THE REPUBLIC OF UGANDA

Ministry of Education and Sports

HOME-STUDY LEARNING

SENIOR 1

MATHEMATICS

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NCDC
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This material has been developed as a home-study intervention for schools during the lockdown caused by the COVID-19 pandemic to support continuity of learning.

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FOREWORD

Following the outbreak of the COVID-19 pandemic, government of Uganda closed all schools and other educational institutions to minimize the spread of the coronavirus. This has affected more than 36,314 primary schools, 3129 secondary schools, 430,778 teachers and 12,777,390 learners.

The COVID-19 outbreak and subsequent closure of all has had drastically impacted on learning especially curriculum coverage, loss of interest in education and learner readiness in case schools open. This could result in massive rates of learner dropouts due to unwanted pregnancies and lack of school fees among others.

To mitigate the impact of the pandemic on the education system in Uganda, the Ministry of Education and Sports (MoES) constituted a Sector Response Taskforce (SRT) to strengthen the sector's preparedness and response measures. The SRT and National Curriculum Development Centre developed print home-study materials, radio and television scripts for some selected subjects for all learners from Pre-Primary to Advanced Level. The materials will enhance continued learning and learning for progression during this period of the lockdown, and will still be relevant when schools resume.

The materials focused on critical competences in all subjects in the curricula to enable the learners to achieve without the teachers' guidance. Therefore effort should be made for all learners to access and use these materials during the lockdown. Similarly, teachers are advised to get these materials in order to plan appropriately for further learning when schools resume, while parents/guardians need to ensure that their children access copies of these materials and use them appropriately.
I recognise the effort of National Curriculum Development Centre in responding to this emergency through appropriate guidance and the timely development of these home study materials. I recommend them for use by all learners during the lockdown.

Alex Kakooza
Permanent Secretary
Ministry of Education and Sports

ACKNOWLEDGEMENTS

National Curriculum Development Centre (NCDC) would like to express its appreciation to all those who worked tirelessly towards the production of home–study materials for Pre-Primary, Primary and Secondary Levels of Education during the COVID-19 lockdown in Uganda.

The Centre appreciates the contribution from all those who guided the development of these materials to make sure they are of quality; Development partners - SESIL, Save the Children and UNICEF; all the Panel members of the various subjects; sister institutions - UNEB and DES for their valuable contributions.

NCDC takes the responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for improvement. The comments and suggestions may be communicated to NCDC through P.O. Box 7002 Kampala or email admin@ncdc.go.ug or by visiting our website at http://ncdc.go.ug/node/13.

Grace K. Baguma
Director,
National Curriculum Development Centre

ABOUT THIS BOOKLET

Dear learner, you are welcome to this home-study package. This content focuses on critical competences in the syllabus.

The content is organised into lesson units. Each unit has lesson activities, summary notes and assessment activities. Some lessons have projects that you need to carry out at home during this period. You are free to use other reference materials to get more information for specific topics.

Seek guidance from people at home who are knowledgeable to clarify in case of a challenge. The knowledge you can acquire from this content can be supplemented with other learning options that may be offered on radio, television, newspaper learning programmes. More learning materials can also be accessed by visiting our website at www.ncdc.go.ug or ncdc-go-ug.digital/. You can access the website using an internet enabled computer or mobile phone.

We encourage you to present your work to your class teacher when schools resume so that your teacher is able to know what you learned during the time you have been away from school. This will form part of your assessment. Your teacher will also assess the assignments you will have done and do corrections where you might not have done it right.

The content has been developed with full awareness of the home learning environment without direct supervision of the teacher. The methods, examples and activities used in the materials have been carefully selected to facilitate continuity of learning.

You are therefore in charge of your own learning. You need to give yourself favourable time for learning. This material can as well be used beyond the home-study situation. Keep it for reference anytime.

Develop your learning timetable to ca ter for continuity of learning and other responsibilities given to you at home.

Enjoy learning

INTRODUCTION

Dear Learner. Welcome to use this study material. As you prepare to start these activities, remember that you are studying from home due to the Covid-19 pandemic. It is therefore important that you keep safe by doing the following

1. Regularly wash your hands with soap and running water or use a sanitizer to sanitize your hands.
2. Always wear a face mask when you are in a crowded place and
3. Keep a distance of 2 meters away from other people

TERM ONE

Topic 3: FRACTIONS, PERCENTAGES AND DECIMALS

Learning outcomes.

By the end of this topic, you will be able to:

i) Describe different types of fractions.
ii) Convert improper fractions to mixed numbers and vice versa.
iii) Work out problems from real life situations.
iv) Carry out operations with fractions.
v) Convert fractions to decimal and vice versa.
vi) Identify and classify decimals.
vii) Convert reoccurring decimals into decimals.
viii) Convert fractions and decimals into percentages and vice versa.
ix) Calculate percentage of a given quantity
x) Work out real life problems involving percentage.

LESSON1. Describing Different Types of Fractions.

In primary school you learnt about different parts of a fraction such as numerator and denominator. When describing different part of a fraction we shall use the knowledge about the different part of a fraction.

Activity 3.1

Create a park of different cards and label them with different types of fractions, decimals and percentages.

From the park of the cards, you pick a card and place it in the most appropriate play area.

Observe the fractions in each play area by looking at the denominators and numerators.

In your groups explore and explain the common of the classification made in the different play areas.

Exercise

1. Sarah shades 3/7 of a shape. What fraction of the shape is left unshaded?
2. A cake is divided into 12 equal parts. John eats 3/12 of the cake and Kate eats another 1/12.What fraction of the cake is left?
3. A car park contains 20 spaces. There are17cars parked in the car park.
    a. What fraction of the car park is full?
    b. What fraction of the car park is empty?
4. Ali eats 3/10 of the sweets in a packet. Tariq eats another 4/10 of the sweets.
    a. What fraction of the sweets has been eaten?
    b. What fraction of the sweets is left?
5. Draw a square with its four lines of symmetry.
    a. Shade 3/8 of the shape.
    b. Shade another 2/8 of the shape.
    c. What is the total fraction now shaded?
    d. How much is left unshaded?

LESSON 2. Converting Improper Fractions to Mixed Numbers and Vice-Versa

Mixed Numbers and improper Fractions

So far you have worked with fractions of the form a/b where a < b, e.g. ¾, 2/7, 5/6 ...

You also need to work with what are sometimes called *improper* fractions, e.g.5/4,7/2, which are of the form a/b when **a** and **b** are whole numbers and **a>b.**

Example
Convert 13/4 into an improper fraction.

Solution
13÷4=3 remainder1. This is written as 3¼.

Exercise

1. Draw diagrams to show these improper fractions:
   (a) 7/2
   (b) 8/3
   (c) 18/5
2. Write each improper fraction as a mixed number.
3. Convert these mixed numbers to improper fractions.
   (a) **1**3/5
   (b**) 7**1/3
   (c) **3**4/5
   (d) **6**1/9
4. Write these fractions in order of increasing size. 6½,18/5,3¼,51/3,17/3
5. In an office there are 2½ packets of paper. There are 500 sheets of paper in each full packet. How many sheets of paper are there in the office?
6. A young child is 44 months old. Find the age of the baby in years as a mixed number in the simplest form.

LESSON 3 Working out problems from real-life situations.

Now we start to use fractions in a practical way.

Example

a) Find 1/5 of UGX.10000

b) Find 4/5 of UGX. 100,000

You can, do this practically, but it is much easier to workout.

a) 1/5 of 10000=1/5x10000=2000
b) 4/5 of 100000 = 4/5 x 100000 = 400000/5 = 80,000

Exercise

1. Find:
   (a) ½ of 12 (b) 1/8 of 40 (c) ¼ of 32

2. Find:
   (a) 2/9 of 18 (b) 7/9 of 45 (c) 7/8 of 56
3. In a test, there are 30 marks. Nasim gets 3/5 of the marks. How many marks does she get?
4. In a certain school there are 550 pupils. If 3/50 of the pupils are left-handed, how many left-handed pupils are there in the school?

LESSON 4. Carrying out operations with fractions.

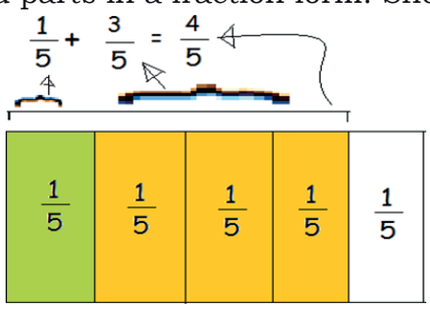
In the previous section, you studied how to find equivalent fractions. In this sub-topic you are going to use the knowledge of equivalent fractions to add and subtract fractions.

Addition of Fractions.

Addition of Fractions with the Same Denominators.

Activity 3.2:

1. In your groups, use a sheet of paper to work out $\frac{1}{5} + \frac{3}{5}$.
2. Fold the paper into five equal parts shade off one part of the five equal parts Shade the three parts of the five equal parts
   a. How many parts have been shaded?
3. Represent the shaded parts in a fraction form. Show the working.



Activity 3.3:

Slice a hexagon into 6 pieces:

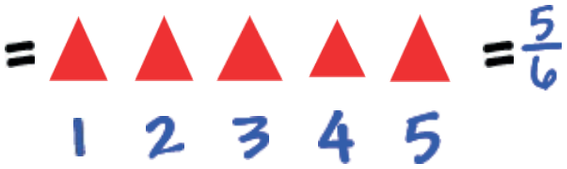
Each piece  is $\frac{1}{6}$ of the hexagon. Right?

And  is $\frac{4}{6}$ of the hexagon. So, what if we wanted to add

$$\frac{1}{6} + \frac{4}{6} ?$$

Hmm... that would be

Count them up



So $\frac{1}{6} + \frac{4}{6} = \frac{5}{6}$

In your groups, use the same method to work out the following:

a) $\frac{3}{7} \square \frac{2}{7}$

b) $\frac{5}{9} \square \frac{4}{9}$

Adding Fractions with the Different Denominators

In the previous topic you studied about lowest common multiple. In this section, you will apply the knowledge of LCM.

$$\frac{1}{2} + \frac{1}{3}$$

Change the $\frac{1}{2}$ using the knowledge of equivalent fractions

$$\frac{1 \times 3}{2 \times 3} = \frac{3}{6}$$

$$\text{So } \frac{1}{2} + \frac{1}{3} \quad \frac{3+2}{6} = \frac{5}{6}$$

Change the $\frac{1}{3}$ using the knowledge of equivalent fractions

The main rule of this game is that we cannot add the fractions until the denominators are the same! We need to find something called the least common denominator (LCD). Which is the LCM of our denominators, 2 and 3.

The LCM of 2 and 3 is 6. So, our LCD 6.

We need to make this our new denominator

Addition of Mixed Fractions

What if we need to add $3 + \frac{7}{8}$?

Hey, remember, that's just $3 \div 8$. Done!

That was easy, but, what about mixed numbers?

How about this?

$$3\frac{2}{5} + 1\frac{4}{7}$$

All we have to do is change these to improper fractions...Then we can add them!

$$3\frac{2}{5} + 1\frac{4}{7} = \frac{17}{5} + \frac{11}{7}$$

change to improper fractions

$$= \frac{17 \times 7}{5 \times 7} + \frac{11 \times 5}{7 \times 5} = \frac{119}{35} + \frac{55}{35}$$

change to the LCD of 35

$$= \frac{119 + 55}{35} = \frac{174}{35}$$

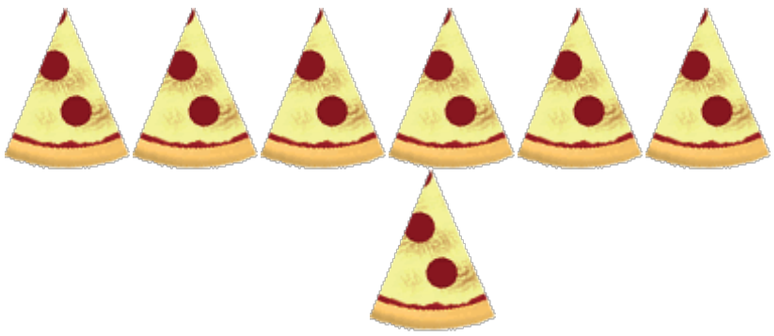
Subtraction of Fractions
Subtraction of Fractions with same Denominator

Let's try $\frac{7}{8} - \frac{3}{8}$

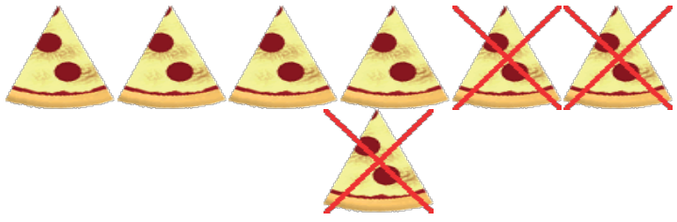
Look at a Chapatti in a conical shape cut into 8 pieces. Each

piece  is of the Chapatti. $\frac{1}{8}$

$\frac{7}{8}$



Take $\frac{3}{8}$ away (that's 3pieces):



We're left with 4 pieces - that's.

So $\frac{7}{8} - \frac{3}{8} = \frac{4}{8}$

But, look what we really did! We just subtracted the numerators!

$\frac{7}{8} - \frac{3}{8} = \frac{7-3}{8} = \frac{4}{8}$ Which is $\frac{1}{2}$

Subtraction of Fractions with Different Denominators

Subtraction works the same way.

$$\frac{6}{11} - \frac{3}{22}$$

The LCM of 11 and 22 is 22... So, the LCD is 22.

We just need to change the $\frac{6}{11}$.

$$\frac{6 \times 2}{11 \times 2} = \frac{12}{22}$$

So $\frac{6}{11} - \frac{3}{22} = \frac{12}{22} - \frac{3}{22} = \frac{12-3}{22} = \frac{9}{22}$

Subtraction of Mixed Fractions

$$5 - \frac{3}{8} ?$$

Well, we can't just stick it together like we would if it was addition.

We need to get a common denominator. But, the 5 does not even have a

denominator! That's OK... Just think of a Chapatti cut into 8 pieces... How many pieces would there be in 5 chapattis?

$5 \times 8 = 40$ pieces

So $5 = \frac{40}{8}$

Check it: $\frac{40}{8}$ is the same as $40 \div 8$ which is $= 5$.

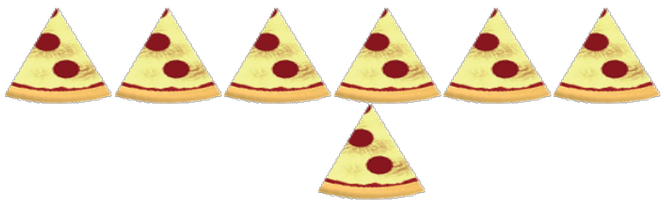
Back to the problem:

$$5 - \frac{3}{8} = \frac{40}{8} - \frac{3}{8} = \frac{40-3}{8} = \frac{37}{8} = 4\frac{5}{8}$$

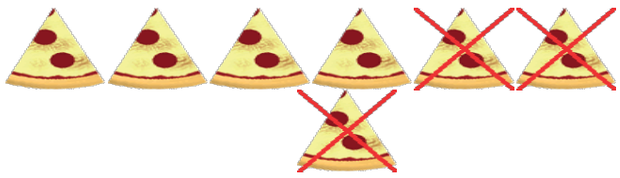
Let's try $\frac{7}{8} - \frac{3}{8}$

Look at a chapatti cut into 8 pieces. Each piece  is $\frac{1}{8}$ of the Chapatti.

$\frac{7}{8}$



Take $\frac{3}{8}$ away (that's 3 pieces):



We're left with 4 pieces, that's.

So $\frac{7}{8} - \frac{3}{8} = \frac{4}{8}$

But, look at what we really did! We just subtracted the numerators!

$\frac{7}{8} - \frac{3}{8} = \frac{7-3}{8} = \frac{4}{8}$ which is $\frac{1}{2}$

Multiplication of Fractions

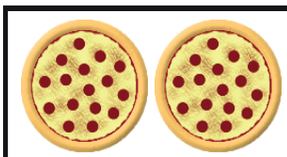
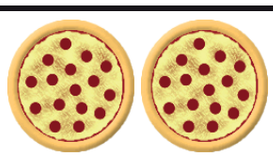
What is $\frac{1}{3} \times 6$?

Well, that is $\frac{1}{3}$ of 6.Think about it:

You have 6 chapattis.

And you get to eat $\frac{1}{3}$ of them.

This is like splitting up the chapatti between 3 people:

 You get 2 chapattis	 Your friend gets 2 chapattis	 And your sister gets 2chapattis

So $\frac{1}{3}$ of 6 is 2. But, how do we do this with just math? EASY! We know how to multiply two fractions...Right?

So, just make both things be fractions. Check it out:

$\frac{1}{3} \times 6$ $\frac{1}{3}$ is already a fraction...

But, what about the 6?

Guess what? We can write 6 as $\frac{6}{1}$.

Think about it:

$\frac{6}{1}$ is the same as $6 \div 1$...which is 6!

(You can do this with any number!)

Back to the problem:

$$\frac{1}{3} \times 6 = \frac{1}{3} \times \frac{6}{1} = \frac{1 \times 6}{3 \times 1} = \frac{6}{3} = 2$$

Just what we figured!

Multiplying Mixed Fractions

What about this?

$$2\frac{3}{5} \times 3\frac{1}{7}$$

I am sure I don't want to try to think about pizza for this one! Let's stick to the math:

Again, let's change these into improper fractions and go for it!

$$2\frac{3}{5} \times 3\frac{1}{7} = \frac{13}{5} \times \frac{22}{7} = \frac{286}{35} = 8\frac{6}{35}$$

This is super easy! Let's just do one:

$$\frac{1}{3} \times \frac{9}{10}$$

We just multiply straight across.

$$\frac{1}{3} \times \frac{9}{10} = \frac{1 \times 9}{3 \times 10} = \frac{9}{30} = \frac{9 \div 3}{30 \div 3} = \frac{3}{10}$$

Then just reduce it

Now, think about it...

$$\frac{1}{3} \times \frac{9}{10}\frac{1}{3} \text{ of } \frac{9}{10}$$

Cut a pizza into 10 pieces like

and look at 9 of the pieces:

We want $\frac{1}{3}$ of these $\left(\frac{1}{3} \text{ of } \frac{9}{10}\right)$ That would be 3 pieces. Right?

That's $\frac{3}{10}$!

Doing math is cooooool! Now that we understand what to do, we can just go for it.

Division of Mixed Fractions (Flip and Multiply)

Check it out:

$$\frac{1}{3} \div \frac{4}{5}$$

flip the second fraction...
and multiply!

$$\frac{1}{3} \times \frac{5}{4}$$

$$\frac{1}{3} \div \frac{4}{5} = \frac{1}{3} \times \frac{5}{4} = \frac{1 \times 5}{3 \times 4} = \frac{5}{12}$$

That's it -- then GO FOR IT!

Done!

$$\frac{6}{11} \div \frac{1}{2}$$

$$\frac{6}{11} \div \frac{1}{2} = \frac{6}{11} \times \frac{2}{1} = \frac{6 \times 2}{11 \times 1} = \frac{12}{11} = 1\frac{1}{11}$$

Look at another one:

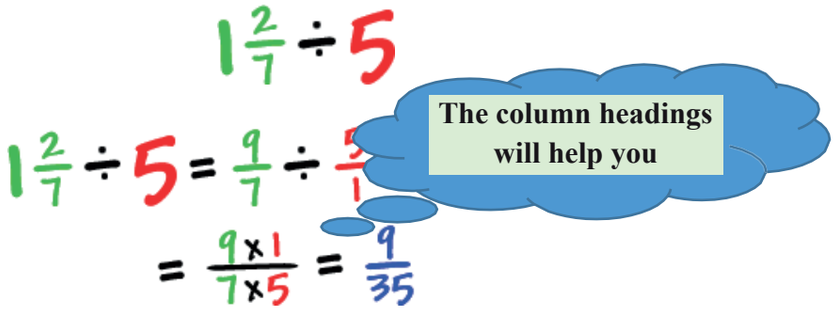
Use the same trick you do when multiplying by changing everything to fractions and then go for it!

Check it out: $\frac{9}{17} \div 3$

$$\frac{9}{17} \div 3 = \frac{9}{17} \div \frac{3}{1} = \frac{9}{17} \times \frac{1}{3} = \frac{9 \times 1}{17 \times 3}$$

$$= \frac{9}{51} = \frac{9 \div 3}{51 \div 3} = \frac{3}{17}$$

How about another one?



Use the same trick you do when multiplying by changing everything into fractions and then go for it!

LESSON 5 Adding, Subtracting, Dividing and Multiplying Decimals.

Activity 3.4: Fractions and Decimals

In groups, copy and complete the table, by explaining how you have obtained the answer. The first three have been done for you

Tens	Ones	Tenth $(\frac{1}{10})$	Hundredth $(\frac{1}{100})$	Thousandth $(\frac{1}{1000})$	Fraction	Percentage
		5			$\frac{1}{2}$	**50**
1	2	4			$12\frac{2}{5}$	1240
		2	5		$\frac{1}{4}$	25
		1	5	2		
		5				

Tens	Ones	Tenth $\left(\frac{1}{10}\right)$	Hundredth $\left(\frac{1}{100}\right)$	Thousandth $\left(\frac{1}{1000}\right)$	Fraction	Percentage
						80
					$\frac{17}{20}$	
						64
		0	0	4		
					$\frac{3}{10}$	
4	0	3				

LESSON 6. Convert Fractions to Decimals and Vice-Versa

A fraction like ¾ means *three quarters or three parts out of four or three divided by four*

3 divided by 4 equals 0.75

So, the fraction ¾ is equal to 0.75 in decimal.

Activity 3.5:

In pairs, convert the following fractions into decimals

a) $2/5$

b) $1/20$

c) $5/8$

d) $2/9$

e) $1/11$

f) What do you notice about (d) and (e)?

LESSON 7. Identifying and Classifying Decimals as Terminating, Non-terminating and Recurring Decimals.

Activity3.6 : Decimal as terminating, non-terminating and recurring decimals

In groups list some terminating, none terminating and recurring decimals. In pairs prove them. Compare your answers with the members of the group.

Fractions like $^{3}/_{5}$, $^{1}/_{2}$, $^{3}/_{8}$ can be converted into decimals and they end or terminate: $^{3}/_{5}$=0.6, ½=0.5and $^{3}/_{8}$=0.375.

Fractions like $^{2}/_{3}$, $^{2}/_{15}$, 1/11do not end or terminate when converted into decimals, $^{2}/_{3}$=0.66666..., $^{2}/_{15}$=0.133333...and
$^{1}/_{11}$ = 0.090909...

These decimals are referred to as **recurring decimals**

Exercise

1. Write the following fractions as decimals:
   (a) $^{3}/_{8}$ (b) $^{7}/_{10}$ (c) $^{17}/_{50}$ (d) $^{13}/_{25}$

2. Write the following as fractions in their lowest terms:

   (a) 0.25 (b) 0.08 (c) 0.35 (d) 0.125

3. Write the following fractions as recurring decimals:
   (a) a $^{2}/_{11}$ (b) $^{1}/_{3}$ (c) $^{1}/_{6}$ (d) $^{7}/_{9}$

LESSON 8. Converting Recurring Decimals into Fractions

Recurring decimals can be converted into fractions.

Example: Convert this recurring decimal into a fraction: 0.333... Note that the decimal repeats itself after one decimal place.

Let r = 0.333... (1)
Multiply both sides of the equation by10i.e.10xr=10x0.333 10r = 3.333(2)

Subtract equation (1) from equation (2):
That is, 10r = 3.333
(r = 0.333) 9r = 3

r = $^{3}/_{9}$ = $^{1}/_{3}$.

Exercise

1. Convert the following recurring decimals into fractions
   a) 0.77---, b) 0.133--- , c)1.25656 ---, d) 0.2727 ---, e) 0.01313
2. Convert the following numbers into recurring decimals

   a) $\frac{1}{3}$, b) $\frac{1}{9}$, c) $\frac{2}{6}$

LESSON 9. Converting Fractions and Decimals into Percentages and Vice-Versa

Activity 3.7: Fraction percentage game

I am $\frac{7}{20}$	Who is 67%?	I am $\frac{67}{100}$	Who is 13%?	I am $\frac{13}{100}$	Who is 22%?
I am 11	Who is 5%?	I am 1	Who is72%?	I am 18	Who is 87%?
Iam 87	Who is 4%?	I am 1	Who is 34%?	I am 8	Who is 42%?
I am 21	Who is 52%?	I am 13	Who is 45%?	I am 9	Who is 58%?
I am 29	Who is 64%?	I am 16	Who is32%?	I am 17	Who is2%?
I am 1	Who is 92%?	I am 23	Who is 98%?	I am 49	Who is 44%?
I am 11	Who is 82%?	I am 41	Who is 65%?	I am 13	Who is 14%?

From the fraction percentage game, identify the equivalent percentage for each fraction.
In your groups, use percentage to identify the smallest and largest fractions from the fraction percentage game.

LESSON 10 Calculating a Percentage of a Given Quantity

The percentage of a quantity can always be calculated in terms of percentage increase or percentage decrease.
Example 1: Find the 10% of 50,000
Solution: $^{10}/_{100}$ x 50,000 = 5,000.
Example2: Opiohad60goats. Now he has 63 goats. What is the percentage increase?

Solution: The increase in the number of goats is 63 — 60 = 3.
Percentage increase is $^{3}/_{60}$ x 100 = 5%.

Activity 3.8: The table below shows students' marks in two mathematics tests. For each one, calculate the percentage difference. Say if it is an increase or a decrease.

	Student	First Test	Second Test
(a)	Marion	50	45
(b)	James	40	52
(c)	Christina	20	35
(d)	Sarah	60	50

LESSON 11.Works out Real-life Problems Involving Percentages

Exercise

1. In a closing-down sale, a shop offers 50% cut to the original prices. What fraction is taken off the prices?
2. In a survey one in five people said they preferred a particular brand of Coca Cola. What is this figure as a percentage?
3. Peter pays tax at the rate of 25%of his income. What fraction of Peter's income is this?
4. When Carol was buying a house, she had to make a deposit of the value of the house. What percentage was this?
5. I bought a coat in the January sales with price cut of the selling price.
6. What percentage was taken off the price of the coat?
7. Adikinyi bought some fabric that was1.75metres long. How could this be written as a fraction?
8. A car park contains 20 spaces. There are 17 cars parked in the car Park.
   a. What fraction of the car park is full?
   b. What fraction of the car park is empty?

Activity of Integration

A primary school has two sections, that is, lower primary (P1-P4) and upper primary (P5-P7). The head teacher of the primary school needs to draw a timetable for both sections. The sections should start and end their morning lessons at the same time before break time, start and end their break time at the same time. The after break lessons should start at the same time. The lunch time for both sections should start at the same time.

Support: The time to start lessons for the two sections is 8. 00am.The duration of the lesson for the lower section is 30 minutes and that of the upper section is 40 minutes.

Resources: Knowledge of fractions, percentages, natural numbers, factors, multiples, lowest common multiples, and the subjects taught in all classes and of time.

Task: Help the head teacher by drawing the time table up to lunch time for the two sections. How many lessons does each section have up to lunch time? Express the total number of lessons for the lower primary as a fraction of the total number of lessons for the whole School. (Consider lessons up to lunch time.)

Topic 4: Rectangular Cartesian Coordinates in 2 Dimensions

Learning outcomes.

By the end of this topic, you will be able to:

i) Identify the x and the y axis.
ii) Read and plot points on the Cartesian plane/ coordinate grid.
iii) Complete polygons on the coordinate grid.
iv) Choose and use appropriate scale for a bivariate data set.

Introduction

This topic is key in building the concept of location. The knowledge achieved from this topic can be used in locating laces. In order to locate places you need a starting point (reference point).

LESSON 1. Identifying the X-axis and Y-axis

The Cartesian axes were created by a French Mathematician, Renes Des Cartes.
They consist of two axes, one vertical(away from you) as the Y-axis and horizontal(across the page from left to right is the X-axis.
Each of these have an arrow at the end to show continuity.
Figures are placed at equally placed positions including zero and negative integers.

Activity 4.1

Draw on graph paper, two lines that cross at the centre of the graph paper.
Make their point of intersection zero.
Mark an arrow at the end of each of these lines.
Label the X-axis and the Y-axis.
At equally spaced positions, mark the integers 1,2,3…to the right after the zero position, on the X-axis and away from you from the zero position along the Y-axis.
Plot the following points.
(2,3)
(0,4)
(5,0)
(-1,3)
(-4,-2)
(-5,4)

LESSON 2. Plotting Points

Now, plot the following points on a graph, (6, 4), (5, 9), (11, 3), (5, 6) and (3, 4).

The x number comes first then the y number: (X, Y). These numbers are called coordinates.

Exercise

1. Use a graph paper to:
   a) Join the points with coordinates (0,3), (5,6), and (5,0) to draw a triangle.
   b) On the same diagram join the points with coordinates (2, 0), (2, 6) and (7, 3) to draw a second triangle.
   c) Describe the shape you have now drawn.
2. On the same graph paper join these points in order.

a)(4,6),(5,7),(6,6),(4,6).
b)(5,8),(4,8),(4,7),(5,8),(6,8),(6,7),(5,8).
c)(4,5),(5,4),(6,5),(5,3),(4,5).
d)(5,2),(3,4),(3,5),(2,5),(2,8),(3,8),(3,9),(7,9),(7,8),(8,8),(8, 5), (7, 5), (7, 4), (5, 2).

We can also use negative numbers in coordinates. We can bring in coordinate axes with positive and negative numbers.

Exercise

1. (a)Draw a set of axes and mark the points with coordinates (4,0),(-4,0),(0,4), (0,-4),(1,2), (1,-2),(3,3),(3,-3),(2,1),(2,-1),(-1,2),(-1,-2),(-3,3),(-3,-3), (-2, 1), (-2, -1)

   (b) Join the points to form an 8 pointed star.

2. (a)On a graph paper, draw the rectangles with corners at the following points with coordinates:
   a) (-6, 6), (-5, 6), (-5, 4), (-6, 4)
   b) (-2, 1), (-3, 1), (-3, 3), (-2, 3)
   c) (3, 1), (3, 3), (4, 3), (4,1).
   d) (10, 1), (10, 3), (9, 3), (9, 1)
   e) (12, 4), (13, 4), (13, 6), (12, 6)

   (b) Join the points with coordinates:

   (1, -5), (1, -1), (2, 0), (5, 0), (6, -1), (6, -5)

LESSON 3. Plotting Polygons (shapes)

Here we look at polygons plotted on coordinate axes, but first, recall the names of polygons.

Names of polygons

Number of sides	Name
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon

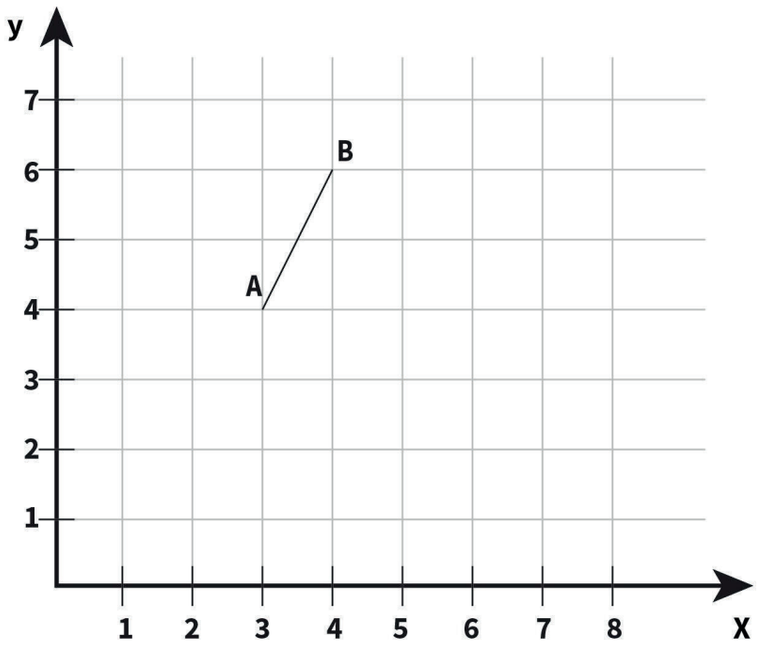
Note:

In a regular polygon:

(a) All the sides are the same.
(b) All the angles are of the same size.

Activity 4.2: The line AB is one side of a square

What are the possible coordinates of the corners of the square?



Exercise

1. In each case the coordinates of 3 corners of a square are given. Find the coordinates of the other corner.

(a) (2, -2), (2, 3) and (-3, 3)

(c) (2,3),(3,4)and(1,4)

(d) (2,2),(4,4)and(4,0)

(e) (-6, 2), (-5, -5) and (1, 3)

(f) (-5, -2), (-2, -1), and (-1, -4)

1. The coordinates of 3 corners of a rectangle are given below. Find the coordinates of the other corner of each rectangle.

(a) (-4,2),(-4,1)and(6,1)
(b) (0,2),(-2,0)and(4,-6)

(c) (-4,5),(-2,-1)and(1,0)

(d) (-5,1),(-2,5)and(6,-1)

2. (a) The coordinates of 2 corners of a square are (-4, 4) and (1,-1). Explain why it is possible to draw three different squares using these two points.

(b) Draw the three different squares.

(c) If the coordinates of the corners had been (-5, 1) and (1, 3) would it still be possible to draw 3 squares? Draw the possible squares.

3. Half of a heptagon with one line of symmetry can be drawn by joining the points with coordinates:(2,4),(-2,1),(-2,-1),(0,-3)and (2, -3). Join the coordinates. You have drawn one half of the heptagon. Complete the heptagon. Write down the coordinates.

LESSON 4. Use of Appropriate Scale for given bivariate data

Activity 4.3: Plot the following points on the axes: (5, 50), (10,100), (15,150), (20,200), (35,350)

Do you realise that on the horizontal axis there are 5 units for each space? On the vertical axis there are 50 units for each space. So, what is the scale for the axes?

Exercise

1. For each part, draw a pair of axes with suitable scales and plot the points:

(a) (1, 15); (4, 35); (8, 45)
(b) (15, 100); (35, 500); (40, 700)

2. Plot the points (2, 60); (4, 50); (0, 70); (7, 60)

Activity of Integration

A Senior One learner has reported in her class and has settled at her desk.

Support: The classroom is arranged in rows and columns. It is a big class with each learner having his / her own desk.

Resources: Knowledge of horizontal and vertical lines i.e. rows and columns, coordinates

Knowledge: counting numbers

Task: The mathematics teacher has asked her to explain how she can access her seat, starting from the entrance of the class. Discuss whether there are other ways of reaching her seat.

Term 2

Topic 5: Geometric Construction Skills

Learning outcomes

You should be able to:

i) Draw perpendicular and parallel lines. (k, s)
ii) Construct perpendiculars, angle bisectors, mediators and parallel lines. (u, s)
iii) Use a pair of compasses and a ruler to construct special angles. (60^0, 45^0) (u, s)
iv) Describe a locus. (u)
v) Relate parallel lines, perpendicular bisector, angle bisector, straight line and a circle as loci. (k, u).
vi) Draw polygons. (u)
vii) Measure lengths and angles. (s)
viii) Construct geometrical figures such as triangle, square, rectangle, rhombus, and parallelogram. (u, s, v/a)

Introduction

In this topic you will learn how to construct lines, angles and geometric figures. Skills developed from this topic can be applied in day-to-day life.

Keywords: perpendicular lines, parallel lines, circumcircle, arcs

LESSON 1: Draw Perpendicular and Parallel Lines

Materials

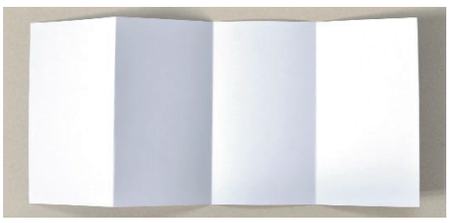
papers**,** geometrical mathematic set.

Introduction

In primary school you learnt what parallel lines and perpendicular lines are, and how they look like.

Activity 5.1 Forming parallel and perpendicular lines

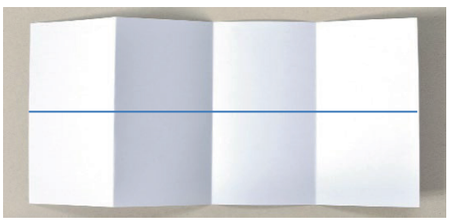
You get a sheet of paper either rectangular shaped or square shaped; divide it into half by folding, then into half again in the same way. Now unfold your paper. Your paper now looks like this.



1. What kind of lines do you see?

_____

Next, fold the same paper into half in the opposite direction. Unfold your paper now.



2. How is the new line you have created, related to the previous lines?

_____

3. In real-life situations, where do we come across perpendicular lines and parallel lines?

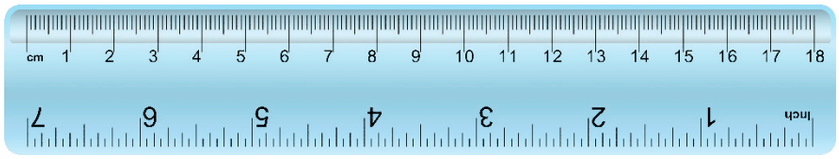
_____, _____,

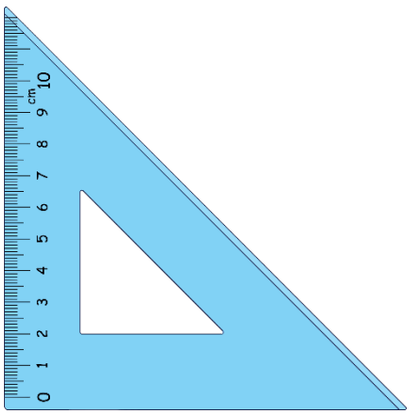
_____

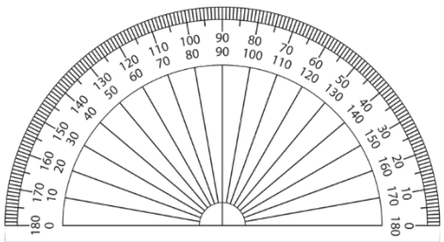
4. Which letters in the alphabet have the above lines?

In this sub-topic, you will have more hands-on work on perpendicular and parallel lines.

Activity 5.2 (Using the materials**)**







1. State the angle between two lines which are perpendicular.

   _____

2. In your exercise book using a ruler or straight edge and a pencil draw two line showing when they are
   i. Parallel
   ii. perpendicular
3. State the type of lines used to form corners of the following.

Common object/situation	**Type of lines**
Corners of common doors	
Corners of houses/rooms	
Opposite Sides of a rectangular door	
Sides of a bed adjacent or next to each other	
Corners of an exercise book	

4. Mention two four-sided figure that are made up of both parallel and perpendicular lines.

5. What is the difference between parallel lines and perpendicular lines?

LESSON 2: Construction of perpendicular lines, angle bisectors, mediators and parallel lines

Keyword: **Arc** is described as "part of the circumference of **a circle"**.

Materials: exercise book, mathematical sets and a pen

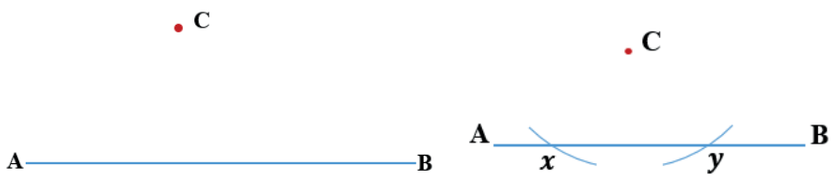
Introduction

Perpendicular lines are two line that meet or cross each other at 90^0. In this lesson you're going to draw a perpendicular line passing through a given line from a point.

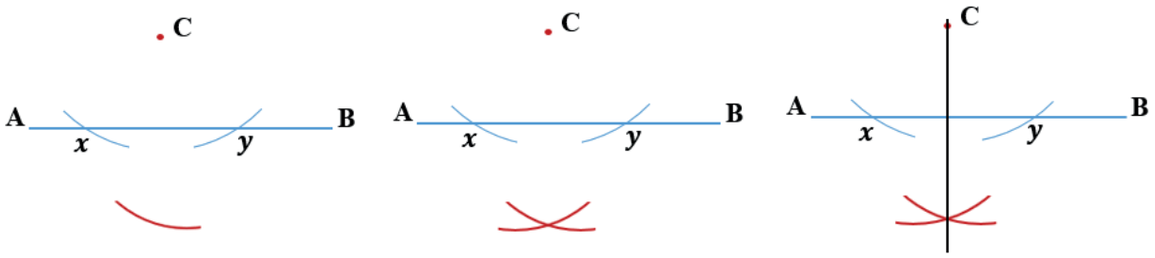
Activity 5.3: Construction of perpendicular line from an external point to a given line

Do this activity in your book.

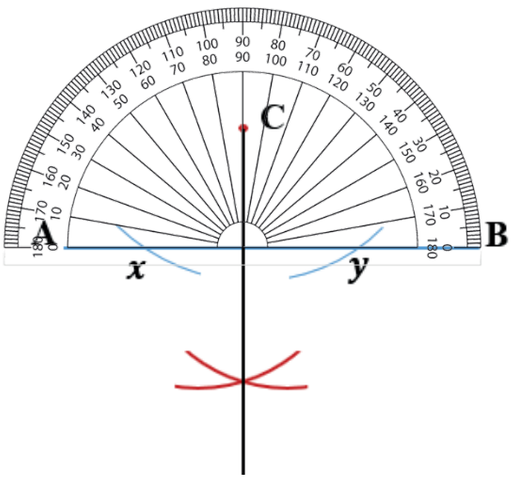
Given line segment **AB** and point **C** outside the line, construct a perpendicular line from point C to line AB.



i. Taking the centre as **C** and any radius, draw two arcs on line AB at x and y.
ii. Now taking x as the centre and any radius, draw an arc below or above the line opposite point C without changing the radius.



iii. Taking y as the centre, draw an arc to intersect the previous arc.
iv. Join the intersection of the arcs to point C.
v. Compare your answers with this notes.



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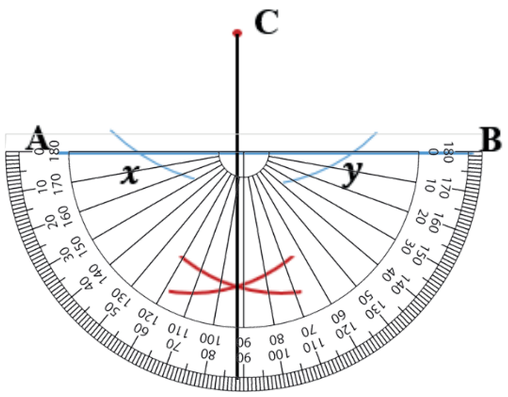
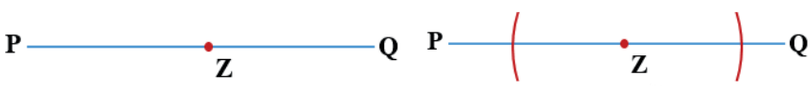


You have constructed a perpendicular line from an external point C to a given line AB

Activity 5.4: Construction of a Perpendicular line to a given point on a given line segment

using an exercise book, pencil, pair of compasses.

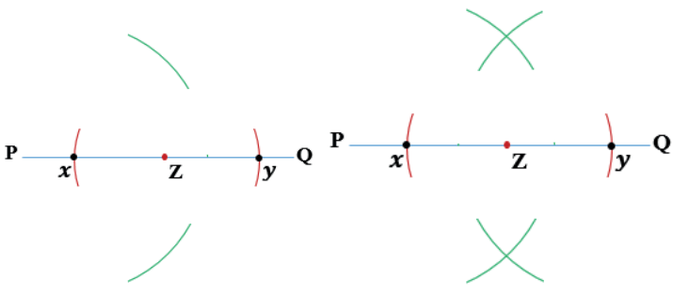
i. Given line PQ and point Z on PQ. Taking Z as the centre and any radius,

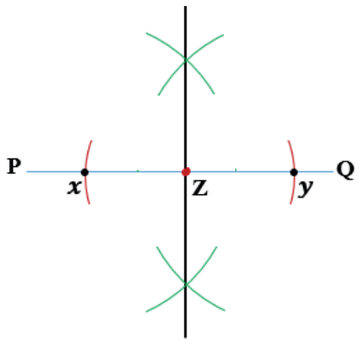


ii. Draw two arcs on either side of Z name the arcs *x* and.

iii. Now taking x as the centre and any radius draw an arc either above or below
the line,

iv. Without changing the radius now taking y as the centre draw an arc to meet the previous arc.





v. Join the intersection of the arcs to point Z.

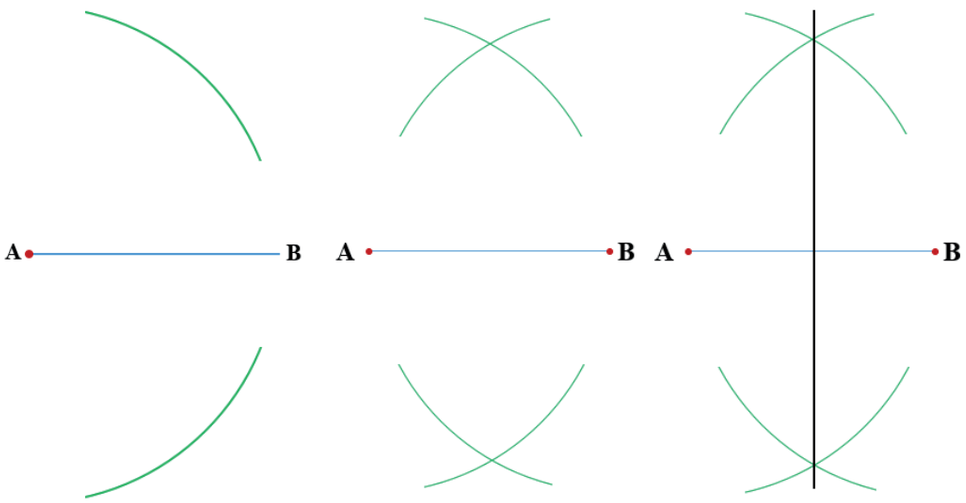
Compare your answers with this work.

Activity 5.5: Construction of a Perpendicular Bisector

In your exercise work book as an individual.

Given line segment AB. 

i. Taking A as centre and AB as the radius, draw two arcs below and above the line,



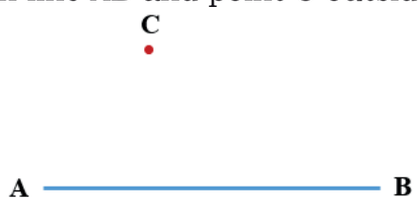
ii. Then now taking B as the centre and without changing the radius, draw arcs to meet the previous arcs.
iii. Join the intersection of the arc.
iv. What do you notice?

v. Compare your answers with this work.

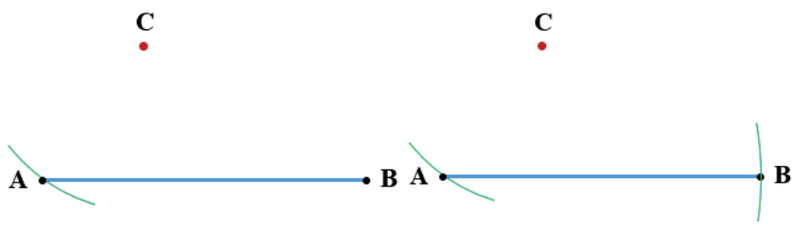
Activity 5.6: Construction of parallel lines

In your exercise workbook.

i. Given line AB and point C outside the line.

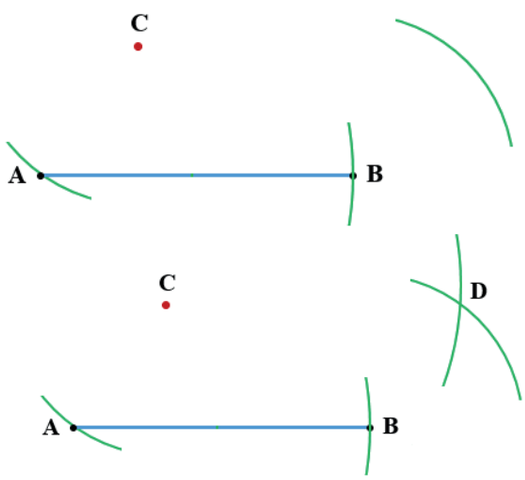


ii. Take C as the centre, draw an arc at point A,



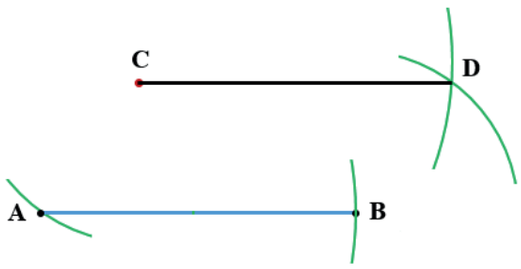
iii. Taking AB as radius and A as the centre, draw an arc at point B.

iv. Now take radius AC and taking B as the centre, draw an arc above B,



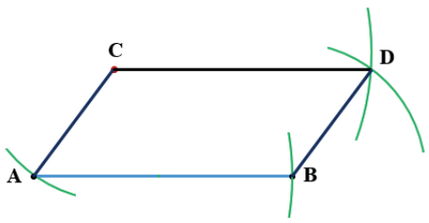
v. Then taking radius AB and C as the centre, draw an arc to meet the previous arc at D.

vi. Join the intersection of the arcs (D) to point C.



vii. What do you notice. _____

viii. Name and describe shape ABCD.



ix. Compare your answers with this work.

LESSON 3: Construct perpendiculars, angle bisectors, mediators and parallel lines. (u, s)

Materials: ruler, pencil and pair of compasses

Introduction

From the **Activity 2.3: Construction of a Perpendicular Bisector.**

Line AB was divided into two equal parts. The line CD which crosses or cuts AB is **a perpendicular bisector.** Since a straight line is equal to **180^0**, it divided into two equal line parts and the angle form at the point of meeting is **90^0.**

To **bisect** is to divide into two equal parts. And **perpendicular** means to meet at **90^0**

In this work the line CD is also called a **mediator**

A perpendicular bisector line makes a path which is **equal distances** from point **A** and point **B** always.

Activity: 5.7

Using a pencil, ruler and pair of compasses; construct a perpendicular Bisector.

i. Measure and record angle CEB (angle form between line CE and line EB. _____

ii. Measure the length of line AE _____
And line EB _____

LESSON 4: Use a pair of compasses and a ruler to construct special angles. (60^0, 45^0)

Materials: ruler, pencil and pair of compasses

Introduction

In this lesson you are extending the knowledge of bisecting to come up with different angle sizes.

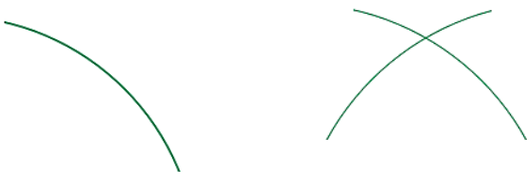
- **90^0**is constructing by bisecting **180^0** (a straight line)
- In this guided activity you will construct 60^0. And the rest are constructed by bisecting **90^0**and **60^0** then picking the wanted angle.

Activity 5.8: Construction of 60^0

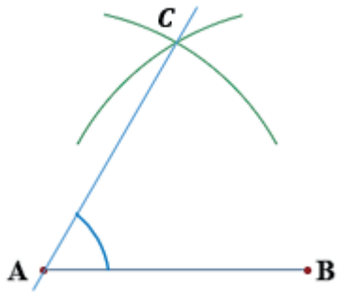
In your exercise work book as an individual.

Given line segment AB. 

i. Taking A as centre and AB as the radius, draw an arc above the line,



ii. Then now taking B as the centre and without changing the radius, draw an arc to meet the previous arc.



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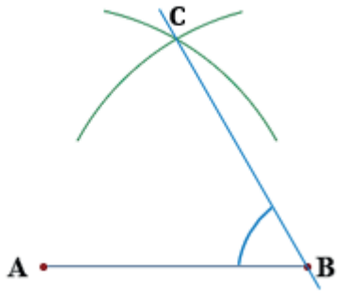
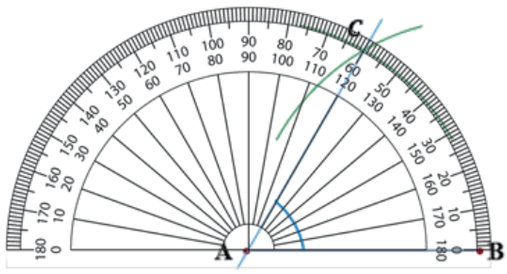


iii. Join Point **A** to the **intersection** of the arcs, form an angle at **A** or Join Point **B** to the **intersection** of the arcs, form an angle at **B.**



iv. Measure the angle formed. _____

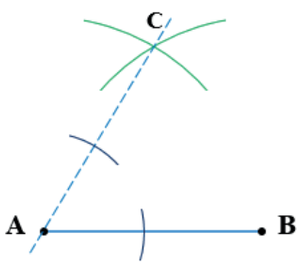
v. Construct angle 120^0.

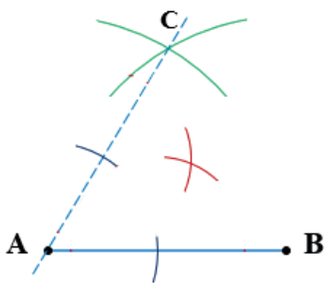
Activity 5.9: Construction of 30^0

i. Repeat Activity 3.1.

ii. Then you're bisecting and 60^0 to form _____ degrees.

iii. Taking A as your centre and radius is the distance between A and B, the draw an arcs cutting line AB and line AC.

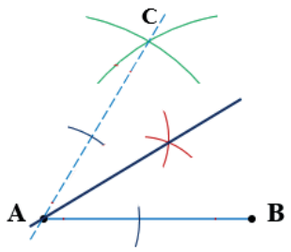




iv. Using the point on AB where the arc cuts it as the centre and radius less than the distance between the two arcs point of intersection on AC and AB, draw an arc above B

v. Using the point on AC where the arc cuts it as the centre and radius less than the distance between the two arcs point of intersection on AC and AB, draw an arc below C and cut the previous arc.

vi. Join point A to the point of intersection of the arcs.



vii. Measure the angle form. _____

Note: This is the process of bisecting an angle 60^0.

Activity 5.10

Constructing the following angles; 120^0, 45^0, 135^0, 150^0, 15^0

LESSON 5: Describe a Locus

Materials

Introduction: Describing Locus Question

What is the path traced out by the tip of the seconds-hand of a clock in the course of each minute?

Activity 5.11: **Discovering what Locus Is**
In your home, find out what happens if a goat is tied to a rope of length 4 metres and around the place where the goat is, there are gardens at a distance of 5 metres.
In your revision exercise work book, draw sketches of the area where the goat can feed from.
In real-life situations, where are such scenarios applied?

Activity5.12: Sketching and Describing Loci
In your exercise workbook at home, sketch and describe what happens about the following:

a) A mark on the floor as the door opens and closes.
b) The centre of a bicycle wheel as the bicycle travels along a straight path.
c) A man is walking and keeping the same distance from two trees P and Q.
d) Path left by opposite tyres of a moving car after rainfall on a murram road.

e) Tie anything with a string of some length. Using your hand rotate it around holding the opposite side of the string.

Relating Lines and Angles to Loci

According to the activities5.1 and 5.2 above, Locus is a trace of a point under some conditions. The trace or path is circular or straight line.

Activity5.13: **Demonstration of some simple Loci**

a) In your exercise work book, demonstrate how one can walk the same distance from a given point.
b) How one can walk the same distance from two fixed points.
c) How one can walk the same distance from a line.
d) How one can walk the same distance from two intersecting lines.
Share your answers with the people at home.

LESSON 6: Relate parallel lines, perpendicular bisector, angle bisector, straight line and a circle as loci. (k, u)

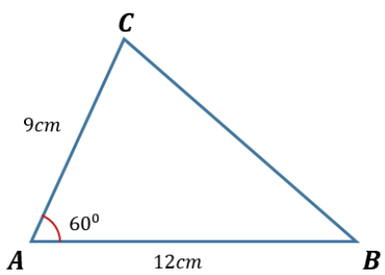
Materials: geometrical set

Introduction: you're going to relate perpendicular bisector, straight line and a circle as loci.

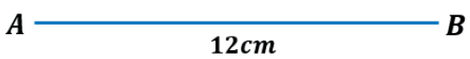
Activity 5.14

Construct a triangle ABC where AB = 12cm, AC=9cm and Angle BAC= 60^0.
Find the point within the triangle where the distance from that point to all the vertices of the triangle is equal taking that point as the centre and the distance from the centre to the vertices as the
radius draw a circle.

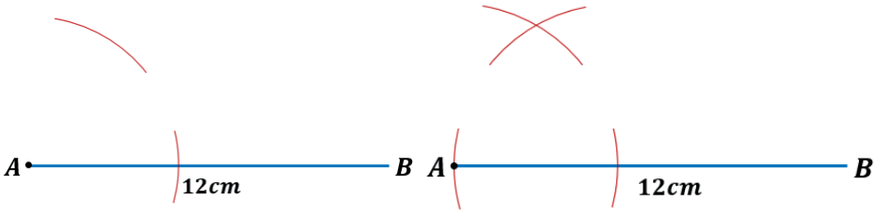
Sketch drawing



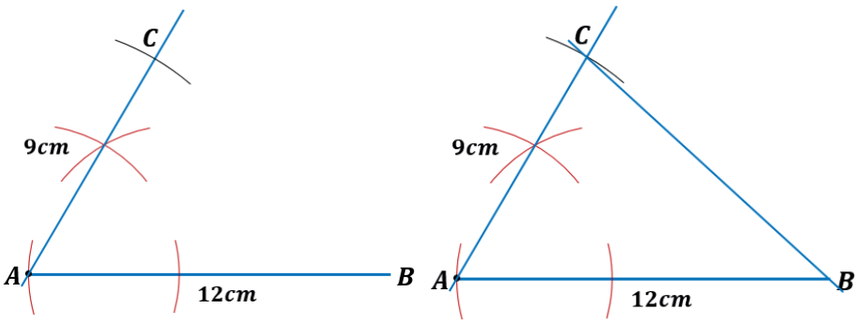
i. Draw line AB which is 12cm.



ii. Construct 60^0 on point A. Use the previous work.



iii. Using point A as the centre of the arc and radius of 9cm, draw an arc to cut the line making 60^0. Name the point of intersection point C.

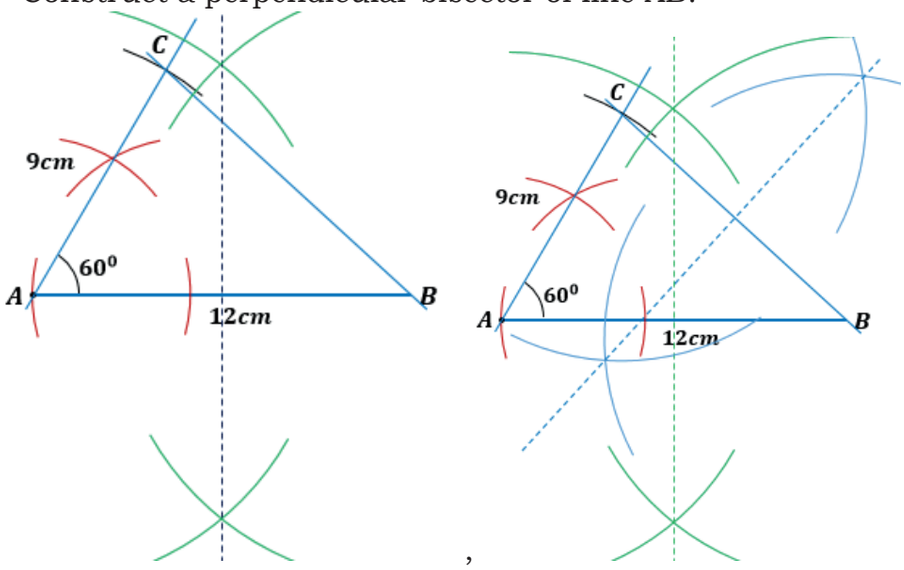


iv. Join point B to point C

v. Measure the length of line BC.

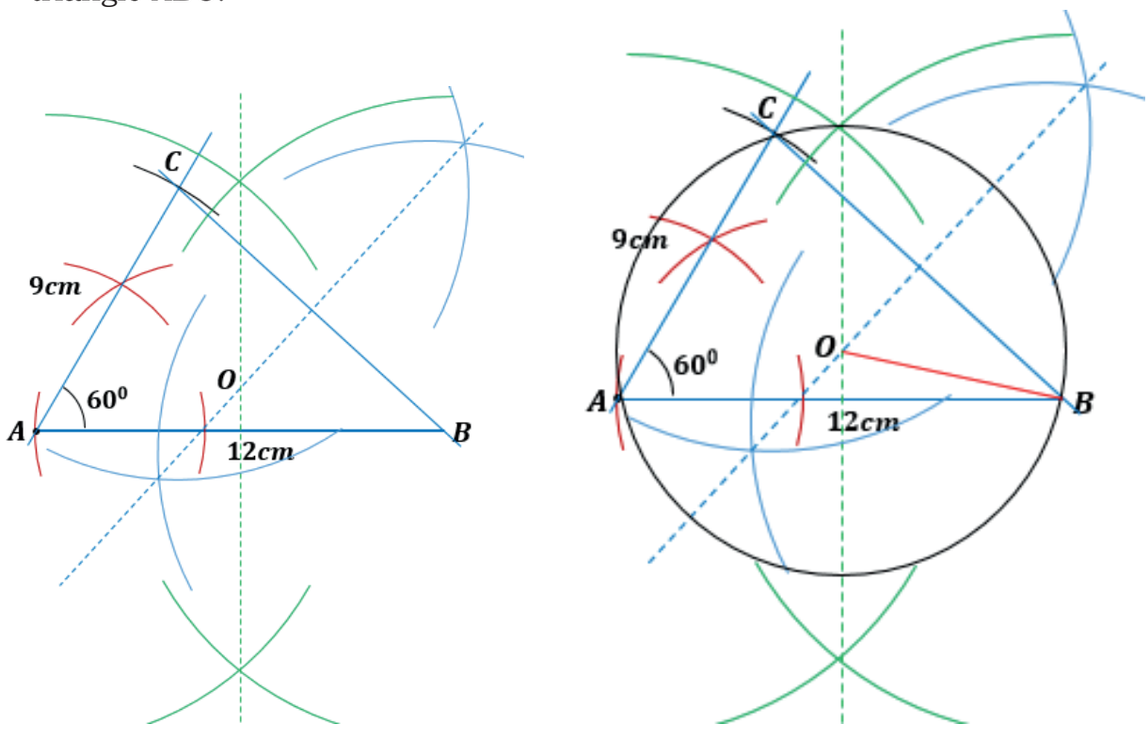
Finding the point within the triangle where the distance from that point to all the vertices of the triangle is equal.

vi. Construct a perpendicular bisector of line AB.



vii. Then construct another perpendicular bisector of either line AC or line BC.

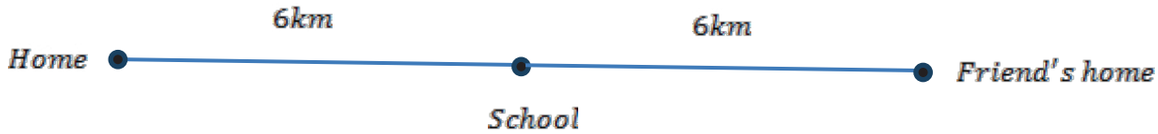
viii. Taking the point of intersection of the two perpendicular bisectors as the centre, ***O***, draw a circle with radius touching the sides or vertices of the triangle ABC.



ix. Draw a line from the centre to any point of intersection of the circle and the vertex of triangle ABC.

Examples:

If you have a friend with whom you go to the same school but come from different places. Assuming you and friend travel to school having moved 6km.



Note: school is equal distance from both homes also known as equidistant

Exercise

1. Construct the locus of a point equidistant from a fixed point.
2. Construct a locus of a point equidistant from a given line.
3. Construct the locus of a point equidistant from two intersecting lines.

LESSON 7: Draw polygons

Materials: geometrical set

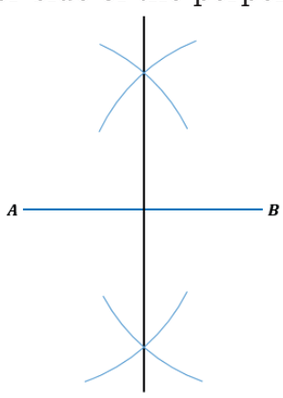
Introduction

Construction of geometric figures most of the time is application of locus. Closed figures of three and more number of sides. From the previous activities/work knowledge to complete the next activity 5.15.

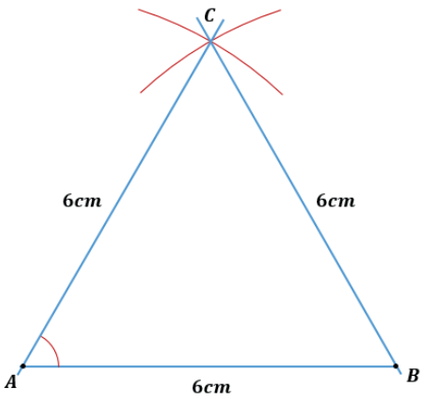
Activity 5.15: **Construction of geometrical figures**

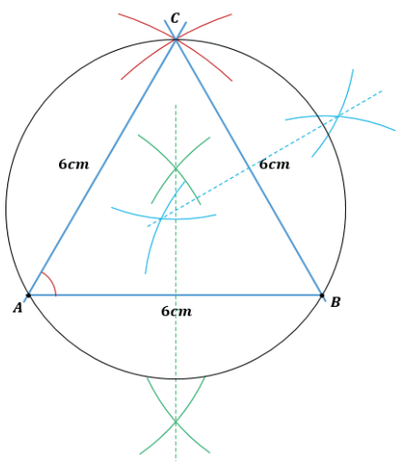
In you exercise workbook,

1. Construct a perpendicular bisector of any line segment.
   i. Measure the distance from the perpendicular line to any of the points on either side of the perpendicular bisector.



   ii. What have you found out?
2. Construct an equilateral triangle with length 6cm.Construct a circumcircle of the triangle.





What type of locus is applied here?

Exercise

1. Construct a triangle ABC in which AB = 8.5cm, BC = 6cm and angle B =30^0.
2. Construct a circle through the vertices of the triangle. Work out the area of the circle.
3. Construct triangle PQR with PQ = QR= 7cm angle Q = 45^0. Construct a circumcircle of the triangle.
4. Construct a parallelogram ABCD in which AB=5cm, BC=4cm and angle B is 120^0.
5. Construct an equilateral triangle ABC of sides 7cm.Bisect AB and BC and let the bisectors intersect at X. With X as the centre and radius XA, draw a circle.

Situation of Integration

In a village, there is an old man who wants to construct a rectangular small house of wattle and mud.

Support

A string, sticks, panga, tape measure and human resource.

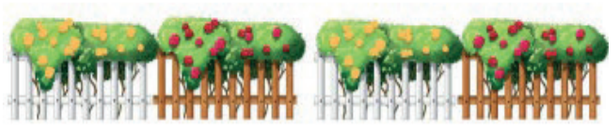
Resources

Knowledge of horizontal and vertical lines i.e. rows and columns, knowledge of construction of geometric figures.

Task:

The community asks you to accurately construct the foundation plan for this old man's house.
Explain to the class how you have accurately constructed the foundation plan.
Discuss whether there are other ways of constructing an accurate foundation plan.

TOPIC 6: SEQUENCE AND PATTERNS



Competency

The learner should be able to explore number patterns and sequences.

Learning Outcomes

You should be able to:

i) draw and identify the patterns.
ii) describe a general rule of a given pattern.
iii) describe a sequence.
iv) determine a term in a sequence.

Introduction

In this topic you will learn how to identify and describe general rules for patterns. You will be able to determine a term in the sequence and find the missing numbers in the sequence.

In this topic you will use previous knowledge skills from other topics.

LESSON 1: Draw and Identify the Patterns

Materials

Household items and environment

Activity 6.1: Drawing and identifying object patterns

At home:

i) Get all your clothes and identify which ones have a certain design/ make/art that is repeated. Share your findings with people at home telling them findings. (E.g. repeated pictures, shapes/figures etc.)

ii) In your exercise work book draw some shapes of your choice and make them repeatedly.

iii) Ask anyone if they can tell you the next/following part or if one is removed for them to complete.

iv) Identify the objects used make this shape,

 .....

Use same objects to draw a boundary around your next page in the exercise workbook.

v) Move at home inside and outside the house, compound and surrounding environment identify things made or planted in a certain order.

vi) Which word would be the best description of the certain order or repetitions from your activity? .....

Activity 6.2: Identifying number patterns

Remember that in topic 2 Working with integers, you learnt about multiples, look at the following sequences, how can you get the next number?

i) 3, 6, 9, 12, 15, ...

ii) 2, 4, 6, 8, 10, 12, ...

Comparing the first three terms

1st term	Finding the next term	2nd Term	3rd Term	Rule
3	From $(6-3)=3$, add 3	$3+3=6$	$6+3=9$	Add 3 to get the next term.

1st term	Finding the next term	2nd Term	3rd Term	Rule
2	From $(4-2)=2$, add 2	$2+2=4$	$4+2=6$	Add 2 to get the next term.

In (i), in order to get the next number, you add 3 to the previous number, 3. The numbers in this sequence are multiples of 3.
Sequence (ii), represents the multiples of 2.

Exercise

i) State the multiples of 3 found in this square table:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

ii) This square shows multiples of a number. What is this number?

iii) Write down the numbers that should go in each of these boxes. The number square will help you with some of them.

a) The **fifth** multiple of … is …
b) The …th multiple of … is 36
c) The 12thmultiple of … is …
d) The 20th multiple of … is …
e) The …th multiple of … is 96.
f) The 100thmultiple of … is …

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Solution

a) the 5thmultiple of 4 is 20
b) the 9thmultiple of 4 is 36
c) the 12th multiple of 4 is 48
d) the 20thmultiple of 4 is 80
e) the 24th multiple of 4 is 96
f) the 100thmultiple of 4 is 400

Exercise

1. Draw a square table like this one, shade all the multiples of 6. Then answer the following questions

a) What is the 4th multiple of 6?
b) What is the 10th multiple of 6?
c) What is the 12th multiple of 6?
d) What is the 100th multiple of 6?

2. The multiples of a number have been shaded on this square. What is the number?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Copy each statement about these multiples and write down the numbers that go in the spaces.
a) The 3rd multiple of ... is ...
b) The 9th multiple of ... is ...
c) The 200th multiple of ... is ...
d) The ...th multiple of ... is 66
e) The ... th multiple of ... is 330.

3.a) Write down the first 8 multiples of 8.
b) Write down the first 8 multiples of 6.
c) What is the smallest number that is a multiple of both 6 and 8?
d) What are the next two numbers that are multiples of both 6 and8?

4. a) Write down the first 6 multiples of 12.
b) What is the 10th multiple of 12?
c) What is the 100th multiple of 12?
d) What is the 500th multiple of 12?
e) If 48 is the nth multiple of 12, what is n?
f) If 96 is the nth multiple of 12, what is n ?
5. a) What multiples have been shaded in this number square?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

b) What is the first multiple not shown in the number square?

6. a) Explain why 12 is a multiple of 6 and 4.
b) Is 12 a multiple of any other numbers?

7. The number 24 is a multiple of 2 and a multiple of 3. What other numbers is it a multiple of?

8. Two multiples of a number have been shaded on this number square. What is the number?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

9. Two multiples of a number have been shaded on this number square.

a) What is the number?
b) What is the 19th multiple of this number?

10. Three multiples of a number are 34, 170 and 255. What is the number?
11. Three multiples of a number are 38, 95 and 133. What is the number?
12. Four multiples of a number are 49, 77, 133 and 203. What is the number?

LESSON 2: Describing the General Rule

Activity 6.3: Finding the Next Term

Can you use the given numbers of the sequence to deduce the pattern and hence find the next term?

Example: What are the next 3 numbers in the sequence:
a) 12, 17, 22 ...?
b) 50, 47, 44, 41, 38?

Solution

a) To find the pattern, it is usually helpful to first find the differences between each term i.e. the difference between 12 and 17 is 5; the difference between 17 and 22 is 5.
So the next term is found by adding 5 to the previous term. This gives you 27, 32, 37.

b) Again you find the difference between:
i) 50 and 47 is -3.
ii) 47 and 44 is -3.
iii) 44 and 41 is -3.
iv) 41 and 38 is -3.

So, the next term is found by taking away 3 from the previous term, giving you 35, 32, 29.

Exercise

1. Copy the following exercise and find the sequence in each case, giving the next three numbers.

a) 18, 30, 42, 54, 66, ...
b) 4.1, 4.7, 5.3, 5.9, 6.5, ...
c) 8, 14, 20,..., 32, ...
d) 3, 11, ..., 27, 35, ...
e) 3.42, 3.56, 3.70, 3.84, 3.98, ...
f) 10, 9.5, 9, 8.5, 8, 7.5, ...

2. Copy each sequence and fill in the missing numbers.

a) 2, 4, ..., 16, 32, ...
b) 100, 81, 64, ..., 36, ...
c) 6, 9, ..., 21, 30, 30, ...
d) 0, 1.5, 4, ..., 12, ...
e) 1, 7, 17, ..., 49, ...

LESSON 3: Generating Number Sequence.

Activity 6.4: Generating a sequence

You can use formulae to generate sequences. For example, the formula5n, with n = 1, 2, 3, 4, … generates the sequence 5×1, 5×2, 5×3, 5×4, …

The sequence generated is 5, 10, 15, 20, …

Example: What sequence do you generate by using the following formula?

a) 5n – 1

b) 6n + 2,m

Solution

a) putting n = 1, 2, 3, 4, … gives 4, 9, 14, 19, …

b) putting n = 1, 2, 3, 4, … gives 8, 14, 20, 26, …

You can find the formula for this sequence, 11, 21, 31, 41, 51, 61, …

How you can find the sequence. The sequence begins with 11, and 11 =10 + 1.

1	11	11	1+10	$1+(10\times 1)=1+10=11$
2	21	11+10	1+10+10	$1+(10\times 2)=1+20=21$
3	31	21+10	1+10+10+10	$1+(10\times 3)=1+30=31$
n				$1+(10\times n)=1+10n=10n+1$

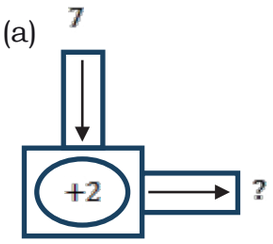
OR

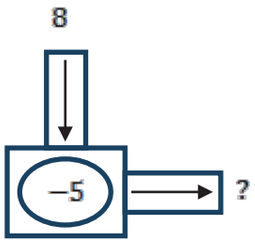
1st	2nd	3rd	nth
11	21	31	
11	$11+10$	$21+10$	
$10+1$	$(10+1)+10$	$(10+10+1)+10$	
$10+1$	$(10+10)+1$	$(10+10+10)+1$	
$(10\times 1)+1$	$(10\times 2)+1$	$(10\times 3)+1$	$10\times n+1=10n+1$

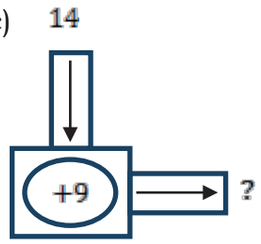
Continue to add 10 each time the formula is 10n + 1.

Exercise

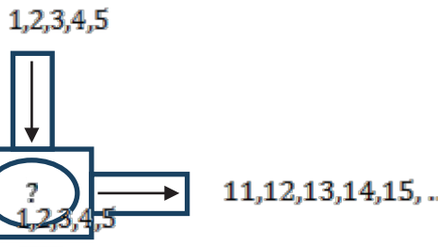
1. What number comes out of each of these number machines?

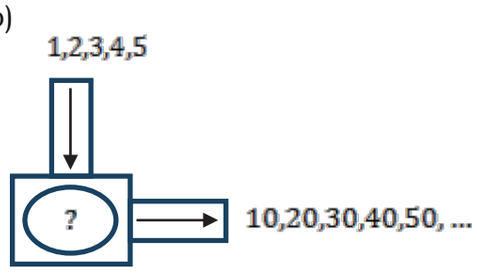
(a) 

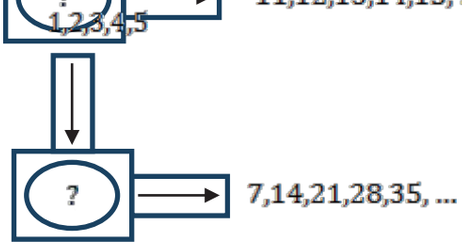
(b) 

(c) 

2. The sequence 1, 2, 3, 4, 5, … is put into each number machine. What does each machine do?

a) 

b) 

c) 

3. Write down the first 5 terms of the sequence given by each of these formulae:

a) 9n b) 12n c) 2n + 4 d) 3n – 1 e) 3n – 2

4. a) What is the 10thterm of the sequence 2n + 1?

b) What is the 8thterm of the sequence 3n + 6?

c) What is the 5thterm of the sequence 4n + 1?

d) What is the 7th term of the sequence 5n – 2?

5. Draw double machines that could be used to get each of these sequences from 1, 2, 3, 4, 5 …

and also write down the formula for each sequence of the following:

a) 5, 9, 13, 17, 21, …

b) 2, 5, 8, 11, 14, …

c) 6, 11, 16, 21, 26, …

d) 4, 9, 14, 19, 24, …

e) 102, 202, 302, 402, 502, …

LESSON 4: Formulae for General Terms.

Activity 6.5 : Identifying the nth term

Note: It is very helpful not only to be able to write down the next few terms in a sequence, but also to be able to write down, for example, the 100^{th} or even the 1000^{th} term.

Example: For the sequence 3, 7, 11, 15, ..., ...
Find:
a) the next three terms.
b) The 100^{th}term.
c) The 1000^{th}term.

Answer
a) You can see that 4 is added each time to get the next term, So you obtain 19, 23, 27.
b) To find the 100^{th}term, starting at 3,
You add 3 to 4 times ninety nine times giving $3 + 4 \times 99 = 3 + 396 = 399$
c) similarly, the 1000th term is $3 + 4 \times 999 = 3 + 3996 = 3999$

I can go one step further and write down the formula for a general term, i.e. the n^{th} term.
This is $3 + 4 \times (n - 1) = 3 + 4n - 4 = 4n - 1$.
Compare your answers with other members of the group and the examples given.

Exercise
1. For each sequence, write down the difference between each term and formula for the n^{th} term.
a) 3, 5, 7, 9, 11, ...
b) 5, 11, 17, 23, 29, ...
c) 4, 7, 10, 13, 16, ...
d) 2, 5, 8, 11, 14, ...
e) 6, 10, 14, 18, 22, ...

2. a) Write down the first 6 multiples of 11.
b) What is the formula for the nth term of the sequence of the multiples of 11?
c) What is the formula for the nth term of this sequence?

3. The formula for the nth term of this sequence is n_2.
1, 4, 9, 16, 25, ...

4. What is the formula for the nth term of the following sequences?
a) 0, 3, 8, 15, 24, ...
b) 10, 13, 18, 25, 34,
c) 2, 8, 18, 32, 50, ...
d) 1, 8, 27, 64, 125, ...

Situation of Integration
There is a family in the neighbourhood of your school. The family has a rectangular compound on which they want to put up a hedge around. The hedge shall be made up of plants of different colours.
Support:

Physical instruments like hoes, machetes, tape measure
Resources:

Knowledge of construction of figures like rectangles, patterns, sequences
Task:

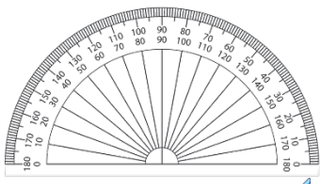
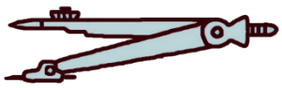
The family requests you to plant the hedge around their rectangular compound so that it looks beautiful.

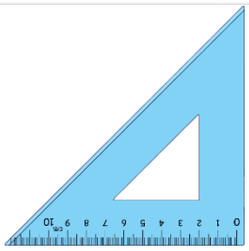
Explain how you will plant the hedge, making sure that the plants at the corners of the compound are the same in terms of colour.

Discuss whether there are other ways of planting the hedge.

TOPIC 7: BEARINGS.

Materials.


Learning outcomes.

By the end of this topic, you should be able to:

1. review the compass.
2. describe the direction of a place from a given point using cardinal points.
3. describe the bearing of a place from a given point.
4. choose and use appropriate scale to draw an accurate drawing.
5. apply bearings in real life situations.

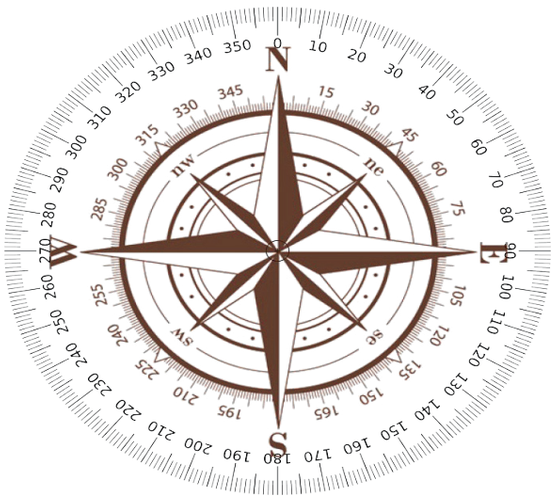
Key words: angle, direction, bearing, scale, line, turn.

LESSON 1. Reviewing the compass.

Which are the cardinal points?

The four main points we can find when looking for an address are: **north, south, east and west**, which are also known by their first letters, generally written in capital letters: **N, S, E and W.** These four addresses are also known by the name of **cardinal addresses**

In addition to the cardinal points, you also need to refer to compass points northeast (NE), southeast (SE), southwest (SW) and northwest (NW)



Activity 7.1: Identifying the compass direction using a personal made compass

At home make a model compass from two sticks tied together when crossing each other at 90^0, on it put makings of the N, E, W and S.

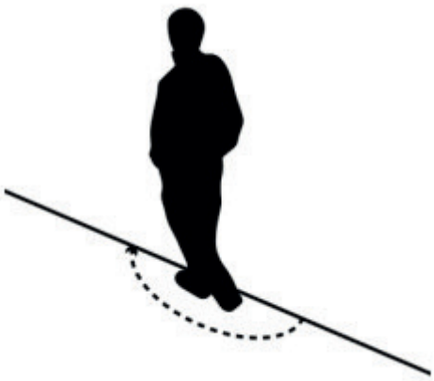
i) Using the morning (sun rise) and Evening (sun set) to identify the east and the west direction.
ii) Place compass on the ground and rotate it the East to point in the sunrise direction and the west in the sunset.
iii) Identify the north and the south directions.
iv) Using a map and that compass you can now locate the directions where the different places are e.g. districts and neighbouring countries.

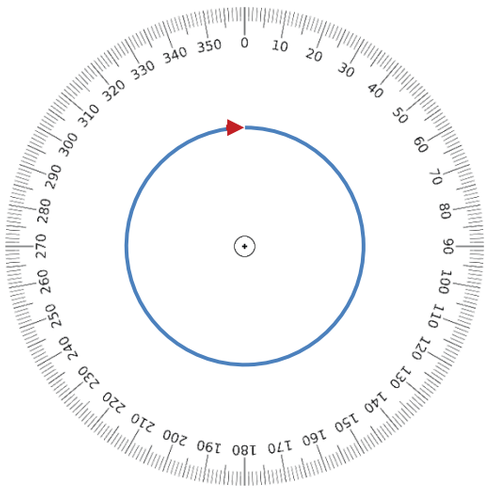
You are now ready to use the compass to locate a place and find the angle turn from the reference direction i.e. the North.

LESSON 2. Describing the direction of a place from a given point using cardinal points.

Angles and Turns

You will need to understand clearly, what the terms such as turn, half turn, etc. mean in terms of angles. There are 360^0in one complete turn, so the following are true.





Activity 7.2: Identifying the angles in relation to the compass direction.

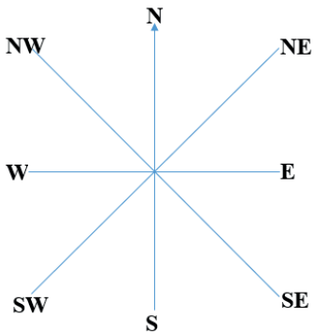
Materials: Ruler and a protractor.

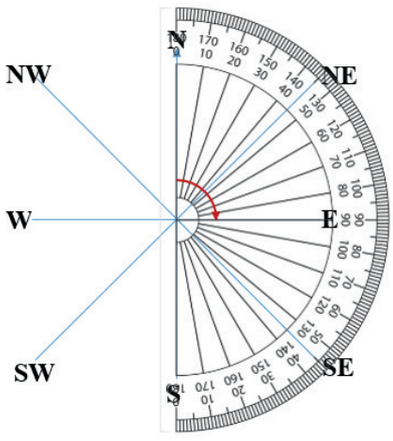
Using a ruler and a protractor, Do the following turns and in each case state the size of the angle you have turned through.

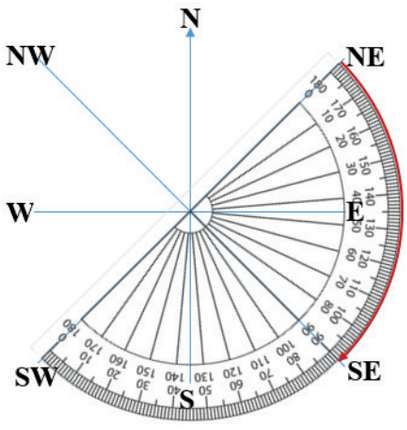
i) Turn from N to S clockwise or anticlockwise

ii) Turn from NE to SE clockwise

iii) Turning clockwise from NE to E







Example
What angle do you turn through if you turn:

a) From NE to NW anticlockwise?
b) From E to N clockwise?

Compare your answers with the given ones.

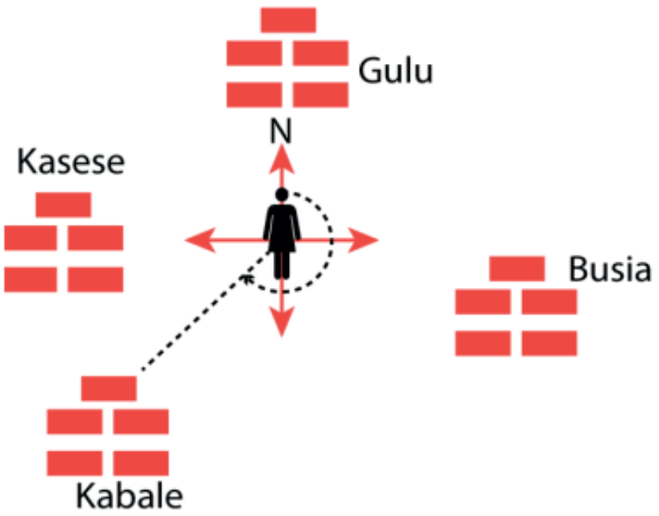
Solution
(a) 90_o (or ¼ turn)
(b) 270_o (¾ turn)

Exercise
1. What angle do you turn through if you turn clockwise from:
(a) N to E? (b) W to NW? (c) SE to NW? (d) NE to N? (e) W to NE? (f) S to SW? (g) S to SE? (h) SE to SW? (i) E to SW?
2. In what direction will you be facing if you turn:
(a) 180_o clockwise from NE? (b) 180_o anticlockwise from SE? (c) 90_o clockwise from SW?
(d) 45_o clockwise from N? (e) 225_o clockwise from SW? (f) 135_o anticlockwise from N?
(g) 315_o clockwise from SW?
3. The sails of a windmill complete one full turn every 40 seconds.
(a) How long does it take the sails to turn through: (i) 180_o (ii) 90_o (iii) 45_o?
(b) What angle do the sails turn through in: (i) 30 seconds? (ii) 15seconds? (iii) 25 seconds?

LESSON 3. Describing the bearing of a place from a given point.

Introduction:
The bearing of a point is the number of degrees in the angle measured in a clockwise direction from North line to the line joining the centre of the compass with the point. A bearing is used to present the direction of one-point relative to another point.

The diagram below shows the bearing of Kabale from where the lady is standing.



Estimate the bearing of the lady from Kabale.

Activity 7.3: Estimating bearings of some places within the home compound.

At home from one place in your compound, estimate the bearings of each building found in the home and the surrounding.

Note:

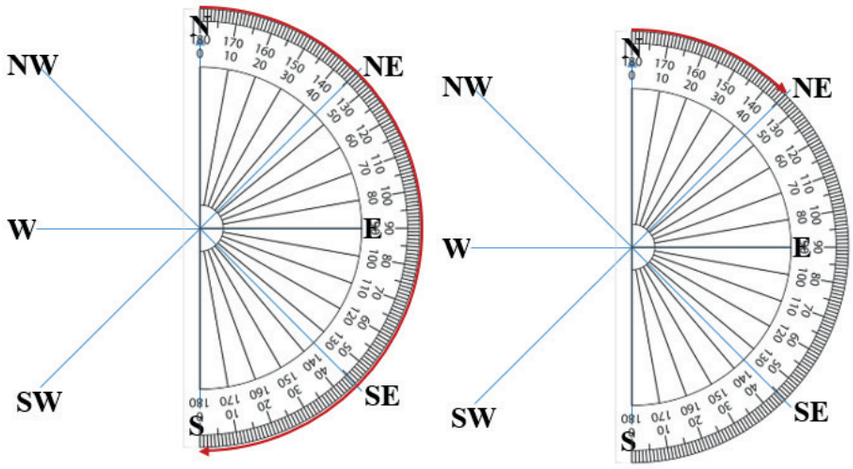
Three figures are used to give bearings.

All bearings are measured in a horizontal plane.

Example

1. Find the bearing of each of the following directions:

(a) S



The bearing of S is 180^0

(b) NE; the bearing of NE is 045^0

Exercise.

1. Find the bearing of each of the following:

(a) N (b) NW

2. Find the bearing of each of the following directions:

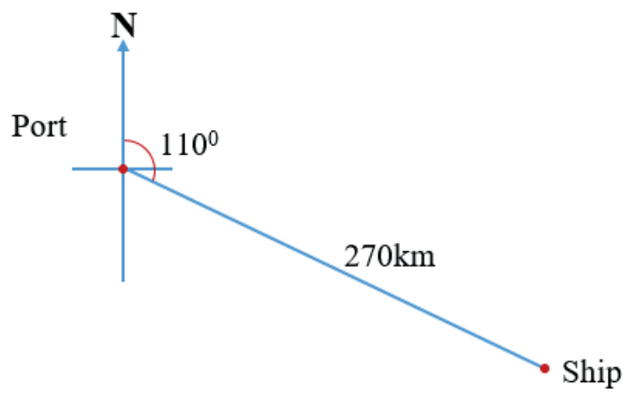
(a) $N60^0E$ (b) $N35^0E$ (c) $N90^0W$ (d) $S40^0E$

LESSON 4. Choosing and using appropriate scale to draw an accurate drawing.

Example.

Draw a scale diagram to show the position of a ship which is 270 km away from a port on a bearing of 110^0.

Sketch drawing. (should show the real bearings and distances).



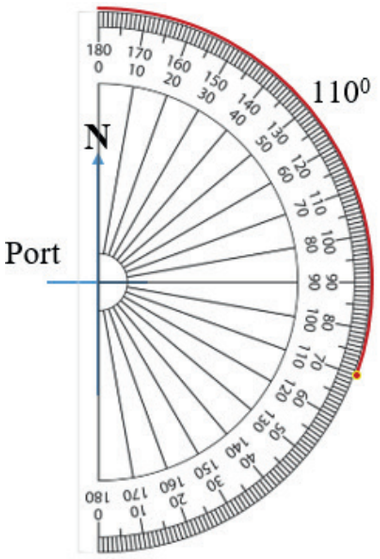
Using a **scale** of 1cm on map (paper) to represent 25km on actual ground

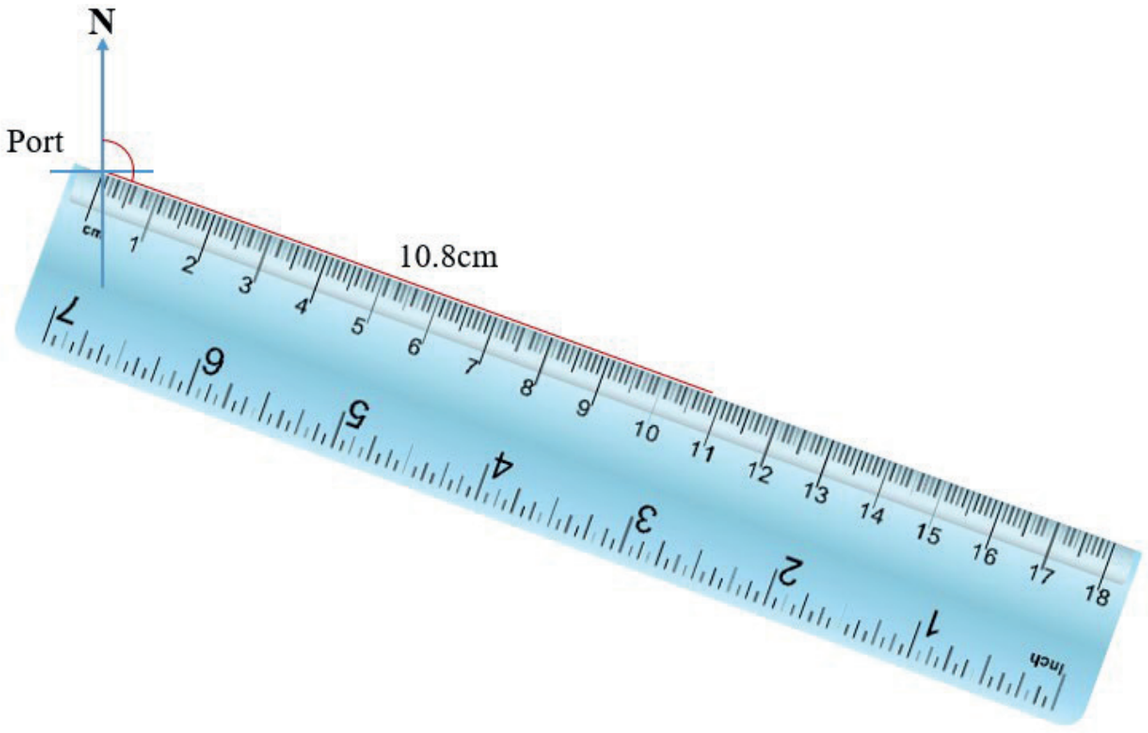
Therefore, $25km \equiv 1cm,$

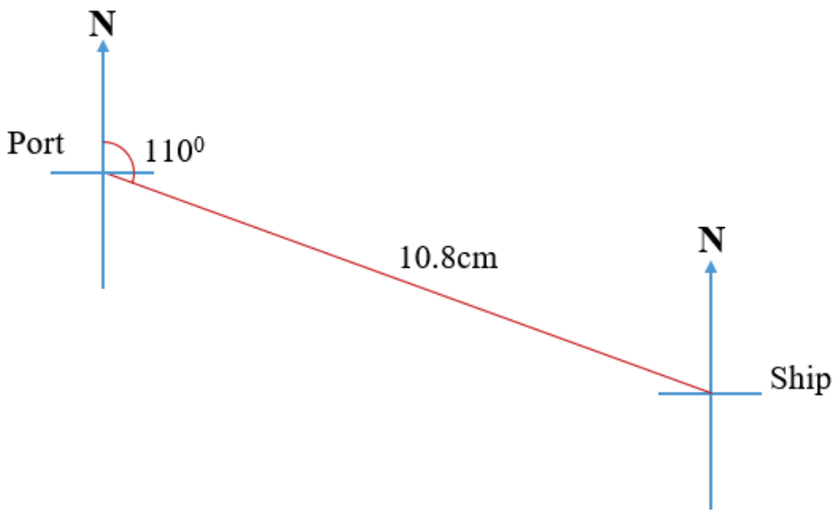
$$1km \equiv \frac{1}{25} cm$$

$$270km \equiv \frac{1}{25} \times 270cm = 10.8cm$$

Scale drawing



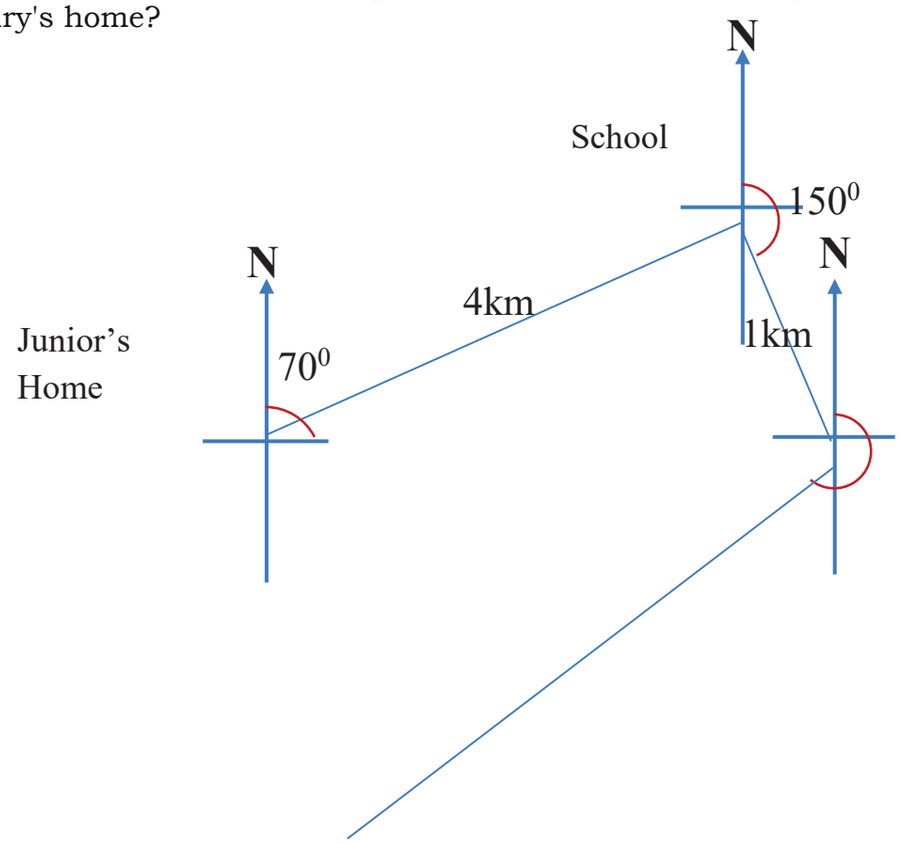




Exercise.
Draw a scale diagram to show the position of a town A which is 320 km away from town B on a bearing of 210^0.

LESSON 4 Draw suitable sketches from the given information.

Example.
Junior's school is 4km away from his home, on a bearing of 070°. The market is 1km away from the school on a bearing of 250°. The hospital is 6km away from the market, on a bearing of 310°. What is the bearing of the hospital from Henry's home?



Activity 7.4. With reference to the sketch above,

(a) Choose and use appropriate scale to draw an accurate drawing.
(b) Differentiate between a sketch and a scale drawing.

LESSON 5 Apply bearings in real life situations.

Scenario

Ajok is in Kampala City and has been told to use a car to move to Lira town. She has never gone to Lira. She has been given the map of Uganda showing routes through which she can access Lira town.

Support

mathematical instruments, pencil, paper, pens, tracing paper and map of Uganda

Resources

Knowledge of construction of figures like triangles, lengths of sides of triangles, operations on numbers.

Task

Ajok wants to use the short distance from Kampala to Lira.
Explain how Ajok can determine the shortest distance. Using the map given to her is it possible for Ajok to use the shortest distance she has determined. Explain your answer.

TERM 3

TOPIC 10. REFLECTION

Learning Outcomes .
By the end of this topic, you should be able to:

i) Identify lines of symmetry for different figures.
ii) Reflect shapes and objects.
iii) Apply reflection in the Cartesian plane.

Materials
plain papers
ink/ wet soil
pencil
ruler
scissors /razor blades.

LESSON 1. Identifying line of symmetry of different figures

Introduction

In primary, you identified lines of symmetry in different shapes. A line of symmetry is the fold line of any shape which is symmetrical. There are shapes which have only one line of symmetry while others might have more than one line of symmetry.
Activity 10.1
1. Fold a piece of paper in half
2. Open the paper and put in one drop of ink/wet soil on the fold line.
3. Close the paper over the ink/wet soil and press down hard on the paper.
4. When the ink/soil has dried, open up your paper.

(a) Look at both sides of the fold line.
i. Are they the same size and shape?
ii. What else do you notice about the points on the blot, on either sides of the fold line?

(b) Look at any two corresponding points on the ink/soil blot, one on either sides of the fold. Join the two corresponding points with a straight line.
(i) What can you say about the distance from one point to the fold line and the distance from the corresponding point to the fold line?
(ii)What is the angle between the line and the fold?

You should have noted the following to the above questions:
(a)
i. The blot has the same shape and size on both sides of the fold line.
ii. Every point on the blot there is a corresponding point directly opposite the fold line.
(b)

i. The distance of one point from the folding line is equal to the distance from the corresponding point to the fold line.
ii. The angle between the line and the fold is 90^o and they are perpendicular lines.

Activity 10.2
1.Fold a rectangular piece of paper once and make sure that the opposite corners lie exactly on each other.
2.Cut out any shape through the fold.
3.Open the piece of paper which you have cut out.
Follow the steps a) and b) as in Activity 10.1..
The two shapes have the properties for symmetrical shapes and the fold line is the line of symmetry.

Exercise.
1.Draw a square on a tracing paper. Fold it to find the lines of symmetry. How many lines of symmetry does a square have?

2.Find the number of lines of symmetry of a
(i) rectangle
(ii) triangle.

3.Identify all the lines of symmetry in the letters of the alphabet written as capital letters
Repeat for numbers.

4.Name any solid objects around you which are symmetrical.

LESSON 2. Reflecting shapes and objects

In the last lesson, you identified the lines of symmetry of different shapes and also the properties of corresponding points in the symmetrical shapes. Reflection of figures takes place when there is a mirror. The figure in front of the mirror is called an **object** and the one behind the mirror is the **image.** The object and the image have the same properties as the corresponding points in the symmetrical objects.

Activity 10.3

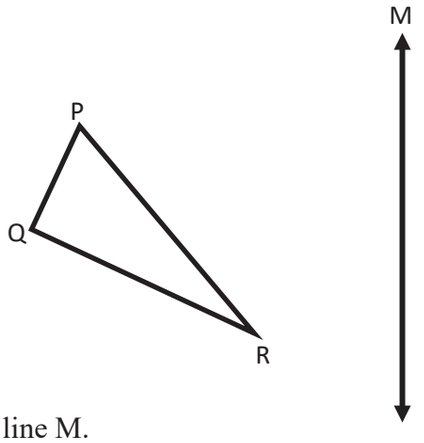
Look at yourself in a mirror/ the water in the bucket.
Touch your nose with your right hand. Which hand in the mirror/water appears to touch the nose?
You are the object and what appears in the mirror is your image. This is reflection in the mirror line.

The following are the properties we always observe in reflection:

The object and the image are oppositely congruent (look exactly the same but in different directions).
The object and image are at equal distances from the mirror line.
The mirror is the line of symmetry.

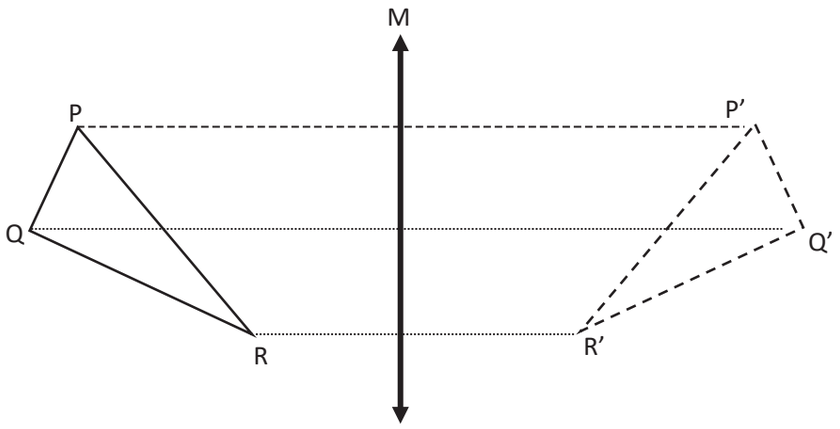
Activity 10.4

Draw on a plain sheet of paper, an object PQR and the mirror line M



Fold the paper along the mirror line M.
Prick through the vertices P, Q and R.
Draw a triangle through the holes.

Label the point P', Q' and R'. We call these image points and always add an apostrophe on them.

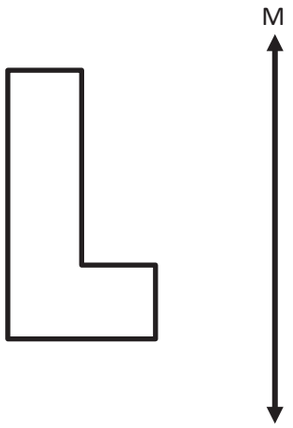


Measure the distances of the object points P, Q and R from the mirror line M.
Measure the distances of the image points P', Q' and R' from the mirror line M.
Compare the distances of each object point and the corresponding image points.
Measure the angles between the connecting lines and the mirror line M.
Write down your observations.

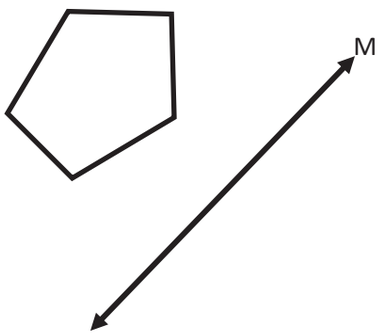
Exercise.

1.Draw the images of each of the objects below, after a reflection in the given mirror line M.

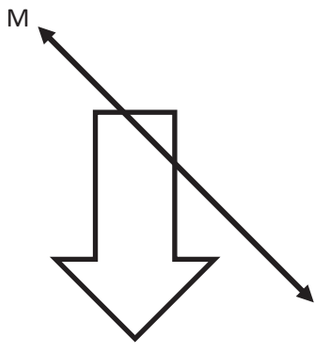
(a)



(b)



(c)



LESSON 3. Applying reflection in the Cartesian plane.

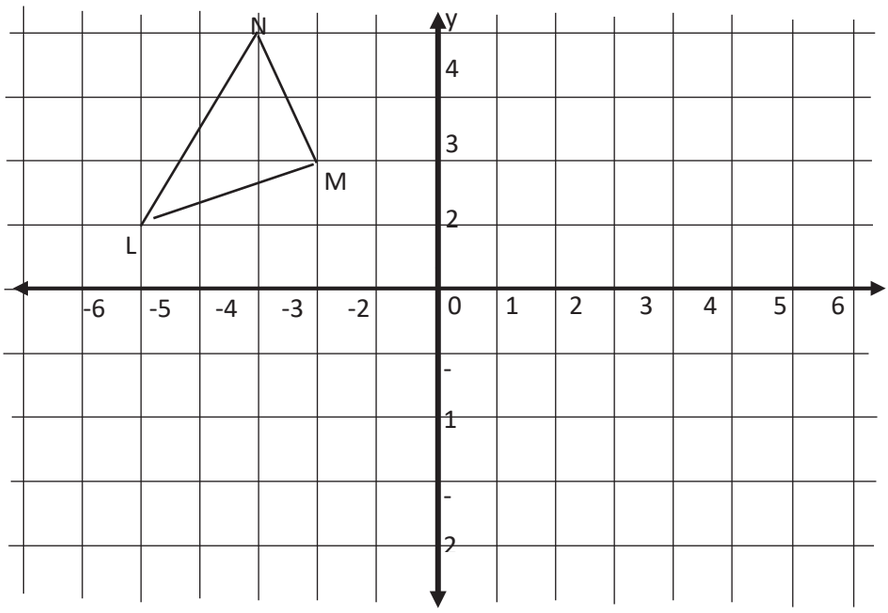
Introduction
In the last lesson, you reflected objects in a mirror line to obtain images. You also stated the properties of reflection. You have also covered the topic RECTANGULAR CARTESIAN COORDINATES IN 2 DIMENSIONS.

You are now going to apply reflection in the Cartesian plane.
We shall consider coordinates of vertices of objects and their corresponding images.
We describe the mirror line using an equation of a line in the x and y axes.

Activity 10.5

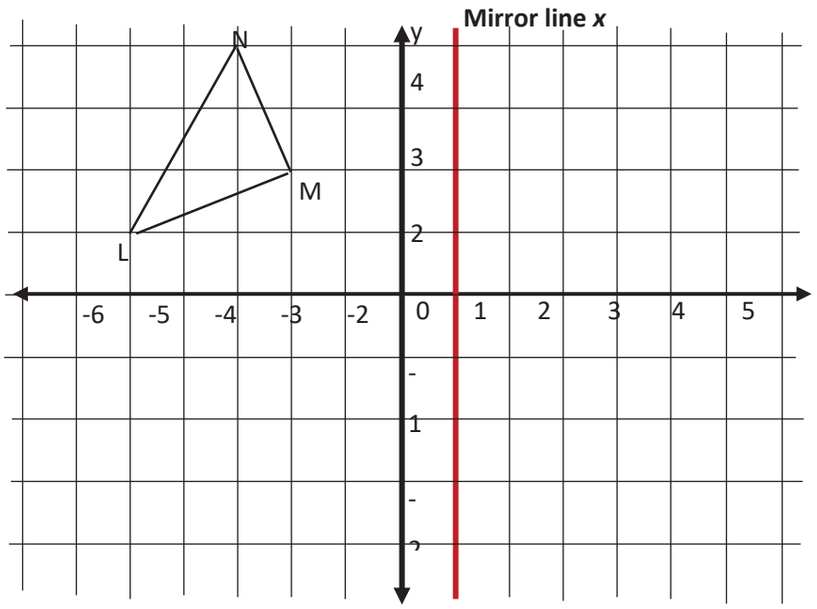
a) Plot the points L (-5, 1), M (-2, 2) and N (-3, 4) on a squared paper.
b) If a mirror is placed on the x axis, where would the images of the three points be?
c) Plot the image points on the squared paper

c) What are the coordinates of the image points L', M' and N'?



Activity 10.6

Draw another pair of axes on a squared paper as shown below.
Plot the same points L, M and N as in instruction one.
Take the line $x = 1$ as the mirror line.
What are the coordinates of the new image points L', M' and N'?



Exercise.

1.Find the image of the point (5, 3) under reflection in the y axis.

2.After a point has been reflected in the x axis, its image is at (6, -4). Find the coordinates of the object point.

3.Draw another pair of axes. Draw the line y = -4. Plot the point D (-4, 3). Using the line y = -4 as the mirror line, find the coordinates of the image point D'.

4.The points A (4, 2), B (1, 3) and C (1, -2) are reflected in the line y =x. Find the coordinates of the image points A', B' and C'.

5.Plot the points P (1, 2), Q (-1, 1) and R (-4, 3) on a Cartesian plane. Join up the points to create the object. After a reflection in a mirror line, the image has the points P' (-2, -1), Q' (-1, 1) and R' (4, -3). Find the equation of the mirror line.

TOPIC 11 EQUATIONS OF LINES

Learning Outcomes
By the end of this topic, you should be able to:
i) Form linear equations with given points.
ii) Draw graph of a line given its equations.

Materials:
Squared Paper
Ruler,
Pencil
Pen
LESSON1 . forming linear equations with given points.

Introduction:
In the last lesson, you reflected object points in a mirror line to obtain image points. You also stated the coordinates of the image points. You have also covered the topic GEOMETRIC CONSTRUCTION SKILLS were you drew perpendicular and parallel lines.
We are now going to form equations of lines from a given set of points.

Lines parallel to the axes.

Activity 11.1

Plot the points (-2, 3), (-1, 3), (0, 3), (1, 3), (2.3), (3, 3) on a squared paper.
What do you observe about these points?
Write any other two points that belong to this set.
What can you say about the y-coordinates of any point in this set?

Observations
All these points are in a straight line.
Every point in this set has its y-coordinate equal to 3.
The equation of the line through these points is therefore y = 3.

Activity 11.2

Plot the points (-2,-2), (-2, -1), (-2, 0), (-2, 1), (-2, 2), (-2, 1) on a squared paper.
What do you observe about these points?
Write any other two points that belong to this set.
What can you say about the x coordinates of any point in this set?
Write the equation of the line through these points.

Activity 11.3

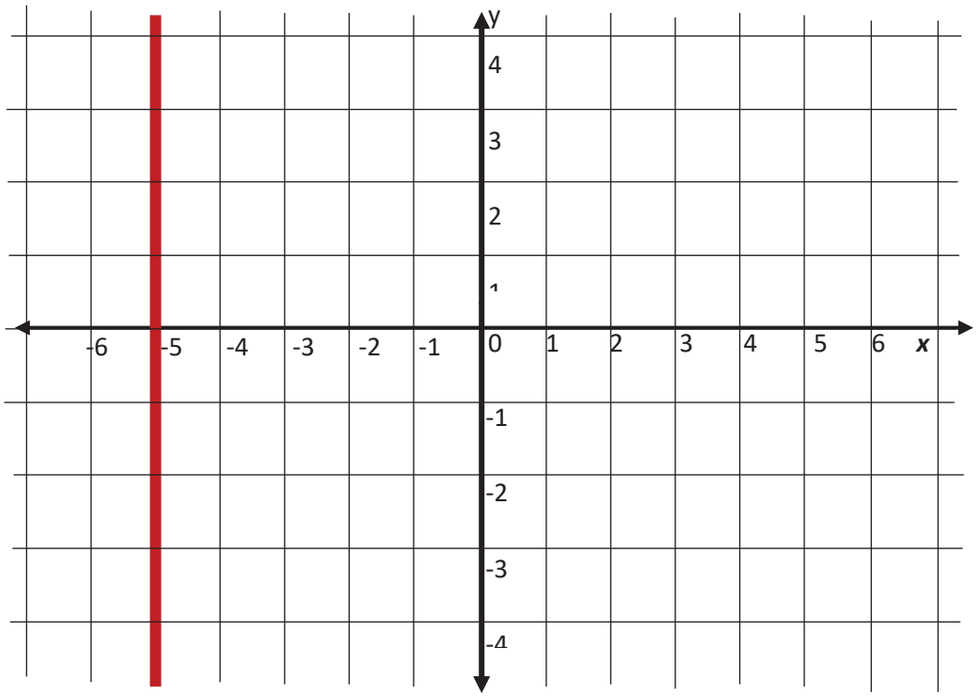
1.Write the coordinates of any four points that lie on the line y = -4.
Plot the four points on a squared paper and join them to form the line y = -4.

2.Draw the line x = 5 on the Cartesian plane.

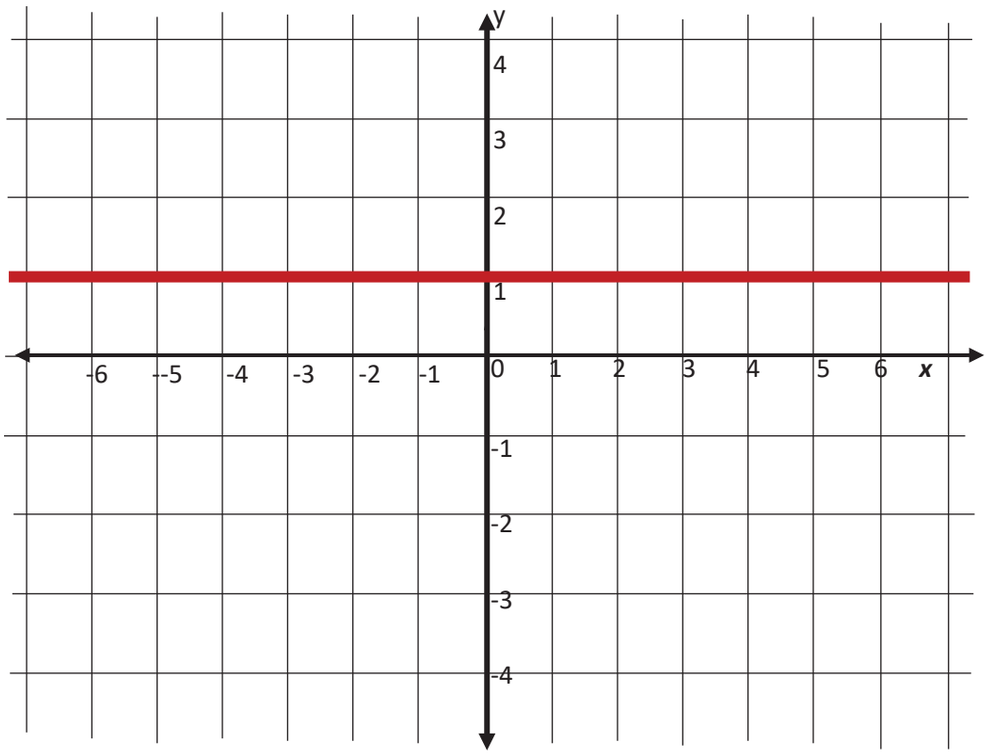
Exercise.

1. Write any five points that lie on the x axis. What is the equation of the x axis?
2. Write any five points that lie on the y axis. What is the equation of the y axis?
3. On the same Cartesian plane, draw the lines x = 4 and y = -3. What can you say about the two lines? Give your comment about the point (4, -3).
4. Write the equations of each of the lines shown on each of the following graphs:

(a)



(b)



Slanting lines

Activity 11.4

Plot the points (-2, -2), (-1, -1), (0, 0), (1, 1), (2, 2) on a squared paper.
What do you observe about these points?
Write any other two points that belong to this set.
What can you say about the x coordinate and the y coordinate of any point in this set?
Draw a straight line through these points. Is the line parallel to any axis?

Observations
All these points are in a straight line.
Every point in this set has its x and y coordinate equal.
The equation of the line through these points is therefore y = x.
The line y = x is not parallel to any axis but a slanting line.

Exercise
1.Plot the points (3, -3), (-1, 1), (0, 0) and (-2, 2) on a squared paper.
What do you observe about these points?
Write any other two points that belong to this set.
What can you say about the x coordinate and the y coordinate of any point in this set?
Draw a straight line through these points. Is the line parallel to any axis?

2. Plot the points (1, 3), (-1, 1), (0, 2) and (-2, 0) on a squared paper.
What do you observe about these points?
Write any other two points that belong to this set.
What can you say about the x coordinate and the y coordinate of any point in this set?
Draw a straight line through these points. Is the line parallel to any axis?

LESSON 2. Drawing the graph of a line given its equation.

Activity 11.5

The point (4, 7) lie on the line whose equation is y = x +4. We can see that when x = 4 then y = 4 + 3 =7. Therefore, we have the point (4, 7).
Write any other four points that lie on the line y = x + 4.
Plot all the five points on a pair of axes.
Draw a line through these points. The equation of this line is y = x + 4.

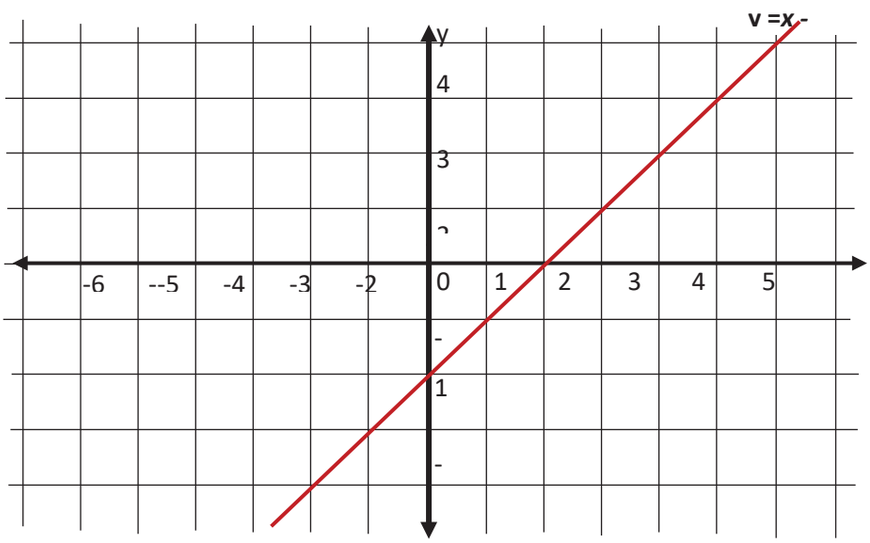
Now, form the equation of the line through these points (5, 2), (7, 4), (-6, -9).

Activity 11.6 drawing the line y = x – 2 on the Cartesian plane.

We work out the coordinates of any four points that lie on this line and put them in a table.
When x = 5 then y = 5 – 2 = 3; When x = 2 then y = 2 – 2 = 0; When x = 0 then y = 0 – 2 = -2;
When x = -2 then y = -2 – 2 = -4. In the table:

x	5	2	0	-2
y	3	0	-2	-4

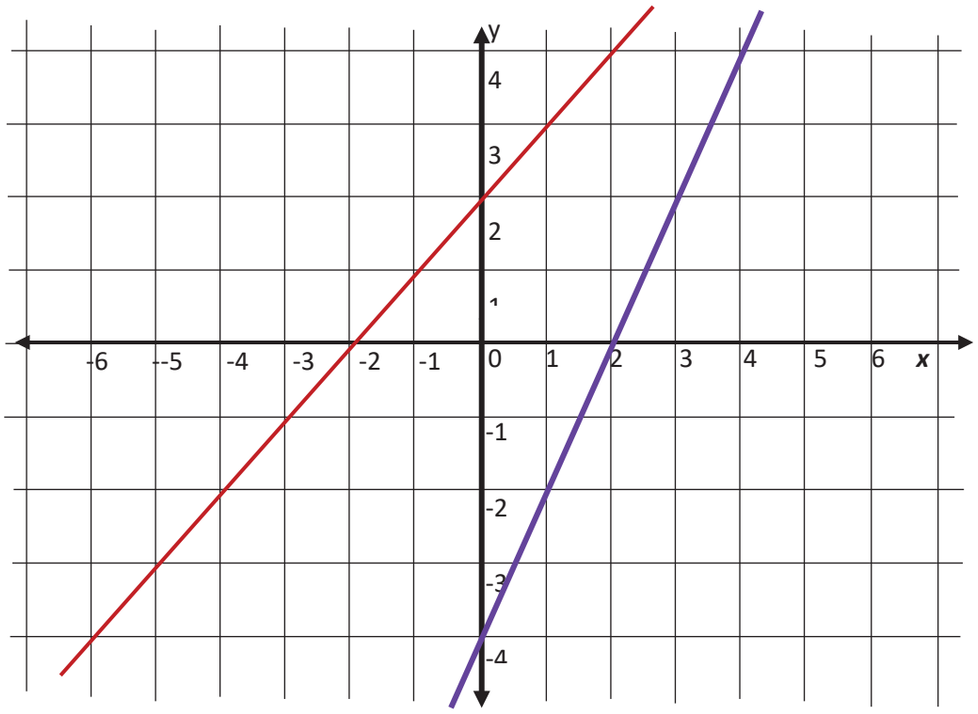
The points we are going to plot are (5, 3), (2, 0), (0, -2), (-3, -5).



Exercise.

1. Draw the lines whose equations are y = 2x and y = 3x – 1.

2.Write the equations of the lines shown on the graph below.



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