities in primary level thus treat this section as a reminder to help them recall the basic facts.

Teaching guidelines 3.17

- Work with the whole class as a revision session. Take them through examples 3.20 and 3.21.
- Let the class do Exercise 3.14. You can guide the learners to do this Exercise orally.

Compound statements

(1 lesson)

By the end of this section, the learners should be able to;

- Identify compound statements and convert them into compound inequalities.
- Represent compound inequalities on a number line.
- Combine pairs of simple inequalities into compound inequalities.

Teaching guidelines 3.18

- Organize the class into groups to work on activity 3.22.
- When done, ask the groups to present their findings through their group secretaries.

- Verify their findings and encourage them to demonstrate the activity on the board.
- Guide the learners through example 3.22.
- Ask the learners to do Exercise 3.15 questions 1 and 2. Encourage the learners to ask where they do not understand.

Solution of linear inequality in one unknown

(2 lessons)

By the end of this section, the learners should be able to;

- Understand and apply the basic rules of inequalities.
- Manipulate inequalities in one unknown.

Information to the teacher

The learners may need your assistance to do activity 3.23. Help them to create specific examples illustrate each part of the activity.

Teaching guidelines 3.19

- Organize the learners into groups to do activity 3.23.
- Ask the learners to do the activity to summarize simple rules that hold for inequalities.
- As the learners to continue with the activity. Encourage them to create simple examples to which these rules will apply. For example, if x =4 and y = 2 then x>y = 4>2
- 4xa > 2xa and 4+a > 2+ a

- When the activity is done get the learners to present their findings through groups secretary. Ensure that you listen to their presentation so that you can verify their conclusions help them summarize these rules in a simple manner, preferably on the chalk board.
- Emphasize the rules tabulated in the student's book.
- Using the same groups, ask the learners to do activity 3.24. This activity is quite straight forward.
- Let the learners do their presentations, allowing others to comment on the presentations. Let the presentation be done on the board with understandable examples.
- Take the students through examples 3.23 to 3.26 let the students do questions 1 to 6 of Exercise 3.16 orally, guided by you. When you are satisfied with the performance, let them go on to do questions 7 to 11 of the same Exercise 3.16.

Solving simultaneous inequalities

(2 lessons)

By the end of this section, the learners should be able to;

- Solve the simultaneous inequalities
- Breakdown and solve the resulting inequalities and solve the resulting inequalities simultaneously.
- Represent solutions on a number line.

Teaching guidelines 3.20

- Organize the learners to work in pairs to do activity 3.25 i.e. to solve simultaneous inequalities.
- Ask the learners to work individually first and then work together to discuss their results.
- After the activity, ask the groups to present their findings. As they present their findings, ensure that their conclusions are in line with the argument. Help them summarize and use these results in examples 3.27 and 3.28.
- Pay special attention when guiding the learners through example 3.27 and 3.28 explaining the procedure and the need of splitting the compound inequality.
- Now ask them to do activity 3.17 in the student's book.

Forming and solving inequalities

(2 lessons)

By the end of this section, the learners should be able to;

- Interpret a problem and convert it into an inequality.
- Form and solve inequality form a given problem.
- Solve the problem.

Information to the teacher

Pay attention to the key words that suggest use of inequality and which type of inequality.

Ensure that you are familiar with words such as 'at most', 'at least', 'less than', 'more than' etc.

Teaching guidelines 3.21

- Organize the class to work in pairs to do activity 3.26 in the student's book.
- Ask the groups to work individually upto a point where they get together to discuss their findings.
- Remind the groups that before they present their finding to the class they need to discuss and compare their results.
- Ask the groups to do their presentations. Help them to summarize their findings and allow others to make comments or suggestions as may be necessary.
- Now take them through examples 3.29 to 3.31. Clarify what may not be clear.
- Ask them to do questions 1 and 2 of Exercise 3.18 as you move round verifying their working. When satisfied let them move on to questions 3 to 7 of the same Exercise.

Application of inequalities in real life

(2 lessons)

By the end of this section, the learners should be able to;

- Transform a given problem into an inequality.
- Solve such an inequality.
- State the solution of the given problem.

Information to the teacher

The activity in this section involves a personal experience. The described situation can also be a Mathematical statement.

Teaching guidelines 3.22

- Organize the class to work in pairs to do activity 3.27 in the student's book.

- Ask the groups to do activity 3.27. Since this is an activity based on a personal experience, let them work individually first then each person presents his/her findings to the partner.

- As they do their presentations, listen to their reports and conclusions to ensure that the situation under discussion is Mathematical, and if need be address any misconception. If you can give the class your personal experience or situation, it would give them more confidence to share their own.

- Take the class through examples 3.32 and 3.33. Ask learners to do questions 1 and 2 of Exercise 3.19, move round checking their working. If satisfied with the work, let the class move on to questions 3-6 while you assist those who may be having challenges. Ask the learners to do the rest of the Exercise as homework.

- Take the learners through unit summary and let them answer all questions in unit Test 3.

ANSWERS

Exercise 3.1 (Page 67)

1. C(-2.5), D (4.5), E (0)

2.
C   B   A D
-5 -4   -3 -2 -1   0   1   2   3   4   5

3.
C   D   B   A E
-2   -1   0   1   2
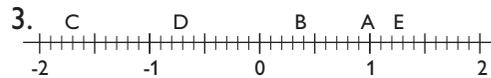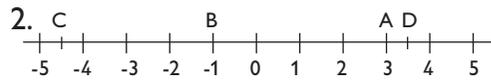
4. P (3, 1)   Q (5, 2)
   S (-1, -2)   T (4, -1)

Exercise 3.2 (Pages 68 - 70)

1. a) A   b) E   c) I
   d) M   e) B   f) F
   g) J   h) N   i) C
   j) G   k) K   l) L
   m) D   n) H   o) L

2. A   (6, 5)   B   (-2, -2)
   C   (-2, 0)   D   (2, 2)
   E   (1, 4)   F   (0, 5)
   G   (-5, 2)   H   (-1, -3)
   I   (2, -1)   J   (1, -2)
   K   (5, -2)

3. a) A (-20, -5)   B (-10, -7.5)
      C (10, 10)
   b) P (10, 5)   Q (15, 5)
      R (5, -7.5)   S (0, -7.5)

4. T (1, -1)   U (1, -2)
   V (4, 0)   W (1, 2)
   X (1, 1)   Y (-2, 1)
   Z (-2, -1)

5. a) (2.2, 5)   b) (2.6, 0.8)
   c) (2.6, 3.6)   d) (7.6, 2.3)
   e) (5, 5.2)   f) (1.8, 4.6)
   g) (3, 2.4)   h) (4.2, 3.4)

Exercise 3.3 (Page 72)

1. D(2, 1.5)

2.
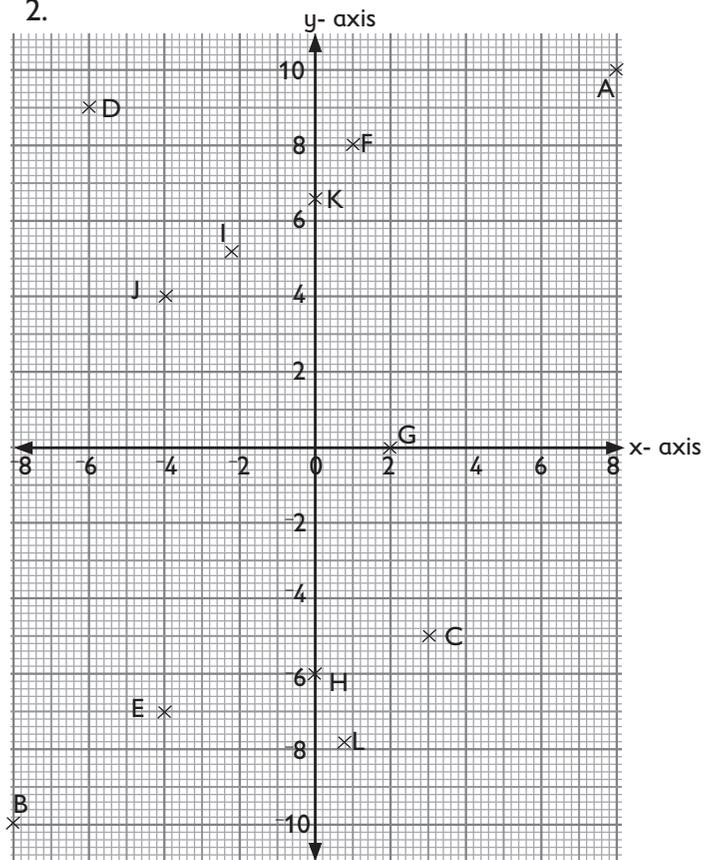
3. 1.875 square units

4.
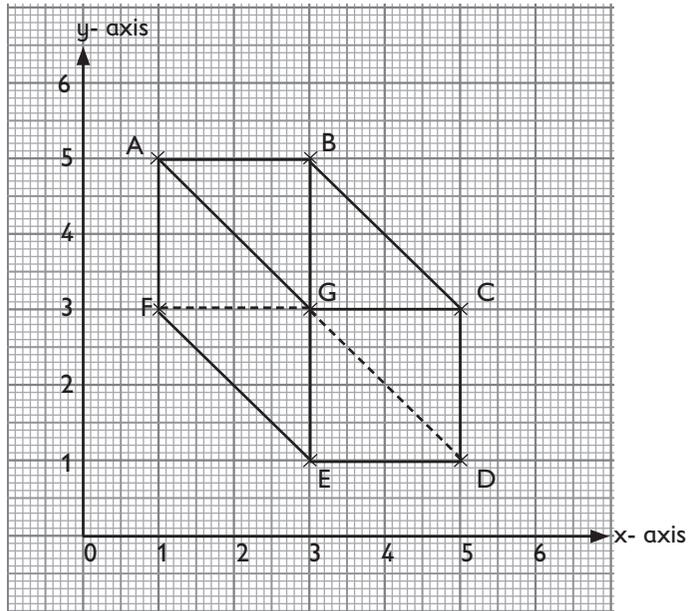
5. a) Straight line (vertical) x = 4

b) Straight horizontal line y = 3

c) Straight line y = x
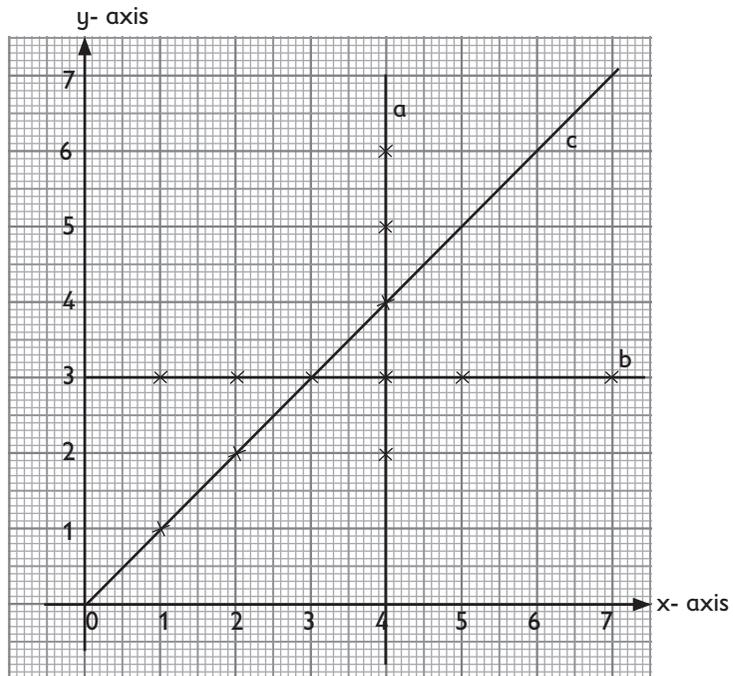
Exercise 3.4 (Page 75)

1.
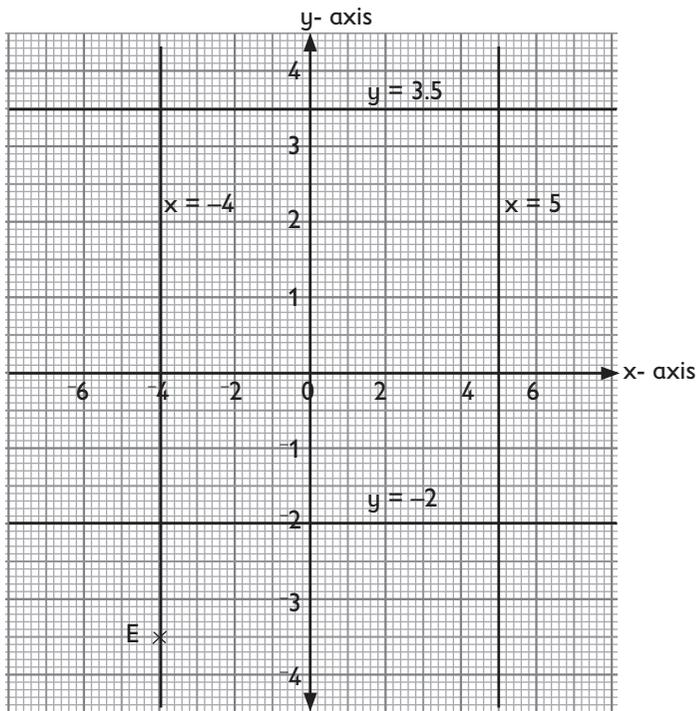
2. Coordinates
   a) $(1, 2)$ and $(2, 3)$
   b) $(1, 4)$ and $(2, 9)$
   c) $(4, 1)$ and $(8, 0)$
   d) $(2, 1)$ and $(2, 3)$

   Coordinates of intersections
   i) $(0.5, 1.5)$
   ii) $(2.2, 1.4)$
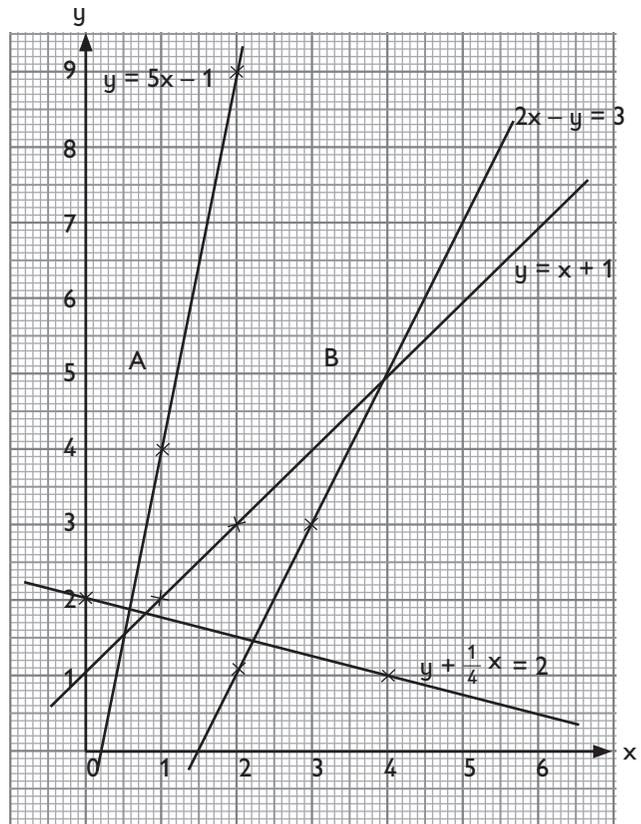
3. a)

x	-6	-3	0	3	6
y	11	9	7	5	3

b) i) $y = 8$

    ii) $x = 4.5$

y- axis

12

11

10

9

8

7

6             $3y + 2x = 21$

5

4

3

2

1

6   ⁻4   ⁻2   0   2   4   6   x- axis

⁻1
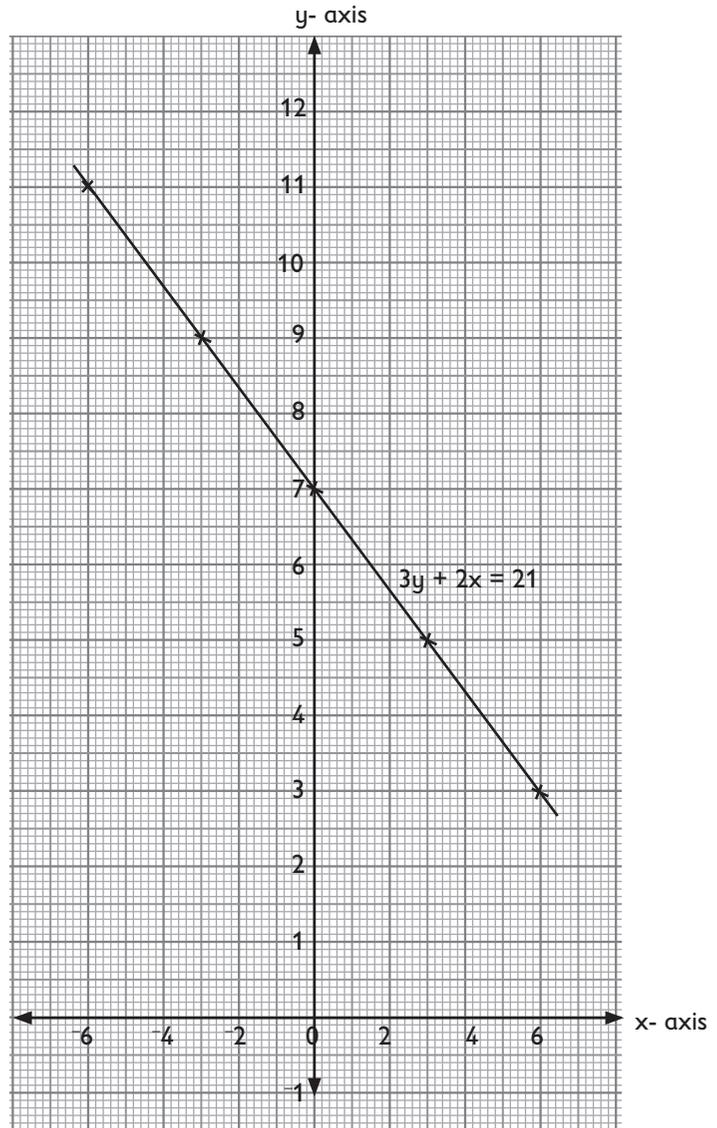
4.
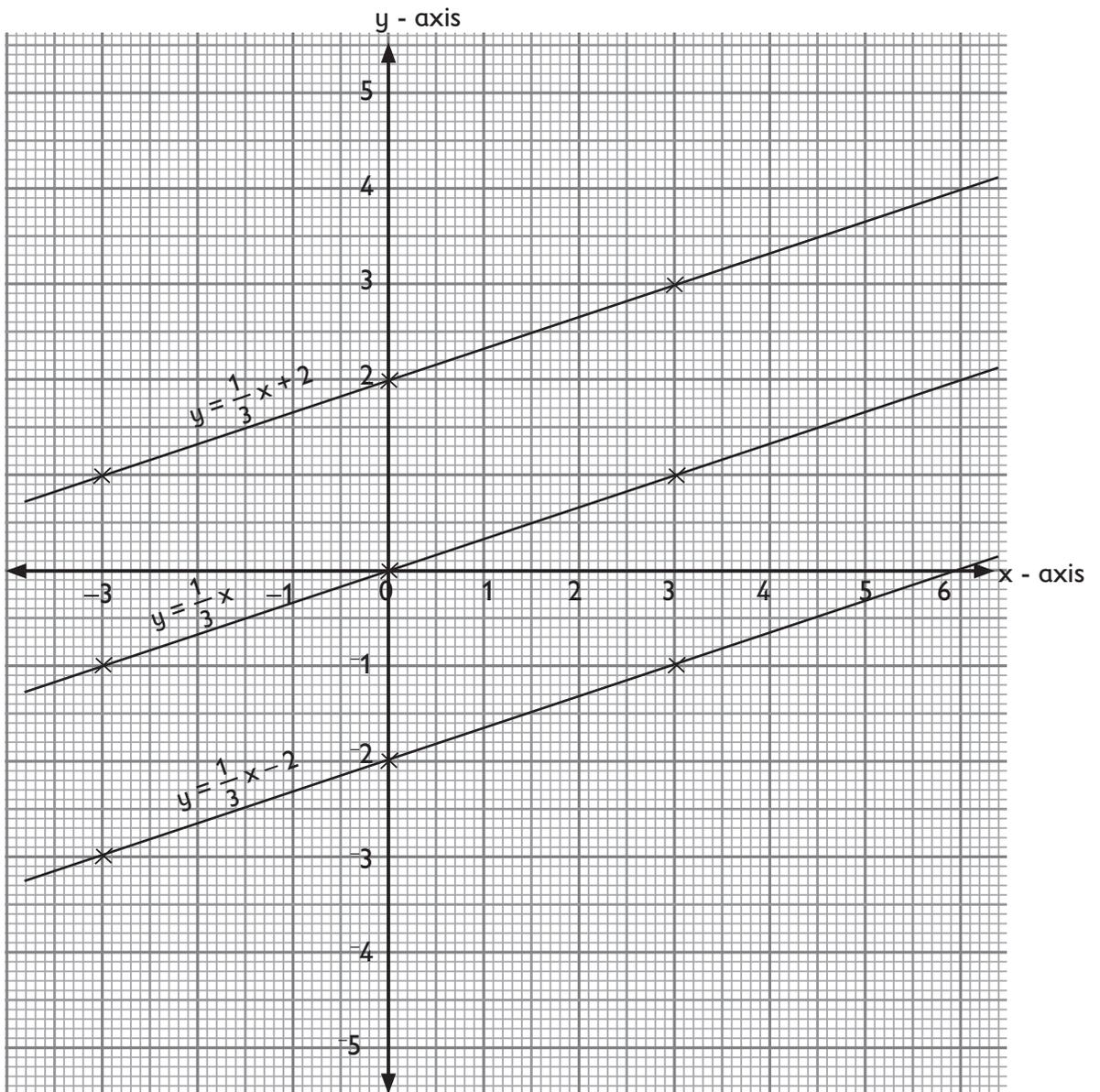
They are parallel

5. a)

x	-2	-1	0	1	2
y	-5	-3	-1	1	3

y- axis

axis

X- axis

$y = 2x - 1$
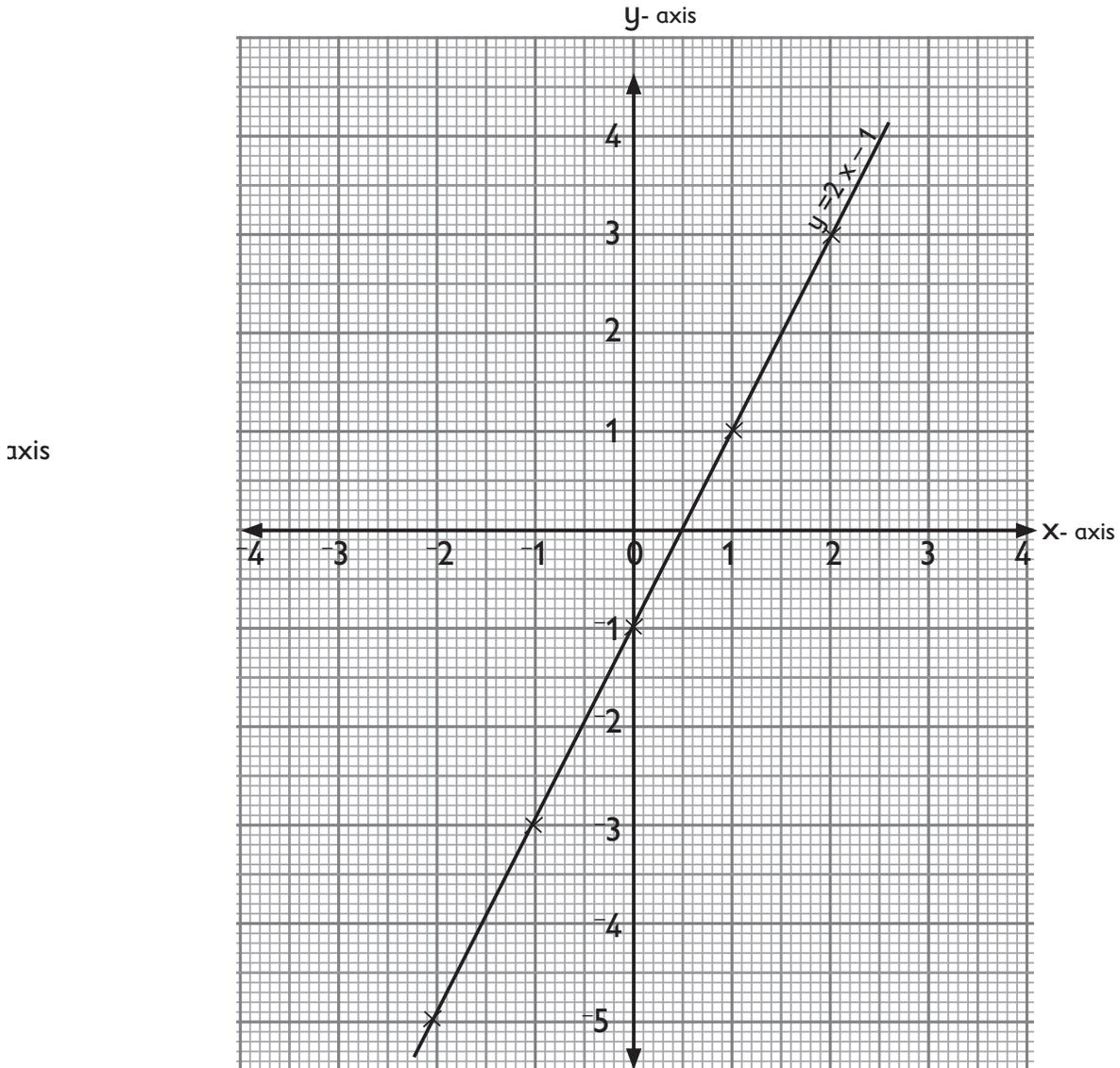
b)   y = 7

c)   x = 0.5

d)   at x – axis (0.5, 0)

y axis (0, -1)

1. a) $y = \dfrac{-5}{2}x$

x	2	−1
y	-5	2.5

b) $y = 3x + 1$

x	1	2
y	4	7

c) $y = -2x + 3$

x	1	2
y	1	-1

d) $y = 2x + \dfrac{3}{2}$

x	1	2
y	3.5	5.5

e) $y = \dfrac{-2}{3}x + 1$

x	3	6
y	-1	-3

f) $y = -\dfrac{5}{2}x - \dfrac{5}{2}$

x	1	2
y	0	2.5

g) $y = \dfrac{-2}{3}x + 2$

x	3	0
y	0	2

h) $y = \dfrac{-7}{4}x + 2$

x	4	2
y	-5	-1.5
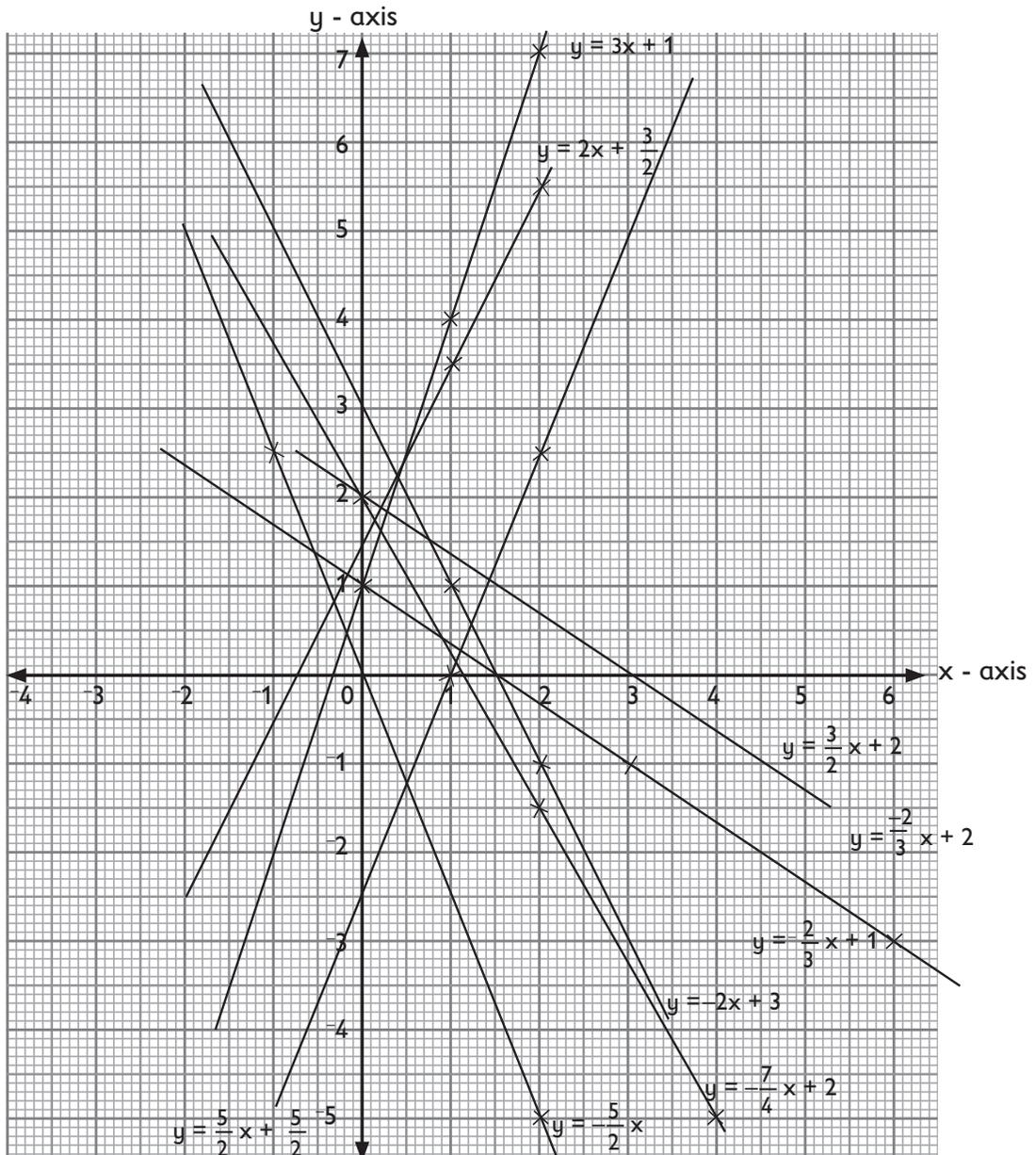
2. a) 7   b) $\frac{7}{4}$ c) 2
    d) $-\frac{1}{12}$ e) 10   f) -60
    g) -4   h) $\frac{7}{2}$ i) $\frac{2}{3}$
    j) 4

3. a) $\frac{-7}{3}$ b) $\frac{7}{2}$ c) 8
    d) $\frac{-1}{2}$ e) $-\frac{45}{2}$ f) -3
    g) $\frac{4}{5}$ h) 7   i) $\frac{4}{5}$
    j) $-\frac{8}{7}$

Exercise 3.6 (Pages 80 - 81)

1. a) Δ x cordiates = 3
        Δ y cordiates = 2
        Gradient = $\frac{2}{3}$
    b) Δ x = 5
        Δ y = -2
        Gradient = $\frac{-2}{5}$
    c) Δ x = 4
        Δ y = 2
        Gradient = $\frac{1}{2}$
    d) Δ x = 2
        Δ y = 10
        Gradient = $\frac{5}{0} = \infty$
    e) Δ x = 4
        Δ y = -4
        Gradient = -1
    f) Δ x = 0
        Δ y = $\frac{5}{0} = \infty$
        (undefined)
    g) Δ x = -4
        Δ y = 16
        Gradient = -4

h) Δ x = 5
    Δ y = 0
    Gradient = 0

2. a) $\frac{1}{2}$ b) $\frac{5}{2}$ c) $\frac{3}{7}$
    d) $\frac{-1}{2}$ e) -1 f) $\frac{2}{7}$
    g) $\frac{1}{3}$ h) 0   i) $\frac{5}{2}$
    j) ∞ (undefined)

3. L_1 : Gradient = 3
    L_2 : Gradient = $\frac{1}{4}$
    L_3 : Gradient = 0
    L_4 : Gradient = -2
    L_5 : Gradient = 0

4. a) (0, -8) (1, -5)
    b) (0, 3) and (2, 4)
    c) (0, 1) and (2, -1)
    d) (1, 7) and (3, 6)
    e) (-4, 7) and (-4, 2)
    f) (3, 3) and (-1, 3)

5.
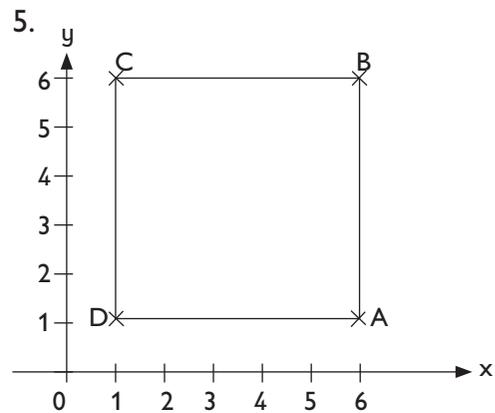
    b) (i)   0   (ii) 0
        (iii) 0   (iv) 0
        (v) -1   (vi) +1

Exercise 3.7 (Page 83)

1. a) $y = \frac{5}{2}x$

    Gradient = $\frac{5}{2}$, y – intercept = 0

    b) $y = 3x + 1$

    Gradient = 3, y – intercept = 1

    c) $y = -2x + 3$

    Gradient = -2, y – intercept = 3

    d) $y = -2x + \frac{3}{2}$

    Gradient = 2, y – intercept = $\frac{3}{2}$

    e) $y = -\frac{2}{3}x + \frac{3}{3}$

    Gradient = $\frac{2}{-3}$, y – intercept = 1

    f) $y = \frac{5}{2}x - \frac{5}{2}$

    Gradient = $\frac{5}{2}$, y – intercept = $-\frac{5}{2}$

    g) $y = \frac{-2}{3}x + 2$

    Gradient = $\frac{-2}{3}$, y – intercept = 2

    h) $y = \frac{-7}{4}x + 2$

    Gradient = $\frac{-7}{4}$, y – intercept = 2

2. a) 0   b) 7   c) 18

    d) 3   e) 2   f) 3

3. a) $y = \frac{2}{3}x + 2$ b) $y = \frac{-4}{3}x + 4$

    c) $y = \frac{2}{3}x - 2$ d) $y = 2$

4.

Fraction	y-intercept	Gradient
$2y + 3x = 2$	1	$\frac{-3}{2}$
$3x + 4y = 8$	2	$\frac{-3}{4}$
$-15 + 9y = 3x$	$\frac{5}{3}$	$\frac{1}{3}$
$2x + 2y = 7$	$\frac{7}{2}$	-1
$-2x - 4y = 6$	$\frac{-3}{2}$	$\frac{-1}{2}$
$5y - 3x = 2$	$\frac{2}{5}$	$\frac{3}{5}$

Exercise 3.8 (Page 84)

1. Equations are b, f, g, i and j

2. a) True   b) True   c) False

    d) False   e) False   f) False

    g) False

3. a) False   b) False   c) True

    d) Open   e) Open   f) False

    g) True   h) True

4. a) $4 + 7 = 11$ b) $5 + 1 = 6$

    c) $4 - 1 = 3$ e) $6 - 6 = 0$

Exercise 3.9 (Page 86)

1. a) 6   b) 2   c) 2

    d) 2   e) 3   f) 4

    g) -4   h) 2   i) 3

    j) -4   k) 7   l) 8

    m) -7   n) -2   o) 3

    p) 0   q) 3   r) -8

2. a) False   b) False

    c) True   d) False

    e) True   f) True

3. a) $x = 14$ b) $x = 14$

    c) $x = 9$ d) $x = 8$

    e) $x = 15$ f) $x = 6$

    g) $x = 2$ h) $x = 6$

    i) $x = 7$ j) $x = 6$

    k) $x = \frac{8}{3}$ l) $x = 0$

    m) $x = 8$ n) $x = 56$

    o) $x = \frac{23}{2}$ p) $x = 1$

    q) $x = 48$ r) $x = 8$

    s) $x = 5$ t) $x = 5$

Exercise 3.10 (Page 88)

1. a) $x = 40$ b) $x = 11$

    c) $x = -20$ d) $x = -12$

2. a) x = 54   b) x = 18
   c) x = -2   d) x = -9
3. a) x = 48   b) x = 102
   c) x = 9   d) x = -3
4. a) x = 3   b) x = -2
   c) x = -8   d) $x = \frac{1}{12}$
5. a) x = 5   b) x = 3
   c) x = 4   d) x = 2

Exercise 3.11 (Page 89)

1. a) x = 72   b) x = 8
   c) k = 0   d) p = 9
2. a) $x = -5\frac{13}{20}$ b) $q = \frac{19}{20}$
   c) p = 5   d) t = 2
3. a) f = 4   b) x = 3
   c) $x = \frac{1}{3}$
4. a) $b = 2\frac{10}{23}$ or $\frac{56}{23}$
   b) h = 6
5. a) x = 0   b) x = -14
   c) $x = \frac{2}{5}$ d) $p = \frac{5}{3}$

Exercise 3.12 (Page 91)

1. d = 4   2. m = 4.4
3. t = 4.75   4. $w = \frac{-6}{13}$
5. $x = \frac{5}{2}$ 6. $x = \frac{11}{3}$
7. $c = \frac{1}{3}$ 8. k = 4
9. x = 3   10. $x = \frac{21}{58}$
11. $x = \frac{-25}{4}$ 12. $y = \frac{21}{58}$
13. $c = \frac{-11}{3}$ 14. x = 9
15. $y = \frac{50}{11}$ 16. $p = \frac{-33}{35}$

17. $x = \frac{1}{2}$ 18. $x = \frac{23}{30}$
19. $y = \frac{1}{2}$ 20. $z = \frac{3}{2}$
21. $x = \frac{13}{2}$ 22. $e = \frac{21}{28}$
23. $y = \frac{-25}{36}$

Exercise 3.13 (Page 93)

1. 21
2. 6
3. 12 and 7
4. Mohammed = 18
   Mr. Ali = 11
5. 13
6. Length = 21cm
   Width = 7cm
7. Nganda = 14 years
   Usemi = 7 years
   Abile = 11years
8. Mr. Chiwa = K 830
   Mr. Driko = K 640
9. 45
10. 36

Exercise 3.14 (Pages 95-96)

1. a) 5 < 7   b) 5 > 2
   c) -1 > 0   e) $x \geq 4$
   f) $y \leq -5$ g) $a \geq 3$
   h) $b \leq 0$ i) $y \geq p$
   i) $10 \leq q$
2. a) <   b) <   c) <
   d) >   e) >   f) <
   g) >   h) >
3. (a)

(b)

-3 -2 -1 0 1 2 3 4 5

(c)

-3 -2 -1 0 1 2 3 4 5

(d)

-2 -1 0 1 2 3 4 5

(e)

-2 -1.5 -1 -0.5 0 0.5 1 2

(f)

-1 -0.5 0 -0.5 1 1.5 2 2.5 3
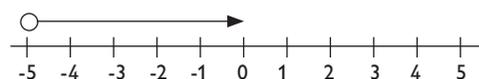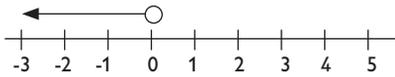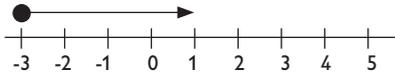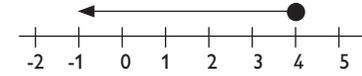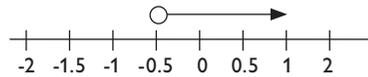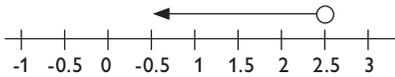
4. a) $x > 2$ b) $x < -1$

   c) $x \geq 3$ d) $x \leq 0$

   e) $x > -4$ f) $x > 0$

Exercise 3.15 (Page 96)

1. a) $4 > x > 2$
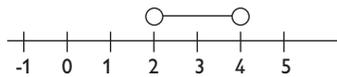
   -1 0 1 2 3 4 5

   b) $3 > x \geq 0$

   -1 0 1 2 3 4 5

   c) $5 \geq x > -2$

   -2 -1 0 1 2 3 4 5 6

   d) $1 \geq x \geq -1$

   -2 -1 0 1 2

e) $1.5 > x \geq -0.5$

   -0.5 0 0.5 1 1.5 2

f) $2.2 \geq x \geq 1.8$

   0 1 1.8 2 2.2 3 4

2. a) $\dfrac{1}{4} > x \geq 0$

   0   $\dfrac{1}{4}$ $\dfrac{1}{2}$ $\dfrac{3}{4}$

   b) $2\dfrac{1}{4} > x \geq \dfrac{3}{4}$

   0   $\dfrac{3}{4}$ 1   2 $2\dfrac{1}{4}$ 3

   c) $3\dfrac{1}{2} > x > 2\dfrac{1}{2}$

   0   1   2 $2\dfrac{1}{2}$ 3 $3\dfrac{1}{2}$ 4

   d) $\dfrac{2}{3} > x > \dfrac{1}{5}$

   0   $\dfrac{1}{5}$ $\dfrac{2}{3}$

   e) $0.75 \geq x \geq -0.75$

   -1 -0.75   0   0.75 1
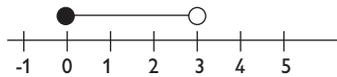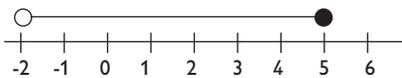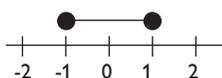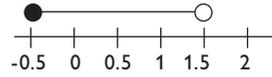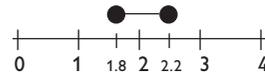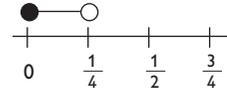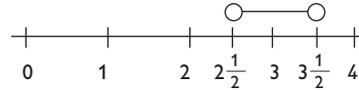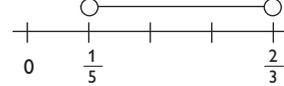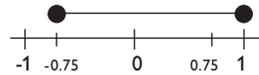
   f) $4\dfrac{1}{2} > x > -\dfrac{1}{2}$

   $\dfrac{-1}{2}$ 0   4 $4\dfrac{1}{2}$
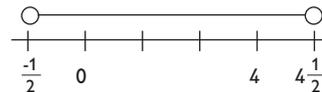
Exercise 3.16 (Page 98)

1. a) $x > 7$

   0 1 2 3 4 5 6 7 8 9 10

   b) $x \leq 11$

   4 5 6 7 8 9 10 11

2. a) $x \leq 6$

-1 0 1 2 3 4 5 6

   b) $x > 5$

2 3 4 5 6 7

3. a) $x < 1\frac{1}{4}$

0 1 $1\frac{1}{4}$ 2 3

   b) $x \geq 1$

-1 0 1 2 3 4

4. a) $x > 1$

-1 0 1 2 3 4

   b) $x \leq 3$

0 1 2 3 4 5

5. a) $x > 21$

19 20 21 22 23

   b) $x < -5$

-6 -5 -4 -3 -2

6. a) $x > 42$

40 41 42 43 44

   b) $x \geq 15$

13 14 15 16 17

7. a) $m > -1$

-2 -1 0 1 2

   b) $m \leq 3$

0 1 2 3 $3\frac{2}{3}$ 4

8. a) $p > 11$

0 1 2 3 $3\frac{2}{3}$ 4

   b) $p > \frac{1}{2}$

0 $\frac{1}{12}$ $\frac{1}{6}$ $\frac{2}{3}$

9. a) $q > \frac{6}{13}$

0 $\frac{6}{13}$ 1 2 3

   b) $q < 6$

5 6 $6\frac{6}{11}$ 7 8

10. a) $r > -45$

-47 -46 -45 -44 -43

    b) $r \leq 2\frac{2}{5}$

0 1 2 $2\frac{2}{5}$ 3

11. a) $x > 5\frac{4}{9}$

3 4 5 $5\frac{4}{9}$ 6 7

    b) $x > 1$

0 1 $1\frac{1}{14}$ 2 3 4
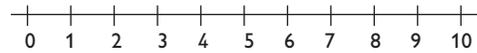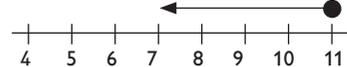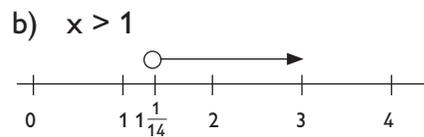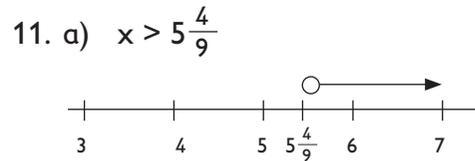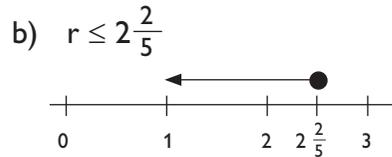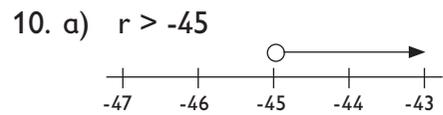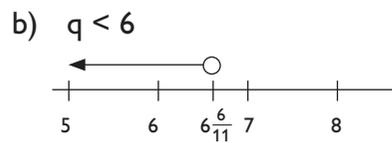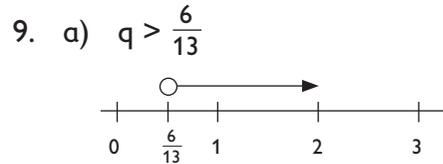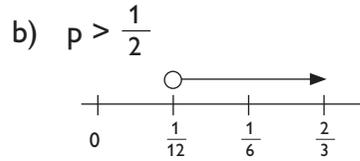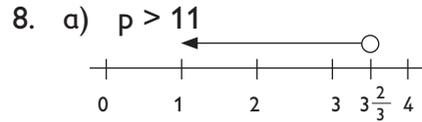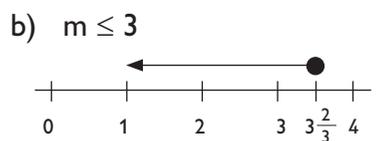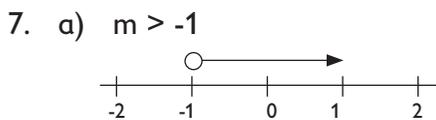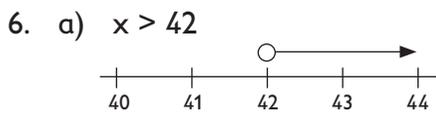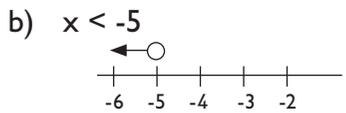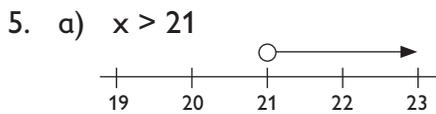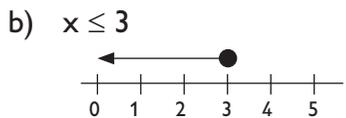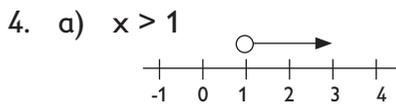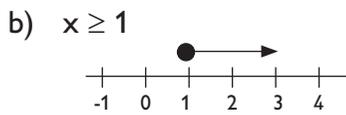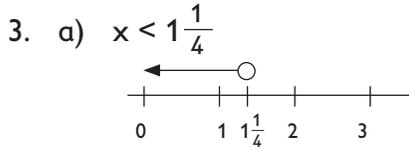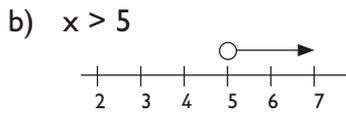
Exercise 3.17 (Pages 99 - 100)

1. a) $5 > x \geq 3$

0 1 2 3 4 5 6 7

   b) $3 \geq x > 0$

-1 0 1 2 3 4
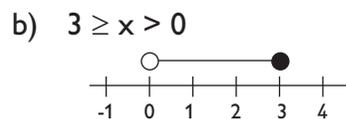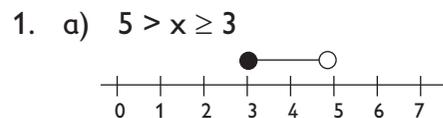
2. a) $-7 > x > -8$
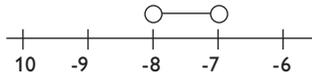
b) $7 \geq x > -8$
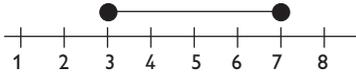
3. a) $8 > x > -1$

b) $5\frac{3}{5} \leq x < 13\frac{3}{5}$

4. a) $1 < x < 6$

b) $\frac{9}{24} < x < 2$

Exercise 3.18 (Pages 100 - 101)

1. $x + 2 > 10$ 2. $y + 5 < 2y$
3. $6x + 5 > 5x + 6$ 4. $x > 86$
5. $S^2 < 45$ or $l^2 > 4l$
6. $y^2 < y^3$

Exercise 3.19 (Page 102)

1. 29
2. 26 FRW
3. 18
4. a) $5000 - 255x \geq 2000$
   b) 13 wells
5. a) $2 + 1.5x \leq 200$
   b) 120 km
6. (a) $3600 + 1.4x \leq 4.2x$
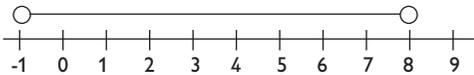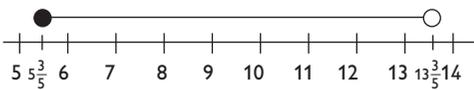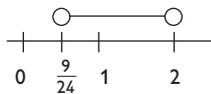
(b) $x \geq 948$ spare parts

8. 18
9. 92
10. 133 333

UNIT TEST 3 (Pages 103-104)

1. a) 1   b) -4
   c) 0   d) $\frac{13}{2}$

2. a) $\frac{4}{5}$ b) $\frac{3}{5}$
   c) $\frac{3}{2}$ d) 0
   e) 1   f) $\frac{20}{21}$

3. a) $x = -\frac{7}{5}$ b) $x = \frac{1}{13}$
   c) $x = 1$ d) $x = -1$

4.
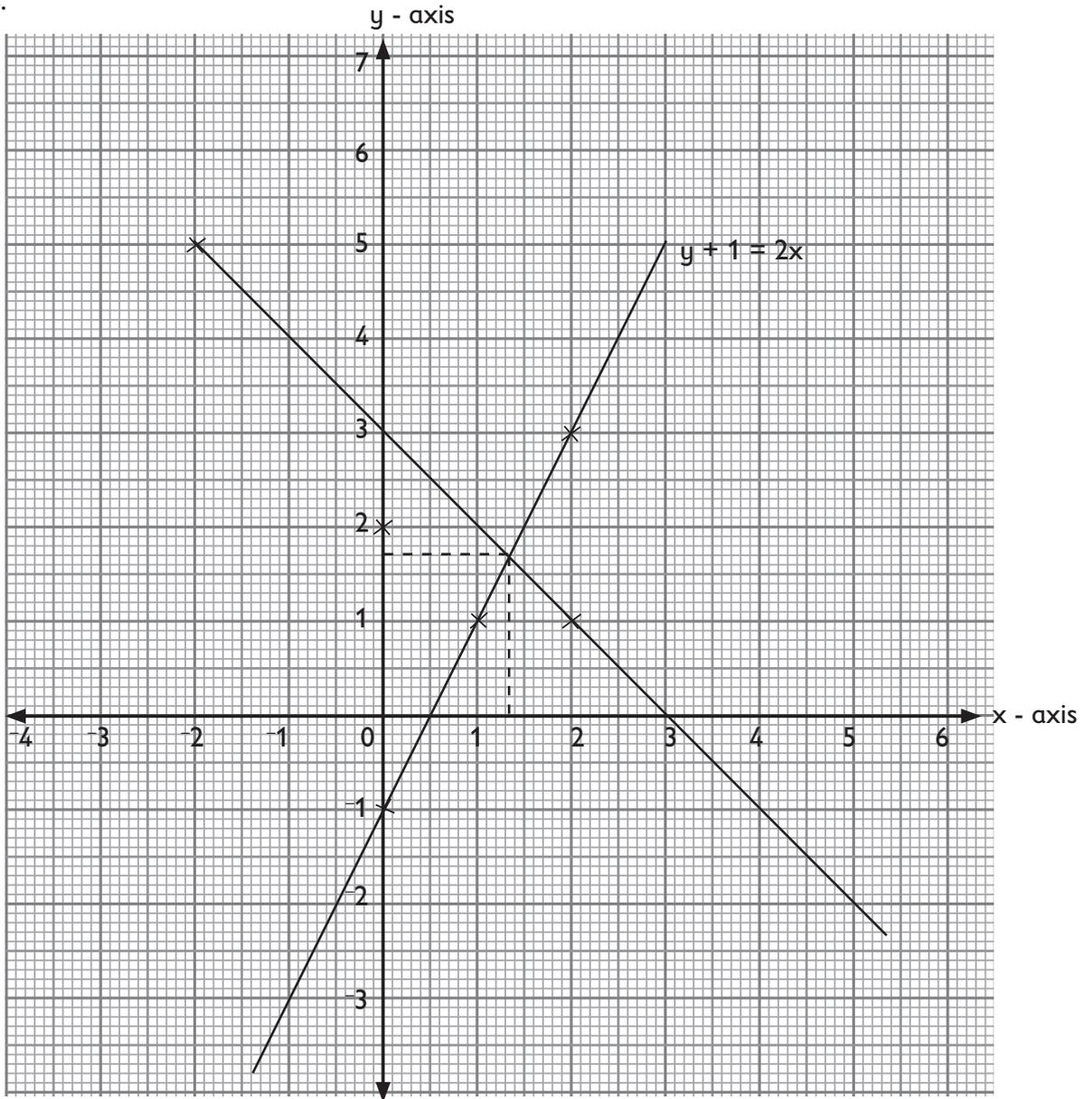
Point of intersection is (1.35, 1.7)

5.
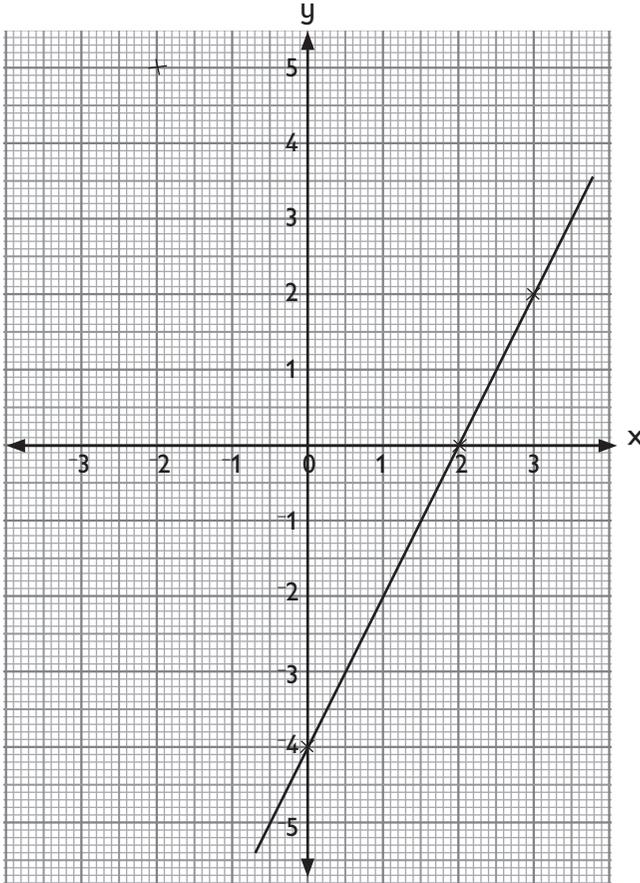
y – intercept = $(0, -4)$

x – intercept = $(2, 0)$

6. Gradient = $\frac{1}{5}$

y – intercept = 2

7. 45

8. 18 750 FRW

9. 12 and 7

10. a) $-3 < x < 8$

b) $-3 \leq x < 2$

11. Points: (1.5, 2), (2, 2), (2, 2.5), (2.5, 2)

(2.5, 2.5), (3.5, 3.5), (4.5, 2.7)

(1.5, 0.5), (1.5, 2.5), (1.5, 2.7)

12. a) $x \geq -2$

b) $-3 \geq x > 4$

Metric measurements (money)

PERCENTAGE, DISCOUNT, PROFIT AND LOSS

Student's Book pages 105 - 122. (12 Lessons)

Key unit competence

By the end of this unit, the learner should be able to solve problems that involve calculating percentage, discount, profit and loss and other financial calculations.

Learning objectives

Knowledge and understanding
Explain how to calculate discount, commission, profit and loss, simple interest, tax

Skills
- Use percentages to calculate discount, commission, profit, loss, interest, taxes
- Solve problems involving
- Discount
- Commission
- Profit and loss
- Loans and savings
- Tax and insurance

Attitudes and values
- Appreciate the role money plays in our life.
- Be honest in managing and using money.
- Appreciate that saving and investing money can increase its value.
- Appreciate the importance of paying taxes.

Generic competences addressed in this unit
- Communication
- Research
- Problem-solving
- Critical thinking
- Co-operative thinking and learning
- Creative thinking

Links to other subjects
- Personal finance calculations in Economics, Entrepreneurship, Finance, Accounting, Business Administration and other related fields.

Cross cutting issues addressed in this unit

- Financial literacy
- Inclusive education
- Environment

Assessment criteria

Able to solve problems that involve calculating percentage, discount, profit and loss and other financial calculations

Background information

This topic enlightens the learner on the basic concepts of business and money. For example, the learners need to know that a business person sells goods at a discount to attract customers, and at a profit to keep the business running. In some cases losses are incurred due to some reasons such as when supply outweighs the demand leading to decrease in price. Therefore, it is good to engage the learner in business activities, business related examples and exercises to arouse their interest and help them understand the concept with ease.

Suggested teaching/learning activities

Percentage

(2 lessons)

By the end of this section the learner should be able to explain the meaning of percentage and solve problems that involve percentage.

Information to the teacher

Learners in lower classes were introduced to percentages. They learnt how to calculate percentages and convert fractions to percentages. These concepts will be highlighted in this section to reinforce their understanding of the concepts. Later in this unit, they will use this understanding to calculate percentage, discount, commission, profit and loss.

Materials

- Charts showing definitions and examples on calculation of percentages.
- Textbooks.

Preparation

Before the lesson, ensure you have prepared or borrowed charts showing calculations of percentage and the meaning of percentages. Ensure that you have all the materials needed for the class.

Teaching guidelines 4.1

- In pairs, engage the learners to do activity 4.1 given in the student's book i.e. to discuss the meaning of percentage and how to convert fractions into percentages.

- At the end of group activity, groups to present their findings in a class discussion through their secretaries. While the class discussion is ongoing, members of the class should be an opportunity to raise their views, points and opinion.

- Guide them during the discussion where necessary.
- Guide them through Example 4.1 to 4.3 and other examples on conversion of fractions into percentages.
- Ask learners to do question 1 given in Exercise 4.1. Go round checking their work and give more guidance to those who could be having challenges.
- Ask them to do questions 2-10 in Exercise 4.1 as homework.
- Note that the information in question 10 is about environment i.e. planting trees. Help the students to understand that trees are very important for our survival. It facilitates rainfall formation, provide food and purify the air. Let us keep increasing forest cover by planting more trees and taking care of them.
- This activity will promote in the learner leadership skills, communication skills among others.

Discount

(2 Lessons)

By the end of the lesson, the learner should be able to define the term discount, solve problems that involve discount.

Materials

- Charts showing formulae of calculating discount, meaning of discount and others.

- Textbooks, internet.

Preparation

- Before the lesson, ask the learner to do research from books and the internet on actual meaning of discount and quantities used to calculate the discount.

Teaching guidelines 4.2 and 4.3

- Organize learners in groups of 2-3 students. Thereafter ask them to do activity 4.2 given in student's book i.e. to discuss the meaning of discount, how to calculate discount, reasons why discount is given to the customer.
- Guide them in a class discussion on their results of activity 4.2 to help them clearly understand meaning of discount, formulae of calculating discount and reasons a business person may decide to give some discount to the customer. Give other class members an opportunity to comment or give their opinion.
- At end of the classroom discussion, summarize the meaning, formulae and calculating discounts.
- Involve them in solving Examples 4.4, 4.5 and 4,6.
- Ask them to do Activity 4.3 in students book i.e. to calculate the discount offered by stationery dealer for a customer buying exercise books.
- Involve them in class discussion

- Allow the learners to do question 1 of Exercise 4.2 in student's book.
- Check their work and giving guidance appropriately.
- Ask learners to do the remaining Exercise 4.2 as homework.

Commission

(1 Lesson)

By the end of this lesson, the learner should be able to explain the meaning of the term commission and solve problems that involve calculating commission.

Information to the teacher

This section will help the learner to understand what is commission and has to calculate it. This knowledge will help them in future, as some of them may become sales and marketing proffessionals.

They should realize how important it is and the more the sale, the more the commission a sale representative gets.

Materials

- Charts showing meaning of commission and formulae of calculating commission
- Textbooks and others

Preparation

- Before the lesson, prepare or borrow the charts showing meaning of commission and formulae and other materials that may be needed.

Teaching guidelines 4.4

- Organize the learners into groups of two students. (Ensure there is gender balance and mix of varied abilities).
- Ask them to do activity 4.4 in student's book.
- After classroom presentation, help them to understand ways to reward salesperson. Commission is one of the reward given to the sales people.
- Show them how commission earned by sales people is calculated. This is through solving examples 4.7, 4.8 and 4.9 and some questions from the Exercise 4.3.
- Ask the learners to do question one Exercise 4.3 in student's book. Check their work and give guidance appropriately.

Profit and loss

(3 Lessons)

By the end of this section, the learner should be able to:

I. Explain meaning of the terms profit and loss.
II. Express profit and loss in terms of percentage.
III. Solve problems related to calculation of profit and loss.

Information to the teacher

This sub-topic involves enlightening learners what is profit and loss in business. The main purpose of business is to make profit but at times we make loss.

The learner should be aware that what they are learning is involved in our daily activities in life. Therefore, you should make them understand this concept of business since it is where people like their parents get income from. Put more emphasis on profit and loss.

Materials

- Charts showing the meaning of profit, loss,percentage, profit and loss.
- Chart showing examples on calculating profit and loss.

Preparations

- Before the lesson, you should ensure that all materials needed for the lesson are available.

Teaching guideline 4.5

- In pairs, ask learners to do activity 4.5 in student's book i.e.to calculate profit and loss in the given transaction. Explain meaning of profit and loss.
- While they are presenting, let the class members give their opinion and comments on determining profit and loss made by either Habanabashaka or Charlotte.
- Make a summary on the formulae of calculating profit and loss i.e. P=SP-B.P and L=B.P −S.P. Thereafter, guide them through example 4.10 to 4.15 and others for them to understand fully the concepts.
- Ask the learners to do question 1 and 2 of Exercise 4.4 in student's book.

- Go round checking their work giving more guidance to those who may be having problems.
- Give the remaining part of Exercise 4.4 as homework.

Loans and savings

(1 Lesson)

By the end of this section, the learner should be able to define the terms loans, saving and simple interest and how to calculate simple interest.

Information to the teacher

Loan is money we need to carry out most of our financial engagements. Arouse the learners by telling them some of their parents pay school fee though these loans. This will help them in futurein that loans exist and the importance of loans.

Materials

- Student's textbooks
- Charts showing advantage of saving money definition of loans & savings, formula of calculating simple interest
- Others

Teacher guidelines 4.6

- Organize the learners into groups of 3 students.
- Guide them to do Activity 4.6 in student's book i.e. to discuss advantages of saving money, advantages and disadvantages of taking loans and ways of managing finances well.

- Let them present the findings inclassroom discussion.
- While the discussion is ongoing, guide them where necessary.
- Ask them to discuss activity 4.7 in student's book i.e. meaning of the terms principal, rate, time of investment and interest as used in determining loans and savings.
- Note that the points discussed equip their knowledge on how to manage our finances well (financial literacy).
- Summarize the points discussed and give them more information on loans and savings to help them understand loaning and saving.
- Ask them to read more on loans and savings

Simple Interest, tax and insurance

(2 lessons)

By the end of this section, the learner should be able to:

I. Define the terms simple interest, principal, rate and time.
II. Solve problems involving calculating simple interest.

Materials

- Chart showing examples on calculating simple interest.
- Chart showing definition of simple interest, principal rate and time.
- Student's textbooks
- Others

Teaching guidelines 4.7

- In groups of two students, engage the learners to discuss activity 4.8 in student's book i.e. to discuss on how to find the simple interest in the given case.
- Let them present their findings in a classroom discussion and members of the class to contribute in the discussion by asking and answering questions. This will make them active in class.
- Guide them during the class discussion for them to understandhow to calculate the simple interest Lucy paid to the bank
- Make a summary on calculation of simple interest when given principal, rate and time by use of the examples provided in the student's book. Explain further on how to find for example principal when given simple interest, rate and time. Use this opportunity to assess achievement of the objectives.
- This activity will promote communication skills, financial knowledge, calculation skills among other competences to the learner.
- Ask the learners to do examples 4.16 to 4.21 and question 1 and 2 of Exercise 4.5 in the student's book.
- Go round checking their work and guide those who may be having problems.
- Ask the learners to do Activity 4.9 and 4.10, followed by examples 4.22 to 4.24 and exercise 4.6, all about tax provided in the student's book.

- Let the learners do the subsequent activity 4.11 on insurance, then examples 4.25 to 4.27 followed by Exercise 4.7.
- Ask the learners to practice on unit Test 4 in student's book.
- Use the results from the unit test to asses whether learners have mastered the unit's concepts well.

ANSWERS

Exercise 4.1 (Pages 106 - 107)

1. a) 41%   b) 755
   c) 54%   d) 60%
   e) 92.50%   f) 52%
   g) 87.5%
2. a) 36%   b) 45%
   c) 81%   d) 4%
   e) 12.5%   f) 8%
   g) 2.5%   h) 80%
3. a) 40%   b) 6%
   c) 21.6%   d) 25%
   e) 2.5%   f) 40%
   g) 255%   h) 1.25%
4. a) 105 FRW.   b) 1.08 Km
   c) 378g   d) 84 m²
   e) 0.61cm   f) 8.4 kg
5. 60%
6. 45% white cars, 25% blue cars, 30% red cars
7. 70%
8. (a) 46.67   (b) 53.33%
9. 90 newspapers ,52 books, 30 sweets and 28 assorted items
10. Rwanda = 4846.192 km²
    Zimbambwe = 149 517.45 km²

Exercise 4.2 (Pages 108 - 109)

1. (a) 4800 FRW   (b) 19200 FRW
2. (a) 480 FRW   (b) 20%
3. (a) 5714.29 FRW
   (b) 1714.29 FRW
4. (a) 10800 FRW
   (b) 20%
5. 240,000 FRW
6. 6324 FRW
7. 44.44%
8. (a) 152 400 FRW
   (b) 544 320 FRW

Exercise 4.3 (Page 110)

1. 264 000 FRW
2. 9 600 FRW
3. 3.125%
4. 2342360 FRW
5. (a) 34 000 FRW
   (b) UK£641

Exercise 4.4 (Pages 112-113)

1. 53.85%
2. 30%
3. 35,000,000 FRW
4. Profit of 6 600 FRW
5. 32 941.1.8 FRW
6. 25%
7. 10 227.27 FRW Profit, 1227.27-loss
8. 160 000 FRW

Exercise 4.5 (Pages 115 - 116)

1. a) 5 760 FRW
   b) 8 658 FRW

c) 1 320 FRW

d) 5 500 FRW

2. a) £10,080

   b) 33 390.72 FRW

   c) 6720 FRW

3. a) 3.75%

   b) 6.67%

   c) 0.56%

   d) 3.33%

4. a) 100,000 FRW

   b) 160 000 FRW

   c) 200 000 FRW

   d) 253 333.33 FRW

5. a) 9 months or 0.74yers

   b) 36 yrs 4months, or 36 years

   c) 2 yrs 6months or $2\frac{1}{2}$ years

   d) $2\frac{2}{7}$

6. a) 81 000 FRW

   b) 801 000 000 FRW

7. 24%

8. 20 000 FRW

Exercise 4.6 (Pages 118-119)

1. 9 440 FRW

2. 44 485 FRW

3. 56 640 FRW

4. 900 FRW

5. 583 665 FRW

6. 30 125 000

7. (a) 18 9720 FRW

   (b) 28 458 FRW

   (c) 161 262 FRW

8 . (a) i)   7 200 000 FRW

      (ii)   6 120 000 FRW

(b) i)   13 838 823.50 FWR

      (ii)   2 075 823.50 FRW

Exercise 4.7 (Pages 121)

1. 2 394 FRW

2. 7 160 000 FRW

3. 37 153. 50 FRW

4. Refer to student's book.

5. 12 250 000 FRW

6. 175 000 FRW

7. 900 000 FRW

Unit Test 4 (Pages 121 -122)

1. a) 85%   b) 35%

   c) 48.15%   d) 18.18%

   e) 71.43%

2. a) 3 750 FRW

   b) 450cm^2

3. 5 000 000 FRW

4. 1860 000 FRW

5. 2271750 FRW

6. a) 0.0085%

   b) 0.043%

   c) 0.29%

   d) 1/714%

7. 10.4%

8. 3 074 740 FRW

9. 51 800 FRW

10. 6 466 680 FRW

11. 55 580 FRW

12. 6 466 680 FRW

13. 12 315 180 FRW

14. a) 13 500 FRW b) 0.45 FRW

    c) 2 025 FRW

Proportional Reasoning

RATIO AND PROPORTION

Student's Book pages 123 - 138. (12 Lessons)

Key unit competence

By the end of this unit, the learner should be able to be able to solve problems involving ratio and proportion.

Learning objectives

Knowledge and understanding
- Express ratios in their simplest form.
- Identify a direct and indirect proportion.
- Differentiate direct from indirect.
- Proportion.

Skills
- Compare quantities using proportions.
- Share quantities in a given
- proportion or ratio.
- Apply ratio and unequal sharing to solve given.
- problems.
- Solve real life problems involving direct and indirect proportion using tables and graphs.

- Interpret ratio and proportions in practical contexts.

Attitudes and values
Appreciate the importance of multiplication when working with ratio and proportion.

Generic competences addressed in this unit.
- Communication skills
- Problem- solving
- Co-operative learning
- Research skills
- Critical thinking
- Creative thinking

Links to other subjects
Any subject where proportional reasoning is required e.g. biology, physics, computer science, chemistry, economics, personal finance etc.

Cross cutting issues addressed to this unit

- Peace and value
- Inclusive education
- Financial literacy
- Environment and sustainability
- Standardisation culture

Assessment criteria

Can solve problems involving ratio and proportion in a variety of contexts.

Background Information

This topic involves ratios and proportionality. It enlightens learners on how quantities can be shared using ratios. Quantities vary either directly or proportionally. These concepts are applied in other disciplines such as physics and chemistry. Therefore engage the learner in many practical examples for them to master the concept of interpreting the relationships, drawing graphs, describing them and how to interpret the graphs.

Suggested Teaching/ Learning Activities

Ratio

(2 lessons)

By the end of this section, the learner should be able to explain the meaning of the term ratio and solve problems involving ratios.

Materials

- Chart showing definition of the term ratio and examples of ratios.
- Text books
- Other materials that may be needed.

Preparation

- Before the lesson, ensure you have the materials needed such as charts and text books.

Teaching Guidelines 5.1

- Organize the learners into groups of two students. Take into consideration of gender balance and mix of varied abilities.
- Ask the groups to do activity 5.1 in student's book i.e. expressing the given relationships in ratios.
- At the end of activity 5.1, guide them in a class discussion. While the class discussion is ongoing, allow the members of the class to point out errors or omissions and ask questions.
- Take them through example 5.1 and 5.2. in the learner's book.
- Ask them to come up with relations and practice presenting them in ratios.
- Ask them to read on simplifying ratios.

Simplifying Ratios

(2 Lessons)

By the end of this section, the learner should be able to solve problems related to simplify ratios.

Materials

- Chart showing examples on simplification of ratios.
- Text books (student's books).
- Improvised materials are highly regarded.

Preparation

Before the lesson, ensure all materials needed for the lesson are available or if not, can be borrowed or improvised. Ask learners to read in time on ratios and simplifying ratios.

Teaching Guidelines 5.2 and 5.3

- In pairs, assign the learners to do Activity 5.2 and 5.3 in student's book i.e. to find the simplest ratios of mangoes shared.
- Ensure that every learner is active and knows what they are discussing.
- Listen as the learners report their discussions. Verify their results and correct possible erroneous conclusions. Allow any opinion from class members.
- Guide them through example 5.3 to 5.6. Ask some students to solve some examples on how to simplify ratios on the chalkboard. Let them try to explain clearly onto the class members.
- Now let them do question 1 of Exercise 5.1 in student's book. Check their work and give guidance to those who may be having challenges.
- Use the outcomes to assess the achievement of the objectives.

- Summarize the concepts and ask them to do question $2 - 6$ in Student's book as homework.

Sharing quantities using ratios

(2 lessons)

By the end of this section, the learner should be able to solve problems involving sharing quantities using ratios.

Information to the teacher

This section will equip the learner with skills of sharing. Therefore, engage the learner in many practical activities of sharing for him/her to understand these concepts with ease.

Materials

- Text books
- Other materials that may be needed.

Teaching guidelines 5.4

- In pairs, ask the groups to do Activity 5.4 in student's book i.e. to determine the ratio of the money shared and how much would get. Ensure every member is active.
- Let the groups present their work in a class discussion. During classroom discussion, guide them where necessary.
- Note that information about activity 5.4 involves disagreements. Take this opportunity to sensitize about conflicts. The effects of conflicts in the society. Tell them we should be crusaders of peace whenever we are, rather than be the ones to fuel

disagreements. We should also take care of the needs of the disabled and facilitate/empower them where we can.

- Summarize the concepts of sharing quantities using ratios and take this opportunity to assess the achievement of the objectives.

- Ask the learners to do Exercise 5.7 and 5.8 followed by question 1 Exercise 5.2 in students book. Go round checking their work, putting more emphasis to slow learners and giving quick learners more work to do.

- Assign the learners to do Exercise 5.2 question 2 – 6 in student's book.

> ## Applications of ratios in Scale drawing

(2 lessons)

By the end of this section, the learner should be able to solve problems involving applications of ratios in scale drawing.

Materials
- Chart showing drawing on scale drawing
- Metre rule
- Text book

Preparation
Before the lesson, collect the materials needed for teaching-learning process such as charts, ruler and others. Ask the learners to come with a complete geometrical set.

Teaching Guidelines 5.5

- Ensure every student is active in a group of two or three students.

- Assign the groups to do Activity 5.5 in students book i.e. to discuss and determine the scale of the plan to the actual house in ratio farm in its simplest form.

- At the end of the activity, ask the groups to present their results or findings. Encourage the members of the class to contribute by asking and answering questions.

- During the classroom discussion, guide the learners on the key points.

- Take this opportunity to explain the meaning of a scale, representing a scale as a ratio, determining scale of a plan. How to solve/ calculate problems involving scales by the help of example 5.9. This is your chance to explain key concepts.

- Ask the learners to do question 1 and 3 Exercise 5.3 in students book. Go round checking their work guiding the slow learners and giving the quick learners more work i.e. the remaining questions.

- Use the response from the learner to assess the achievement of the objective.

> ### Proportion

(2 lessons)

By the end of this section, the learner should be able to:

- Explain the meaning of proportions.
- Start the properties of the proportions
- Apply the properties of the proportions in solving problems

Information to the teacher

Proportional reasoning involves an understanding of the mathematical relationship embedded in proportional situations. This relationship are always multiplicative in nature.

It also involves the ability to solve a variety of problems, and two types of qualitative situations are among the types of problems that are important for children to understand. Proportional reasoning involves the ability to discriminate proportional from nonproportional situation. That is, students should be able to overcome the effect of unfamiliar setting.

The understanding of underlying proportional reasoning are complex. We should expect this type of reasoning to develop slowly with time.

Teaching Guidelines 5.6

- In pairs, assign the student to do Activities 5.6 to 5.10 given in student's book.
- Ensure that every student in each pair is actively involved.
- Guide the students through the discussion of their results from the activies.
- Lead them through Examples 5.10 to 5.13 given in student's book.

- Help them to understand the properties of proportions.
- Guide the students to understand how to apply the properties of proportions to solve problems.\
- Ask them to do Excercise 5.4 given in student's book.

Direct Proportion

(2 lessons)

By the end of this section, the learner should be able to:

- Explain the meaning of direct proportion.
- Solve problems involving direct proportion.

Information to the teacher

Direct proportion can be applied in many disciplines such as Physics. Therefore, engage the leaner in many practical activities for them to understand the concepts better.

Materials

- Ruler (metre rule)
- Coloured chalks
- Graph on the chalkboard
- Graph papers
- Sources of data
- Text books

Preparation

Before the lesson starts, ask the learner to come with complete geometrical set, graphs books or graph papers. Ensure

you have borrowed or improvised materials to be used during the lesson.

Teaching guidelines 5.7

- With learners in pairs or groups of 3 students, assign them to do activity 5.11 in student's book i.e. to determine the relationship between number of persons and cost and comment about it.

- At the end of the Activity 5.11, ask the learners to do Activity 5.12 in student's book i.e. use the value in table 5.1 to draw the graph of number of pens (N) against cost (C) and to describe the graph.

- Then let the groups to present their findings in a class discussion. Allow the members to contribute by asking questions, correction of the errors, omissions and other points.

- During the discussion guide them on the key points, correct the mistakes.

- Thereafter take this opportunity to point out the key points. Explain the concept of direct proportion, how to interpret the direct proportion relationship and drawing the graph of direct proportion. Solve the provided examples for them to understand with ease. This is your chance to assess the concepts and achievement of the objectives.

- Guide the learners through example 5.14 to 5.15 in the learners book.

- Ask the learners to do questions 1 and 2 of Exercise 5.5 in student's book. Go round checking their work and guiding them accordingly.

- Ask the learner to do the remaining questions and evaluate masterly of the concept.

Inverse Proportion

(2 lessons)

By the end of this section, the learner should be able to explain the meaning of inverse proportion, interpret the inverse relationship and solve problems involving inverse proportion.

Materials

- Metre rule
- Graph on the chalk board
- Graph papers
- Student's book (Text books)
- Coloured chalks

Preparations

Before the lesson, ask the learner to come with complete geometrical set and graph book /graph papers. You should also borrow or improvise the materials needed for teaching-learning process. Ask the learner to read about inverse proportion in time.

Teaching guidelines 5.8

- In groups of two students, ask them to do Activity 5.13 in student's book, i.e. to observe change in speed with time.

- At the end of the activity, ask the groups to present their findings in a class discussion and other student contribute to the discussion.

- Guide them during the class discussion pointing out key points and correcting the errors.

- Take this opportunity to explain the concepts clearly. Interpreting the inverse proportion, drawing the graphs on inverse proportion and solving problems involving inverse proportion.

- Assist the learners to solve example 5.19 to 5.21 in the learners book to illustrate this.

- Task the learners to do question 1, 2 and 9 of Exercise 5.6 in student's book. Go round checking their work guiding the slow learners and quick learners accordingly.

- Show them how to interpret the graphs either directly proportion an inverse proportion. Then evaluate the concept masterly by asking the learner to do the remaining question of Exercise 5.6.

- Give unit Test 5 as a summative assessment to test their understanding of the unit concepts.

Answers

Exercise 5.1 (Pages 125 - 126)

1. (a) 2:3 (b) 3:5 (c) 4:5
   (d) 1:2 (e) 2:5 (f) 20:1
   (g) 20:1 (h) 2:1 (i) 1:1
2. (a) 5:1 (b) 5:1 (c) 5:2
   (d) 3:40 (e) 5:4 (f) 3:2
3. 4:3
4. (a) 6:5 (b) 5:11 (c) 6:11

5. (a) 24 (b) 9 (c) 117
   (d) 8 (e) 4 (f) 4
6. (a) 20:15:9 (b) 15:20:8

Exercise 5.2 (Page 127)

1. (a) 600 FRW, 1 000 FRW
   (b) 4.8 ha, 7.2 ha, 12 ha
   (c) 27.25 kg, 136.25 kg, 163.5 kg
   (d) 434 chicken, 341 chicken
2. 1440
3. A − 3 270 000 000 FRW
   B − 5 450 000 000 FRW
4. 6:4 or 3:2
5. 6:3:1, BEN − 57 600 FRW
6. (a) 11:9 (b) 180 girls

Exercise 5.3 (Page 128)

1. (a) 7.3 cm (b) 14.6 cm
   (c) 10 cm (d) 3.8 cm
2. (a) 21.9 m (b) 17 km
   (c) 1.06 km (d) 780 m
3. 6 cm by 4.5 cm 4. 1:500

Exercise 5.4 (Page 131)

1. (a) True (b) False (c) False
   (d) False (e) True
2. (a) $x = 6$ (b) $x = 2$ (c) $x = 18$
   (d) $x = 6$ (e) $x = 12$ (f) $x = 9$
3. (a) $a = 5$ (b) $b = 32$ (c) $r = 4$
   (d) $p = 63$
4. (a) 1:21 (b) 8:1
5. (a) 7:1 (b) 3:4

Exercise 5.5 (Page 133 - 134)

1. 4.12 l 2. 12.9 N
3. 37.5 g 4. FRW 16 200

5.   3 litres

6.

X	1	4	10
Y	5	20	50

7. $1 \frac{1}{3}$ hours

8.   (a) 4

(b) (i)   16 mm
     (ii) 1.0 N

Exercise 5.6 (Page 137)

1.   9 hrs   2.   4 days

3.   4 men   4.   3.8 hours

5.

X	1	4	16	24
Y	32	8	2	0.5

6.   20 books

7.   36 km/h
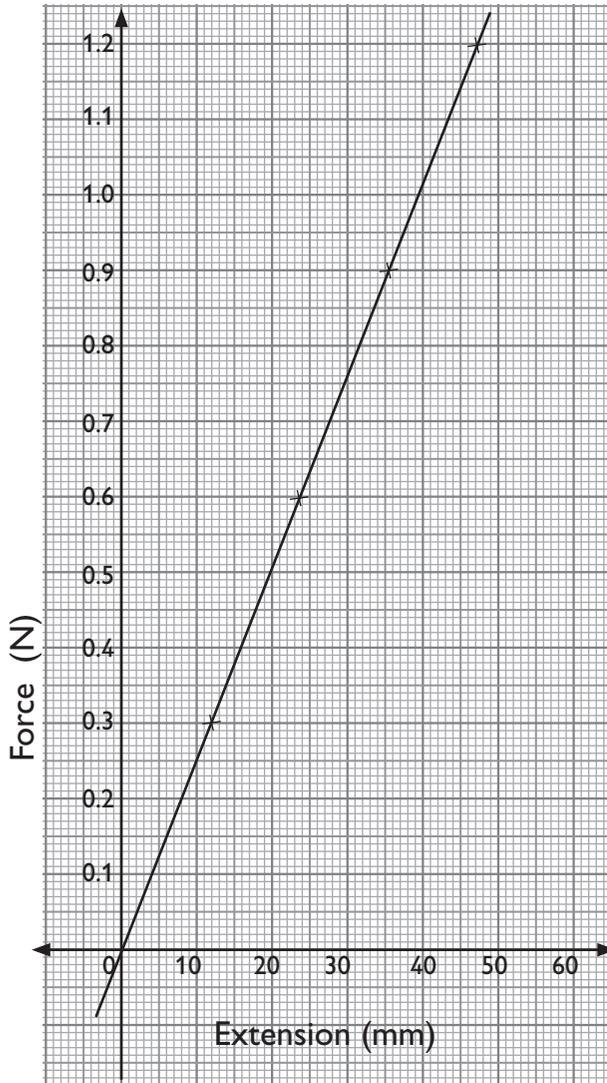
8. (a)
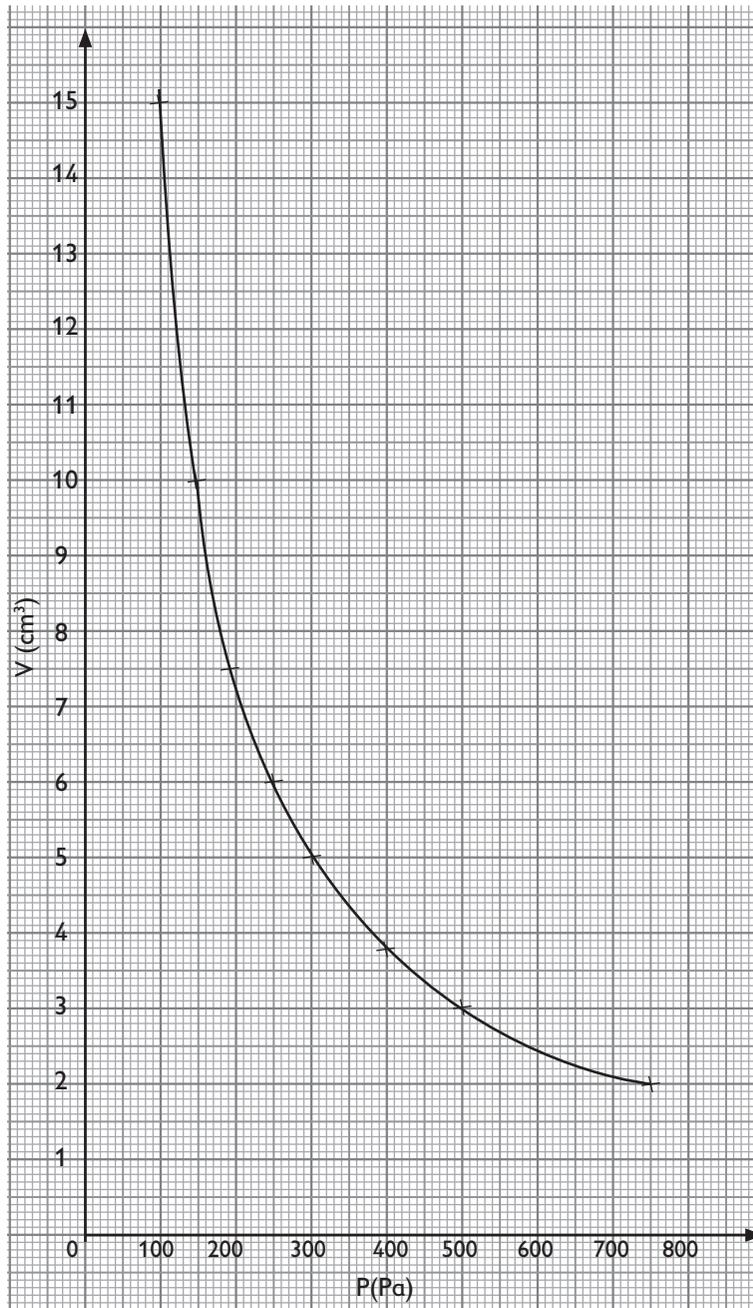
(b) (i) 187.5 pa

(ii) 4.29 m³

(c) 2.5m³

9. (a)
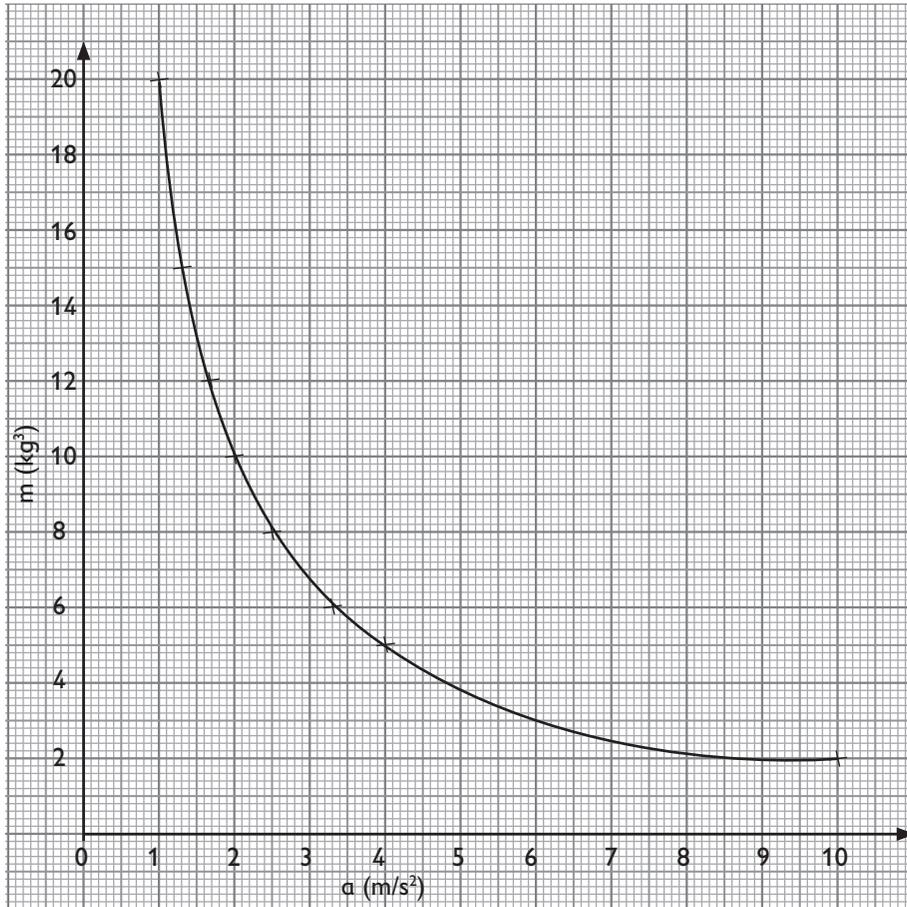
(b) (i) 6.67 kg

(ii) 2.22 m/s^2

(c) 4.44 kg

Unit Test 5 (page 138)

1. 40 days

2. 5 sweets

3.
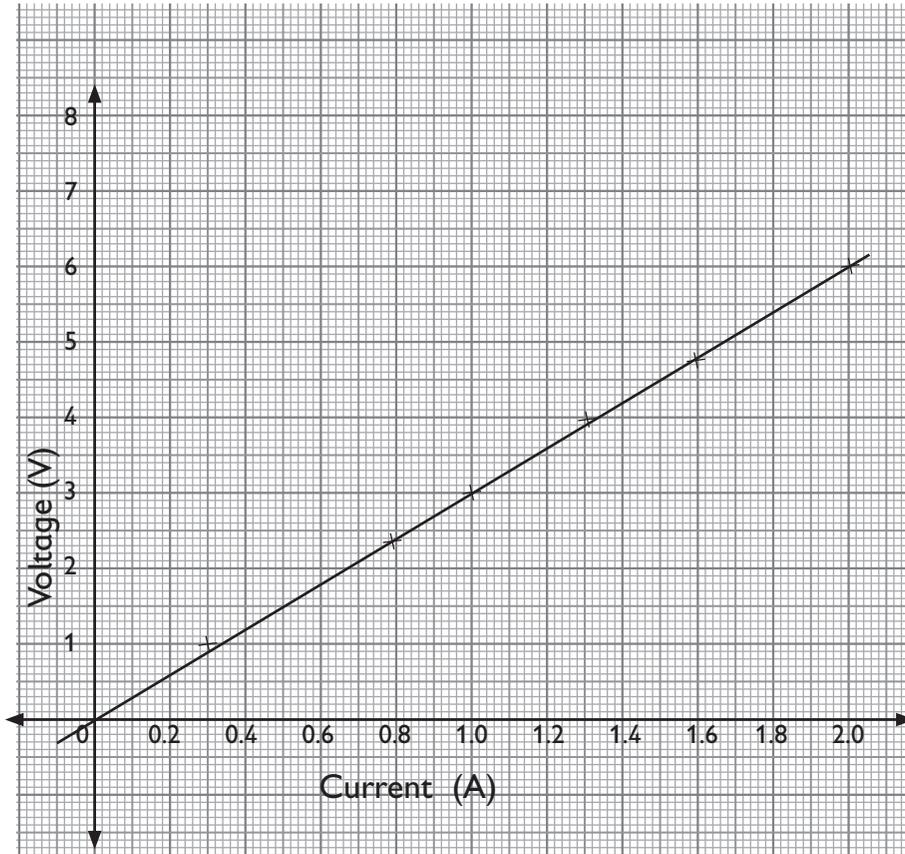
b) (i) 3.6 v

(ii) 1.18 A

4. (i) 30 rows

(ii) 42 chairs

5. a:b:c

6: 27: 99

b) a:b:c

6:27:99

c) a:b:c

8:10:25

d) a:b:c

9:27:39

6. Female: male
   - 14: 25

b. Male: all workers
   - 25: 39

c. Female: All workers
   - 14: 39

7. a. 20: 3

b. 20: 37

c. 10:7

d. 14:15

8. 2: 5: 3
   - 36°: 90°: 54°

9. 45 litres

10. 0.12 cm by 0.1cm

Geometry

POINTS, LINES AND ANGLES

Student's Book pages 139 -153. (12 Lessons)

Key unit competence

By the end of this unit, the learner should be able to be able to construct mathematical arguments using the angle properties of parallel lines.

Learning objectives

Knowledge and understanding

- Recognize the position of an angle at a point sum to 360°; angles at a point on straight line sum to $180^0.$

- Distinguish and recognize vertically opposite, corresponding, alternate and supplementary angles

Skills

- Use knowledge of angle properties of parallel lines and shapes to construct arguments when finding missing angles in geometric diagrams.

- Construct and calculate angles.

Attitudes and values

- Appreciate the need to give reasons when developing solutions to missing angle problems.

- Value a variety of different approaches to reach the same conclusion.

Generic competences addressed in this unit

- Innovations

- Co-operative and interpersonal learning

- Research and Problem solving

- Communication skills

Links to other subjects

- Physics, construction, engineering, geography, fine arts, scientific drawing.

Cross cutting issues addressed in this unit

- Environment and sustainability

- Peace and value

- Finance education

Assessment criteria

* construct mathematical arguments using the angle properties of parallel lines.

Background information

This is an introductory part in geometry. In this unit, the students will learn about aline, segment, rays and angles, various types of angles and how to solve related problems. Make use of angles on real objects in the classroom e.g. desks and doors and to help the learners understand with ease and appreciate the application of angles in real life.

Suggested teaching/ learning activities

Points and lines

(1 lesson)

By the end of this section, the learner should be able to differentiate between a line, segment and a ray. Identify and draw a line, segment and a ray.

Materials

* Metre rule
* Geometrical instruments
* Manila papers
* Colored chalks
* Textbooks
* Chart showing a line, segment and a ray

Preparation

Before the lesson, ask the learners to come with a complete geometrical set. Prepare or borrow a chart showing a line, segment and ray.

Teaching guidelines 6.1

* In pairs, ensure every learner has access to the textbook and knows what he or she is doing.

* Assign them to do Activities 6.1 and 6.2 given in student's book i.e. to define a point, a line, a segment and a ray. Give them guidance or clarifications where necessary.

* Give them a chance to present their observations through in a class discussion and members of the class to contribute by asking questions or give opinion.

* While the discussion is ongoing, guide them where necessary on their findings.

* Take the opportunity at end of class discussion to summarize their presentations.

* Illustrate the concepts through Example 6.1.

* Assess the achievement of the objective by asking the learners questions and answering theirs.

* Task learners to do question 1 and 2 in Exercise 6.1. Go round checking their work giving more guidance to those who may be having challenges.

Angles

(3 lessons)

By the end of this section, the learner

should be able to identify various types of angles and solve problems related to angles.

Materials

- Textbooks
- Clock
- Geometrical instruments
- Manila papers
- Piece of paper
- Protractor
- Chart showing various types of angles

Preparation

Before the lesson, ensure you have the chart showing various types of angles. Ensure every learner has access to the textbook and has a piece of paper. If there is no classroom clock, borrow one from the staffroom or principal's office.

Teaching guidelines 6.2

- Organize the learners into pairs. Taking into consideration of gender and ability.
- Ask them to do activity 6.3 given in student's book i.e. to discuss with their partners about a right angle and obtain a right angle using a piece of paper or a door.
- While they are presenting their work, guide them accordingly. Where necessary ask the class members to contribute.
- At the end of the activity 6.3, ask the learners to do activities 6.4, 6.5, 6.6 and 6.7 in students' book i.e. to discuss other types of angles and obtain them by use a clock.
- Let them present their finding in a class discussion and members of the class to contribute.
- While the class discussion is ongoing, guide them where necessary on their findings of the activities to help them understand and master the various types of angles.
- Take this opportunity to summarize their presentations. Explain the key points: types of angles. Acute angle, right angle, obtuse angle, straight angle, reflex angle and their properties.
- Use this opportunity to assess the achievement of the objective by asking the learners questions and answering them.
- Ask learners to do question 1 and 2 in Exercise 6.2 in student's book. Check their work, there after give the remaining exercise as homework.

Angles on a straight line

(1 lesson)

By the end of this section, the learner should be able to construct the argument of angles on straight line and solve problems related to angles on a straight line.

Materials

- Textbooks
- Colored chalks
- Geometrical instruments
- Manila papers

Preparation

Ensure you have prepared well for the lesson by acquiring all materials needed during the lesson.

Teaching guidelines 6.7

- In pairs, impose activity 6.8 given in student's book to learners i.e. to determine the property of angles on a straight line by folding a paper.

- Let them present what they discuss through the secretaries in a class discussion and members of the class to contribute by asking questions and correct the errors or omissions.

- While the discussion is ongoing, guide them where necessary on their findings of the activity to help them understand that angles on a straight line add up to 180^0.

- Take this opportunity to summarize their presentations. Explain the key point that angles on a straight line add up to 180^0. Involve them in solving problems related to angles on a straight line. Illustrate this by use of examples 6.2.

- Assess the achievement of the objective.

- Give them work to do. Ask them to do Exercise 6.3 in student's book. Go round checking their work.

Angles at a point

(1 lesson)

By the end of this section, the learner should be able to construct the mathematical argument of angles at a point and solve problems related to angles at a point.

Materials

- Textbooks
- Colored chalks
- Geometrical instruments
- Manila papers

Preparation

Ensure you have prepared well for the lesson by acquiring all materials needed during the lesson.

Teaching guidelines 6.8

- In pairs, task them to do activity 6.9 given in student's book i.e. to determine the angles at a point.

- Allow active presentations in a class discussion.

- While the discussion is ongoing, guide them where necessary on their findings on the activity to help them understand that *angles at a point add up to 360^0*.

- Explain the key point that *angles at a point add up to 180^0*. Involve them in solving problems related to angles at a point.

- Reinforce the concepts by taking them through example 6.3.

- Assess the achievement of the objective by asking the learners questions and give them a chance to answer them.

- Ask them to do Exercise 6.4 in student's book. Go round checking their work. Guide them accordingly.

Angles on a parallel line

(2lessons)

By the end of this section, the learner should be able to construct the argument of angles on a parallel line and solve problems related to angles on a parallel line.

Materials
- Textbooks
- Colored chalks
- Geometrical instruments
- Manila papers

Preparation
Ensure you have prepared well for the lesson by acquiring all materials needed during the lesson.

Teaching guidelines 6.9
- Organize the learners into pairs. Ensure every learner has access to the textbook and knows what he or she is doing.

- Assign them activity 6.10 given in student's book i.e. to determine the property of angles on a parallel line by use of a ruler.

- Let them present what they discuss through the secretaries in a class discussion and let the members of the class to contribute by asking questions and giving their input.

- While the discussion is ongoing, guide them where necessary on their findings on the activity to help them understand properties of angles on parallel lines.

- This is your time to explain the key concepts. A transversal line, corresponding angles, alternate angles, vertically opposite angles and supplementary angles. Involve them in solving problems related to angles on parallel lines. Reinforce the concepts by taking them through the provided examples.

- Reinforce the concept by taking the learners through example 6.4 in the learners book.

- Assess the achievement of the objective by asking the learners questions.

- Give them work to do on Exercise 6.5 in student's book.

Answers
Exercise 6.1 (Page 140)
1. (a) A, B, C and D
   (b) BC
   (c) AB and AD
   (d) CD
2. (a) PQ and QR   (b) PR
   (c) TQ and QS

Exercise 6.2 (Pages 143 - 144)
1. a) Acute

b) Acute

c) Reflex

d) Right angle

e) Straight line

f) Obtuse

g) Obtuse

h) Reflex

2. a) Acute

b) Right angle

c) i. Obtuse

h. Acute

d) j Acute

k Obtuse

e) l Obtuse

f) m – acute

n – acute

3.

(a)   (b)

(c)

(d)
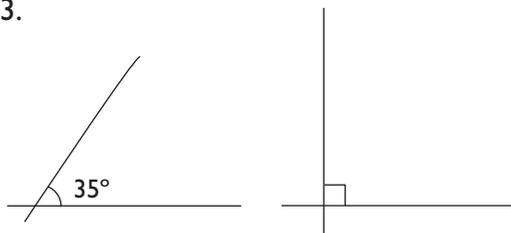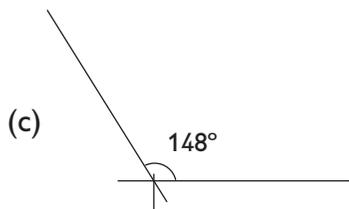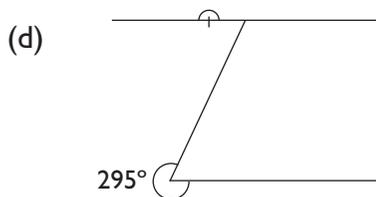
Exercise 6.3 (Pages 146)

1. a) a - 67°

b) b - 132°

c) c – 90°

d) d – 50°

e) e – 150°

f) f - 230

2. a) $a + b + c = 180^0$

$b + d = 180^0$

b) $h + g = 180^0$,

c) $k + j + l = 180^0$

$m + l = 180^0$

Exercise 6.4 (Pages 148)

1. $g = 45^0, f = 120^0$

2. $b = 72^0$

3. $a = 57.75^0$

4. $a = 55.38^0$

5. $x = 72^0, \quad y = 120^0$

6. $a = 35.7^0, \ c = 90^0$

Exercise 6.5 (Pages 151 - 152)

1.A (i) Corresponding angles

a and g, b and d, c and e, f and 80^0.

(ii) Alternate angles

80^0 and e, c and g

(iii) co-interior angles 80 and g, c and d

B (i) Corresponding angles

None

(ii) Alternate angles

J and 40^0

(iii) Co interior angles

100^0 and h

125

l and 40^0

C (i) Corresponding angles

None

(ii) Alternate angles

None

(iii) Co-interior angles

K and l, 40 and m

L and m, k and 40

D (i) Corresponding angles

80^0 and q, 35^0 and r

(ii) Alternate angles

80^0 and p

(iii) Co-interior angles

80^0 and n

(b) a=100^0, b=80^0, c=100^0, d=80^0, e=100^0, f=80^0, g=100^0, h=80^0, i=140^0, j=40^0, k=140^0, l=40^0 m=140^0 , n=100^0 p=80^0, q=80^0, r=$35^{0,}$ s=145^0, t=145^0

2. AP//QF

BP//QE

3. (a) a = 32.5^0

(b) x = 95^0

Test Unit 6 (page 152 - 153)

1. (a) Rays: AD, BA, CD, BC

(b) Line segments BD, BC

(c) BC, BD

2. (a) Reflex angle, 240^0

(b) e and d – obtuse angles

c and b – acute angles

(c) g – acute angle

f – obtuse angle

(d) i – obtuse angle

h – reflex angle

j – acute angle

3. (a) 41.67^0

(b) B = 78^0

C = 78^0

(c) h = 88^0

F = 46^0

G = 46^0

(d) t = 150^0

r = 90^0

s = 60^0

Geometry

SOLIDS

Student's Book page 154 - 192. (24 Lessons)

Key unit competence

By the end of this unit, the learner should be able to select and use formulae to find the surface area and volume of solids.

Learning objectives

Knowledge and understanding
- Explain the surface area of a solid as the area of the net.
- Illustrate the volume as the space occupied by a solid.
- Distinguish between surface area and volume and know the correct units.

Skills
- Derive the surface area for prism and cylinder.
- Calculate the surface area and volume of common geometrical solids, using formulas where necessary.
- Distinguish between surface area and volume and select appropriate formulae and units to use in various contexts.

Attitudes and values
- Appreciate the difference between surface area and volume and recognize solids in the environment.

Generic competences addressed in this unit
- Critical thinking
- Research skills
- Cooperation and interpersonal relationships
- Problem solving
- Communication skills
- Creativity and innovation

Links to other subjects

Where volume and area calculations may be needed e.g. physics, construction, engineering, geography, fine arts, scientific drawing etc.

Cross-cutting issues

- Inclusive education
- HIV and AIDS
- Financial education
- Environment sustainability

Assessment criteria

Able to select and use formulae to find the surface area and volume of solids.

Background information

Nature is full geometric shapes and solids. For example, one can make a career out of designing and making packaging materials and containers in different shapes and sizes. This unit is highly practical. You should therefore engage the learners in as many activities as possible to arouse interest and help them be innovative. The provided activities, will help the learners visualize different types of solids, design some common solids and calculate the areas of materials required, calculate volumes and capacities of such solids.

Suggested teaching/learning activities

Definition of a solid

By the end of this section, the learner should be able to:

- Define a solid, polyhedral and distinguish between them.
- Identify and sketch common solids.
- Describe a solid in terms of number of faces, edges and vertices.

- State properties of solids.
- Relate number of edges, faces and vertices of solids with polygonal faces.

Information to the teacher

Learners were introduced to solids in primary school. They designed nets of cubes and cuboids and prisms. They used these nets to calculate surface areas of solids. So, the topic is not completely new to them.

Materials

Mathematics/English dictionaries access to internet i.e. computer.

Preparation

Ensure that the learners have access to the required materials.

Teaching guidelines 7.1

- Organize the class into groups. Ask the groups to do activity 7.1 given in the student's book i.e to discuss the meaning of solids, polyhedral.
- Let the groups present their findings, as the others analyze their work and offer alternatives where necessary.
- Summarize the class findings ensuring that the learners do the same in their exercise books.
- Let the class answer the questions after the summary of activities 7.1, 7.2 and 7.3 as an individual activity, and ensure that they know and understand what they are doing. Let them also copy and complete Table 7.2 on their own but check on them to ensure that they are doing the right thing.

- Exercise 7.1 is purely for class discussion. Go round checking that their discussions are in the right direction, helping where there is challenge.

Surface area of a cuboid

By the end of this section, the learner should be able to

- Construct accurately the netof a cuboid, full size or to scale.
- Calculate the area of the net.
- State the surface area of the cuboid = the sum of the area of the net.

Information to the teacher
Remember that this is revision work to the learners. Ensure that they can remember the procedure and key points learnt on the previous lessons. Ensure that every group has at least one box to work with.

Preparation
Ask your students to bring small empty cartons the day before the lesson.

Teaching guidelines 7.2
- Organize the learners to work in pairs to do activity 7.4.
- Let different groups open similar boxes along different edges to demonstrate the fact that the net of a solid is not unique.
- Ask the learners to measure the edges of their boxes, and use the measurements to construct the nets of their boxes.

- Ask the groups to calculate the total surface area of their boxes.
- Take students through example 7.1 in the student's book.
- Let the students summarize the findings of their activity and present them in a class discussion.
- Summarize their presentations, by highlighting the key points observed i.e.
  - (i) The formula for the surface area of a cuboid.
  - (ii) The symmetry of the pairs of opposite faces of a cuboid.
- Ask students to do questions (a) and 4 of Exercise 7.2 in the student's book.

Surface area of a cube

By the end of this section, the learner should be able to:
- Construct the net of any cube.
- Calculate the surface area of a cube without necessarily drawing a net.
- Find the length of a cube given its total surface area.

Materials
Mathematical instruments, paper scissors, manila sheets or adhesive tape.

Teaching guidelines 7.3
- Let the learners work individually to do activity 7.5 in the student's book.
- Give them specific size of a cube to work on and ask them to construct the net, calculate its area and state

the total surface area of the cube.

- Inspect their work as they progress, and summarize it by stating the formula for finding the surface area of a cube.

- Take class through example, 7.2 and 7.3 in the student's book.

- Create some questions on the surface area of a cube and let the students do them individually, as you go round checking their working.

Surface area of a cylinder

By the end of this section, the learner should be able to:

- Construct on accurate net of a closed cylinder.
- Calculate the curved surface area of a cylinder.
- Calculate the total surface area of a cylinder.
- Derive the formula for finding surface area of a cylinder.

Information to the teacher

Learners were introduced to the surface area of a cylinder in primary level. In this section, the learners will consolidate their work on nets and areas of cylinders, including derivation of the formula for finding the surface area without necessarily construction the net.

Materials

Empty cylindrical cans, measuring tape mathematical instruments, manila sheets, plain papers, paper scissors, glue or adhesive tape.

Preparations

Ask the students to bring empty cylindrical the day before the lesson.

Ensure that you have plain sheets of paper for use in the activity.

Ensure that you have a measuring tape per group, as well as a pair of paper scissors.

Teaching guideline 7.4

- Organize the class into groups, ensuring that every group has the necessary materials to do activity 7.6.

- Ask the groups to do activity 7.6 given in the student book i.e. to calculate the curved surface area of a cylinder, area of circular faces, and total surface area of a cylinder derive the formula for total surface area of a cylinder etc.

- Ask the groups to construct the net of a cylinder i.e. Take measurements of the height of the cylinder, the radius of the end faces and use them to draw the net.

- Let the groups present their findings in a class discussion through their group secretaries and allow other members of the class to comment on the work.

- Summarize their presentations by helping the learners to understand the relationship between the curved surface of a cylinder and the net of the cylinder. State the formula for the area of a cylinder and ensure

that the procedure and reasoning is clear to all.

- Take the class through examples 7.4 and 7.5 to ensure that learning has taken place.

- Ask the class to do questions 1, 2, 3, 5 of Exercise 7.2.

- Ask the learners to save their cylinders for use in a late activity.

Surface area of a prism

By the end of this section, the learner should be able to:

- Identify a prism, describe the shape of the faces that make up the prism i.e. identify true shape of faces.

- Construct the net of a prism.

- Calculate the total surface area of a prism.

Information to the teacher

Probe the students to ensure that they understand the properties of a prism. Ensure that they are able to describe different types of prisms, as well as the shapes of the faces that make a prism.

Preparation

Find a number of boxes in assorted types of prism for identification and demonstration before the class starts on the activities.

Teaching guidelines 7.5

- Organize the class into groups of two to do activity 7.7 in the student's book.

- Ask groups to do activities 7.7 i.e. to:

  (i)   Describe the prism including shapes and sizes of face.

  (ii) Construct nets of the prism.

  (iii) Calculate total surface area.

- When done, let learners present their findings in a class discussion verify their findings and conclusions emphasize the key points by making them answer and discuss the questions just before Example 7.6 in the student's book.

- Take the learners through example 7.6 then ask them to do questions 1 (b) (c) (e) (f) of Exercise 7.2 of the student's book.

Surface area of a pyramid

By the end of this section, the learner should be able to:

- Identify and state properties of a tetrahedron.

- Construct and use the altitude of any non-right angled triangle.

- Construct the net of a tetrahedron.

- Use the net to calculate the area of a tetrahedron.

Information to the teacher

As you summarize the findings of activity 7.8, remind the learners that the base of a pyramid can be any polygonal shape. However, the method of finding surface area remains the same.

Materials

- Paper scissors

- Manila sheets
- Colored pencils
- Glue or adhesive tape

Preparation

Construct models of a tetrahedron from different nets for demonstration before the class construct their own. If you are able, to obtain tetrapacks or ask the students to look for some the day before the lesson.

Teaching guidelines 7.6

- Organize the class into groups to do activity 7.8 in the student's book i.e. to design a wrapper in the shape of a tetrahedron.

- After introducing the activity ask the groups to do activity 7.9 in the student's book.

- At the end of the activity, let the groups present their findings and conclusions in a class discussion. Through their group secretaries and allow other groups to comment on the presentation.

- Comment on their presentations, a point at a time, verifying the quality of their work.

- Summarize their presentation demonstration on the board for all to see and compare with their own work.

- As you summarize, help the learners to identify the link of this activity to other subject areas i.e. art and design, advertisement and marketing etc.

- Appreciate the fact that this activity helps promote.

(i)   Creativity and innovation

(ii) Critical thinking

(iii) Link learning with serious business

(iv) Fun in learning among other competences

- Take your class through example 7.7 in student's book. Ask the class to do questions 3, 4 of Exercise 7.3.

- Activity 7.8 is an example of a pyramid with a base other than a triangle. Let the learners do this activity as homework. Then as you summarize their findings, take them through examples 7.7 to 7.9. Distinguish between stand height and height of a pyramid.

- Let the learners do Exercise 7.3.

Surface area of a cone

By the end of this section, the learner should be able to:

- Use part of a circle to form the curved surface of a cone.

- Relate the circumference of the base of a cone to the circumference of the circle from which it was formed.

- Derive formula for the surface area of a cone.

- Use formula to find surface area of a cone.

- Find the radius of the base of a cone.

- Calculate the total surface area of a cone.

Materials

- Scissors, adhesive tape or glue
- Manila papers
- Mathematical sets

Preparation

Prepare a model of a cone before this lesson. To make this model, we use the same approach as the activity in their book. Do the activity in advance so that you can help your student.

Teaching guideline 7.7

- Organize the class into groups to do Activity 7.10 in the students' book.
- Ask the groups to work through the activity and supervise as they work, helping those who may have challenges.
- When the activity is over, give the groups an opportunity to present their findings as you listen and verify them.
- Summarize their presentations ensuring that they have arrived at the formula for calculating the surface area of a cone.
- Now, guide the class through the argument and discussion under the subheading observations and conclusions.
- Now, take the class through examples 7.10 and 7.11 in order to consolidate the findings and conclusions achieved.
- Let the class questions 1-3 of Exercise 7.4. Move round to check that they are doing the right thing.

When satisfied with their work, let them do questions 4-7 of the same Exercise. The fast ones may continue to question 5 and 9. This ensures that all learners' abilities are taken into consideration.

- Ask the leaners to preserve the cones in this activity for use in later activity on volume of a cone.

Surface area of a sphere

By the end of this section, the learner should be able to

- Derive the formula for the surface area of a sphere.
- Use the formula to find the area of a sphere.
- Derive the formula for the area of a hemisphere.
- Use the formula to find the surface area of a sphere.

Materials

- Plain paper
- Mathematical instruments
- Scissors
- Sharp cutting blades i.e. razor blade.

Preparation

The day before this lesson, ask the students to bring a suitable fruit as described in the activity 7.11 in the student's book. If you can find spherical items they can use, the better.

Provide the cutting blades and anything else that the students cannot find.

Teaching guidelines 7.8

- Organize the class into groups to do activity 7.11 in the student's book. Ensure that every group has the required material for the activity.
- Ask the groups to do the activity and go round ensuring cutting is done correctly.
- Remind the class that to achieve the desired result, every step of the activity must be done correctly.
- When the activity is over, let the groups present their findings in a class discussion, allowing all members to participate actively.
- Summarize their findings, ensuring that the desired result has been achieved as shown in the student's book.
- Let the class use the derived formulae to do Exercise 7.5 in the student's book.

Surface area of composite solid

By the end of this section, learners should be able to

- Describe a composite solid in terms of simpler solids.
- Calculate the surface area of a composite solid.

Information to the teacher

Since this is not a new concept, probe the learner to define the term **composite solids** and verify their answers.

Teaching guidelines 7.9

Guide them through Activity 7.12.

Take the class through example 7.13 in the student's book.

Ask the class to do questions 1 to 3 of Exercise 7.6 in the student's book.

Volume of a cubes and cuboids

By the end of this section, the learner should be able to:

- Derive the formula for volume of a cuboid.
- Use the formula to find volume of a cuboid.
- Convert cm^3 into m^3 and vice versa.

Information to the teacher

Volume of cuboid was introduction to learners in primary school. Begin by investigating how much of this concept the students remember before they start working on the activity.

Materials

- Manila papers,
- Paper scissors
- Glue or adhesive tape
- Mathematical instruments

Preparation

On the day before this lesson, assign every learner to make atleast 3 cubes of sides 1"

Identify prospective group leaders to make an additional cuboid of sides 4" by 2" b 3".

This is the beginning of activity 7.13.

Teaching guidelines 7.10

- Organize your class into groups to complete activity 7.13 in the student's book.

- Ask the learners to complete activity 7.13 in the student's book.

- Ensure that each group has enough of the small cubes to fit and to fill the larger cuboid.

- When the activity is over, let the groups present their findings in a class discussion through the group secretaries. Listen to their presentations allowing other members of the class to comment.

- Verify their findings and ensure that your the students are able to relate the number of small cubes that fill the cuboid to the volume of the cuboid.

- Product of the three dimensions of the cuboids i.e. number of "1" cubes required to fill the cuboid is equal to the product length x breadth x height.

- Now discuss the next under the 'units of volume' and the demonstration under 'volume of a cuboid' in the student's book.

- Take the students through example 7.14 in the student's book, as students to do questions 2(a), of Exercise 7.7.

Volume of a prism

By the end of this section, a learner should be able to

- Identify different types of prisms.

- Calculate the volume of a prism whatever the shape of the cross-section (base).

Materials

A cutting blade

Mathematical instruments

Thick foam or plasticine, a block of soft wood.

Preparation

Ensure that the required materials are available and the learners have access.

Teaching guideline 7.11

- Organize the learners to work in pairs to do activity 7.14 in the student's book. Derive a formula for calculating the volume of a prism.

- Guide them on how to cut out the design shown in the student's book, under the activity 7.14. If the working materials are not available the learners can use the 1" cubs, they made earlier in activity 7.14; arrange them in the pattern shown in activity 7.14 and proceed with the activity.

- When the activity is over, let the groups present their findings and draw their conclusions as you are listening and verify them.

- Highlight the key points of the activity. Explain to the learners that in future, they do not have to do activities, to calculate volumes

of prisms or any other solids. We use the formulas derived from these activities.

- Now take the learners through Examples 7.15 to 7.17 in the student's book. Ask them to do questions 1 (b) (c) (e) (f) Exercise 7.7 as you move round the class checking their working and helping those having challenges. When satisfied with the working, let the class do questions 3, 4, 7 of the same Exercise. Fast workers can move on to question 3.

Volume of a cylinder

By the end of this section, the learner should be able to:

- Calculate the volume of a cylinder.
- Find dimensions of a cylinder given its volume and other relevant information.

Information to the teacher
Remind the learners that by definition, a cylinder is a prism.

Teaching guideline 7.12
- Working with the whole class, guide them to apply the concept and methods of working with prisms to the cylinder.
- Guide them through Activity 7.15.
- Describe the cylinder i.e. its base, length and state the formula for the volume of a cylinder.
- Take them through Examples 7.18 and 7.19 in the student's book. Ask

them to do question 1 of Exercise 7.8 as you move round checking the work. When you are satisfied, let them do question 2-5. The faster learners may continue to question 8.

- Note that Exercise 7.8 questions 7 to 12 are on cuboids and prisms. Let the class do these questions as homework at their own pace.

Volume of a cone

By the end of this section, learners should be able to:

- Relate volume of a cone to that of a cylinder.
- Derive the formula for the volume of a cone.
- Use formula to final volume of a cone.

Information to the teacher
The models of cylinder and cone from earlier activities are going to be in use in this activity with slight adjustments to make both radii and heights equal as peractivity. This will save time.

Materials
The cones and cylinders save earlier

Manila sheets, scissors or adhesive tape, mathematical instruments, dry stuff as suggested in the Activity 7.16.

Preparation
Ask the learners to make the suggested cone and cylinder suggested in activity 7.16 in the student's book. If they saved the earlier cones and cylinders, then may

adjust them accordingly. Ensure that you provide all the required materials.

Teaching guideline 7.13

- Organize the learners into groups to do activity 7.16 in the student's book. To release the volume of a cone to that of a cylinder.

- Ask the groups to do activity 7.16, ensuring that every group is doing the right thing and that they have the required materials.

- When the activity is over, let the groups present their findings in a class discussion through their group secretaries or any other member and allow other members of the class to give their comments. Listen to their presentations and verify their conclusions.

- Summarize their presentations by helping the learners to relate the volume of the cone to that of the cylinder as explained in the student's book following the activity under the subheading "observation".

- Take the class through examples 7.20 and 7.21.

- Ask the class to do questions, 1 and Exercise 7.9 in the student's book. Go round the class as they work verifying that they understand what they are doing. Then let them do questions 3 to 6 of the same Exercise and workers may go on to questions 7 and 8.

- Give questions 9 to11 as homework.

- It would be fruitful and interesting to display activity 7.16 on the class notice board, with comments such as display would give confidence to the learner and motivate them to try new challenges.

Volume of a pyramid

By the end of this section, the learner should be able to:

- Relate the volume of a square-based pyramid to that of a cube whose faces are identical to the base of the pyramid.

- Derive the formula for the volume of a pyramid.

- Calculate the volume of a pyramid.

- Generalize the volume of a pyramid.

- Relate volume to capacity.

Information to the teacher

Activity 7.17 is similar to activity 7.16 related to volume of a cone to that of a cylinder. Help the learners to do this comparison before doing activity 7.17 to arouse curiosity and interest.

Materials
Manila papers, scissors, glue or adhesive tape

Mathematical instruments.

Preparation
If possible, ask the learners to make a sketch of the net given in activity 7.17 and draw the accurate net as homework

the day before this lesson. Insist every learner makes one net.

Teaching guideline 7.14

- Organize the learners into groups of three to do activity 7.17 of in the student's book.

- Ensure that every learner has an accurate net, ready to cut it out to model the pyramid.

- Ask the groups to do the activity according to the instructions.

- When the activity is over, let the groups present their findings and conclusions in a class discussion. Allow them to participate constructively.

- Summarize their presentations as you verify their findings i.e.

- Volume of the cube = 6 x 6 x 6

-                    = 216 cm^3

- Volume of 1 pyramid = 216 (since there are 3 identical pyramids)

- Note: The height of each pyramid is at one vertex of the pyramid.

- Activity 7.18 in the student's book is similar to activity 7.17 in the same book. It requires the same materials and preparation as activity 7.17.

- Let your learners work in groups as before and do activity 7.19.

- When the activity is over, allow the groups to present their findings. Listen keenly as groups do their presentations so that you can verify the findings and summaries them.

- Discuss the observations in the student's book just after activity 7.19. Now take them through Examples 7.22 and 7.23 and ask the learners to do questions 1, 2 and 3 of Exercise 7.10 as you move round checking their work. When you are satisfied with their work, let them go on to questions 4 to 7 of the same Exercise the faster learners more go on to questions 8 and 9 you can give the remaining questions as home work for all.

Volume of a sphere

By the end of this section, learners should be able to:

- Drive the formula for calculating volume of a sphere.

- Use the formula to find the volume of a sphere.

Information to the teacher
It is not easy to design a suitable activity that can used to derive the formula for the volume of a sphere.

Materials
A classroom globe, a ball spherical balloons etc. a more model globe for demonstration

Preparation
Try to get one ball or balloon between ever two learners. You may ask the learners to bring these items if possible.

Teaching guidelines 7.15

- On your demonstration on sphere, mark a small square as the base of a pyramid whose vertex is at the centre of the sphere as shown in Fig. 7.63 in the student's book.

- Ensure that the learners can visualize of the pyramid.

- Ask the learners to mark the base of pyramids on their "spheres" and imagine their pyramids.

- Guide the learners through the discussion given in their book, up to the point where volume of a sphere.

- Give the learners an opportunity to repeat the procedure on their own, just to verify that they have understood the concept and the procedure.

- Now, take your class through the examples 7.24 to 7.26. Ask the learners to do questions 1 and 2 Exercise 7.11 on. Ensure that all are working and doing the correct thing.

- When you are satisfied with the work of the learners, ask them to go onto questions 3 to 7. Those who finish early may continue to work on question 7 to 9 of the same Exercise. Let them complete the Exercise as homework.

Problem solving: Areas and volumes

This section is to help consolidate skills and techniques learnt in this unit. Let the learners work through activity 7.21 individually first, then allow them to work in pairs to compare their results. Finally, verify the results of the activity. You could use a manila sheet to make a neat copy of table 7.3 and display it in the classroom notice board.

Materials

Activity 7.22 in the student's book requires plasticine or thick foam and a sharp cutting blade. Ensure that you provide the required working materials for this activity.

Teaching guidelines 7.16

- The figure in the Activity 7.22 shows one way of cutting the cube to create three distinct solids.

- Ensure that the learners identify the solids and name them.

- There are several other ways of cutting the cube to expose different faces and solids. Help and guide yourclass to investigate some of them. You could have different groups cutting the cube differently.

- Choose some of the results of this activity and have the learners display them in the room would such a display have any effect on the learners?

- This and many other activities done in this unit promotes critical thinking, creativity and innovation, spirit of good team work, self-confidence, ability to link learning to serious business among other skills and attitudes. Probe the learners to get a feedback from them i.e about the

activities, group work etc. and their relevance to the learning.

Now take the students through example 7.26 in the student's book.

Exercise 7.12 has assorted questions and problems. Encourage the learners to do them all including Unit Test 7, not in one sitting but in the course of time.

Answers

Exercise 7.1 (Page 158)

1. Cuboid
2. Cylinder and cone
3. Cylinder
4. Cylinder
5. Cylinder and pyramid
6. Cylinder, cuboid
7. Cone, cylinder

Exercise 7.2 (Pages 164 - 165)

1. (a) 136 cm^2 (b) 120cm^2
   (c) 437.67 cm^2
   (d) 1154.685 cm^2
   (e) 551.29cm^2
   (f) 519.589 cm^2
2. 387□ cm^2
3. 461.874 cm^2
4. 11 cm
5. 472.81 cm^2

Exercise 7.3 (Pages 167 -168)

1. 84 cm^2
2. 77.51 cm^2
3. 39.82 cm^2
5. SA = 251.84 cm^2

6. 208.22 cm^2
7. 43.712 cm^2
8. 108.1024 cm^2
9. 61.2548 cm^2

Exercise 7.4 (Page 171)

1. 263.928 cm^2
2. 942.6 cm^2
3. 502.72 cm^2
4. (a) 628.4 cm^2
   (b) 11.3 cm
5. (a) 2.81 cm
   (b) 81.71 cm
6. 282.78 cm^2
7. 46.51 cm^2
8. (a) 4.8 cm
   (b) 17.87 cm^2
9. 30.67 cm^2

Exercise 7.5 (Page 172)

1. (a) 128.67 cm^2
   (b) 18.10 cm^2
   (c) 221.67 cm^2
2. (a) 2412.74 cm^2
   (b) 603.19 cm^2
3. (a) 2.5 cm
   (b) 3.8 cm
4. 235.6 cm^2
5. 4536.46 cm^2

Exercise 7.6 (Pages 174 - 175)

1. 747.699 cm^2
2. 361.33 cm^2
3. (a) 596.499 cm^2
   (b) 250 cm^2

Exercise 7.7 (Pages 178 - 179)

1. (a) 96 cm^3
    (b) 54 cm^3
    (c) 402.85 cm^3
    (d) 2424.84 cm^3
    (e) 735 cm^3
    (f) 20.142 cm^3
2. 134,400 cm^3 or 0.1344 m^3
3. 11643.88 cm^2
4. (a) 15 600 cm^2
    (b) 16 800 cm^2
    (c) 52 800 cm^2
    (d) 21367.497 cm^2
5. 3.081
6. 70 cm or 0.7 m
7. 45 cm
8. 4.47 cm

Exercise 7.8 (Pages 180 - 181)

1. (a) 4.1569 cm^3
    (b) 6.9281 cm^3
    (c) 35.6302 cm^3
    (d) 39.5892 m^3
    (e) 188.5986 cm^3
2. 5.60 m
3. (a) 188.52 cm^3
    (b) 195.31 cm^3
    (c) 9435.426 cm^3
4. 45 cm
5. 10.395 m^3
6. 14 hrs
7. (a) 120 cm^3
    (b) 40 cm^3
    (c) 36 cm^3

8. 960.64 m^3
9. (a) 2.2356 m^3
    (b) 1.93036 m^3
10. 4872 cm^3
11. (a) 3.1 cm
    (b) 1.3 cm
12. (a) 70,560 l
    (b) 11 022 40 l

Exercise 7.9 (Page 183)

1. 60 cm^3
2. 199.51 cm^3
3. 754.08 cm^3
4. 301.632 cm^3
5. 75.408 cm^3
6. 204.23 cm^3
7. 33.261 cm^3
8. 9.9 cm
9. 3.34cm, 0.53, 1.67 cm^3
10. 19.6375 m^3
11. 84.89 cm^2

Exercise 7.10 (Page 185)

1. 48 cm^3
2. 162 cm^3
3. 40 cm^3
4. 40 cm^3
5. 181.02 cm^3
6. 174.54 cm^3
7. 51.961 cm^3
8. 15.08 cm^3
9. 66.179 cm^3
10. 18 cm^2
11. 12 cm
12. 81.3879 cm^3

Exercise 7.11 (Page 187)

1. (a) 137.28 cm^3
   (b) 7.2 cm^3
   (c) 310.38 cm^3
2. (a) 2.6 cm
   (b) 4.8 cm
3. (a) 9.1798 cm^3
   (b) 2849.899 cm^3
4. 261.83 cm^3
5. 323.4 g
6. 4317.997 cm^3
7. 3.02 cm
8. 8.61 cm^3
9. (a) 455.27 cm^2
   (b) 6.897 cm or 7.0 cm

Exercise 7.12 (Pages 189 - 190)

1. (a) 938.9 cm^2
   (b) 1438.697 cm^2
   (c) 7.62 cm^3
2. (a) 182.11 cm^2
   (b) 66.471 cm^2
3. (a) 4494.336 cm^3
   (b) 8.736 cm^3
   (c) 1221.888 cm^3
   (d) 36.65 cm^3

4. 795.32 cm^2
5. (a) 2.8 cm
   (b) 6.7 cm
6. (a) 195.46 cm^3
   (b) 162.88 cm^2
7. (a) 884.54 cm^2
   (b) 2184.13 cm^3

Unit Test 7 (Pages 191 - 192)

1. (a) 4.7086 m^2
   (b) 0.8786 m^3
2. (a) V = 489.44 m^2, SA = 352.91 m^2
   (b) SA = 342.64 cm^2,
       V = 374.272 cm^3
   (c) SA = 213.852 m^2,
       V = 294.05 cm^3
   (d) SA = 460.49 cm^2,
       V = 274.55 cm^3
3. (a) 31480 cm^2
   (b) 219 containers
4. 38 scoops
5. 20 cm
6. (a) 45 students
7. 67.03 cm^3

Statistics and Probability

STATISTICS (UNGROUPED DATA)

Student's Book pages 193 - 230.   (24 Lessons)

Key unit competence

By the end of this unit, the learner should be able to collect, represent and interpret quantitative discrete data appropriate to a question or problem.

Learning objectives

Knowledge and understanding

- Define quantitative data and qualitative data.
- Differentiate discrete and continuous data.
- Present data on a frequency distribution.
- Define mode and median of given statistical data.
- Recognize formulae used to calculate the mean and median.
- Read diagram of statistical data.

Skills

- Apply data collection to carry out a certain research.
- Represent statistical information using frequency distribution table, bar chart, Histogram, Polygon, Pie chart or pictogram.

- Determine the mode, mean and median of statistical data.
- Interpret correctly the graphs involving statistical data.

Attitudes and values

- Help in decision making and draw conclusion.
- Self confidence and determination.
- Develop competitiveness.
- Appreciate the importance of order in daily activities.
- Develop research and creativity.
- Respect each other.

Generic competences addressed in this unit

- Critical thinking.
- Problems solving.
- Cooperation and team work.

- Organization and leadership skills.
- Research skills.
- Listening and sharing information.
- Creativity and innovation.

Links to other subjects

Any subject where data collection, data representation, and data interpretation are important e.g. biology, geography, physics, computer science, finance, economics, engineering, etc.

Cross cutting issues addressed in this unit

- Inclusive education.
- Environment, climate and sustainability.
- HIV and AIDS.

Assessment criteria

Consistently make appropriate data collection and data representation to solve a problem, and then draw conclusions consistent with findings.

Background information

Statistics is one of the branches of mathematics. It is one area in mathematics that the learner can pursue a career in such as a Bachelor of Science in Statistics. It is a highly practical subject hence you should engage the learners in as many practical activities as possible. Such activities can arouse their interest and curiosity and therefore help them understand statistical concepts with ease. These activities include data collection and analysis.

Suggested teaching/learning activities

Meaning of statistics

(1 lesson)

By the end of this section, the learner should be able to

- Define the term statistics.
- Establish processes involved in statistics.
- Identify any data about the learners to classify as statistics.

Information to the teacher

In primary school, learners were introduced to simple/basic definition of statistics. In this section, you will help them discover the comprehensive definition of statistics. In this section, you will help them discover the comprehensive definition and the processes involved in statistics.

Materials

- English/mathematics dictionaries.
- Reference books and materials in the school libs.
- Access to internet.

Teaching guideline 8.1

- Organise into reasonable groups taking ino consideration of gender (if mixed class) and different abilities. Ask learners to do Activity 8.1 in learners book.

- Lead them through a discussion about the meaning of statistics till they master it
- This activity will promote in the learner:
    – Leadership and organization skills,
    – Communication skills among other competences.

Types of Data

(4 lessons)

By the end of this section, the learner should be able to: -

- Define the terms data, qualitative and quantitative data, discrete and continuous data.
- Distinguish between the above terms.
- Give an example of each type of data.

Information to the teacher

These terminologies were introduced to the learners in primary school. However let the learners research the terms individually before they go into groups. This can serve as homework.

Materials

- Access to internet for research.
- English/Mathematics dictionaries.
- Reference books from school library.

Preparation

- Ensure that all learners have access to the required materials.

- Emphasize the importance of completing homework for effective group discussion.

Teaching guidelines 8.2 (a)

- Organize the class into groups of two.
- Ensure that every learner has a partner and that both know what they are looking for.
- Ask the learners to do activity 8.2 in the student's book i.e. to do research on the meanings of data, qualitative data, quantitative data, discrete and continuous data.
- Ensure that the sources of information are available to the learners; lack of access to research materials will impair learning.
- When activity is done, listen as different groups make their presentation.
- Verify their findings and make conclusions. Emphasize the key points, correct possible erroneous conclusions.
- Summarize the conclusions in line with the definitions discussed in the student's book.
- Verify that the definitions are clear in the learners' minds i.e. that the objectives of the activity have been achieved.
- In groups of 3 ot 4 ask learners to do Activity 8.3 as a practice.

Teaching guidelines 8.2 (b)

- Organize the learners to work in pairs to do activity 8.4 in the student's book.

- Ensure learners are working with reference to Table 8.1 in the student's book.

- Part (b) of activity 8.4 is based on the personal statistics of the class collected earlier on i.e. the mass in kg, the length in cm and age in years or months.

- When activity is done, listen to the group responses and presentations. Ensure that the conclusions are accurate. Summarize and emphasize on the key points and concepts.

Teaching guidelines 8.2 (c)

- Organize the class into pairs to do activity 8.5 given in the student's book based on table 8.1 in the pupils book.

- Ask the learners to discuss and answer the questions accompanying the table. Ensure that they record their findings.

- When the activity is done, ask the groups to present their findings.

- Listen to their reports with the aim of correcting and refining their findings.

- Help the learners to do a comprehensive summary of the responses to the questions.

- For the (b) part of the activity 8.5 ensure that learners can identify and describe quantitative/ qualitative date.

- Ensure learners can identify continuous and discrete data and describe them accurately.

- Help learners to summarize their findings.

- Ask learners to do Activities 8.6 to 8.8 given in the students book on collection and organising data.

Additional information to the teacher

As much as these activities are meant for the learners, ensure you do them in advance. This is the only way you can guide them efficiently and accurately. You must always be ahead of your class.

Frequency distribution table

(2 lessons)

By the end of this section, the learner should be able to

- Organize data using frequency distribution table.

Materials

Charts showing frequency distribution tables and sources of data.

Preparation

Identify some raw data and use them to make a frequency distribution table for demonstration. Make a big chart for class display.

Teaching guideline 8.3

- Organize the learners into groups to do activity 8.9 i.e. to organize raw data through a frequency distribution table.

- Guide them on how to arrange the data from the lowest entry to the highest.
- Guide them on how to draw the frequency distribution with the help of the tally marks.
- Reference to the illustration in the student's book.
- Ask the groups to move on with the activity. Remind the group secretary to record all the entries in the table whencounting and tallying has been agreed by the group.
- When the activity is done ask the groups to do their presentation to the class.
- Ask the groups to be alert as others do their presentations. This will help them to pick any discrepancies.
- At the end of the presentations, guide the whole class to repeat together the counting and tallying if there were any discrepancies. Get them to do corrections.
- Ask learners to work in pairs. Activity 8.10. Guide them through this activity.
- Remind the learners that the data on the people infected with HIV and AIDS in some town. Take this opportunity to sensitize the learners on the spread of HIV and AIDS. Discuss how they can avoid being infected with the disease. Let them see the need to care for both the infected and the affected in the community.
- When you are satisfied that you have the objective, take the learners through example 8.1 in the student's book.

- Let the whole class do question 1 Exercise 8.1.
- Example 8.1 Illustrate one way of collecting data. The Exercise that follows is meant to provide situations that may necessitate use of various techniques of collecting data. It provides good questions for group work.

Measures of central tendency

By the end of this section, the learner should be able to

- Define the term **average** generally, and give some examples of such.
- Define (i) arithmetic mean (mean) (ii) median (iii) mode.
- Distinguish between the three basic averages.
- Describe the meaning of the term **measures of central tendency** with reference to mean, median and mode.
- Calculate the mean, the median and the mode.

The Mean

Information to the teacher

Generally, discuss the meaning of the term average according to English dictionary definition, narrowing down to the **mean** the **median** and the **mode.**

The term average was introduced in primary school under proportional resource.

Materials

Reference books and materials from the school library, electronic materials i.e. computers for searching in the internet, dictionaries, English and mathematics weighing scale, measuring tape etc.

Preparation

Ensure that the required materials are available.

If the school does not have these materials, make arrangements to borrow them. For example you may need to borrow a weighing scale the day before.

Teaching guidelines 8.4 (a)

• Organize the learners into groups to do activities 8.11 and 8.12 in the student's book.

• When the activities are over, let the groups present their findings in a class discussion through their group secretaries. Allow members of the class to point out omissions or errors in the facts presented.

• Summarize the presentations ensuring that the objectives of the activity have been achieved.

• Note that the summary of activity 8.11 and 8.12 concentrates on the arithmetic mean. The median and the mode will be dealt with later.

• Take the learners through example 8.2 in the student's book. Let the learners do questions 1-5 Exercise 8.1.

The Mode

By the end of this activity 8.13, the learner should be able to: -

• Organize raw data in a

i) Frequency table, rank order and a

ii) Bar graph to help identify the mode of the data.

Information to the teacher

Remember in activity 8.11 the mode was defined.

Thus, activity 8.13 should be a means of clarification and revision.

Teaching guidelines 8.4 (b)

• Let the learners work in pairs to do activity 8.13 to identify the mode.

• When activity is done, summarize their finding.

• Ensure that the learners can use a frequency distribution table, and a bar chart to find that mode of a distribution.

• Take the class through example 8.4 in student's book. Ask learners to create simple questions and use them to find their modes.

The Median

By the end of this section, the learner should be able to;

i) Define the use rank order to identify the median of set of data.

ii) Calculate the median of a set of data.

Information to the teacher

Learners are already familiar with the

definition of the word median from activity 8.11. Explain the significance of:

i) Odd number of items and

ii) Even number of item with reference to the median. Use simple examples to explain this significance.

Teaching guidelines 8.4 (c)

• Organize the class into groups, to do activity 8.14. By this time, they should know the need of a group leader and a secretary.

• Ask them to use the class data collected earlier.

• Let learners present their findings in a class discussion. Check their conclusions to ensure that they are identical since they are using the same data.

• Now, take the class through the discussion in the student's book. Generalize the median as in the pupils book emphasizing the effect when

    i)   The number of items is odd and

    ii)   The number of items is even.

• Take learners through examples 8.5 and 8.6 in the student's book.

• Ask pupils to do question 1 of Exercise 8.3. Go round checking that the learners are doing the right thing. When you are satisfied that the learners know that they are doing, ask them to do questions 2-5 of the Exercise.

• The fast workers may go on to question 5 of the same Exercise. This way, every learner is catered for.

Quartiles

By the end of this section a learner should be able to:

• Define the word quartile.

• Use rank order list of a set of data to locate the quartiles including the median.

• Relate quartiles to the median.

• Distinguish between the quartiles.

Information to the teacher

Use the approached you used to estimate the median to estimate the quartiles and distinguish between them.

Materials

• Mathematics/English dictionary.

• Electronic equipment i.e. computer.

• Reference materials and books from the school library.

Preparation

Ensure that learners have access to the materials they need.

Teaching guidelines 8.5 (a)

• Organize the learners into groups to do activity 8.15 in the student's book.

• Let groups do the activity as you go round checking the work and helping those may be having challenge, affirming those who are doing well.

• When activity is done, let groups present their findings in a class discussion.

- Summarize their representations in a manner similar to what follows immediately after the activity 8.17. Use this opportunity to emphasize the key points and possibly correct any wrong concept.
- Use sample numerical examples to find their quartiles.

Teaching guidelines 8.5(b)

- Organize the class into groups to do activity 8.16 in the student's book.
- When the activity is over, let the group report their findings as a class discuss. Verify that all the findings are the same since they are using same data.
- Emphasize 'points to note' in the student's book. Ensure what learner can apply these points to any other set of data.
- Help learner to generalize the formula for findings quartiles when the number of entries N is odd, and when it is even.
- Take pupils through Example 8.7 Ask them to do Exercise 8.4 questions 1-3.

Presentation and reading of data statistical

(4 lessons)

By the end of this section, the learner should be able to define and present data using; Rank order list, frequency distribution table, pictograph, bar chart, pie chart, line graph.

Information to the teacher

In primary school the learners were introduced to methods of data display using bar chart, pie chart and pictograph. Using activities 8.17 to 8.19, begin by revising work before proceeding to line graph presentation.

Preparation

Ensure that you are conversant with requirement for drawing pictograph, bar chart and pie chart.

Materials

Mathematics instruments, square or graph books (graph papers will do).

Teaching guidelines 8.6(a) (Rank order list)

- Ask individual learners to do Activity 8.17.
- Hold a who;e class discussion on their finding.
- Guide them through their discussion on rank and order list.
- Lead them through the learning points provided in student book to emphasize and clarify the points

Teaching guidelines 8.6(b) (pictograph)

- Organize the class into groups to do activity 8.18 given in the student's book. Prompt the groups to choose group leaders and secretaries.
- This activity should highlight: -
    i) The requirement for drawing a pictograph.

ii) The procedure of drawing.

iii) Suitability of the method.

iv) Advantages etc.

- When the activity is done, let the groups present their findings in a class discussion. Allow other members of the class to critique the presentations in order to point out omissions and/or errors in the presentations.

- Summarize their presentations by helping learners to understand

i) The choice of picture to be used.

ii) Procedure.

iii) Suitability of the method.

iv) Advantages and disadvantages etc.

- Take learners through Examples 8.8 and 8.9 in the student's book.

- Emphasize that when using drawings, each drawing takes up the same amount of space and is simple and clear.

- Ask the learners to do Exercise 8.5 questions 1 to 5.

Teaching guidelines 8.6(c) (pie chart)

- Organize the class into groups. Ensure that each group has a leader and a secretary to rec rod and report the group's findings.

- Ask the learners to do activity 8.19 in the student's book. Through this activity, learners should discuss

i) Requirement to draw a good pie chart,

ii) The procedure of getting the right sector in a pie chart.

iii) How to construct a pie chart.

iv) How to construct a pie chart.

v) Advantages and disadvantages of using a pie chart to display data etc.

- When the activity is done, let the groups present their findings in a class discussion. Allow other members to the class to critique the presentations in order to point out possible omissions or errors in the facts presented.

- Summarize the presentations. Help the learners to emphasize the key points and note them in their notebooks. Take this opportunity to refine findings and conclusions.

- Take the class through examples 8.10 and 8.11 Ask the class to do question 1 of Exercise 8.5. Go round checking their work and give help to those who may experience challenges.

- When you are satisfied with the pupils work, ask them to do questions 2-4 of Exercise 8.6.

- If some pupils are fast and accurate, and therefore finish work before others, ask them to do question 7 of same Exercise.

Additional information to the teacher

In order to draw a pie chart, the frequencies must be converted into degrees i.e. suppose the total number of frequencies is 60, and 1 group has 12 items, the angle corresponding to the frequency of 12 is   x 360° = 72°

You do that for all the groups.

Now, to draw a pie chart,

i)   Draw a circle of any suitable radius i.e. 5cm.

ii) Draw one radius as shown and complete the diagram using a protractor. Label each sector.

Teaching guidelines 8.6(d) (Bar graph)

*   Organize the class into groups to do activity 8.20 in the student's book.

*   Ask the groups to do activity 8.20. Move round the class to ensure that the group discussions are in the right direction. Ensure that the learners understand what they are doing.

*   Ensure that all the groups address all the questions raised in the activity.

*   Have the groups present their findings in a class discussion through their secretaries. Allow other members of the class to point out omissions or errors in the facts presented.

*   Summarize their presentations. Help the learners to emphasize the key points and possibly correct any erroneous conclusions. Use this opportunity to assess how effective the activity was.

*   Take learners through examples 8.12 and 8.13 in the student's book. Ask pupils to do questions 6 and 8 of Exercise 8.6.

Additional information to the teacher

When you encourage learners to summarize and report their findings, you are teaching them to be; good speakers and good listeners, good organizers.

They also get the benefit of learning how to use different methods of researching for information.

Line graph

By the end of this section, the learner should be able to:

*   Present a set of given data in a line graph.

*   Read values from a line graph.

*   Determine the kind of information that is best displayed on a line graph.

*   Analyze the advantages and disadvantages of this method.

*   Create own problems and represent them graphically.

Information to the teacher

The learners were introduced to drawing and interpreting line graph in unit 3 of this course.

Materials

Graph books or papers

Ruler and pencil.

Teaching guideline 8.7 (a)

- Organize the class into groups of two to do activity 8.21.

- Let groups research on the kind of data that can be represented in a line graph, including the requirements needed to draw such a group.

- Ensure that learners discuss the procedure of drawing a line graph, advantage and/or disadvantages of using this method compared to other methods, and interpretation of the graph.

- As the groups discuss, go round checking the group work helping where necessary.

- Ask the groups to present their findings in a class discussion.

- Summarize their presentations, ensuring that the key points are tabulated and well understood. Assess whether the objectives have been achieved and act accordingly.

- Take the class through the discussion of Examples 8.14 and 8.15 in the student's book under the subheading, line graph to assess level of competence achieved, create simple questions to be discussed by the class orally.

Emphasize

A good line graph must relate two measures be on a graph paper, have an appropriate scale. It must show a definite trend of the graph. The two quantities must compare easily.

Teaching guideline 8.7 (b)

- Organize your class into groups to do Activity 8.22 and 8.25 in the student's book. This activity is about representation and interpretation of different methods including line graphs.

- At the end of activity ask the groups to present their findings in a class discussion as you listen to their arguments to verify them and correct any possible erroneous conclusions. Summarize the findings of the activity to emphasize the key points and level of competences achieved.

- The foregoing activities in this section should act as examples to enable the learners to work through Exercise 8.6 individually.

- Ask learners to do question 1 of Exercise 8.7. Go round checking that the pupils understand what they are supposed to do, helping those who may find the work challenge.

- When you are satisfied that the concept is mastered, ask them to do questions 2-4, Exercise 8.7, for fast leaners, who complete work faster, ask them to do question 5. This arrangement ensures that every learner is taken care of.

Additional information to the teacher

Summary: activity 8.11

- Four different methods are; pie chart, bar chart, pictograph, and line graph.

- Most appropriate method – line graph.
- Best performance – 4th game.
- Worst performance – 6th game.
- Line graphs is easy to read and compare.
- 1st half of season 50%, 2nd half 50%

Histogram and Frequency Polygon

By the end of this section, the learner should be able to

- Define a histogram.
- Distinguish between a histogram and a bar graph.
- Represent a given discrete set of data in a histogram.
- Define a frequency polygon.
- Draw a frequency polygon.

Information to the teacher

Remember for ungroup data, it is not common practice to represent data with a histogram. Thus, in this section, we use a limited type of data just to give the learners on idea of a histogram. Emphasize that will deal with histograms as more comprehensively when we come to grouped data.

Materials

- English/mathematics dictionaries.
- Reference books and materials from the school library.
- Electric materials.

Preparation

Ensure that the required materials are available.

Teaching guidelines 8.8

- Let learners work in pairs. Try not to pair them according to their abilities, but ensure that both are actively involved.
- Ask the learners to do activity 8.24 in the student's book.
- Let pupils present their findings in a class discussion.
- Summarize the class findings especially with reference to the discussion in the student's book.
- Define frequency polygon with reference to the histogram.
- Explain how one can construct a frequency polygon without necessarily drawing a histogram.
- Take learners through examples 8.16 to 8.18. Ask the pupils to do question 1 of Exercise 8.8. After ensuring that the learners are comfortable with this question, ask them to do questions 2-4 Exercise 8.8. Those who are fast and accurate may continue to question 5 of the same Exercise.

Cumulative frequency diagram

By the end of this section, the learner should be able to

- Define the expression 'cumulative frequency.'
- Make a cumulative frequency table.
- Use a cumulative frequency graph.
- Interpret a cumulative frequency graph i.e. use the cumulative

frequency graph to determine median, lower quartile and upper quartile.

Information to the teacher

Use the frequency distribution table in the student's book to explain the procedure of making a cumulative frequency table. Illustrate how to obtain coordinates from this table.

Materials

Graph papers or books

Mathematics/English dictionaries

Electronic equipment

Preparation

Do your cumulative frequency graph in advance for demonstration and display.

Teaching guidelines 8.9

- Let the learners work individually to do activity 8.25 and 8.26 in the student's book.

- Ensure that learners plot cumulative frequency against age. Go round the class checking the plotting is ok, helping those who may be having challenges.

- When the activity is done, discuss their findings and summarize them. Ensure that the graphs are correct and the readings from the graph are correct.

- Take pupils through Example 8.19. Now ask pupils to work through Exercise 8.9 questions 1-2.

Answers

Practice Exercise 8.1 (Pages 197 - 199)

Mark students work and guide them appropriately.

Exercise 8.2 (Pages 200 - 201)

1. (a) 4 (b) 5
   (c) 3 (d) 8
   (e) 3.3 (f) 5.83
   (g) 6.125 (h) 12.25
   (i) 3.44

2. (a) 2.425 (b) 3.3
   (c) 0.64 (d) $3\frac{13}{32}$ or
   $\qquad$ 3.41

3. 51.125 kg

4. 29

5.

Leg	Tally	Frequency
2	IIII	4
3	⊬⊬ II	7
4	⊬⊬ IIII	9
5	⊬⊬ ⊬⊬ II	12
6	⊬⊬ ⊬⊬	10
7	⊬⊬III	8
		50

6. 10

7. Biology = 9.69
   English = 9.98
   German = 8.39
   French = 7.14
   Art = 6.35
   Maths = 5.57

Exercise 8.3 (Pages 203 - 204)

1. (a) $x = 6$ (b) $x = 9$

   (c) $x = 6.5$ (d) $x = 2.59$

2. $Q_2 = 5$ $Q_2 = 7$ $Q_2 = 8$

   $Q_2 = 2$

   Mode = 4   Mode = 7   Mode = 9

   Mode = 2

3. (a) 51 kg   (b) 50 kg

   (c) 50 kg

4. (a) 4.75 cm   (b) 5 cm

   (c) 5 cm

5. (a) $-6\frac{2}{3}$ (b) $-6\frac{2}{3}$

   (c) $-6\frac{2}{3}$

Exercise 8.4 (Page 206)

1. (a) $Q_2 = 31.5$ (b) $Q_1 = 25$

   (c) 5.5

2. (a) 15   (b) 41.33

   (c) 40, 43   (d) 3

3. (a) 5   (b) 5

   (c) 4 and 7   (d) 3

Exercise 8.5 (Pages 209 - 210)

1. (a) Allow correct represented data on pictograph

   (b) death

2. (a) Saturday and Sunday

   (b) Monday and Tuesday

   (c) Saturday and Sunday, Monday and Tuesday

(d)

| Day	Tally	frequency
Monday	⁙	5
Tuesday	⁙ I	6
Wed	⁙ III	8
Thur	⁙	5
Fri	⁙ II	7
Sat	⁙ IIII	9
Sun	⁙ IIII	9
		49

3. (a) Orange house

   (b) Blue and Violet houses

   (c) Blue and violet, purple and white Red house

   (d) 53 goals

| House	Tally	Frequency
Green	⁙	5
Red	⁙ I	6
Blue	III	3
Yellow	IIII	4
Orange	⁙ ⁙ I	11
Purple	⁙ I	6
Brown	⁙ IIII	9
Violet	III	3
White	⁙ I	6
	⁙ ⁙ ⁙ ⁙ III	23

4. Mark correct data represented on pictograph

5. (a) Mark correct data represented on pictograph

   (b) 3 pens

Exercise 8.6 (Pages 214 - 216)

1.
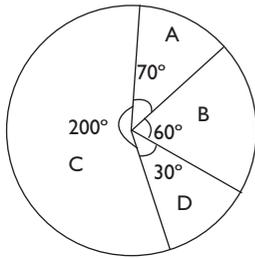
2.
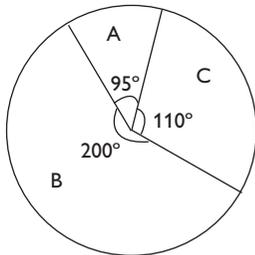
3. (a) (i) $\frac{3}{8}$ (ii) $\frac{1}{8}$

 (iv) $\frac{1}{8}$ (v) $\frac{1}{4}$

 (b) (i) 18 ha

 (ii) 6 ha (iii) 6 ha

 (iv) 6 ha (v) 12 ha

4. (a) 2,666.67 FRW

 (b) 3,000 FRW

 (c) 1,166.67 FRW

 (d) 2,000 FRW

 (e) 2,500 FRW

5. (a)

Subject	English	Kiswahili	Maths	Physics	History
Marks	72	78	94	84	86

 (b) j

 (c) (i) 22 (ii) 414

6. (a)

Cereal	Maize	Beans	Millet	Sorghum	Wheat
Marks	80	40	45	35	70

 (b) Mark correct bar graph

 (c) (i) maize

 (ii) sorghum

 (d) millet and wheat

 (e) 335 bags

 (f) 25 bags

7. (a) x = 470

 (b) $\frac{47}{360}$ – savings, $\frac{11}{60}$ – school fee

 $\frac{11}{60}$ – rent, $\frac{3}{20}$ – transport

 $\frac{1}{4}$ – food, $\frac{5}{72}$ – insurance

 (c) Savings – 12 533.33 FRW

 School fees = 17 600 FRW

 Rent = 20 800 FRW

 Transport = 14 400 FRW

 Food = 24 000 FWR

 Insurance = 6 666.67 FRW

 (d) Food

 (e) Insurance

8. (a) 2 cm rep 5 eggs

 (b) (i) Wed & Friday

 (ii) Monday

 (c) 18 eggs

 (d) 5 280 FRW

 (e)

| Day	Frequency
Mon	11
Tue	17
Wed	21
Thur	18
Fri	21

9. (a)
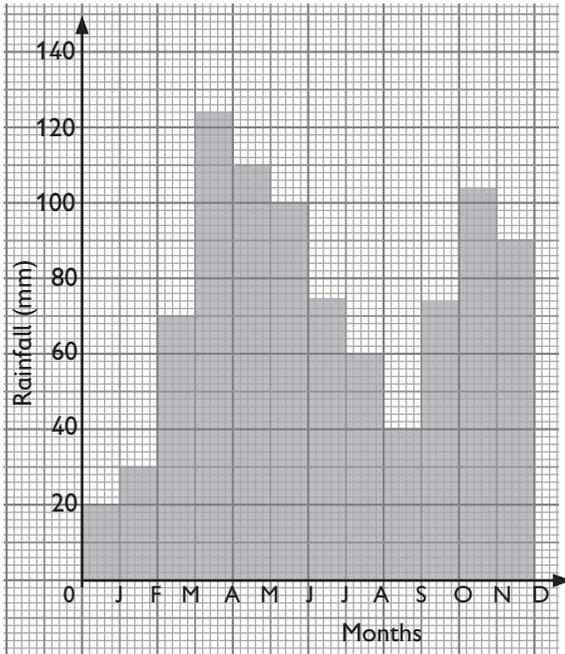
(b) 245 mm

(c) 75 mm

(d) J & O

10. (a) Vertical axis
(b) Horizontal axis
(c) 900 km
(d) Kibuye
(e) 1000 km
(f) Cyangungu

(g)

| Town	Frequency
Gisenyi	200
Ruhengai	150
Gitarama	450
Kigali	380
Kibungo	-650
Kibuye	500
Butare	800
Cyangungu	900

11.
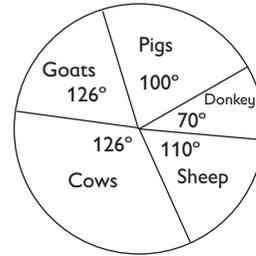
Exercise 8.7 (Pages 219 - 221)

1. (a)
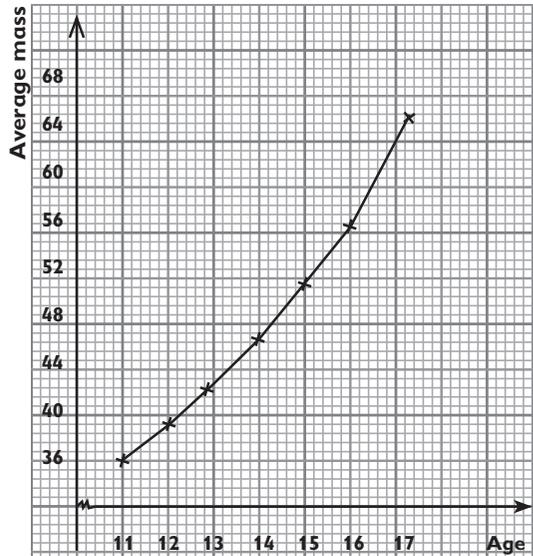
(b) (i)   38.5 kg   (ii)   42.5 kg
(iii)   55 kg

2. (a)
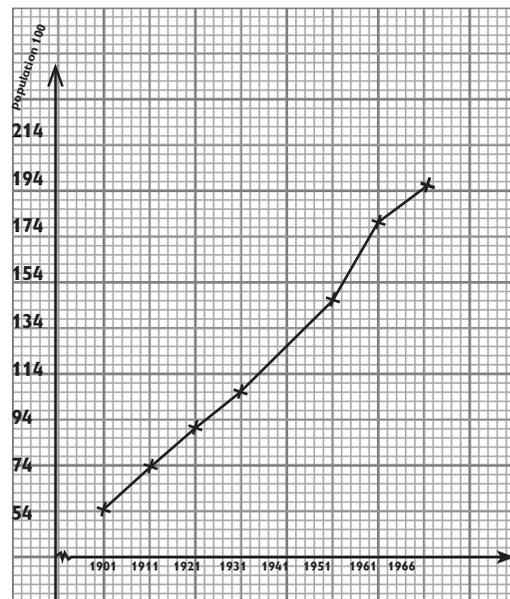
(b) i) 9400

ii) 21400

3. (a) (i) 240   (ii) 96

(iii) 150   (iv) 126

(v) 300

(b) 2 min 36 sec

(ii) 4 min

(iii) 10 min

(iv) 1 min 40 sec

(v) 8 min 12 sec

(c)

| Time (min)	Frequency
1	30
2	60
3	90
4	120
5	150
6	180
7	210
8	240
9	270
10	300

(a)

(b) 26 & 15, 26 & 13 (c) Yes

(d) From the graph

4. (a)
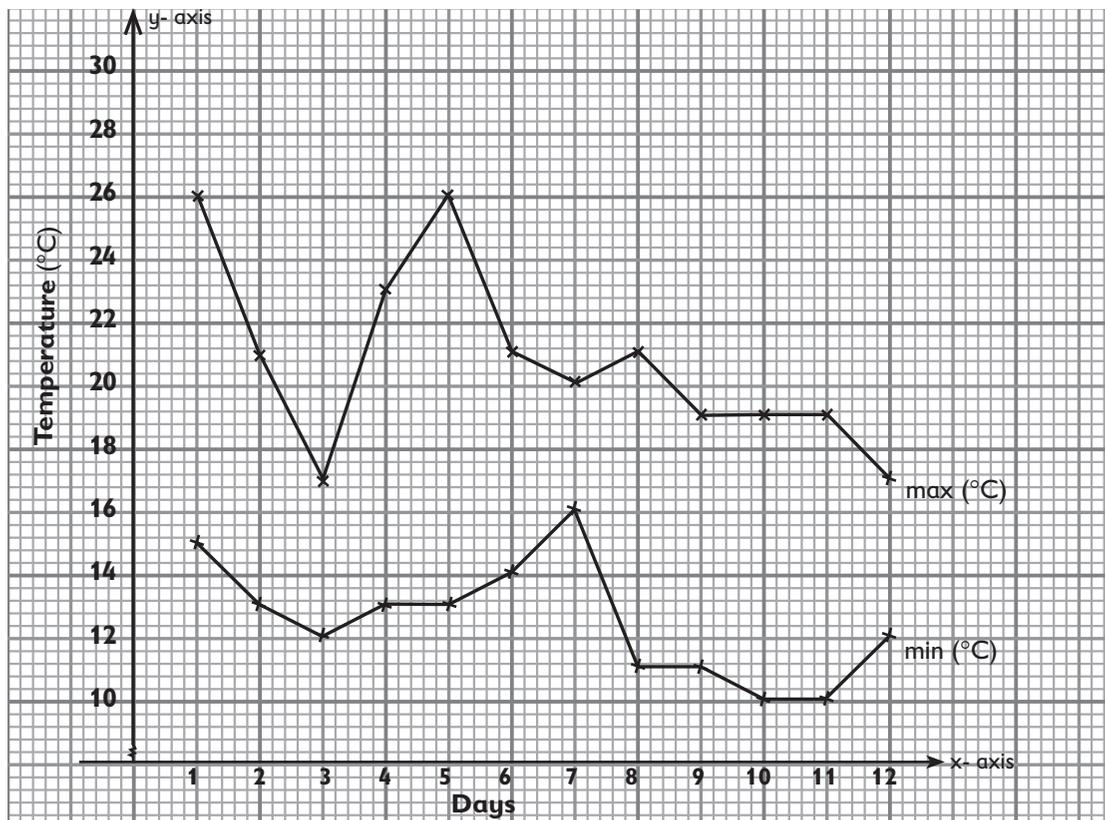
(b) Temperature show greater variation.

(c) They can be estimated from their respective line graphs

(b) The maximum temperatures will fall when the minimum temperature are increasing on 13th September

5. (a)
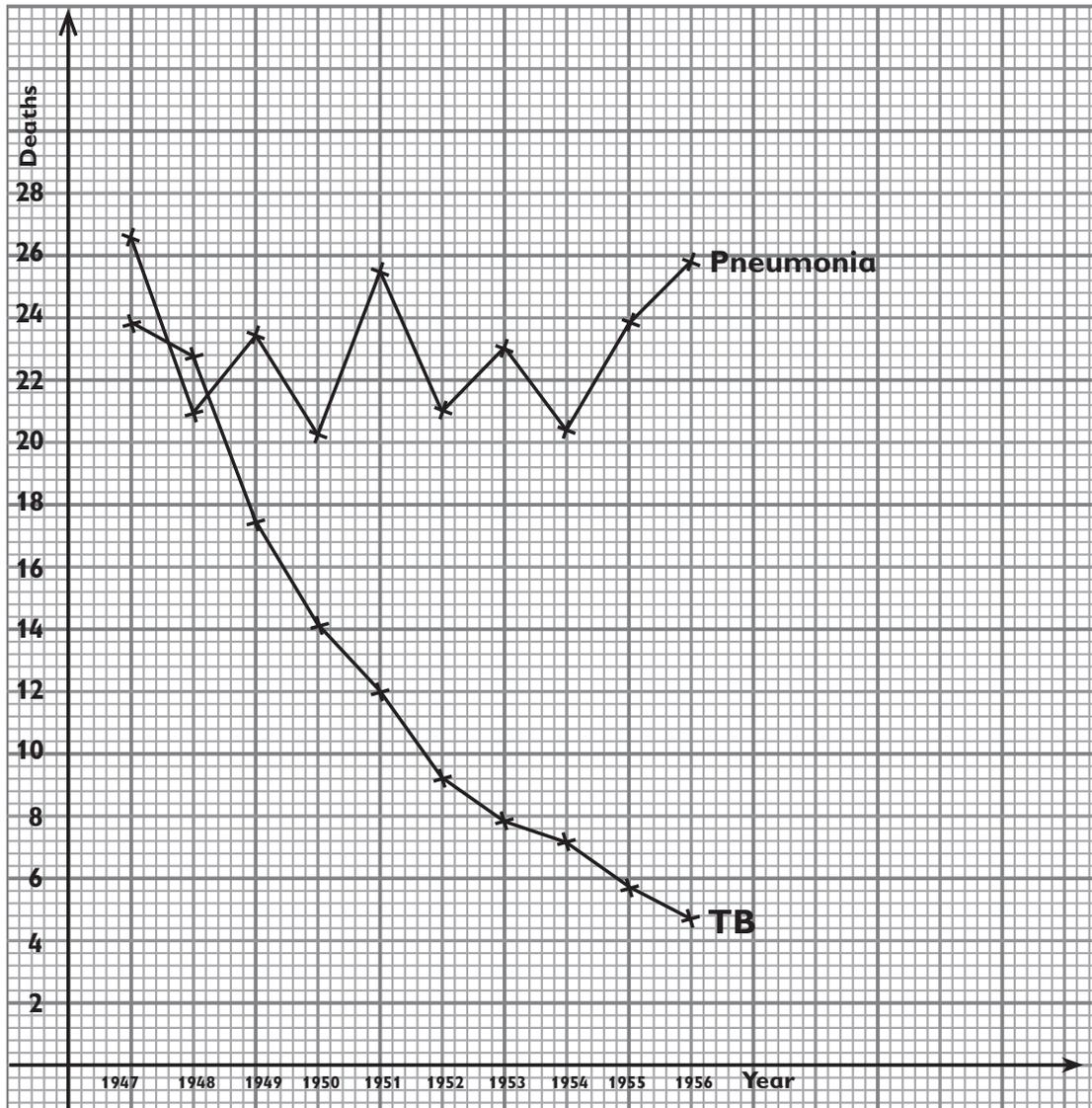
The TB deaths were dropping rapidly but the pneumonia deaths were increasing and dropping for some years.

6. (a) (i) 1 cm rep 20 km
       (ii) 1 cm rep 1 hr
    (b) 32 km   (c) 11.48

7. (a)
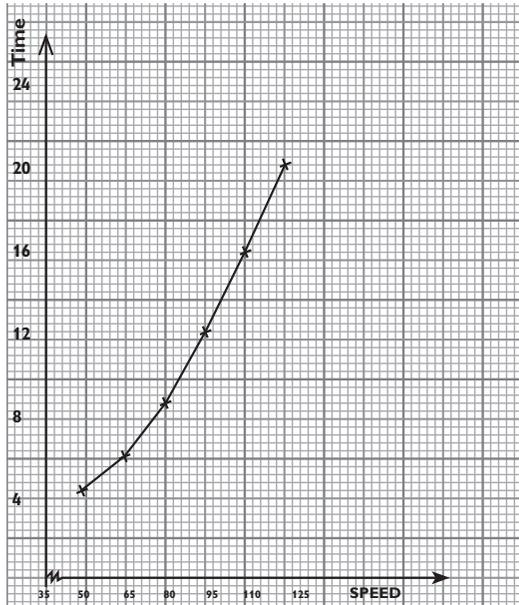
(b) (i) 7 h (ii) 18.1 h

8. (a) Line graph
   (b)
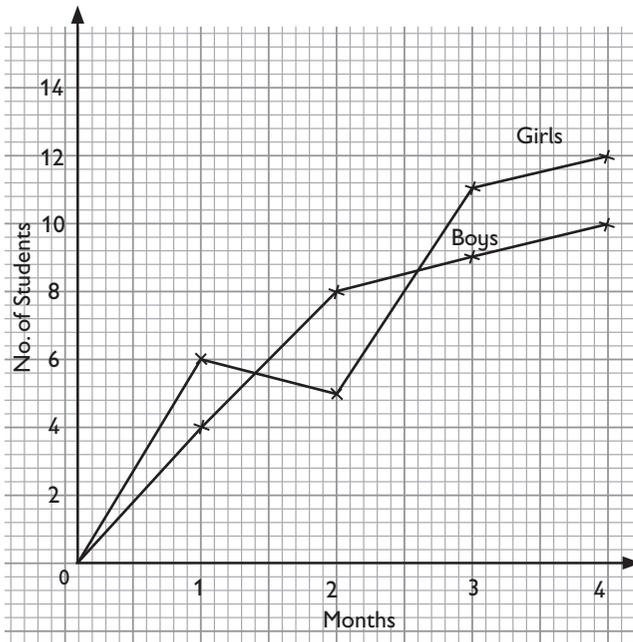
(c) (i) 10 students in the first month
    (ii) 22 students in the 4th month
    (iii) 15 students

Exercise 8.8 (pages 223 - 225)

1. (a)

Mark	Tally	Frequency
26	III	3
35	II	2
40	I	1
46	III	3
55	IIII	5
64	IIII II	7
76	IIII	5
87	III	3
92	I	1
		30

(b)

Class interval	Frequency	Mid point
21 - 30	3	25.5
31 - 40	3	35.5
41 - 50	3	45.5
51 - 60	5	55.5
61 - 70	7	65.5
71 - 80	5	75.5
81 - 90	3	85.5
91 - 100	1	95.5

(c) 64

(d)
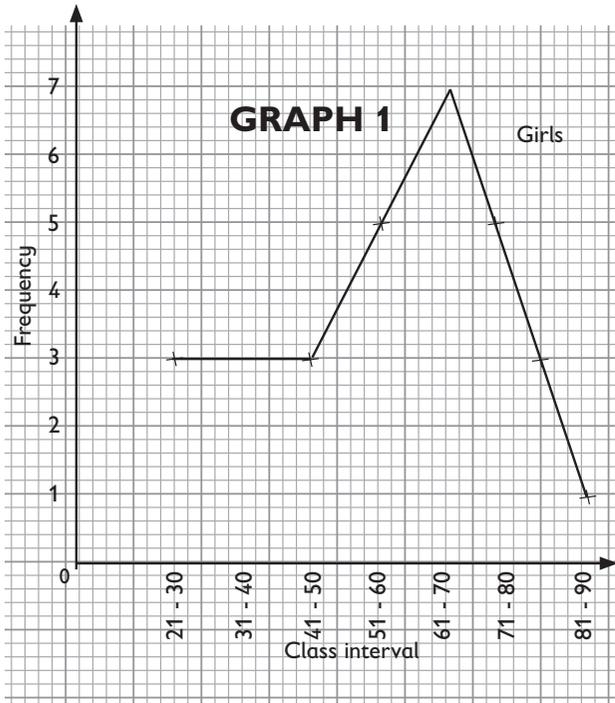
2. (a) 4 students

(b) 9 students

3. (a) 59.4

(b) 64 mean

5. (a) 44   (b) 40

(c) 850 shirts   (d) 50

(d)

Class	Frequency
34	100
36	200
38	150
40	250
42	100
44	50
Total	850

6. (a) 3   (b) highest shops = 850 – least shops = 3 shops

(c) 30

(d)

Daily earning	No. of shops
250	3
350	12
450	15
550	30
650	26
750	12
850	3

(e) 568.92

Exercise 8.9 (Page 227)

1. (a)

No. of people	Frequency
125	0
175	6
225	13
275	21
325	26
375	29
425	30

(b) (i) 266.67 (ii) 225
(iii) 325 (iv) 100

2. (a) 166.67
(b) $Q_1 = 163, Q_3 = 170$
(c) 7

Unit Test 8 (Pages 228 - 230)

1. (a) median = 3.8, mode = 1
(b) median = 1.25, mode = 1
(c) median = 20.2, mode = 9
(d) median = 3.45, mode = 2.3

2. (a) $\bar{x} = 5.83, Q_2 = 4$, mode = 4
(b) $\bar{x} = 6, Q_2 = 7$, mode = 7
(c) $\bar{x} = 13, Q_1 = 12$, mode = 12

3. (a) 1.8

(b)

Mass (x)	Tally	f
1.8	IIII IIII	9
1.7	IIII	4
1.6	IIII	4
1.5	I	1
2.1	III	3
1.9	IIII	4
2.0	II	2
1.4	I	1
1.2	I	1
2.5	I	1
		30

$\bar{x} = 1.796$

4. x = 45.76

5. A – 2 333 333 bags
B – 3 000 000 bags
C – 1 166 667 bags
D – 5 500 000

6.

Class	Tally	f
10 - 14	IIII	4
15 - 19	III	3
20 - 24	IIII II	7
25 - 29	IIII IIII	10
30 - 34	IIII IIII	10
35 - 39	IIII I	6
40 - 44	IIII II	7
45 - 49	III	3
		50

x	f
12	4
17	3
22	7
27	10
32	10
37	6
42	7
47	3
Total	50

7. x = 34 Mode 11

8. (a) 4.72 (b) 4

Frequency polygon
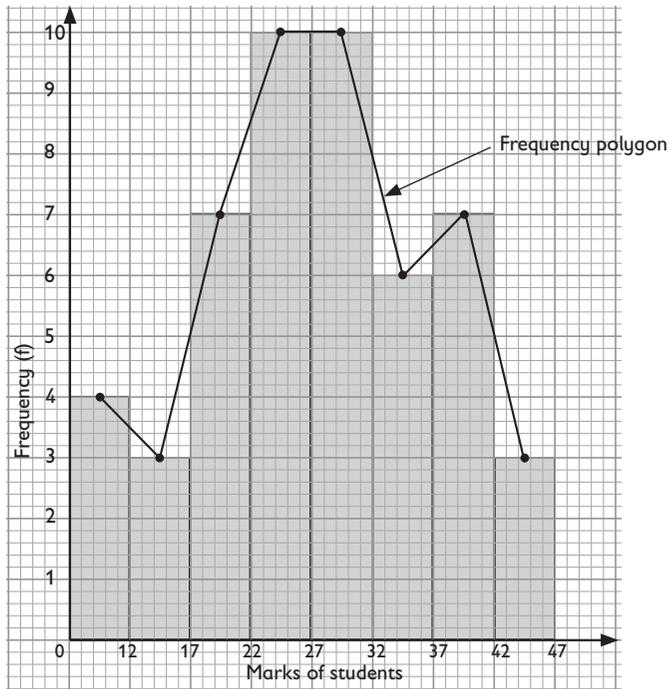
7. x = 34   Mode 11

8. (a) 4.72   (b) 4

9.
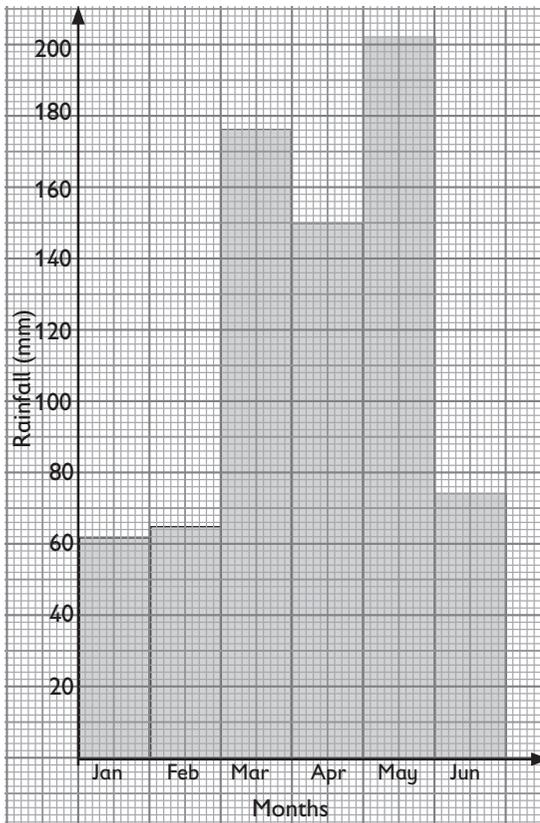
10.
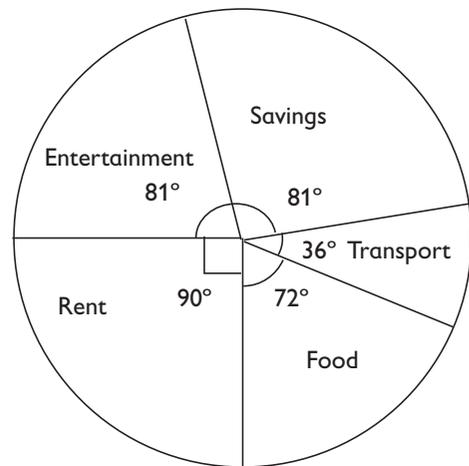
11.
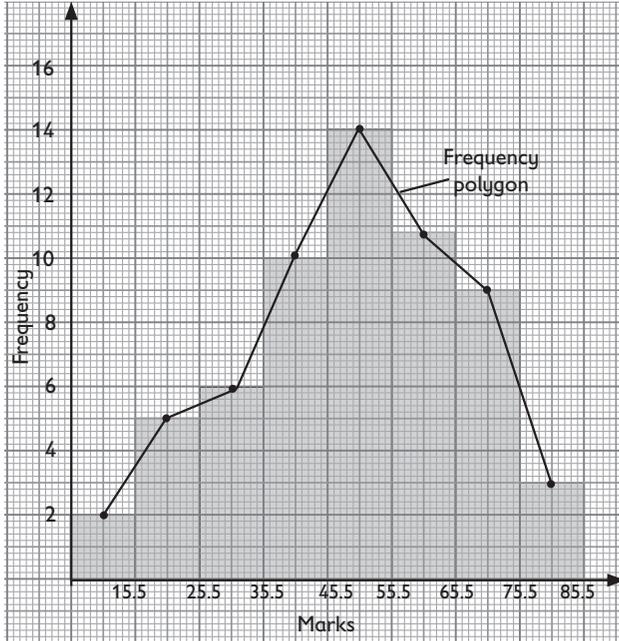
12.
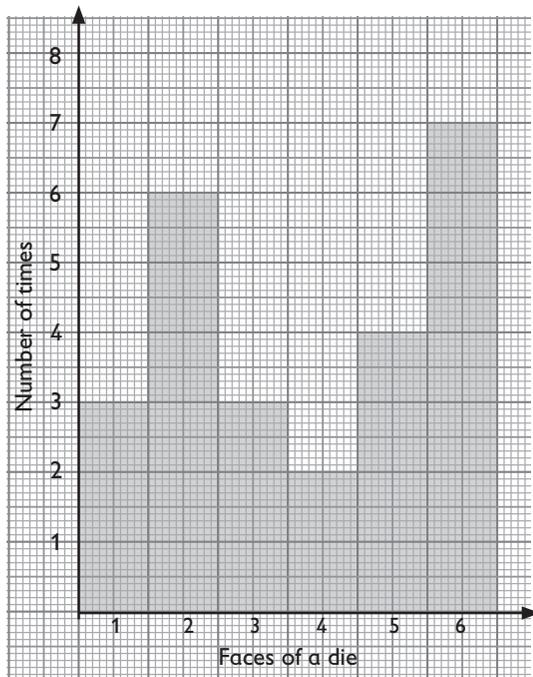
13. $a = 5, Q = 5$

14. 58.5

15. (a) $x = 38.15$, median = 38.25

(b) 36.40   (c) 38.40

16. (b) (i) 100

(ii) 5

Statistics and Probability

PROBABILITY

Student's Book pages 231 - 242. (6 Lessons)

Key unit competence

By the end of the unit, learners should be able to determine the probability of an event happening using equally likely events or experiments.

Learning objectives

Knowledge and understanding

- Define an event and explain why probabilities can only be between 0 (impossible) and 1 (certain).
- Explain that probabilities can be calculated using equally likely outcomes (e.g. tossing a coin or dice, drawing a card from a deck) or estimated using experimental data (e.g. weather, sports, arriving late to school).
- Demonstrate that the more data collected, the better the estimate of the probability.

Skills

- Calculate the probability of an event where there are equally likely outcomes e.g. heads or tails on a coin, a score on a dice.

- Estimate probabilities using data.

Attitudes and values

- Appreciate that the chance of an event happening is given by its probability which is number between 0 (impossible) and 1 (certain).
- Distinguish when an experiment is necessary to find a probability and that more data improves the estimate.

Generic competences addressed in this unit

- Critical thinking through group discussions.
- Problem solving through group work and thinking.
- Communication skills in group discussions and presentations when debating in activities.

- Research skills to be obtained through learning activities.
- Creativity & innovation through learning winning and losing.
- Co-operation, interpersonal management and life skills in debates and group discussions.

Links to other subjects
- Subjects where probability is important such economics, finance, physics, chemistry, biology.

Cross cutting issues addressed in this unit
- Comprehensive sexuality education (HIV/AIDS, STI, Family planning, Gender equality and reproductive health)
- Financial education.

Assessment criteria
- Can use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations.

Background information

Probability is one of the branches of mathematics. It is one area in mathematics that the learners can have a career in, for example Bachelor of Science in statistics which involves a combination Statistics and Probability. It is a highly practical subject hence you should engage the learners in many practical activities to arouse their interest and help them understand probability concepts with ease. Such activities may in be in simple experiments like playing cards, throwing coins, dice and analysis and so on.

Suggested teaching/ learning activities
- In groups, think and debate chance situations such as playing cards, tossing a coin, rolling a dice. What are the chances of getting a particular outcome? Introduce probability scale.
- Consider playing football, basketball ball, volleyball, hand ball or any other game.
- Discuss the chance of a win, a loss or a draw.
- Use results to estimate probabilities.
- Investigate the relationship between experimental and calculated probability by tossing a dice or a coin many times and estimating the probability of a particular outcome. Plot a graph to show the experimental probability and note how that tends to the calculated probability.

Definition of terms used to describe probability

(1 lesson)

By the end of this lesson, the learners should be able to define the term probability and establish the process involved in probability.

Information to the teacher

Learners are much exposed on the daily activities that involve chances. For example playing games like football,

cards and dice games. The learners should know the chances of winning, losing or drawing in a game.

Materials

Reference materials including textbooks, coins, dice, playing cards.

Preparation

For the first lesson, a teacher should know that materials like dice, playing cards and coins can make students understand much about probability. These materials should be used in group activities and allow students to perform experiments on their own.

Teaching guidelines 9.1

- Organize the class into groups of three learners to carry out Activity 9.1 . Prompt them to realise that they need a group leader. Ensure that each group has a secretary to record and report the group's findings.

- Ask the learners in their groups to do Activity 9.1 in the Student's book.

- Let the groups present their findings in a class discussion through their secretaries. Allow other members of the class to point out omissions or errors in the facts presented by each group.

- Summarise the presentation of the learners by helping them understand the accurate definition pf probability.

- Ask the learners to carry out Activity 9.2 in the learner's book. Summarise their presentation by

helping the learners to understand the terms involved like Sample space/ possibility space, experiment, events or outcomes of an experiment. This is your chance to emphasize the key points and possibly correct any erroneous conclusions. Use this opportunity to assess whether the objective have been met.

- This activity will promote in the learner:
  - Leadership and organization skills,
  - Communication skills among other competences.

Types of events

(2 lessons)

Information to teacher

Learners should be much exposed on experiments like tossing coins, rolling dice and playing cards.

Learners should be made to understand disjoint, dependent and independent events.

Materials

Reference materials including books, materials for experiments include dice, playing cards and coins.

Preparation

Prepare in advance to have playing cards, coins, dice and any other material that can be used in playing a game of chance.

Teaching guidelines 9.2

- Organise the learners in pairs to do Activity 9.3 in the Student's book. Let this activity be done practically and let the students record their findings.

- Ensure that every learner has a partner and that both partners are active and know what they are looking for. Make sure that the sources of information are available to the learners; lack of access to research materials will impair learning.

- This activity will help learners to be familiar with the basic values of probability adn drawing conclusions o the value of probabiliies of an event.

- When the activity is done, listen as different learners report their findings. Verify their findings and conclusions; emphasize the key points and correct possible erroneous conclusions, guided by the discussion and the definitions given on the student's book.

- This section will promote communication skills, leadership skills, debating skills among other competences.

- Ask the learners some questions on the definition of some of the basic rules of probability to assess whether learning has taken place and the objective of the activity has been achieved.

- Guide them through Activity and examples 9.1 to 9.5 given in the Student's book.

- Ask the learners to do questions 1 to 5 of Exercise 9.1 on the learner's book. Identify quick learners and slow learners during this exercise. Keep the quick learners busy by allowing them to do numbers 6 and 7 on the same exercises. Help slow learners to get more knowledge through your guidance as a teacher.

Theoritical Probability

(I lesson)

By the end of this lesson, the learners should understand and see how certain probabilities can be formed without experimenting.

Information to the teacher

Learners have learnt probability, ensure that learners are well linked with probability definition.

Materials

Reference textbooks, coins, dice and playing cards.

Preparation

Arrange to have dice, coins and playing cards before the start of the lesson.

Teaching guidelines 9.3

- Organize the learners into pairs.

- Guide them on how to determine the sample space when a coin is thrown, when a die is rolled and when a playing card is picked from a well shuffled packet of playing cards.

- Let the learners understand that Theoritical probability of an event in this case is the number of ways an event can occur, divided by the total number of outcomes. Therefore, it involves the finding of probability of events that come from a sample space of known equally likely outcomes

- Learners should be made to understand that the number of events in any experiment can never exceed the sample space in this section.

- Ask the pairs to then move on with the activity with one student as the secretary when the pair has agreed on the results obtained.

- After the end of the activity, take the learners through Examples 9.6 and 9.10 in student's book.

- Ask learners to do Exercise 9.2 given in the learners book.

- Mark their work and guide them appropriately.

- The activity will promote communication skills, leadership skill and self-confidence among other competencies

Answers

Exercise 9.1 (Pages 236 - 238)

1. a) $\{1, 2, 3, 4, 5, 6\}$

   b) $\frac{1}{2}$ c) $\frac{1}{3}$

2. a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) 0

3. Depends on arrangement of pages

4. a) $\frac{1}{2}$ b) $\frac{1}{2}$

5. a) $\frac{1}{4}$ b) $\frac{1}{4}$ c) $\frac{1}{2}$

6. a) $\frac{1}{4}$ b) $\frac{1}{4}$ c) $\frac{1}{4}$

7. Depends on the content of the text book used

8. a) $\frac{7}{20}$ b) $\frac{11}{20}$

9. 3 matches

10. a) $\frac{4}{5}$ b) $\frac{1}{5}$

11. 0.7

12. 40 games

13. a) $\frac{3}{4}$ b) 1   c) $\frac{9}{10}$

14. a) $\frac{1}{20}$ b) $\frac{19}{20}$ c) 1

$P(H) + P(T) = 1$

No. of tosses	20	40	60	80	100
P(H)	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{100}$
P(T)	$\frac{19}{20}$	$\frac{39}{40}$	$\frac{59}{60}$	$\frac{79}{80}$	$\frac{99}{100}$
P(H)+P(T)	1	1	1	1	1

In each case, $P(H) + P(T) = 1$

15. i) $\frac{3}{10}$ ii) $\frac{1}{2}$ iii) $\frac{1}{5}$

Exercise 9.2 (Pages 241 - 242)

1. $\frac{12}{37}$

2. a) $\frac{1}{4}$ b) $\frac{3}{4}$

3. $\frac{7}{8}$

4. $\dfrac{1}{2}$

5. a) $\dfrac{11}{36}$ b) $\dfrac{1}{6}$ c) $\dfrac{3}{10}$

6. $\dfrac{3}{7}$

7. $\dfrac{3}{8}$

8. $\dfrac{3}{5}$

9. a) $\dfrac{1}{3}$ b) $\dfrac{1}{5}$

10. $\dfrac{3}{10}$

11. a) $\dfrac{5}{11}$ b) $\dfrac{7}{22}$

12. a) $\dfrac{X}{10}$ b) X=3

13. $\dfrac{3}{10}$ $\dfrac{3}{10}$ 0

Unit Test 9 (Page 242)

1. $\dfrac{19}{20}$

2. $\dfrac{25}{37}$

3. (a) $\dfrac{5}{18}$ (b) $\dfrac{11}{36}$ (c) $\dfrac{35}{36}$

4. $\dfrac{3}{10}$

5. a) $\dfrac{1}{13}$ b) $\dfrac{1}{13}$

6. a) (i) $\dfrac{3}{5}$ (ii) $\dfrac{2}{5}$

   b) (i) $\dfrac{5}{9}$ (ii) $\dfrac{4}{9}$

7. a) $\dfrac{1}{6}$ b) $\dfrac{1}{2}$

   a) $\dfrac{1}{3}$ d) $\dfrac{1}{3}$

8. a) $\dfrac{1}{11}$

   b) $\dfrac{2}{11}$

   c) 0