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KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

CURRICULUM GRADE 1 - 9
DIRECTORATE

NCS (CAPS)

TEACHER SUPPORT DOCUMENT

GRADE 9

MATHEMATICS

TRACE -THE- CONCEPT PROGRAMME

2022

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KWAZULU-NATAL PROVINCE
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DIRECTORATE:

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Dear Senior Phase teacher

It is with absolute delight that we present this material to assist you in your efforts to lay solid foundations at senior phase level as your contribution towards a well-capacitated body of learners who will be sitting for the Grade 12 NSC examinations in the next few years.

Just as a disclaimer: the material is not a replacement for your Recovery Annual Teaching Plan nor is it meant necessarily to replace your daily lesson plans. It does not even cover all the prescribed areas in your subject, but only focuses on those concepts and skills where the majority of learners show a poor foundation in the NSC examinations. It is essentially intended as extra support which you may adapt to suit your various purposes and endeavours in your classroom.

As a starting point in developing this material, we asked key questions i.e.: 'what are the critical skills and concepts that our learners struggle with in later grades' and 'how can we support teachers to be able to help entrench those skills and concepts early on among their learners so that by the time they reach Grade 12 they are better-equipped to perform optimally?'. We then embarked on a process of identifying all the knowledge, skills and concepts where learners struggle according to successive NSC examinations diagnostic reports. After that we assembled our subject advisors (both FET and GET) and some of our top teachers in the Senior Phase to develop materials that will make teaching these problematic areas easier for teachers.

Another key focus area of this material is its thrust that teachers teach and assess at all cognitive and difficulty levels. We want to bring an end to unbalanced lessons and assessments. To that end, you will be expected to attend a content and methodology workshop to capacitate you on teaching and assessment that caters for all cognitive demands and difficulty levels. We shall also ensure that Departmental Heads are sufficiently equipped to support your efforts and to assist with effective use and manipulation of this material to achieve this end across all our classrooms.

We are convinced that after our learners have been taught all these concepts and skills as proposed in this document, and after you have given them enough practice in these problematic areas taking into account all cognitive demands, our Matric pass percentage as a province will improve significantly in the next few years when our current Grades 7, 8 and 9 finally reach Grade 12.

We sincerely hope you will find this material to be very useful and that it will afford your learners an opportunity to thrive in areas historically found to be challenging by those who came before them. We believe a better-equipped teacher is more inclined to deliver quality outcomes.

Wishing you all the best.

Dr Bheka A. Makhathini

(A) Chief Director: Curriculum Management

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TOPIC : WHOLE NUMBERS (PROPERTIES OF WHOLE NUMBERS)					
LESSON 1:					
Term	1	**Week**		**Grade**	9
Duration	1 hour	**Date**			
Concepts and Skills	Describe the real number system by recognising, defining and distinguishing properties of: Natural numbers; whole numbers; integers; rational numbers; irrational numbers				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Natural numbers; whole numbers and their properties; integers; rational numbers; irrational numbers

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Whole numbers, natural numbers and integers done in grade 8; Number line

RESOURCES

Textbooks, DBE Workbook, DBE books, any grade 9 relevant textbook, Calculator

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Differentiating between whole numbers and natural numbers; Differentiating rational and irrational numbers

METHODOLOGY

INTRODUCTION

Give the following activity to learners to check their prior knowledge

GUIDED PRACTICE 1

1. Define and list the examples of the following terms
   (a) Natural number (b) Whole numbers (c) Integers

2. Match column the following columns

COLUMN A	COLUMN B
$0,1,2,3,4,5,6....\infty$	Integers
$1,2,3,4,5,6....\infty$	Whole numbers
$-6,-5,-4,-3,-2,-1,0,1,2,3,4,5,6....\infty$	Natural number

3. Match each property of to the most correct answer.

COLUMN A	COLUMN B
Associative property of addition	$\frac{30}{0}$ is undefined
Commutative property of addition	$2(a+b)=2a+2b$
Distributive	(3+4)+8=3+(4+8)
Multiplicative identity	2+7+3=7+3+2
additive property	$5\times1=5$
Division property	$12+0=12$

Note: The teacher must explain and illustrate in detail each property with more examples

LESSON PRESENTATION/DEVELOPMENT

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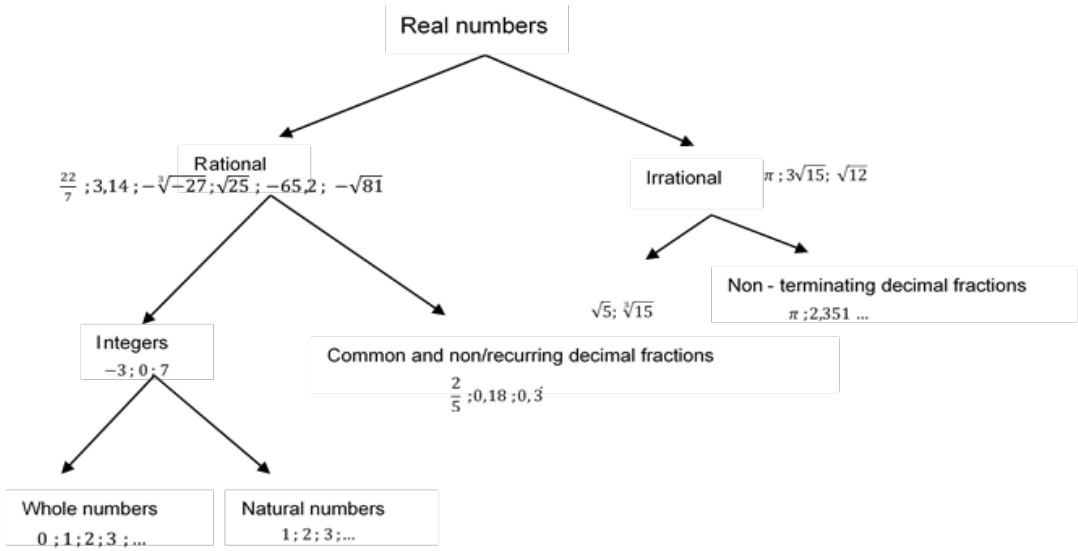
Define the concept of the number system including rational number and irrational number (refer to page 119 in CAPS) giving examples in each case:



- Natural numbers are set of positive numbers (integers) that start from. They do not include decimals or fractions.
- Whole numbers are a set of positive number (integers) of the number line and they include zero.
- Integers are a set of positive as well as the negative numbers (collection of all the numbers in the number line)
- Rational numbers are type of numbers that can be represented or written in fraction form where the denominator is not equal zero. Why $\frac{a}{0}$ is undefined?

  Examples: 3; -7; $\frac{1}{3}$; $\frac{5}{2}$; $\sqrt{4}$; $\sqrt[3]{8}$; 1,5;0, 3333.... etc.
- Irrational numbers are type of numbers that cannot be represented or written in fraction form of a fraction $\sqrt{5}$; 1,531..., π etc

NOTE: Learners should recognize the following distinguishing features of the number system:

- integers extend natural and whole number systems by including operations $a - b,\ where\ a < b$ i.e. integers include negative numbers
- rational numbers extend the set of integers by including the operation $\frac{a}{b}$ where $a < b$
- Since integers are subset of rational numbers, every integer, can be expressed as a rational number $\frac{a}{b}$

NB! Pi (π) is an irrational number even though we use $\frac{22}{7}$ or 3, 14 as rational number approximations for Pi in calculation done.

GUIDED PRACTICE 2

Match the numbers to the number type below:

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	Number	Example
1	1;2;3;4…	Irrational number(⟦ ')
2	√3;π	Natural Numbers(•)
3	0;1;2;3;4….	Rational numbers(~)
4	½;0.25	Integers (ℤ)
5	-4;-3;-2;-1;0;1;2;3	Whole numbers (• o)

ACTIVITIES/ASSESSMENTS

CLASSWORK

1. Complete the table below by ticking the correct column. The first one has been done for you. All the numbers are real.

	Real	Natural number	Whole number	Integers	Rational number	Irrational number
(a)	**9**	✓	✓	✓	✓	
(b)	**1.25**					
(c)	$\sqrt{7}$					
(d)	$0,\dot{3}$					
(e)	$7\frac{3}{4}$					
(f)	$\frac{22}{7}$					

2. Between which two consecutive integers $\sqrt{5}$ lie.

3. **Choose the correct answer.**
   Which of the following numbers is irrational?

A. $0,\dot{8}$	B. **0,5**	**C.** $-\sqrt{3}$	**D.** $\sqrt{2\frac{1}{4}}$

CONSOLIDATION/CONCLUSION & HOMEWORK

a) Emphasise the following:

- Rational numbers: Numbers that can be written in the form $\frac{a}{b}$ where a and b are integers and a ≠ b
- Irrational numbers: Numbers are numbers that cannot be expressed as a rational number in the form $\frac{a}{b}$

b) The primary purpose of Homework is to give each learner an opportunity to demonstrate mastery of mathematics skills taught in class. Therefore, Homework should be purposeful and the principle of 'Less is more' is recommended, i.e. give learners few high quality activities that address variety of skills than many activities that do not enhance learners' conceptual understanding.

c) Carefully select appropriate activities from the Sasol-Inzalo books, workbooks and/or textbooks for learners' homework. The selected activities should address different cognitive levels.

HOMEWORK

1. In each of the following cases, say whether the answer is a natural number or not:

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a. $100+400$	b. $100-400$
c. 100×400	d $100\div400$

2. Is there an identity element for multiplication in the whole numbers? Explain your answer.

3. Study the following numbers and answer the questions that follow:

$$\mathbf{7}\ ;\ -\frac{5}{2}\ ;\ \sqrt[3]{-27}\ ;\ \sqrt{-20}\ ;\ -3\ ;\ \sqrt{12}\ ;\ \pi\ ;\ (-2)^2\ ;\ \frac{17}{0}\ ;\ 3\%$$

3.1. List the natural numbers.

3.2. List all the rational numbers that are not natural numbers

3.3. Classify $\frac{17}{0}$

4.

Sasol Inzalo Books	DBE workbook	Textbook
	Page 4 No. 2 and 3	

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TOPIC: WHOLE NUMBERS (CALCULATION TECHNIQUES)					
LESSON 2:					
Term	1	**Week**		**Grade**	9
Duration	1 hour	**Date**			
Concepts and Skills	Estimation Adding, subtracting and multiplying in columns Long division Rounding off and compensating Using a calculator				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Estimation: An attempt to arrive at an answer roughly without accurate calculations.
Approximate: Means to try to find out more or less how much it is, without measuring or calculating it precisely.
Error: Difference between an estimate and the actual answer
Place value tables

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Calculation techniques done in Grade 8 (addition, subtraction, multiplication and division)

RESOURCES

Textbooks, DBE Workbook, Sasol-Inzalo books, any grade 9 relevant textbook, Calculator

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Differentiating between estimation and approximation; rounding up and rounding down (taking note of the deciding number 5)

METHODOLOGY

INTRODUCTION: Revise work done in grade 8.
Work with learners on the practice below as revision on the work done in grade 8

Guided practice

1. A shop owner wants to buy chickens from a farmer. The farmer wants R38 for each chicken. Answer the following questions without doing written calculations:

(a) If the shop owner has R10 000 to buy chickens, do you think he can buy more than 500 chickens?
(b) Can he buy more than 200 chickens? *Yes he can buy 263 chickens*
(c) Can he buy more than 264 chickens? *No because 263.157895 must be rounded down to 263*

2. In each case, estimate the total cost by rounding off to calculate the approximate cost, without using a calculator. In each case make two estimates. First make a rough estimate by rounding the numbers off to the nearest 100 before calculating. Then make a better estimate by rounding the numbers off to the nearest 10 before calculating.

(a) 83 goats are sold for R243 each.
Rounding off to the nearest hundred $100 \times 200 = 20000$ *goats*
Rounding off to the nearest ten: $80 \times 240 = 19200$ *goats*

(b) 121 chairs are sold for R258 each.
Rounding off to the nearest hundred $100 \times 300 = 30000$ *goats*
Rounding off to the nearest ten: $120 \times 260 = 31200$ *goats*

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LESSON PRESENTATION/DEVELOPMENT

Rounding off and compensating

- Rounding off to or approximating is adjusting one or more numbers to the nearest whole number or multiple (of 5, 10,100,1000 etc) to make them simpler and east to count. If the number is greater than 5 in the number will go up by one
- To compensate is when subtract the the values you added when rounding off to get the estimated answer to make the answer correct. That difference you add is called between correct answer and the estimated answer is called an **error**

$37 + 19$

↓ +1 (rounding of 19 to 20)

$37 + 20 = 57$

↓ -1 (compensating the rounding off value/ error)

56

Example of rounding off

13 can be rounded off to 10 since 13 is closer to 13 rather than 10 (this is rounding off to the nearest ten)

142 can be rounded off to 140 since it is closer 40 than 50 (this is rounding off to the nearest 10)85 can be rounded off to 100 since it is closer to 100 than 50 (this rounding off to the nearest 100)

GUIDED PRACTICE

1. Complete the following by rounding to the nearest 10 and 100

	Ten	**Hundred**	**Thousand**
A. 2334			
B. 9888			
C. 1116			

2. Estimate each of the following by rounding off the numbers to the nearest 100
   (a) 812 – 342
   (b) 2 342 – 1 876
3. Find the exact answer for each of the calculations in question 1, by working out the errors caused by rounding and compensating for them.

Adding in columns (Pg. 9 DBE book)

Do examples below with learners

(a) Write 8 000 + 1 100 + 130 + 14 as a single number	(b) Write 3 000 + 700 + 50 + 8 as a single number	(c) Write 5 486 in expanded notation, as shown in (b)

Subtracting in columns (Pg. 12 DBE book)

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8 432 − 3 957 can be calculated as shown below.

	8 432
	- 3 957
Step 1	5
Step 2	70
Step 3	400
Step 4	4 000
Step 5	4 475

In step 1, the 7 of 3 957 is subtracted from 12.
To do the subtraction in each column, you need to think of
8 432 as 8 000 + 400 + 30 + 2, in fact you have to think of it as 7 000 + 1 300 + 120 + 12.

Multiplying in columns (Pg. 11 Sasol Inzalo book)

(a) Write 3 489 in expanded notation:
(b) Write an expression without brackets that is equivalent to: 7 × (3 000 + 400 + 80 + 9):

	3 489		Short method using a calcalotor
	x 7		
Step 1	63 = 9 x 7		
Step 2	560 = 80 x 7	OR	3 489
Step 3	2 800 = 400 x 7		x 7
Step 4	21 000 = 3000 x 7		24 423
	24 423		

Note for the teacher
Learners must multiply each ten, unit, hundred and thousand by 7
Step 1 9 x 7 **, 9 is a unit**

Long Division (Pg. 14 DBE Book)
Study this method for calculating 13 254 ÷ 56:

$$\begin{array}{r} 236 \\ 56\overline{)13\,254} \\ \underline{-11\,200} \\ 2\,054 \\ \underline{-1\,680} \\ 374 \\ \underline{-336} \\ 38 \end{array}$$

$step\,1: 132 \div 26 = 2\; and\; 2 \times 56 = 112$

CLASSWORK

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1**. Round off the following numbers** 1.1. 213 to the nearest ten 1.2. 9 656 to the nearest hundred	2. **Round off the following** 2.1. Round of 2.8541732 to two decimal places 2.2. 199.96865 to two decimals places 2.3. 465 685.75613 to three decimal places
3. calculate the following by estimation and compensation 3.1. 256 + 98 3.2. R3.99 + R4.99 + R5.99 3.3. 4500.99 + R688.30+ R3659.29	4. Use the column method to calculate the following 4.1. $122+198$ 4.2. $6\ 589-485$ 4.3. 155×15
5. Divide the following using long division 5.1. $4\ 920\div12$ 5.2. $286\div10$	

CONSOLIDATION/CONCLUSION & HOMEWORK
Recommended Homework 1. A municipality has budgeted R85 000 for putting up new street name boards. The Street name boards cost R72 each. How many new street name boards can be put up? 2. Use column method to multiply 7894×34 3. John bought 58 goats, all at the same price. He paid R65 500 in total. What was the price for each goat? Round off your answer to two decimals

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TOPIC: Whole Numbers(multiples and factors)					
LESSON 3:					
Term	1	**Week**		**Grade**	9
Duration	1 hour	**Date**			
Concepts Skills	Using prime factorisation of numbers to find LCM and HCF				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

- Multiple: A multiple is a number obtained by multiplying two other numbers
- Factor: A factor of a number, can be divided into that number without leaving a remainder
- Prime number: Only has two factors, 1 and itself
- Highest common factor: The highest factor that is common for two or more numbers
- Lowest common multiple: A lowest multiple that is common for two or more numbers
- Composite numbers: Have more than 2 factors
- The 12 x 12 multiplication table
- Prime factorization

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

The concept of multiples and factors from grade 8; Classify numbers as even, odd or prime.

RESOURCES

Textbooks, DBE Workbooks and Sasol-Inzalo Books, GEPD lesson plans, WCED lesson plans

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Differentiating between HCF and LCM
Unable to list multiples in reverse order
How multiplication and division relates to factors and multiples of number

METHODOLOGY

Steps needed for learners to understand the concept. Multiples are associated with multiplying vs factor(division)

INTRODUCTION

1. Look at the table

(a) Complete the following

$3\times1=$	$3\times2=$	$3\times3=$	$3\times4=$	$3\times5=$

(b) Give a mathematical term for the answer on the right
(c) Give a mathematical term for the numbers being multiplied
(d) What is the relationship c do you notice for the answer and the constant number being multiplied

Solutions:

1.(a). 3, 6, 9,12, 15
(b) Product/ Multiple
(c) Factor
(d) Multiples of 3

MENTAL MATHS

1. Revise concept of multiples by asking learners to list multiples of 2 less than 20 and 3 less than 45
2. Revise the concepts of factors by asking learners to list factors of 20 and 45.
3. Revise the concept of prime numbers by asking learners to list recall the properties of prime numbers and to list all the prime numbers less than 45.

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Solutions:

1. M_2 = 2, 4, 6, 8, 10, 12, 14, 16, 18 M_3 = 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42

2. F_{20} = 1, 2, 4, 5, 10, 20 F_{45} = 1, 3, 5, 9, 15, 45

3. **Properties of prime numbers**:
- A prime number only has two factors i.e, 1 and itself.
- A prime number can only be expressed as the product of 1 and the number itself
- Prime numbers less than **45:** 2, 3, 5,7, 9, 11, 13, 17, 19, 21, 23, 25, 27, 29, 31, 35, 37, 39, 41, 43

LESSON DEVELOPMENT

The teacher will explain the following concepts linking them to prime factorisation

A multiple is a number made up by multiplying two other numbers together.

For example, $\mathbf{5 \times 7 = 35}$ therefore 35 is a multiple of 5 and of 7.

The numbers 6; 12; 18; 24; ... are **multiples of 6.**

The numbers 7; 14; 21; 28; ... are **multiples of 7.**

A factor of a number can be divided into that number without leaving a remainder.

For example: 3 is a factor of 48 because $\mathbf{48 \div 3 = 16}$ (no remainder).

Prime number: Only has two factors, 1 and itself

For example: List the factors of 60 and identify the prime factors

$\mathbf{F_{60}}$ = 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

Prime factors = 2, 3, 5 (Emphasize that: 2, 3 and 5 are **prime numbers** as well **factors** of 60, this makes them **prime factors**)

4. Define the concept of LCM and HCF.

The LCM is the lowest multiple that is common to two or more numbers.

The HCF is the highest factor that is common to two or more numbers.

F_{20} = 1, 2, 4, 5, 10, 20 **Prime factors: 2, 5**

F_{45} = 1, 3, 5, 9, 15, 45 **Prime factors: 3, 5**

5. Demonstrate to learners how to determine the LCM and HCF of two numbers using prime factors.

Example 1: Find the LCM and HCF of 260 and 40.

Solutions: Prime factorization

Note: Learners are supposed to use the ladder method to find the prime factors

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Ladder method

Calculating LCM

260	2
130	2
65	5
13	13
1	

Calculating HCF

40	2
20	2
10	2
5	5
1	

$260 = 2 \times 2 \times 5 \times 13 = 2^2 \times 5 \times 13$

$40 = 2 \times 2 \times 2 \times 5 = 2^3 \times 5$

$\therefore$ LCM $= 2^3 \times 5 \times 13$

$= 520$

$260 = 2 \times 2 \times 5 \times 13 = 2^2 \times 5 \times 13$

$40 = 2 \times 2 \times 2 \times 5 = 2^3 \times 5$

HCF $= 2^2 \times 5$

HCF $= 20$

Example 2: Find the LCM and HCF of 1820 and 3 510.

Solution: Prime factorisation

$1\,820 = 2 \times 2 \times 5 \times 7 \times 13$ and

$3\,510 = 2 \times 3 \times 3 \times 3 \times 5 \times 13$

$\therefore$ LCM $= 2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 7 \times 13 = 49140$

HCF $= 2 \times 5 \times 13 = 130$

ACTIVITIES/ASSESSMENTS

In each case find the LCM and HCF of the numbers:

1. 24 and 32
2. 360 and 1 360

3.Calculate the LCM using prime factorization for the following numbers:

a. 243 and 729

b. 200 and 1 000

4. Determine the LCM and HCF for the following numbers:

a. 24, 28 and 42

b. 75, 120 and 200

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TOPIC : WHOLE NUMBERS (SOLVING PROBLEMS)					
LESSON : 4					
TERM	1	**WEEK**		**GRADE**	1
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Solving problems in contexts involving rates and ratios				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Ratio: A comparison of two or more quantities of the same type.

Rate: A comparison of two different types of measurement.

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

Skill of addition, multiplication and division

RESOURCES: Grade 9 Classroom Mathematics by Laridon et al. , DBE Workbook and Sasol-Inzalo Books, calculators.

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Differentiating between Rate and Ratio.

Learners may not conceptualise rate as a comparison of quantity.

METHODOLOGY

RATIO			
The following examples would be discussed with learners			
Example 1	There are 4 green, 10 blue and 8 red balloons in a packet. Express this as a ratio in its simplest form.		
Solution:	The ratio of green balloons to blue balloons to red balloons is 4:10:8. To find the simplest		
	form**, divide all the three quantities by their HCF** which is 2. In its simplest form, the ratio of green balloons to blue balloons to red balloons is 2:5:4.		
Example 2	Divide $240\,g$ in the ratio $5:3:4$		
Solution:	$\frac{5}{12}\times 240=100$	$\frac{3}{12}\times 240=60$	$\frac{4}{12}\times 240=80$
	$\therefore 240g\ in\ the\ ratio\ of\ 5:3:4\ is\ 100:60:80$		
Example 3:	The ratio of Boys to Girls at a certain school is 4:5.		
	Calculate the number of boys if there are 1080 learners in the school.		
Solution:	$\therefore Number\ of\ boys\ will\ be\ \frac{4}{9}\times 1080=480$		
Example 4:	Increase 50 in the ratio of 3:5		
	$50\times\frac{5}{3}=83,3$		
Example 5:	Decrease 28g in the ratio of 4:3		
Solution:	$28\times\frac{3}{4}=21\ g$		

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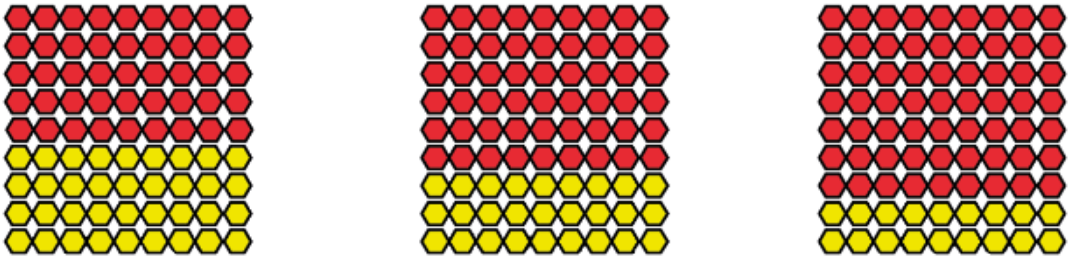
Example 6:	 *Pattern A* *Pattern B* *Pattern C*
	In pattern A above, there are five red beads for every four yellow beads.
	How else could we define the ratio above?
Solution:	In **pattern A**, the **ratio** of yellow beads to red beads is 4 to 5. This is written as $4:5$.
	In **pattern B**, the ratio between yellow beads and red beads is $3:6$, and in pattern C the ratio
	is $2:7$.
RATE	
Example 1.	Water drips from a tap at a rate of $15\,ml$ of water per minute.
	How many litres of water drips from the tap in a day?
Solution:	60 minutes in 1 hour $\times$ 24 hours in a day = 1440 minutes in a day.
	$\therefore$ Water wasted in a day = $50\,ml$ $\times$ $1\,440$ minutes = $72\,000\,ml$
	Converted to $l = \dfrac{72\,000}{1000} = 72\ l$
SPEED, TIME AND DISTANCE	
	Formulae that we use to calculate distance, speed and time: $speed = \dfrac{dis\tan ce}{time}$; $dis\tan ce = speed \times time$; $time = \dfrac{dis\tan ce}{speed}$
Example 2.	A motorist covers a distance of 360 km in exactly 4 hours. Calculate the average speed of the car.
Solution:	$speed = \dfrac{dis\tan ce}{time}$ $\therefore average\ speed = \dfrac{360}{4} = 90\,km/h$
Example 3.	A car travelling at a constant speed travels 60 km in 18 minutes. How far, travelling at the same speed, will the car travel in 1 hour 12 minutes.
Solution:	$time\ in\ hours = \dfrac{18\min utes}{60\min utes} = 0,3\ h$ $\therefore Dis\tan ce = \dfrac{60}{0,3} = 1,2 = 240\ km$

Example 4. A motorist covers a distance of 360 km in exactly 4 hours. Calculate the average speed of car.

Solution: $Speed = \dfrac{dis\tan ce}{time}$ $\therefore Speed = \dfrac{360}{4} = 90\,km/h$

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CLASS WORK ACTIVITIES

1. Express each of the following comparisons as ratios in the simplest form:
   a) A tower of height $420\,m$ to a building of high $70\,m$.
   b) The price of a car costing $R240\,000$ to a smaller car that costs only $R160\,000$.
   c) A 40 year old father to his 12 year old son.
   d) The length of the door, $210\,cm$, to its width, $90\,cm$.
2. Write a ratio in its simplest form to compare the salaries of Simon, Julie and John If Simons earn $R4\,000$ per month, Julie earns $R6\,000$ per month and John earns $R3\,500$.
3. Marry and Lerato are in the same netball team. In one season, Lerato scored Six more goals than Mary. Use ratios to compare the goals scored by the two players in each of the following situations:
   a) Lerato scored 42 goals.
   b) Mary scored 18 goals.
4. Company A spends $R150\,000$ on advertising and makes a profit of $R1\,200\,000$, while company B spends $R250\,000$ on advertising and makes a profit of $R2\,000\,000$. Calculate the ratio of money spent on advertising to profit in each case.
5. Sam buys a box of 30 nutty chocolate bars which costs $R138$. He also busy a box of milk chocolate bars which contains 40 bars at a cost of $R190$. Calculate the price per bar of chocolate in each case, and determine which one was more expensive.
6. Peter drives $720\,km$ from Johannesburg to Mtunzini in $7\,hour\ 30\,minutes$. Jill drives $1560\,km$ from Fish Hoek to Pretoria in $15\,h$. Which driver maintained a high average speed?
7. Moeneba collects apples in the orchard. She picks about five apples each minute. Approximately how many apples will Moeneba pick in each of the following periods of time?
   a) eight minutes
   b) 11 minutes
   c) 15 minutes
   d) 20 minutes

CONSOLIDATION/CONCLUSION		
NB!		Make sure learners recognize and are able to convert correctly between units for time and
		distance. Speed is usually given as constant speed or average speed.
		HOMEWORK ACTIVITIES
1.		To make biscuits of a certain kind, five parts of flour are to be mixed with two parts of
		oatmeal, and one part of cocoa powder. How much oatmeal and how much cocoa powder
		must be used If 500 g of flour is used?
2.		A motorist completes a journey in three sections, making two long stops to eat and relax
		between sections. During section A he covers $440\ km$ in four hours. During section B he
		covers $540\,km$ in six hours. During section C he covers $280\ km$ in four hours.
	a)	Calculate his average speed over each of the three sections.

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	b)	Calculate his average speed for the journey as a whole.
	c)	On the next day, the motorist has to travel $874\ km$. How much time (stops excluded) will he need to do this? Justify your answer with calculations.

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TOPIC : Whole numbers (Solving problems)					
LESSON: 5					
TERM	1	**WEEK**		**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Solving problems in contexts involving direct and indirect proportion				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Direct proportion - an increase in one, matches an increase in the other OR as one quantity decreases, the other decreases.
Two quantities (say x and y), are directly proportional if, as the value of x increases the value of y increases in the same proportion, and as the value of x decreases the value of y decreases in the same proportion i.e. x is directly proportional to y if $\frac{x}{y} = c$.

The direct proportional relationship is represented by a straight line.

Indirect (inverse) proportion - an increase in one, matches a decrease in the other OR as one quantity increases, the other decreases.
Two quantities (say x and y), are indirectly proportional if , as the value of x increases the value of y decreases in the same proportion, and as the value of x decreases the value of y increases in the same proportion i.e. x is indirectly or inversely proportional to y if $\frac{c}{x} = y$.

An indirect proportional relationship is represented by a non-linear curve.

Ratio: A comparison of two or more quantities of the same type.

Rate: A comparison of two different types of measurement.

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

The concept of ratio and rate done in grade 8; Skill of addition, multiplication and division of whole numbers; conversion between units.

RESOURCES: Grade 9 Classroom Mathematics by Laridon et al, DBE Workbook and Sasol-Inzalo Books, calculators.

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Distinguish between direct and indirect proportion

METHODOLOGY

DIRECT AND INDIRECT PROPORTION

Example:1

A farmer hires 12 men to construct a building. The job is completed in 18 days. If he had hired 24 men the job would have been completed in half of the time. If he had hired 6 men the job would have taken twice as long to complete.

1. Match each table with the correct graphs and state whether it is direct or inverse proportion.

1.1 Table 1

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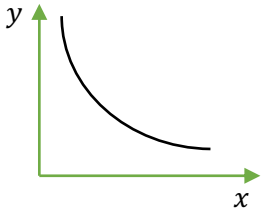
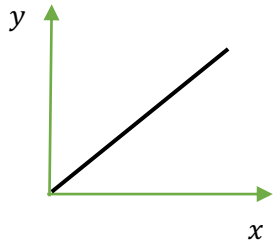
x	0	1	2	3
y	0	50	100	150

1.2 Table 2

x	12	6	4	3
y	1	2	3	4





Solution:

Table 1 match with graph B …direct proportion

Table 2 match with graph A … indirect proportion

CLASS WORK ACTIVITIES

1. Garth and Kate also collect apples in the orchard, but they both work faster than Moeneba. Garth collects at a rate of about 12 apples per minute, and Kate collects at a rate of 15 apples per minute.

Period time in minutes	**1**	**2**	**3**	**8**	**10**	**20**
Moeneba	5			40		
Garth	12					
Kate	15					
The three together	**32**					

a) Copy and complete the table above to show approximately how many apples they will each collect in different periods of time.

b) What is the ratio between the numbers of apples collected by Kate and Garth during a period of time?

c) Would it be correct to also say that the ratio between the numbers of apples collected by Kate and Garth is $5:4$? Explain your answer.

2. Different vehicles travel at different average speeds. A large transport truck with a heavy load travels much slower than a passenger car. A small bakkie is also slower than a passenger car. In the table below, some average speeds and the times needed are given for different vehicles that all have to be driven for the same distance of 720 km.

Time in hours	**12**	**9**	**8**	**6**	**5**
Average speed in km/h	60				

a) Complete the following table above.

b) What happens to the time needed if the average speed increases?

c) What happens to the average speed if the time is reduced?

d) What can you say about the product average speed × time, for the numbers in the table?

*In the situation above, the average speed is said to be **indirectly proportional** to the time needed for the journey.*

CONSOLIDATION/CONCLUSION

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NB! Make sure learners recognize and are able to convert correctly between units for time and distance.
Emphasise the difference between direct and indirect proportion.

HOMEWORK ACTIVITIES	
1.	Use the three methods to solve this problem and draw the graph.
	5 shirts cost $R120$. How much 9 shirts will cost?
2.	3 people take 10 days to build a house, how long will it take 8 people to build the
	same house?

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TOPIC : INTEGERS					
LESSON 1:					
Term	1	**Week**		**Grade**	9
Duration	1 hour	**Date**			
Skills/Concepts	Calculations involving all four operations				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC:

Additive inverse; Positive integers; Negative integers

PRIOR KNOWLEDGE/ BACKGROUND KNOWLEDGE:

Revision of Grade 8 basic calculations involving integers; Dealing with additive inverses; Properties of whole numbers.

ERRORS MISCONCEPTIONS AND PROBLEM AREAS

Disregarding of negative signs when working positive and negative integers.

METHODOLOGY

Introduction:

- **Define additive inverses**
- We may say that for each "positive" number there is a **corresponding** or **opposite** negative number. Two positive and negative numbers that correspond, for example 4 and (-4), are called additive inverses.

Addition

- **Number line.** Addition of integers is presented as a movement of so many units either to the right or to the left. The first number in the expression is your "starting point". If you add a positive integer, you move that many units right. If you add a negative integer, you move that many units left.
- For example, $5 + (-6)$ means you start at 5, and you move 6 units to the left. $-9 + 5$ means you start at -9, and move 5 units to the right.
- This idea is usually relatively simple for learners to grasp.
- Further explain the concept of negative numbers by talking about the concept of "owing" someone money or having a "negative" amount of money. Sinaluthando was owing Othandiwe $R5$ and her mother gave her $R8$ to pay off her debt, how much does she has left.
  - $R5 + R8 = +R3$
  - Extend by adding and subtracting terms with coefficients. For example:
    - $-15y + 7y = -8y$
    - $20ab - 29ab = -9ab$

ACTIVITIES/ASSESSMENTS

Calculate the following:

1. $-7 + 9$
2. $20 - 17 - 15$
3. $-20 + 17 + 15$
4. $(-12) - (-17)$
5. $35 - (-20)$
6. $-15 + (-14) - 9$
7. $-45x^2 + 37x + 14x^2 - 52x$
8. $16a^2 - 21b - 3a^2 + 19b$
9. $xy^2 + xy - 9xy^2 - xy$

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TOPIC : INTEGERS					
LESSON 2:					
Term	1	**Week**	1	**Grade**	9
Duration	1 hour	**Date**			
Skills/Concepts	Calculations involving all four operations (multiplication and division)				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC:

- Multiplication and division of integers with like and unlike signs
- Using BODMAS when multiplying and dividing integers.

PRIOR KNOWLEDGE/ BACKGROUND KNOWLEDGE:

- **The following operations must be remembered when multiplying and dividing integers:**

$+ \times + = +$ $- \times - = +$ $+ \times - = -$ $- \times + = -$	$+ \div + = +$ $- \div - = +$ $+ \div - = -$ $- \div + = -$
When multiplying and dividing: If the signs are the **same**, the answer is **positive**. If the signs are **different**, the answer is **negative**.	

ERRORS, MISCONCEPTIONS AND PROBLEM AREAS

- Learners tend to believe that when two negative numbers are multiplied or divided, the final answer should be negative.
- In cases where there are different signs, learners tend to disregard the negative signs.

METHODOLOGY

Introduction:

The rules that govern how to multiply and divide integers are very similar.
If the signs are the **same**, the answer is **positive**.
If the signs are **different**, the answer is **negative**.

Examples:

Calculate:

1. $(-12) \times 102 = -1224$	5. $15 \times (66 \div 2) = 495$
2. $(-4) \times (-16) = 64$	6. $(-35) \div 5 = -7$
3. $(-234) \times (-32) = 7488$	7. $(5 + 25) \div 3 = 10$
4. $10 \times [50 + (-30)] = -200$	

ACTIVITIES/ASSESSMENTS

Calculate the following:

1. $-4 \times 8 =$	5. $14 \times (23 + 58) =$
2. $(-5) \times -12 =$	6. $200 \div 8 =$
3. $(-120) \times (-11) =$	7. $(200 + 25) \div 5 =$
4. $10 \times (-50) \times 2 =$	

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TOPIC : INTEGERS					
LESSON 3:					
Term	1	**Week**	1	**Grade**	9
Duration	1 hour	**Date**			
Skills/Concepts	Perform calculations involving all four operations with numbers that involve the squares, cubes, square roots and cube roots of integers				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC:

Square and cube roots; Exponents

PRIOR KNOWLEDGE/ BACKGROUND KNOWLEDGE:

- Perform calculations involving all four operations with integers
- Square, cubes, square roots and cube roots of integers done in Grade 8

ERRORS, MISCONCEPTIONS AND PROBLEM AREAS

Emphasize that:

- The symbol $\sqrt{\ }$ means you must take a positive square root.
- If $n \times n = n^2$, then $\sqrt{n^2} = n$
- If $n \times n \times n = n^3$, then $\sqrt[3]{n^3} = n$
- $-2^2 = -4$ and $(-2)^2 = 4$, therefore $-2^2 \neq (-2)^2$

METHODOLOGY

Introduction:

Revise the work done in Grade 8 by asking learners to define and give an example of each of the following:

- Squares
- Square root
- Cubes
- Cube root

Explain the following with examples:

Square of a number:

The square of a number is a product of the number and itself.

Example : The square of 5 is 25, since $5^2 = 5 \times 5 = 25$. The square of -5 is also 25, since $(-5)^2 = -5 \times -5 = 25$. Note: $-5^2 = -25$ not 25

Square root of a number:

The square root of a number (m) is a number (n) by which, when multiplied by itself gives a square number (m): $n \times n = n^2 = m$.

The square root of any number (m) is is represented this way $\sqrt{m}$

Therefore $\sqrt{m} = \sqrt{n \times n} = n$

Example: $\sqrt{16} = \sqrt{4 \times 4} = 4$

Cube of a number:

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A cube root of a number is a number that can be multiplied by itself three times. The symbol for a cube root of any number (x) is $\sqrt[3]{x}$ Example: $\sqrt[3]{8} = \sqrt[3]{2 \times 2 \times 2} = 2$ $2^3 = 2 \times 2 \times 2 = 8$
ACTIVITIES/ASSESSMENTS
Calculate the following expressions: 1. $\sqrt{9} - \sqrt{4}$ 2. $\sqrt{64} - \sqrt{9}$ 3. $\sqrt[3]{27} + (-\sqrt[3]{64})$ 4. $8^2 - 10^2 + 6^2$ 5. $6^3 - 5^3 - 2^3 - 1^3$

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TOPIC : INTEGERS					
LESSON 4:					
Term	1	**Week**	1	**Grade**	9
Duration	1 hour	**Date**			
Skills/Concepts	• the commutative, associative, distributive properties of addition and multiplication for integers • additive and multiplicative inverses operations for integers				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC:

Like terms; coefficient; exponents.

PRIOR KNOWLEDGE/ BACKGROUND KNOWLEDGE:

Perform basic calculations with integers; order of operations; properties of integers done in grade 8.

ERRORS, MISCONCEPTIONS AND PROBLEM AREAS

Incorrect application of distributive property, e.g. $a(b+c) = ab + ac$ not $a(b+c) = ab + c$

METHODOLOGY

Introduction:

Commutative Property

The ***commutative property*** of whole numbers, represented by $a+b=b+a$ and $a \times b = b \times a$ is applicable for addition and multiplication.

The commutative property tells us that order does not matter when we add or multiply integers. To commute means to "*switch around*".

Examples:

1.1 $(-10) + 5 = 5 + (-10) = -5$
1.2 $7 + 3 = 3 + 7 = 10$
1.3 $p \times r \times n = n \times r \times p = prn$
1.4 $2x \times 3y = 3y \times 2x = 6xy$
1.5 $1 - 5x = -5x + 1$

ACTIVITIES/ASSESSMENTS

Apply the commutative property to calculate the following:

1. $6 + 5$
2. $-3 + 6$
3. $2x + (-x)$
4. $5x \times (-7x)$
5. $x \times 2y$

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TOPIC : INTEGERS					
LESSON 5:					
Term	1	**Week**	1	**Grade**	9
Duration	1 hour	**Date**			
Skills/Concepts	• the commutative, associative, distributive properties of addition and multiplication for integers • additive and multiplicative inverses operations for integers				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC:

Like terms; coefficient; exponents

PRIOR KNOWLEDGE/ BACKGROUND KNOWLEDGE:

Perform basic calculations with integers; order of operations; properties of integers done in grade 8.

ERRORS, MISCONCEPTIONS AND PROBLEM AREAS

Incorrect application of associative property

METHODOLOGY

Introduction:

Associative property

The ***associative property*** of whole numbers, represented by $(a + b) + c = a + (b + c)$ and $(a \times b) \times c = a \times (b \times c)$, is applicable for addition and multiplication.

The associative (grouping) property tells us that we can group numbers in any way when we add or multiply in any way and still get the same results.

Examples:

1. $(-9 + 8) + (-6) = -9 + [8 + (-6)]$
2. $b + (4 + 2) = (b + 4) + 2 = (b + 2) + 4$
3. $a \times (xy) = (ax) \times y$
4. $(2xa^2) \times y = 2x \times (a^2y) = 2(xa^2y)$

ACTIVITIES/ASSESSMENTS

Apply the associative property to calculate the following:

1. $-80 + (-40 + 20)$
2. $(m + n) - p$
3. $(-35 \times -2) \times 3$
4. $-12x \times (11x \times -23x)$
5. $(3ab^2) \times k$

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TOPIC : INTEGERS					
LESSON 6:					
Term	1	**Week**	1	**Grade**	9
Duration	1 hour	**Date**			
Skills/Concepts	• the commutative, associative, distributive properties of addition and multiplication for integers • additive and multiplicative inverses operations for integers				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC:

Like terms; coefficient; exponents

PRIOR KNOWLEDGE/ BACKGROUND KNOWLEDGE:

Perform basic calculations with integers; order of operations; properties of integers done in grade 8.

ERRORS, MISCONCEPTIONS AND PROBLEM AREAS

Incorrect application of distributive property

METHODOLOGY

Introduction:

Distributive property

The ***distributive property*** of whole numbers, represented by $a(b + c) = (a \times b) + (a \times c)$ and $a(b - c) = (a \times b) - (a \times c)$ is applicable to addition and subtraction.

Distributive property is determining the product of a monomial and a polynomial. It tells us that we can add first and then multiply or multiply first then add. Either way, the multiplication is "distributed" over all the terms inside the parentheses.

Examples:

1. $7 \times [(-3) + (-4)] = (7 \times -3) + (8 \times -4)$
2. $-3x[12 - (-9)] = (-3x \times 12) - (-3x \times -9)$

ACTIVITIES/ASSESSMENTS

Apply the distributive property to calculate the following:

1. $4 \times [20 + (-5)]$
2. $2(3 + 9x)$
3. $-6(-2 - 2m)$
4. $-8(6 - 7n) + 5n$
5. $-11(n - 12) - 12(-5n - 3)$

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TOPIC : INTEGERS					
LESSON 7:					
Term	1	**Week**	1	**Grade**	9
Duration	1 hour	**Date**			
Skills/Concepts	• solve problems in context involving multiple operations with integers				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC:

- like terms; coefficient; exponents
- squares, cubes, square roots, cube roots
- properties of integers
- above, increase, ascend → (positive)
- below, decrease, descend → (negative)

PRIOR KNOWLEDGE/ BACKGROUND KNOWLEDGE:

- calculations with integers
- properties of integers

ERRORS, MISCONCEPTIONS AND PROBLEM AREAS

Failure to recognize integers in real life situations

METHODOLOGY

Introduction:

When it is very cold and the temperature is below freezing, negative numbers are used to indicate the temperature. If a person owes money to the bank, the person is in debts and the account is overdrawn. These debts are shown as negative numbers. Again, when you deposit money into the bank, the person is credited, i.e. receiving a positive (increase) balance.

Example:

Othandiwe had R3 875 in her bank account. She issued a cheque for R2 850 and then another one for R1 980. What is the balance of her account now? Comment on her balance.

$\text{R } 3\,875 - (\text{R}2\,850 + \text{R}1\,980)$

$= -\text{R}955$

She has overdrawn her account

ACTIVITIES/ASSESSMENTS

1. The temperature one night in Ulundi was measured at $-1°\text{C}$. The temperature increased to $8°\text{C}$ the next day. By how many degrees did the temperature rise?
2. Which temperature is higher?
   $-7°\text{C}\ or\ -9°\text{C}$
3. A submarine is $75\ m$ below the surface of the sea. It then rises by $21\ m$. How far below the surface is it now?

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TEST: INTEGERS

Question 1

Evaluate the following:

1.1 $60 - 10 \times 4$ (2)

1.2 $54 \div 6 \times 6$ (2)

1.3 $9 \times 7 + 84 \div 12$ (3)

1.4 $(77)^2 - 77 \times 77$ (2)

[9]

Question 2

2.1 Calculate the following **WITHOUT** using a calculator:

2.1.1 $7 - (-2)(3) - (-1)^3$ (3)

2.1.2 $(-48) \div (-8) - 4$ (2)

2.1.3 $(5)(-3)(-3) - 18 \div 3$ (2)

2.1.4 $\dfrac{-16x - (-8x)(-20x)}{(-11x)(-8x)}$ (3)

2.1.5 $\sqrt{8 - (-2)^3}$ (2)

2.1.6 $(7 + 2)^2 - (2 - 7)^2$ (2)

2.2 Calculate the value of t if:

$1{,}5 \times 174 = t \times 4{,}5 \times 8$ (3)

2.3 The temperature in Mahlabathini drops from 2 °C to -1°C in one hour, and then another two degrees in the next hour. How many degrees in total did the temperature drop over two hours? (3)

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TOPIC : ALGEBRAIC EQUATIONS					
LESSON 1					
TERM	3	**WEEK**		**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS and SKILLS	Set up equations to describe problem situation				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Less, subtract and decrease; More, add, increase and sum; Same, equal to, gives and total; product and times

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

Equal sign as representing equivalence; Linear equations

RESOURCES

Textbooks

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

No clear understanding of which operation sign to use when setting up equation to describe a situation because of the use of English as a language of teaching and learning.

METHODOLOGY

To be discussed with learners to check their prior knowledge before they do the activity.

1 **Expressions:**

The tables below contain verbal and algebraic expressions. The letter h represents 'a number'. Match the columns. There may be more than one correct answer for some options.

Verbal expressions			**Algebraic Expressions**	
1	Add 6 to a number		A	6 + h
2	A number multiply by 6		B	6h
3	6 less than a number		C	h + 6
4	6 divided by a number		D	h – 6
5	A number subtracted from 6		E	6(h)
6	A number divided 6		F	$\frac{6}{h}$
1.	A number subtract 6		G	6 – h
			H	$h \div 6$

2. Equations

Write equations for the following statements.

a) The sum of 5 and a number is – 1
b) The product of a number and - 7 is 140
c) A number decrease by 8 is 11
d) A number divided by 5 gives 10 times 7
e) Seven times a number added to 4 gives - 15
f) The sum of one-third of a number and 6 gives 10
g) If 19 is added to a number and the results is divided by two, the answer is 20
h) The dimensions of a triangle are x cm and (x + 2) cm. the area of the rectangle is 48 cm^2. Determine the dimensions of the rectangle.

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ACTIVITIES/ASSESSMENTS
1.1 Write equations for the following statements a) Two times a number subtract 9 gives – 1 b) The sum of a number and one – quarter gives 2 c) The product of a number and one quarter gives – 2 d) The difference between 2 and a number gives – 21 e) The sum of a number and 5 is the same as the product of the number and 6 f) A number subtract 5 is the same as the product of the number and 6 g) Ten subtract a number is the same as the same as the number decreased by 10 1.2 The sum of two consecutive odd numbers is 72. Determine the numbers. The perpendicular height of a triangle is x cm and the base is (x + 5)cm. the area of the triangle is 12 cm^2. Determine the height and base of the triangle. 1.3 The perimeter of a rectangle is 18cm. find the length and the width of the rectangle if the length is 3 cm less than twice its width

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TOPIC : ALGEBRAIC EQUATIONS					
LESSON 2					
TERM	3	**WEEK**		**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Use substitution in equations to generate tables of ordered pairs Find input and output values for given rules in flow diagrams, tables and formulae				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Input and Output; Ordered pair; Flow diagram; table

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

Substitution; working backwards when given output; Equal sign as representing equivalence.

RESOURCES

Textbook/ workbook

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Incorrect substitution; Calculate output when ask to determine input; Transposition error

METHODOLOGY

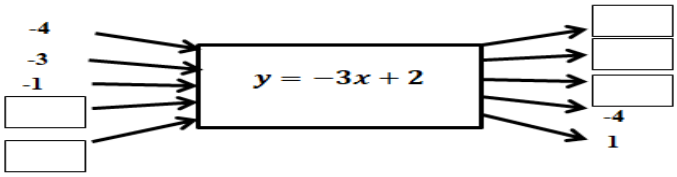
Example 1

Complete the table below for y values for the equation $y = 2x - 4$

x	-2	-1	0	1	2
y					

Example 2

a) Find the missing input and output values for the flow diagram



b) Give your answers to 1 as a table of ordered pair

ACTIVITIES/ASSESSMENTS

1. Complete the table

x	-3	-1	0	2	4	10
$y = -x + 3$						

2. Complete the table

x	-2	-1	0	1	2	
$y = x^2 - 1$						24

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3. a) Fill the missing input and output values for the flow diagram

$$y = -3x - 7$$

b) Give your answer to a) as a table of ordered pairs.

x	-4		2		7	
y		-1		-19		-37

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 3					
TERM	2	**WEEK**		**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Solve equations by inspection				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Substitution; Equality; Constant; Co-efficient

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

Seeing equal sign as representing equivalence; Distributive property; Commutative and associative property; Inverses and inverse operations; The idea of balancing the equation

RESOURCES

Wits Maths Connect Supporting Secondary Maths(WMCS Equations); Mathematics TODAY Grade 9 learners' Book; Mathematics Grade 9 Examination Aid; Classroom mathematics

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Seeing equal sign as used to mean " and the answer is" instead of saying "same as"

METHODOLOGY

Examples

Solve the following equations by inspection

1. $x-4=11$
2. $x+10=25$
3. $2x-3=24$
4. $2(x-3)=24$
5. $x+9=12+3-9$

ACTIVITIES/ASSESSMENTS

Solve the following equations by inspection:

1. $5x+7=-3$
2. $6-x=8$
3. $10-4x=50$
4. $4(x-4)=60$
5. $27=6x+3$
6. $7-2x=11$
7. $3x=12$
8. $\frac{3x}{4}+5=14$
9. $\frac{x}{2}-3=9$
10. $\frac{x}{2}=5-\frac{x}{3}$
11. $x+7=3x-15$

Question 10 and 11 was included for the purpose of preparing learners for next lesson: solving equations using multiplicative and additive inverses.

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 4					
TERM	2	**WEEK**		**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS and SKILLS	Solve Equations By using Additive and Multiplicative Inverses (equations with variables on one side)				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Constant. Additive inverse, multiplicative inverse, Co-efficient, Distributive law

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

Seeing equal sign as equivalence; Distributive property; Commutative and associative property; Inverses and inverse operations; Addition of like terms

RESOURCES

- Wits Maths Connect Supporting Secondary Maths(WMCS Equations); Mathematics TODAY Grade 9 learners' Book; Mathematics Grade 9 Examination Aid; Classroom mathematics

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Invalid distribution of brackets; Deletion error; Transposition error; Sign errors; Interference of new/old knowledge

METHODOLOGY

Worked examples

Solve for x:

1. $x+5=7$
2. $2x+3=7$
3. $11=3x-4$
4. $4(x+5)=40$
5. $3(x+2)+5=23$

Solutions

1. $x+5=7$

Step 1 Add -5, the additive inverse of 5 on both side of the equation

$x+5+(-5)=7+(-5)$

Step 2 Simplify

$x+5-5=7-5$

Step 3 Add like terms

$\therefore x=2$

2. $2x+3=7$

Step 1 Subtract 3 to both sides of the equation so that constant terms sum to zero on the left hand Side

$2x+3-3=7-3$

We get

$2x=4$

Step 2 We are looking for x not 2x, therefore we multiply both sides by the multiplicative inverse of 2

$2x\times\frac{1}{2}=4\times\frac{1}{2}$

Step 3 **Simplify** $\therefore x=2$

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Note: In example 1 we added negative 5. We could also have said "subtract 5"because adding a negative number" is the same as "subtracting a positive number". In example 2, we multiplied by the multiplicative inverse of 2 which is $\frac{1}{2}$. We could have also said "divide by 2" because dividing 2" is the same as "multiplying by $\frac{1}{2}$"

3. $11 = 3x - 4$

Step 1	Add the additive inverse to both sides of the equations	$11 + 4 = 3x - 4 + 4$
Step 3	Add the like terms	$15 = 3x$
Step 4	Divide both side by 3	$\frac{15}{3} = \frac{3x}{3}$
Step 5	Simplify	$\therefore 5 = x$

4. $4(x + 5) = 40$

Step 1	Remove brackets by applying the distributive law	$4x + 20 = 40$
Step 2	Add the additive inverse to both sides of the equation	$4x + 20 - 20 = 40 - 20$
Step 3	Add the like terms	$4x = 20$
Step 3	Divide both sides by 4	$\frac{4x}{4} = \frac{20}{4}$
Step4	Simplify	$\therefore x = 5$

5. $3(x + 2) + 5 = 23$

Step 1	Remove brackets by applying the distributive law	$3x + 6 + 5 = 23$
Step 2	Add like terms on the left hand side of the equation	$3x + 11 = 23$
Step 4	Add the additive inverse of +11 to both side of the equation	$3x + 11 - 11 = 23 - 11$
Step 5	Add the like terms	$3x = 12$
Step 4	Divide by the 3 to both sides of the equation	$\frac{3x}{3} = \frac{12}{3}$
Step 5	Simplify	

ACTIVITIES/ASSESSMENTS

1. Solve for the variables in each of the following

1.1 $6x - 1 = 17$	1..2 $2p + 3 = 15$	1.3 $3y - 8 = 19$
1.4 $17 = 3 + 3x$	1.5 $3 = -3 + 3x$	1.6 $\frac{1}{2}x + 2 = 14$

2. Solve for x

2.1 $2(x + 5) = 8$	2.2 $4(x + 3) = 32$	2.3 $2(3x + 1) = 14$
2.4 $3(2x - 1) = 9$	2.5 $2(x + 1) + 3 = 9$	2.6 $2(x - 5) + 17 = 23$

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3. Solve for x

3.1 $3(x+1)+2(2x+3)=23$

3.2 $2(3x+4)+2x=64$

3.3 $5x+3(6-x)=14$

3.4 $4x-4-2(x+3)-4=8$

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 5					
TERM	2	**WEEK**		**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Solve Equations By using Additive and Multiplicative Inverses (equations with variables on both sides)				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Constant. Additive inverse, multiplicative inverse, Co-efficient, Distributive law

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

- Seeing equal sign as equivalence
- Distributive property
- Commutative and associative property
- Inverses and inverse operations
- Identify and Addition of like terms

RESOURCES

Wits Maths Connect Supporting Secondary Maths(WMCS Equations); Mathematics TODAY Grade 9 learners' Book; Mathematics Grade 9 Examination Aid; Classroom mathematics

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Transposing without changing the signs

METHODOLOGY

1. *Solve for x*

1.1 $5x-8=2x+4$

1.2 $2-3x=7-x$

1.2 $3x+5=11-x$

1.4 $5(x-4)=3(x+2)+8$

ACTIVITIES/ASSESSMENTS

1. Solve for x

1.1 $x+7=3x-15$ 1.2 $15-2x=9x-7$ 1.3 $6x+3=x-27$

1.4 $7x-5=4x+16$ 1.5 $3x+6=-10-5x$ 1.6 $3x-6=x+2$

2. Solve for x

1.1 $x+7=3x-15$ 1.2 $15-2x=9x-7$ 1.3 $6x+3=x-27$

1.4 $7x-5=4x+16$ 1.5 $3x+6=-10-5x$ 1.6 $3x-6=x+2$

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3. Solve for x

2.1 $3(x+3)=2(2x-3)$

2.2 $3(x-1)-24=2(-1-x)$

2.3 $6(x-1)-x=-2(x+1)+x-1$

2.4 $3(x+2)=-3(x-1)+9$

2.5 $-4(x+3)+5=2(x-6)-1$

2.6 $(x-2)^2+3x-2=(x+3)^2$

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 6					
TERM	3	**WEEK**	2	**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Solve Equations By using Additive and Multiplicative Inverses (equations with fractions)				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Constant. Additive inverse, multiplicative inverse, Co-efficient, Distributive law, Highest Common Factor (HCF)

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

Seeing equal sign as equivalence; Distributive property; Commutative and associative property; Inverses and inverse operations; Addition of like terms

RESOURCES

Wits Maths Connect Supporting Secondary Maths(WMCS Equations); Mathematics TODAY Grade 9 learners' Book; Mathematics Grade 9 Examination Aid; Classroom mathematics

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Invalid distribution of brackets; Deletion error; Transposition error; Sign errors; Interference of new/ old knowledge

METHODOLOGY

1. Solve for x

1.1 $\frac{x}{4}+\frac{x}{2}=3$

1.2 $\frac{p}{4}-\frac{2p}{3}=\frac{5}{6}$

1.3 $\frac{y+3}{4}-\frac{y+2}{8}=\frac{y}{2}-1$

1.4 $\frac{a+1}{2}-\frac{2a}{3}=1$

ACTIVITIES/ASSESSMENTS

1. Solve the following equations

1.1 $\frac{5x}{4}-\frac{10x}{3}=15$

1.1 $\frac{5x}{3}+3=-\frac{2x}{5}$

1.3 $\frac{3x}{2}-\frac{15}{2}=\frac{2x}{3}-\frac{5}{3}$

1.4 $\frac{x}{5}=\frac{3}{35}+\frac{x+1}{7}$

1.5 $\frac{3x}{2}+\frac{2}{3}=\frac{1}{2}+x+\frac{7}{6}$

2. Solve for the unknown variable in each of the following equations

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2.1	$\frac{x+2}{3}-\frac{x+3}{2}=5$	2.2	$\frac{a+1}{2}-\frac{a+2}{3}=2+\frac{a+3}{4}$
2.3	$\frac{p+1}{3}-\frac{5p-1}{2}=\frac{2p-4}{2}$	2.4	$\frac{2k}{5}+\frac{2k-18}{3}+\frac{k}{3}=3k-2$

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 7					
TERM	3	**WEEK**	2	**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS and SKILLS	Solve equations by using laws of exponents				

RELATED CONCEPTS / TERMS / VOCABULARY / EAC

Constant. Additive inverse, multiplicative inverse, Co-efficient, Distributive law, Base, Exponent, Power

PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE

Understanding of Prime Numbers; literal equations

RESOURCES

Calculator

ERRORS/MISCONCEPTIONS / PROBLEM AREAS

Confusing bases with exponents

METHODOLOGY

Examples:

Solve for the unknown

1.1 $5^x = 25$

1.2 $a^2 = 49$

1.3 $2^{x-3} = 16$

1.4 $3^x + 3 = 83$

1.5 $v^3 = 1000$

1.6 $3^{2x} = \frac{1}{27}$

1.7 $2.3^x = 18$

1.8 $x^3 = 64$

ACTIVITIES/ASSESSMENTS

Solve for the unknown

1.1 $2^m = 32$

1.2 $m^2 = 225$

1.3 $2^{x+3} = 128$

1.4 $5^{-x} = \frac{1}{25}$

1.5 $9^x = 1$

1.6 $3^x = 81$

1.7 $x^3 = 729$

1.8 $3^{x-1} = 27$

1.9 $5^x = \frac{1}{125}$

1.10 $7^{x+1} = 1$

1.11 $5.5^x = 100$

1.12 $3n^2 = 27$

1.13 $3^{3x+1} = 81$

1.14 $x^2 = \frac{1}{64}$

1.15 $13^{2x-1} = 1$

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 8					
TERM	3	**WEEK**	2	**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Determine the numerical value of an expression by substitution				
RELATED CONCEPTS / TERMS / VOCABULARY / EAC					
Factorisation					
PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE					
Integers					
RESOURCES					
DBE Workbooks; DBE Training Manual					
ERRORS/MISCONCEPTIONS / PROBLEM AREAS					
Solving equations without equating to zero					
METHODOLOGY					
Example 1: $If\ y = 2x^2 + 4x + 3,\quad Calculate\ y\ when\ x = -2$ Example 2: Determine the numerical value of $-3x^2 + 6x - 1$ if: 2.1 $x = 2$ 2.2 $x = -1$					
ACTIVITIES/ASSESSMENTS					
1. Determine the value of $-x^2 - x + 2$ if $x = -3$ **2.** Determine the value of $3 + x - 2x^2\ if\ \ x = -2$ **3.** Determine the value of $\frac{x^2 + 3x}{2}\ if\ \ x = -2$ **4.** Determine the numerical value of $3x^2 - 10xy + 3y^2$ if $x = -3\quad and\quad y = -2$ **5.** Determine the value of $x^2 - xy + y^2$ if $x = -3\quad and\quad y = -2$					

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 9					
TERM	3	**WEEK**	2	**GRADE**	9
DURATION	2 hours	**DATE**			
CONCEPTS SKILLS	Solve Equations of the form : a product of factors = 0				
RELATED CONCEPTS / TERMS / VOCABULARY / EAC					
Equations					
PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE					
Multiplication; Multiplication					
RESOURCES					
DBE Workbook					
ERRORS/MISCONCEPTIONS / PROBLEM AREAS					
Confusion between Multiplication					
METHODOLOGY					
Examples Solve for x 1. $(x+3)(x-7)=0$ 2. andDivision					
ACTIVITIES/ASSESSMENTS					
1. Solve for x 1.1 $(x-3)(x+4)=0$ 1.2 $(x-2)(x+3)=0$ 1.3 $(2x+3)(x+1)=0$ 2. Solve for x 2.1 $x(x-3)=0$ 2.2 $5x(x-1)=0$ 2.3 $x(x+5)=0$					

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TOPIC: ALGEBRAIC EQUATIONS					
LESSON 10					
TERM	3	**WEEK**	2	**GRADE**	9
DURATION	1 hour	**DATE**			
CONCEPTS SKILLS	Solve equations of the form: a product of factors = 0				
RELATED CONCEPTS / TERMS / VOCABULARY / EAC					
Multiplication					
PRIOR-KNOWLEDGE / BACKGROUND KNOWLEDGE					
Common Factor					
RESOURCES					
DBE Workbook					
ERRORS/MISCONCEPTIONS / PROBLEM AREAS					
Confusing Multiplication and Division					
METHODOLOGY					

Worked examples

Solve for x

1. $3x^2 - 18x = 0$
2. $x^2 - 3x - 10 = 0$
3. $x^2 + 2x = 24$
4. $x^2 - 25 = 0$

ACTIVITIES/ASSESSMENTS

1. Solve for x

   a) $2x^2 + 10x = 0$ b) $x^2 - 4x = 0$ c) $x^2 + 3x = 0$

2. Solve for x

   $a)$ $5(x-4) = 60$ $b)$ $x(x-1) + 2(x-1) = 0$ $c)$ $x^2 - 7x + 6 = 0$

   $d)$ $x^2 + x = 12$ $e)$ $5x^2 + 25x = 30$ $f)$ $2x^2 - 10x = 72$

   $g)$ $3x^2 + 18x = -24$ $h)$ $x^2 = x + 56$ $i)$ $21x - 72 = -x^2$

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TOPIC : FUNCTIONS AND RELATIONSHIPS							
LESSON 1:							
Term	2	**Duration**	1 hour	**Week7**		**Grade**	**9**
Concept and Skills	• Identifying and stating rules in words (Revision). • Writing rules as number sentences.						

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Input, Output, Flow diagram, Ordered pairs, Relationships, Functions, Rule Mapping and All four operations

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Basic operations on Integers, Tables, Patterns, Input and output

RESOURCES

Learners Work Book, Mind Action Series Grade 9, Mathematics study guide

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Learners do not check enough corresponding values to see if a rule works or not, they just conclude with the first input.

METHODOLOGY

Introduction

- A relationship exists between variables if one variable is influenced by the other, for example, the cost of fuel is influenced by the number of litres that are put into the tank. The relationship is usually given as a rule that we apply to each input value to get an output value. It works like a "machine" that we can represent in a flow diagram as follows:
- Ask learners to give examples of relationship in general that they know, with an emphasis on one to one relationship.

Activities needed for the learners to understand the concept.

Revision work done in grade 8.

Teacher together with the learners will do the following class activity to sensitize learners in to identifying relationships:

Example 1

Fig. 1

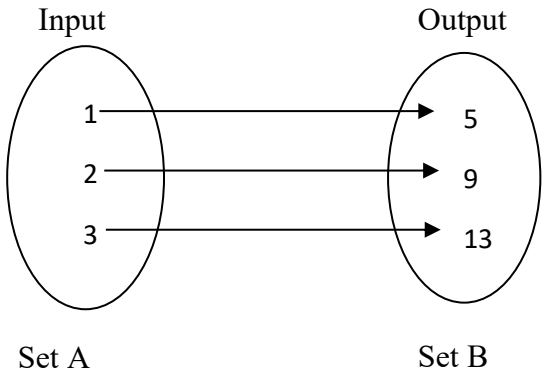
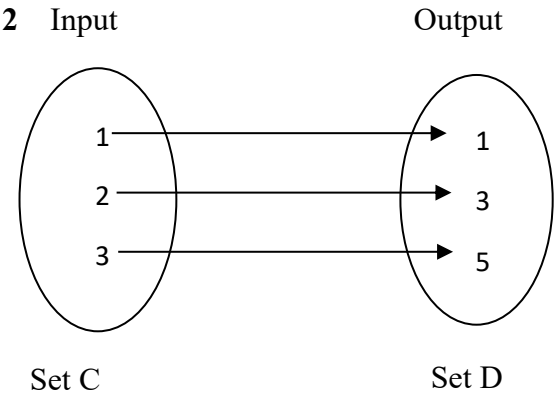


Fig. 2



Learners explain in words what do they do to the members of Set A to get the members of Set B

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1.2 Learners explain in words what do they do to the members of Set C to get the members of Set D
1.3 The learners write down the formula used in Fig 1 to get the values of Set B.
1.4 The learners write down the formula used in Fig 2 to get the values of Set D.

Responses should be as follows:
1.1 Multiply numbers in Set A by 4 and add 1
1.2 Multiply numbers in Set C by 2 and subtract 1
1.3 $\times 4 + 1$ or $4n + 1$
1.4 $\times 2 - 1$ or $2n - 1$

1.5 Teacher concludes the above activities by revising the formal definition of a function and a relationship highlighting the input and output.

- A function is a relationship between two sets such that one element on the first set (input) associates with one element on the second set (output).

1.6 The teacher gives the terminology used for functions and give examples.

- **Input:** The value we put (substitute) in the rule.
- **Output:** The value we get after substituting an input value into the rule.
- **Formula:** A formula generally refers to an identity which equates one mathematical expression to another
- **Rule:** A set of things (usually numbers) that are in a particular order.
- **Flow diagram:** Flow diagram is a collective term for a diagram representing a flow or set of dynamic relationships in a system
- **Ordered pairs** A set of two numbers that are written in the form (a;b)

1.7 The teacher instructs learners to fill in the two tables below using the information in Fig 1 and Fig 2 given above.

SET A			
SET B			

SET C			
SET D			

1.8 The teacher instructs learners to use the above tables to represent the pair as ordered pairs.

Consolidation

The teacher points out that functions can be represented using flow diagrams, tables, ordered pairs and graphs (graphs are to be dealt with in coming lessons)

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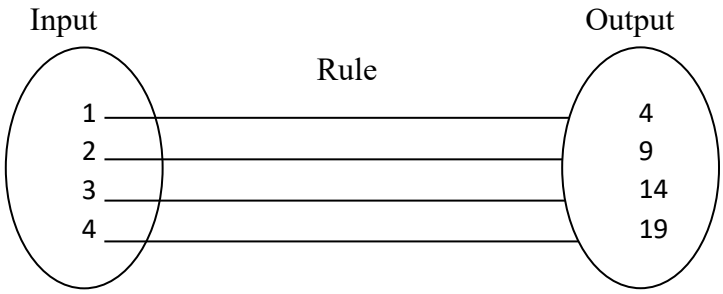
ACTIVITIES/ASSESSMENTS

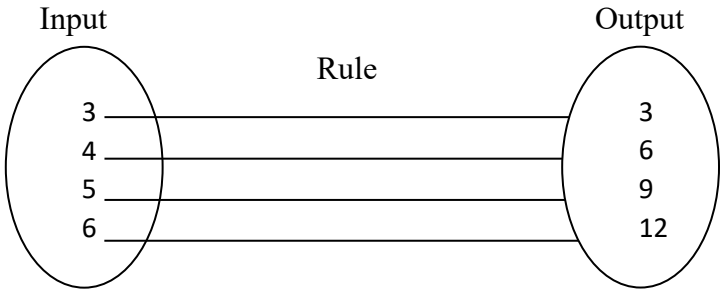
Activities for Day 1

1. Determine the rule in the given flow diagram.

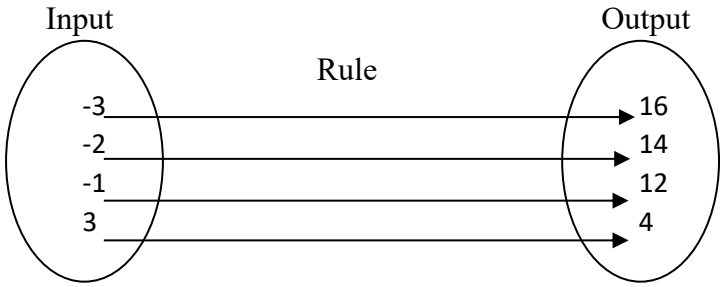
a)



b)



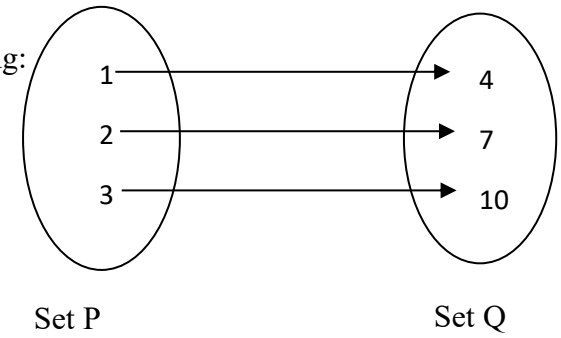
c)



Activities for Day 2

Class Work Activity:

1. Represent the information in this flow diagram using:
   a) Tables
   b) Ordered pairs
   c) State the rule in words



2. Represent this information in this ordered pairs (0;2), (1;4), (2;6), (3;8) in:
   a) Tables
   b) Flow diagram
   c) State the rule in words

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TOPIC : FUNCTIONS AND RELATIONSHIPS							
LESSON 2:							
Term	2	**Duration**	1 hour	**Week**		**Grade**	**9**
Concept and Skills	Flow diagram and tables						

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Input, Output, Flow diagram, Ordered pairs, Relationships, Functions, Rule Mapping and All four operations

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Basic operations on Integers, Filling in of tables, Patterns, Input and output and substitution

RESOURCES

Learners Work Book, Mind Action Series Grade 9, Mathematics study guide

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Some learners write input and output values in a non-corresponding way when substituting into the table.

METHODOLOGY

Introduction

Functions can be represented in different ways:

• A table; which shows some values of the two variables. A table shows clearly which value of the output variable corresponds to each particular value of the input variable.

• A flow diagram; which shows what calculations are to be done to calculate the output number that corresponds to a given input variable.

• A formula; which also describes what calculations are to be done to calculate the output number that corresponds to a given input variable.

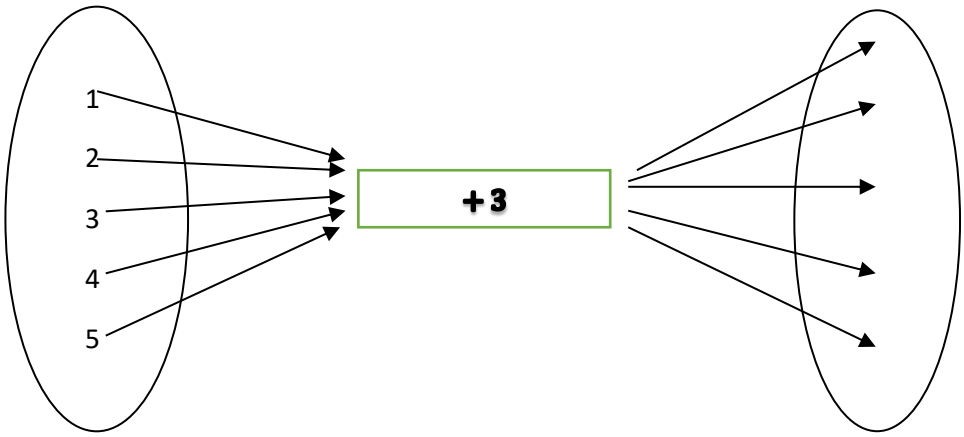
• A graph.

Activities needed for the learners to understand how to calculate the output values.

Example. 1

Teacher gives learners a flow diagram.

Fig: 1 Input (x) Output (y)



Solution
1+3=4
2+3=5
3+3=6
3+4=7
3+4=8

Learner use the rule provided to calculate the output values.

Example 2

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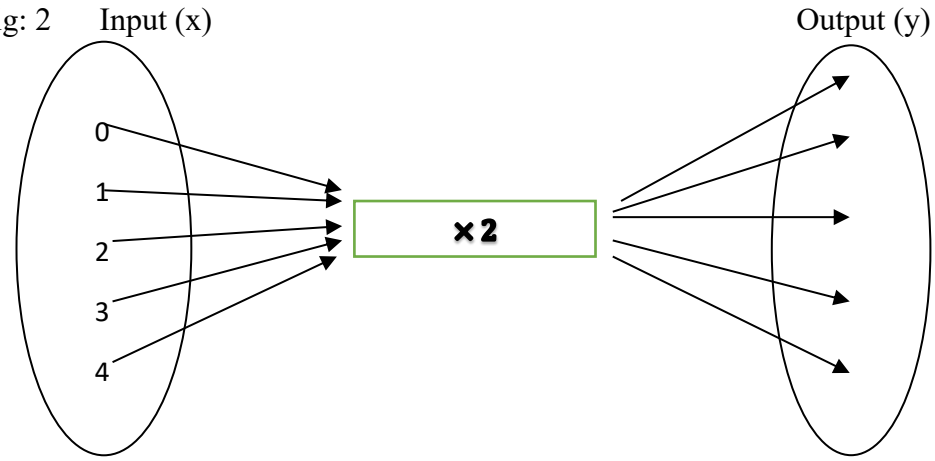
Teacher gives learners a flow diagram

Fig: 2

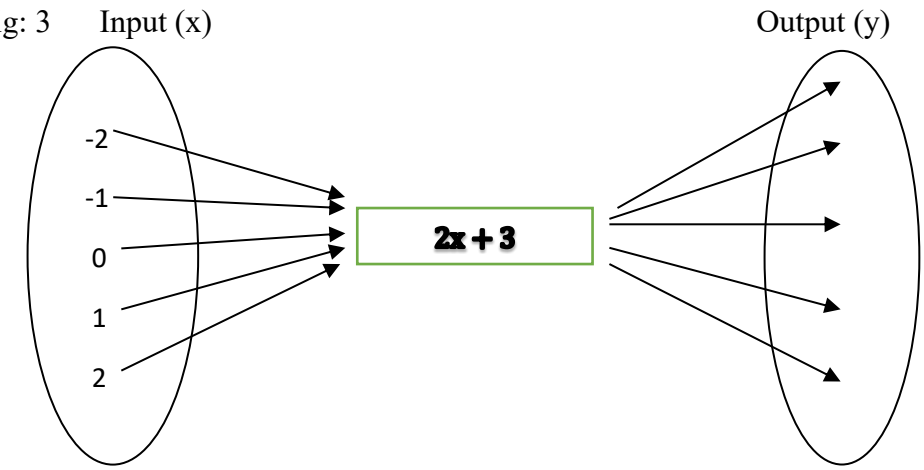


Solution
$0 \times 2 = 0$
$1 \times 2 = 2$
$2 \times 2 = 4$
$3 \times 2 = 6$
$4 \times 2 = 8$

Learner use the rule provided to calculate the output.

Example 3

Fig: 3



Solution
$-2 \times 2 + 3 = -1$
$-1 \times 2 + 3 = 1$
$0 \times 2 + 3 = 3$
$1 \times 2 + 3 = 5$
$2 \times 2 + 3 = 7$

Learners use the rule to calculate the output values and plot on the table.

Example 4

Use the following table and the given formula to determine the output values: $y = \frac{1}{3}x + 2$

x	-3	-1	0	1	3	6
y						

Solution:

x	-3	-1	0	1	3	6
y	1	$\frac{5}{3}$	2	$\frac{7}{3}$	3	4

Consolidation:

Teacher draws the learner's attention of the learners to the components of the rule, how they influence the output values and the fact that input values are not just natural numbers but can be rational, integers and whole numbers. Expressing the input and output values in a form of a table.

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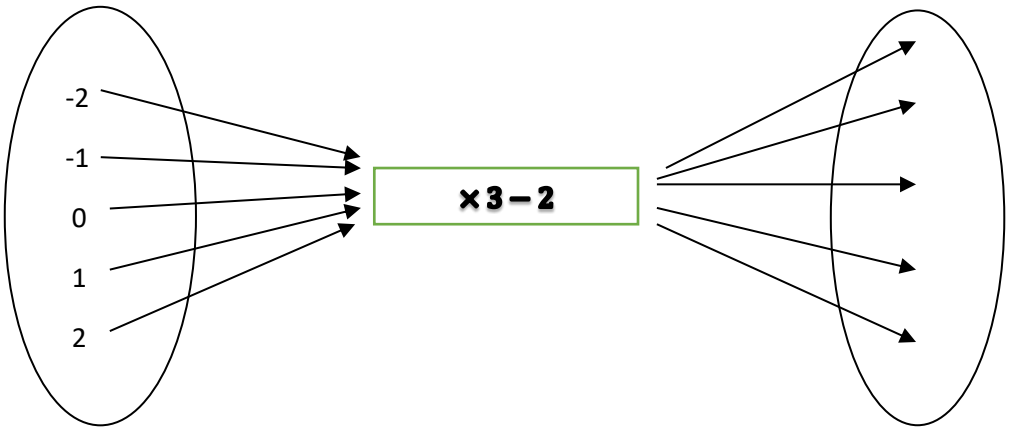
ACTIVITIES/ASSESSMENTS

Class work

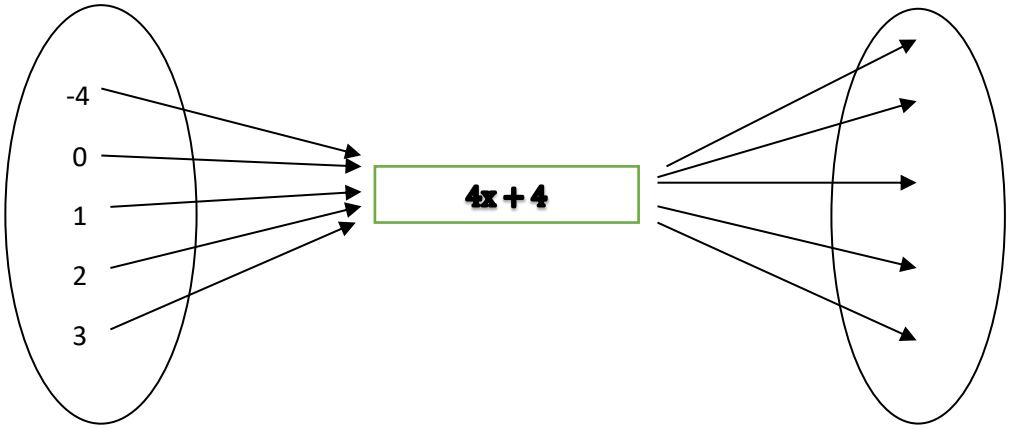
Activity 1

1. Determine the output values in the following flow diagram:

a) Input Output



b) Input Output



2. Use the following table and the given formula to determine the output values: $y = 4x - 2$

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

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TOPIC 6: FUNCTIONS AND RELATIONSHIPS							
LESSON 3:							
Term	2	**Duration**	1 hour	**Week**	**9**	**Grade**	9
Concept and Skills	Calculating the value of the input; Interpreting flow diagrams.						

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Output, Flow diagram, Ordered pairs, Relationships, and All four operations

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Basic operations on Integers, Patterns, Input and output and substitution

RESOURCES

Learners Work Book, Mind Action Series Grade 9, Mathematics study guide

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Learners have a challenge when they have to calculate the input value from the output.

METHODOLOGY

Activities needed for the learners to understand how to calculate the input values.

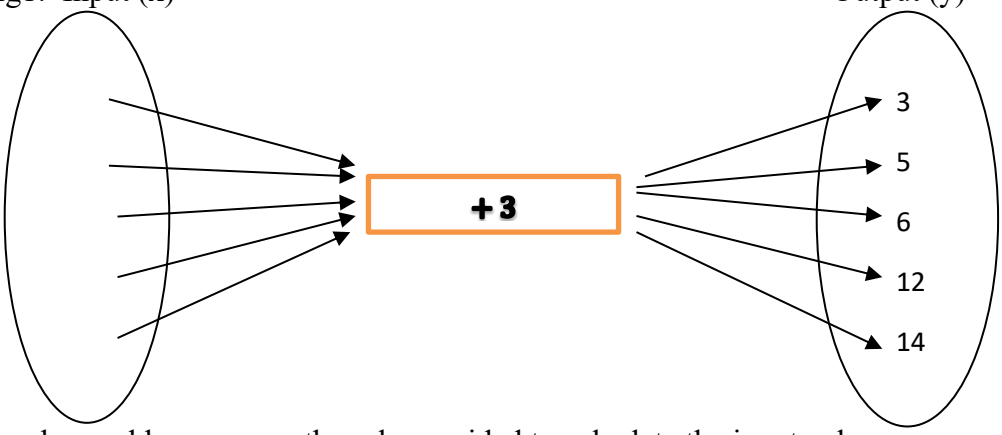
When calculating the input value we go again the written rule, what does that mean?

We calculate inversely to the rule or formula.

Example. 1

Teacher gives learners a flow diagram.

Fig1: Input (x) Output (y)

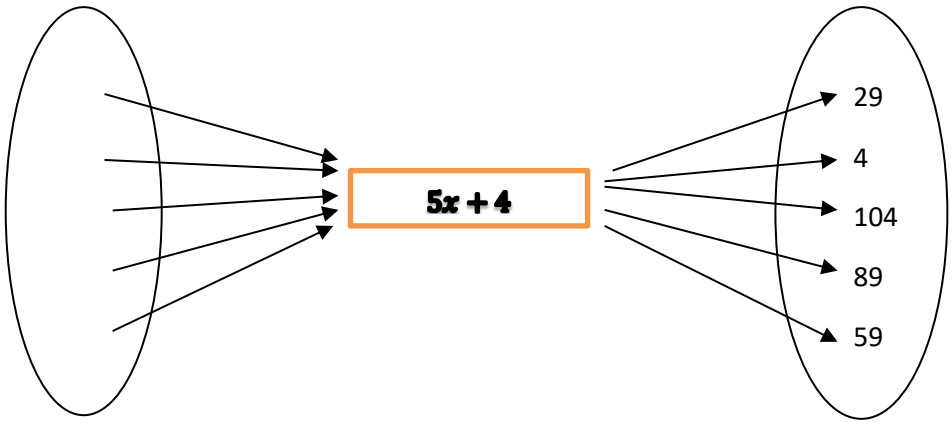


Solution
3-3=0
5-3=2
6-3=3
12-3=9
14-3=11

Teacher and learners use the rule provided to calculate the input values

Example 2

Fig: 2 Input (x) Output (y)



Teacher and learners use the rule provided to calculate the input.

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Solution for one: $29 - 5 = 2x$

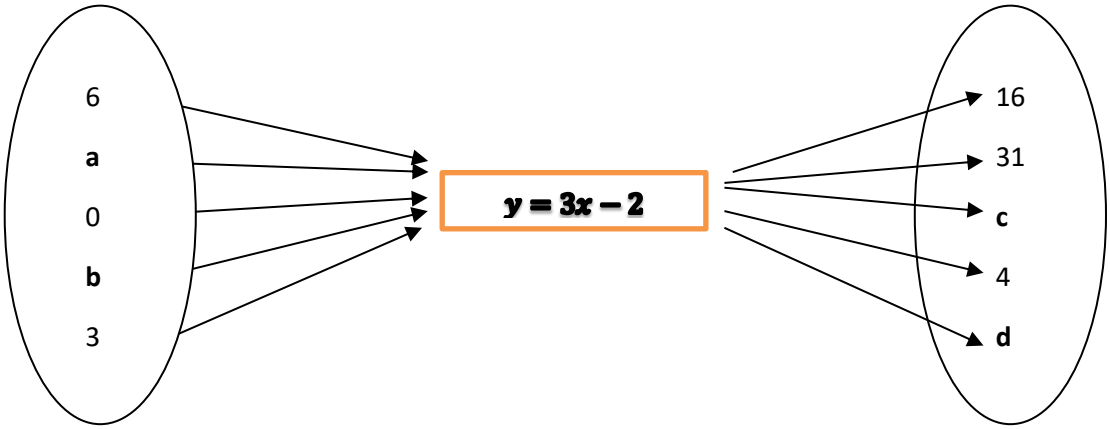
$$24 = 2x$$

$$x = 12$$

The rest of the values are calculated using the same method.

Example 3

Fig: 3 Input (x) Output (y)



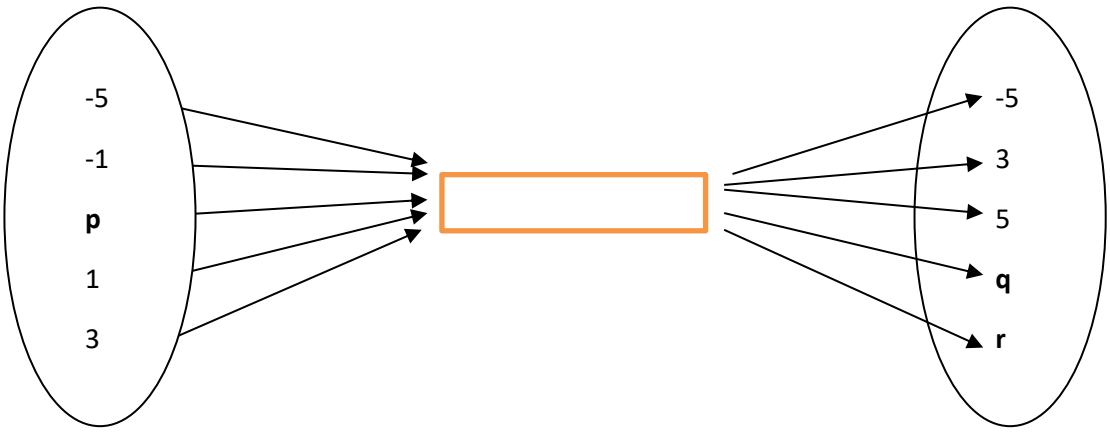
Using the above flow diagram and determine the values of a, b, c and d

Solutions

$31 = 3(a) - 2$ $a = 11$	$4 = 3(b) - 2$ $b = 3$	$c = 3(0) - 2$ $c = -2$	$d = 3(3) - 2$ $d = 7$

Example 4

Fig: 4 Input (x) Output (y)



3.1 Teacher and learners determine the rule to calculate the unknown values.

3.2 Teacher and learners proceed to calculate the value of the unknowns denoted by p, q, and r.

Solutions

3.1. $y = 2x + 5$ 3.2. $5 = 2(p) + 5$ $q = 2(1) + 5 = 7$

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$5 - 5 = 2p$ $\qquad$ $r = 2(3) + 5 = 11$

$0 = 2p$

$p = 0$

Teacher draws the learner's attention to the calculation of both the input and the output, noting that input and output values may not be given in any order.

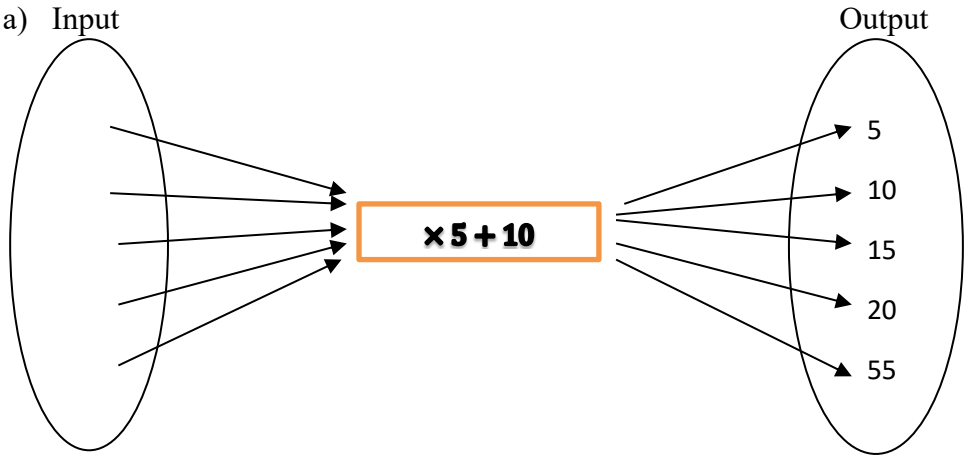
ACTIVITIES/ASSESSMENTS

Class work

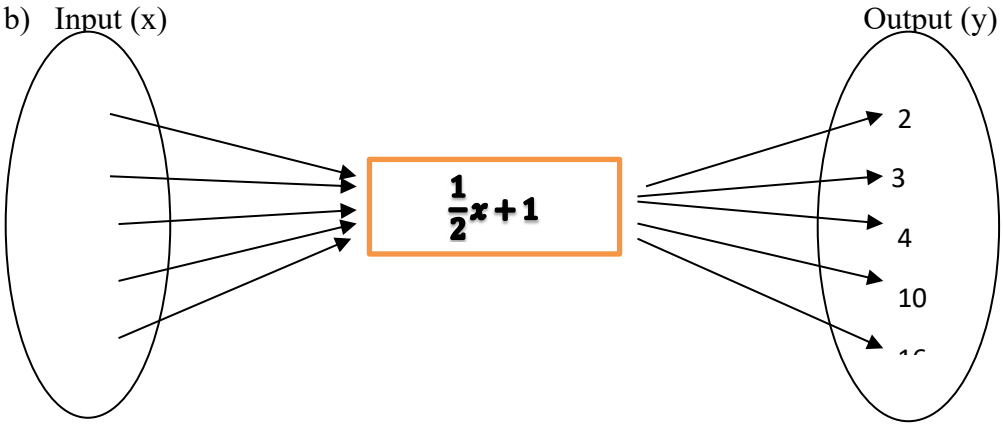
Activity 1

1. Determine the input values in the following flow diagrams:

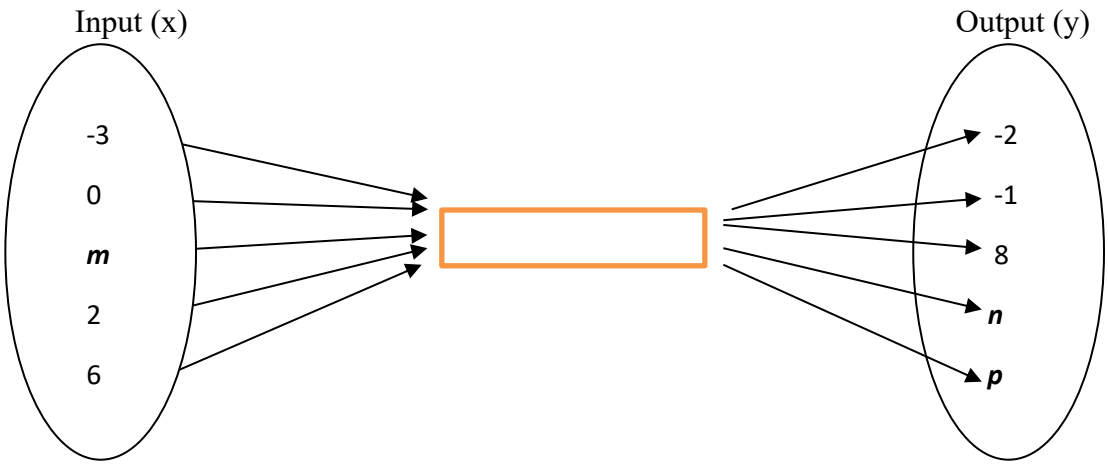
a) Input



b) Input (x)



2. Study the following flow diagram and answer the questions that follow.



Determine the relation between the input and output values and calculate the value of *m, n* and *p*.

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3. Use the given equation to calculate the unknown values in the table.

a) $$y = 2x + 3$$

x	-2	**b**	3	**d**	2	4
y	**a**	5	**c**	3	**e**	**f**

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TOPIC : FUNCTIONS AND RELATIONSHIPS							
LESSON 4:							
Term	2	**Duration**	1 hour	**Week**	**9**	**Grade**	**9**
Concept and Skills	Relationships involving formulae						

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Relationships, Functions, Substitution, and All four operations

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Basic operations on Integers, Filling in of tables, Patterns, Input and output and substitution

RESOURCES

Learners Work Book, Mind Action Series Grade 9, Mathematics study guide

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Learners find it difficult to manipulate formulae in order to calculate the desired variable.

METHODOLOGY

Substitution into a given formula and manipulating a formula.

Example 1

Given the following rule $y = 3x + 2$

1.1 Calculate the value of y if the value of x is 4.
1.2 Calculate the value of x if the value of y in 11.

Solutions

1.1 The teacher and learners work on this together
$y = 3x + 2$
In the place of x we put (substitute) 4 into the equation.
$y = 3(4) + 2$
$y = 12 + 2$
$y = 14$

1.2 The teacher and the learner work on this together
In the place of y put (substitute) 11 into the equation.
$11 = 3x + 2$
$11 - 2 = 3x$
$\frac{9}{3} = \frac{3x}{3}$
$x = 3$

Example 2
The length of a rectangle is L and the area is A. The perimeter P can be calculated using the formula

$$P = 2L + \frac{2A}{L}$$

1.1 If L=3 and A=12, calculate the perimeter.
1.2 If the perimeter is 20 and the length is 8, calculate the area.

Solutions

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1.1 $P = 2L + \frac{2A}{L}$ $P = 2(3) + \frac{2(12)}{3}$ $P = 6 + 8$ $P = 14$	1.2 $P = 2L + \frac{2A}{L}$ $20 = 2(8) + \frac{2A}{8}$ $20 = 16 + \frac{A}{4}$ $20 - 16 = \frac{A}{4}$ $A = 16$

ACTIVITIES/ASSESSMENTS

Class work

Activity 1

1.1 Given the rule $y = 5x - 3$, calculate the value of:

$a)$ y if the value of x is 4.

$b)$ x if the value of y is 28

1.2 The temperature T°C outside an helicopter flying at a height of h metres is given by the formula $T = 25 - \frac{h}{152}$.

a) If the height of the helicopter is 4500m, calculate the temperature outside.

b) If the temperature outside is -15°C, what height is the helicopter?

1.3 Given $y = 3x + 2$ and $m = 4n^2$, find the value of:

a) y if $x = 3$ b) x if $y = 20$ c) m if $n = 4$ d) n if $m = 36$

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TOPIC : FUNCTIONS AND RELATIONSHIPS							
LESSON 5:							
Term	2	**Duration**	1 hour	**Week**	**9**	**Grade**	**9**
Concept and Skills	Table, ordered pairs and plotting a straight line graph.						

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Flow diagram, Ordered pairs, Relationships, Functions, Rule Mapping and All four operations

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Basic operations on Integers, Filling in of tables, Patterns, Input and output and substitution

RESOURCES

Learners Work Book, Mind Action Series Grade 9, Mathematics study guide

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Failing to substitute correctly

METHODOLOGY

Activities needed for the learners to understand how to draw a graph using value calculated on a table.

Example. 1

1.1 If the rule for finding y in the table below is $y = -3x + 2$, determine the output values for the given input values.

x	-2	-1	0	1	2	3	5	7
y								

Learners fill the table with the values they have calculated.

Solution

x	-2	-1	0	1	2	3	5	7
y	8	5	2	-1	-4	-7	-13	-19

1.2 Represent your findings in 1.1 in the form of ordered pairs.

Solution

(-2;8), (-1;5), (0;2), (1;-1), (2;-4), (3;-7), (5;-13), (7;-19)

- Draw learner's attention to the input value that with give a 0 as an output vice versa.

1.3 Stretch the learner's skills and use the ordered pairs to draw a straight line graph.

Example 2

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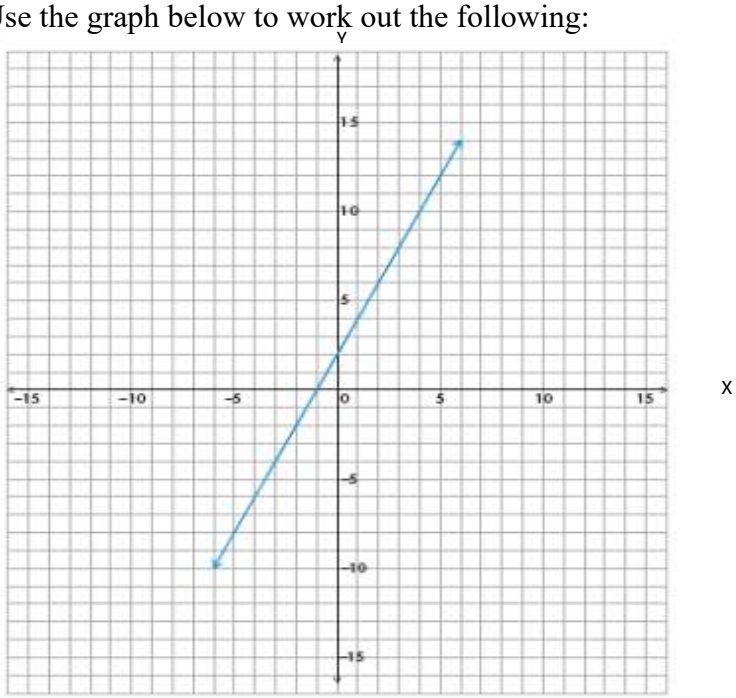
Use the graph below to work out the following:



2.1 Write down the ordered pairs where $x \in \{-3; -2; -1; 0; 1; 2; 3\}$ (teacher and learners)

Solution.

(-3;-4), (-2;-2), (-1;0), (0;2), (1;4), (2;6), (3;8)

2.3 Represent the ordered pairs in 2.1 on a table.

Solution

x	-3	-2	-1	0	1	2	3
y	-4	-2	0	2	4	6	8

2.3 Hence find the equation (rule) used to draw the line.

Solution

$-3 \times 2 + 2 = -4$
$-2 \times 2 + 2 = -2$
$-1 \times 2 + 2 = -0$
$1 \times 2 + 2 = 4$
$y = 2x + 2$

ACTIVITIES/ASSESSMENTS

Note:

Learners activity provided are but a guide and as such they are kept to the minimum.

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LESSON 1:

TOPIC 8: GEOMETRIC OF 2D SHAPES
(INVESTIGATION OF GEOMETRIC FIGURES)

LESSON 1

Term	3	**Week**		**Grade**	9
Duration	1 Hour				

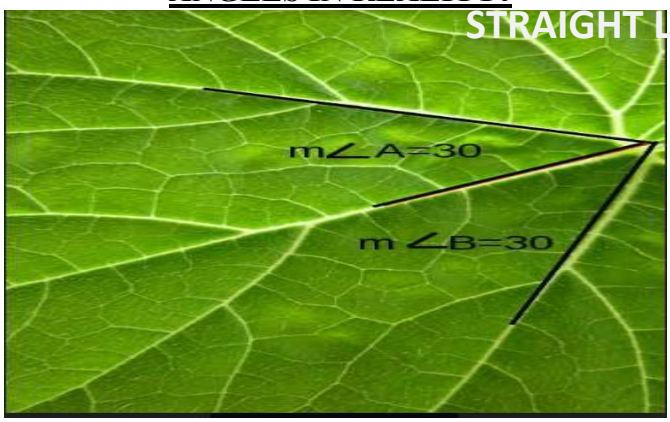
RELATED CONCEPTS/ TERMS/VOCABULARY

Angles; Parallel Lines; Perpendicular Lines; Bisecting Or The Bisect (Comes From The Word " Bi " Means Two Dividing Into Two Angles

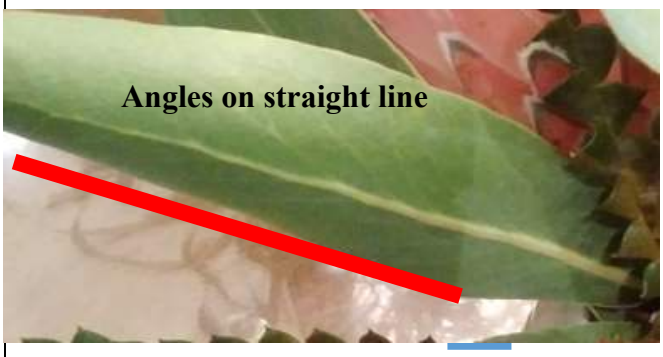
INTRODUCTION LESSON

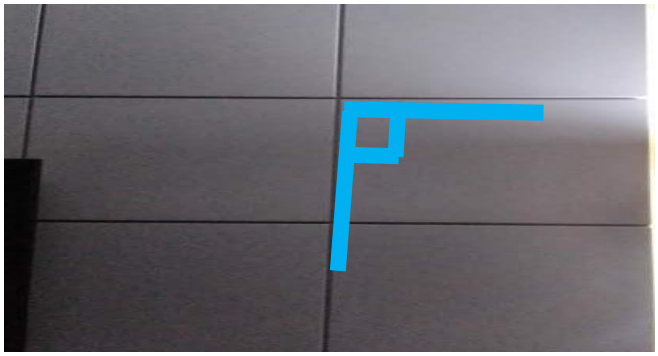
STEP ONE : SHOW EXAMPLES OF ANGLES IN REAL LIFE

ANGLES IN REALITY:



ACUTE ANGLE





PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Different types of angles : acute angle, right angle (perpendicular angle), obtuse angle,

Different types of lines : parallel lines , perpendicular lines

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RESOURCES :
Opening and closing of doors / windows; Prepared worksheets; videos; DBE Training Manuals
ERRORS/MISCONCEPTIONS/PROBLEM AREAS
Not knowing how to identify an angle: Not understanding that two lines joined at a point forms an angle…
METHODOLOGY
• Visual perception of angles • See above
ACTIVITIES/ASSESSMENTS
ACTIVITY ONE: CREATIVE ACTIVITY **STEP ONE:** Collect pictures from newspaper, magazines, any visual representations of angles you can identify in the world around you. **STEP TWO:** On the pictures collected and draw the different types of angles you can identify. **STEP THREE :** Create a chart on different types of quadrilaterals including the properties

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TOPIC : GEOMETRIC OF 2D SHAPES (SUM OF INTERIOR ANGLES OF TRIANGLE AND EXTERIOR ANGLES OF TRIANGLE)					
LESSON 2					
Term	3	**Week**	8	**Grade**	9
Duration	2 Hours			**Date**	
CONCEPTS AND SKILLS	• Angles in triangle must be equal to 180 • Exterior angle equals to the sum of the interior angles of triangle				
RELATED CONCEPTS/ TERMS/VOCABULARY					
Right angle; Interior angles of triangle; Equilateral triangles; Properties of parallel lines					
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE					
Types of triangles; Interior angles of triangle; Exterior angles of triangle					
RESOURCES					
Siyavula Grade 9; Answer Series Grade 9; Mind Action Grade 9					
ERRORS/MISCONCEPTIONS/PROBLEM AREAS					
Not knowing different properties of triangle; Cannot identify the interior angle and exterior angle of triangle					
METHODOLOGY					
• Solving for missing angles in a triangle; Using equations to solve missing; angles • Educator to reteach equations done earlier					

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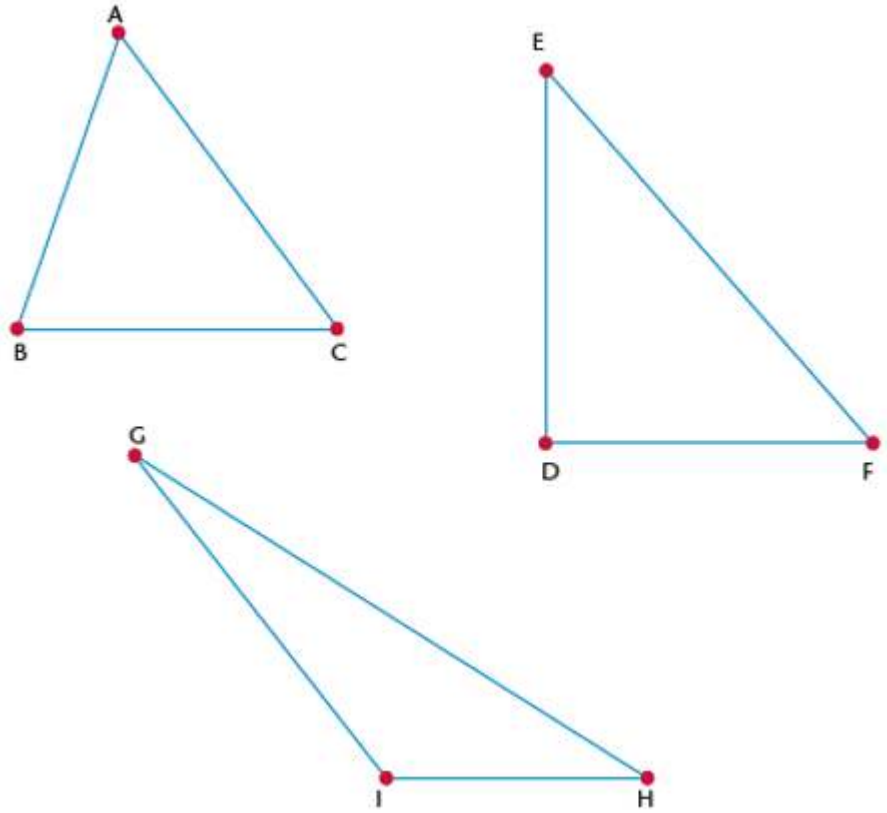
ACTIVITY ONE

TYPE ONE : INVESTIGATION

1. Revision: Classification of triangles

1.1 Use a protractor to measure the interior angles of each of the following triangles. Write down the sizes of the angles.



1.2 Classify the triangles in question 1.1 according to their angle properties. Copy and complete the following statements by choosing from the following types of triangles: **acute-angled, obtuse-angled and right-angled.**

(a) ΔABC is an ……. triangle, because ……..
(b) ΔDEF is an ……. triangle, because ……..
(c) ΔGHI is an ……. triangle, because ……..

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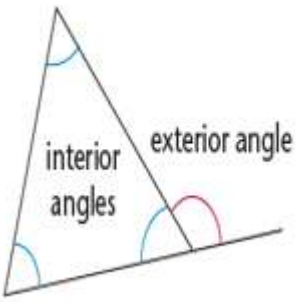
ACTIVITY TWO : PRACTICE EXERCISE WORKSHEET

WHAT ARE INTERIOR AND EXTERIOR ANGLES?

Interior angle is an angle that lies between two sides of a triangle. It is inside the triangle.

A triangle has three angles

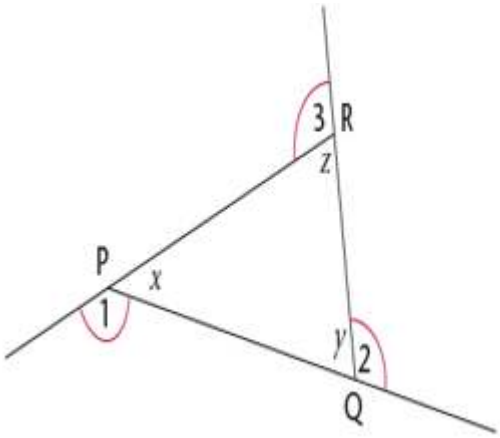


Look at triangle PQR. Its three sides are extended to create three exterior angles.

Each exterior angles has one interior adjacent angle (next to it) and two interior opposite angles, as seen in the diagram below :

ACTIVITY 3.1 INVESTIGATION

STEP ONE: any triangles and extend the lines to form exterior angles .



STEP TWO: Measure the interior angles and then the exterior angles

STEP THREE : CONCLUSION

EXTERIOR ANGLE	INTERIOR ANGLE	INTERIOR OPPOSITE ANGLE
1	X	Z and y
2	Y	X and z
3	Z	X and y

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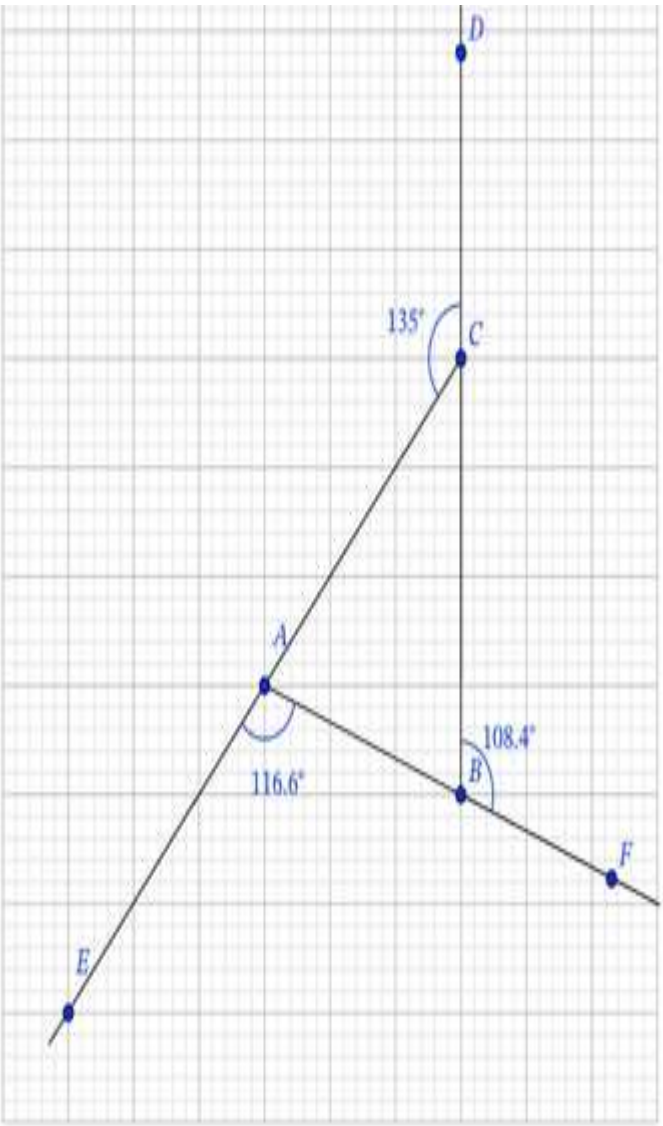
ACTIVITY FOUR

4.1 THE FIGURES SHOWS THE EXTERIOR ANGLES. FIND THE SUM OF THE EXTERIOR ANGLES



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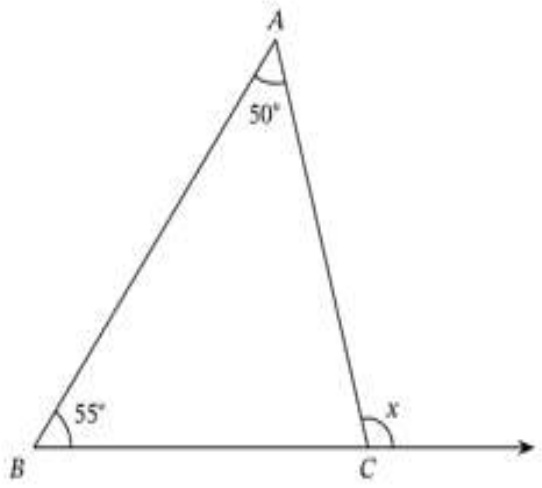
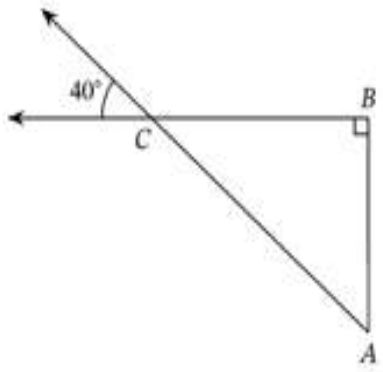
4.2 Calculate angle x



4.3 Calculate angle a



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TOPIC: GEOMETRIC OF 2D SHAPES (QUADRILATERALS)					
LESSON 3					
Term	3	**Week**	9	**Grade**	9
Duration	1 Hour			**Date**	

CONCEPTS AND SKILLS:	Different types and their properties of quadrilaterals with regards to the angles; diagonals and sides

RELATED CONCEPTS/ TERMS/VOCABULARY

What is the meaning of quadrilateral? Understanding parallel lines

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Introduction in identifying quadrilaterals used in real life or world around us

RESOURCES

Internet; Mind Action Series; Answer Series; Siyavula

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Not Learning The Properties Of Quadrilaterals; Confusing The Bisection Of Diagonals; Confused About The Diagonals Intersecting At 90 Degrees

METHODOLOGY:

- Method of understanding that a parallelogram is a tilted rectangle
- Method of learning that a rhombus is a tilted square
- Learn the properties of quadrilaterals with a picture
- Joining two right angle triangles to make a rectangle

ACTIVITIES/ASSESSMENTS

ACTIVITY ONE CREATIVE ACTIVITY

STEP ONE : Choose pictures from reality to show quadrilaterals
STEP TWO : Write the name of different types of quadrilaterals

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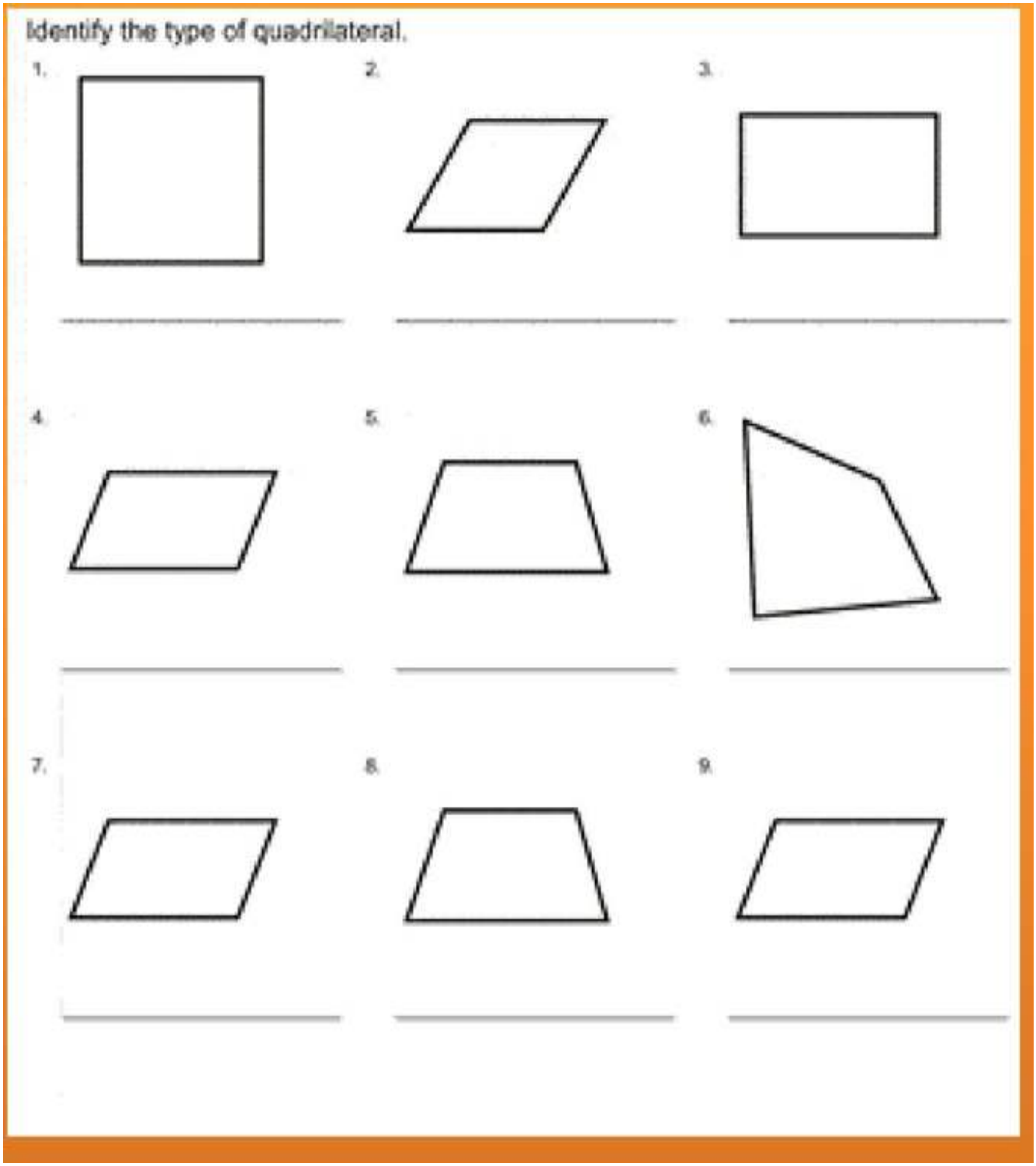
ACTIVITY TWO : NAME DIFFERENT TYPES OF QUADRILATERALS



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TOPIC: GEOMETRIC OF 2D SHAPES (PROPERTIES OF QUADRILATERALS)					
LESSON 4					
Term	3	**Week**	9	**Grade**	9
Duration	1 Hour			**Date**	

CONCEPTS AND SKILLS	• Identify the different types of quadrilaterals • Learn the properties of the different quadrilaterals

RELATED CONCEPTS/ TERMS/VOCABULARY

Parallel Lines; Diagonal; Bisect; Perpendicular; Intersect

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Basic Knowledge Of Quad; Interior Angles Of Quad; Diagonals Bisect Each Other; Diagonals Intersect At 90

RESOURCES

Mind Action Series; Answer Series

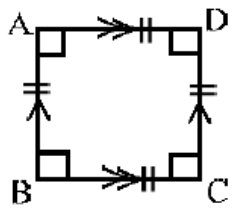
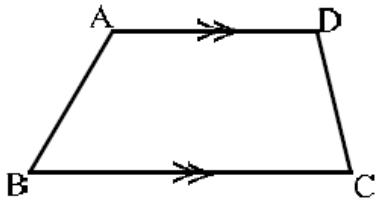
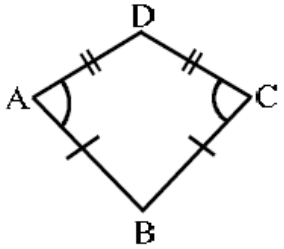
ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Not applying the knowledge that opposite angles of a parm are equal
- Not understanding the knowledge that diagonals of a parm bisect each other
- Diagonals of a rhombus intersect at 90
- Learning the properties of a kite and remembering them by repeating and recalling the properties on a daily basis
- Orally test the learners and for every incorrect answer repeat 10 times

METHODOLOGY

RECALL , REMEMBER, REPEAT (X 3)

Learning basic properties of quadrilaterals

	A square is a parallelogram with equal adjacent sides and interior angles equal to 90°.	The interior angles of a square are equal to 90°. The interior angles add up to 360°.	The opposite sides of a squ are parallel ar all sides are equal.
	A trapezium is a quadrilateral with one pair of opposite sides parallel.	The interior angles add up to 360°.	One pair of opposite sides are parallel.
	A kite is a quadrilateral with two pairs of adjacent sides equal.	One pair of opposite angles are equal. The interior angles add up to 360°.	Two pairs of adjacent sides are equal.

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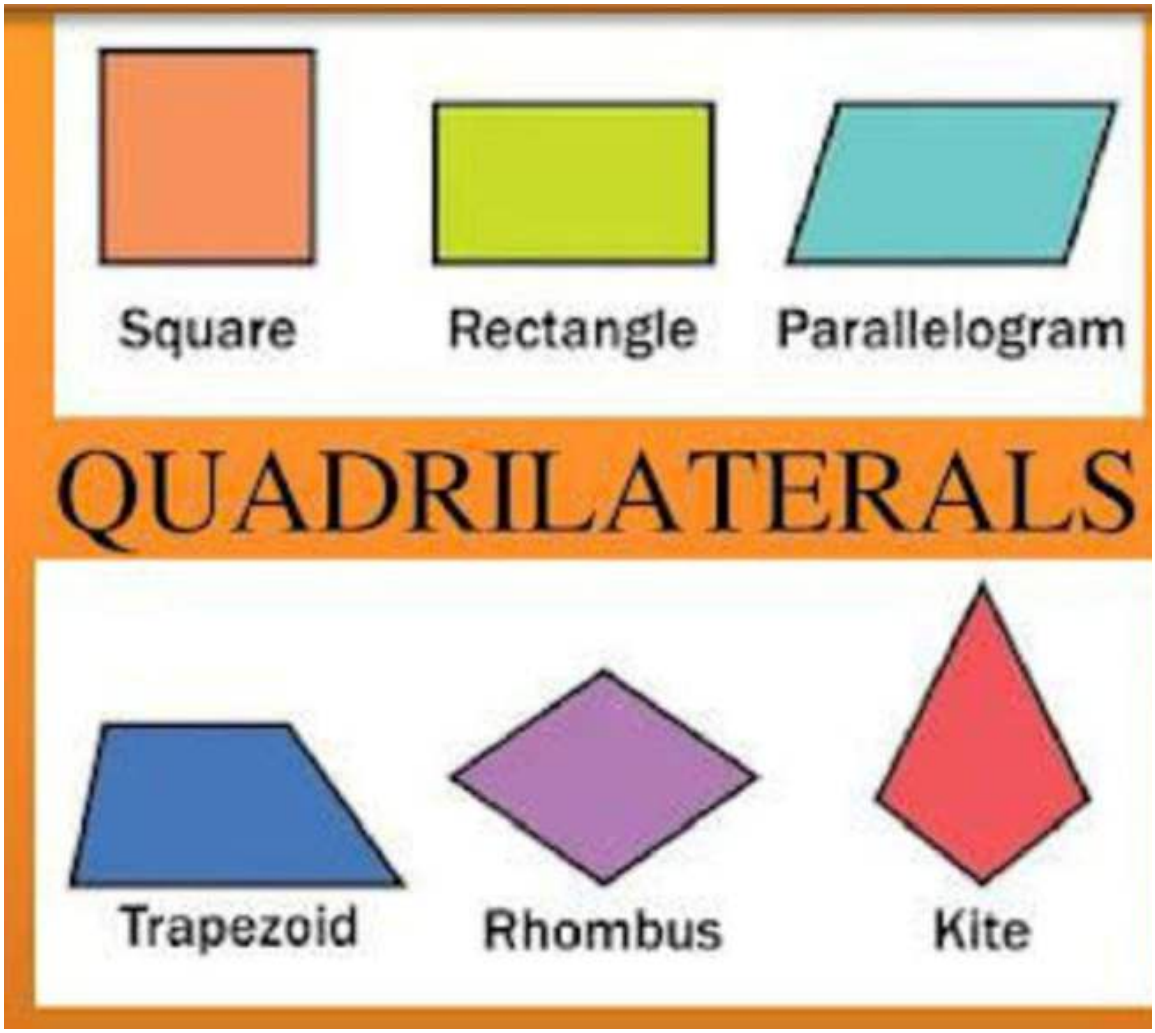
ACTIVITIES/ASSESSMENTS

<u>ACTIVITY ONE</u> : DRAW DIAGONALS OF ALL THE QUADRILATERALS BELOW

<u>ACTIVITY TWO</u> : WHAT DO YOU CONCLUDE ABOUT THE DIAGONALS – MAKE SPECIAL REFERENCE TO THE LENGTHS OF THE DIAGONALS – EXAMPLE ARE THE TWO DIAGONALS EQUAL IN LENGTH AND THE ANGLES WHEN THE DIAGONALS BISECT EACH OTHER EQUAL OR ARE PERPENDICULAR TO EACH OTHER



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ACTIVITY TWO : GROUP ACTIVITY

- Divide the class into 5 or 10 groups and give each group a sheet with one quadrilateral on it.
- Students need to name their quadrilateral, as specially as possible, and then cut it out.
- Use rulers and protractors to draw and measure diagonals and angles, find as many relationships as possible between opposite sides, opposite angles and diagonals.
- Ask them to find answer of following questions:
    - *Relation between lengths of sides.*
    - *Relation between angles.*
    - *Number of parallel pairs.*
- Ask each group to record its findings and write inside the shape.
- Invite one presenter in front of class and present the quadrilateral given to that group.
- Distribute a worksheet or draw the given table on board and then check mark each characteristic for reinforcement.
- Teacher leads students to recognize relationships between quadrilaterals and fill the table.
- Ask them to look for things similar to these quadrilaterals and write their names. This can be given as homework as well

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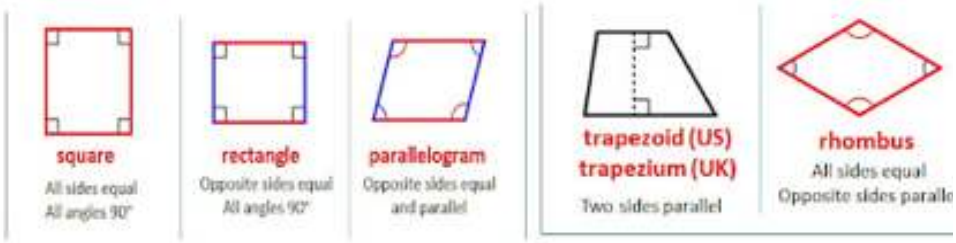
TOPIC : GEOMETRIC OF 2D SHAPES (CALCULATIONS OF SIDES , ANGLES AND DIAGONALS IN A QUADRILATERAL)					
LESSON 5					
Term	3	**Week**	9	**Grade**	9
Duration	1 Hour				
CONCEPTS AND SKILLS	All angles in a quadrilateral equals to 360				
RELATED CONCEPTS/ TERMS/VOCABULARY					
Paralellogram; Rhombus; Kite; Interior Angles Of Quad; Square; Rectangle					
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE					
Properties of the above quadrilateral					
RESOURCES					
Mind Action Series Grade 9; Answer Series Grade 9; Siyavula Workbook Grade 9					
ERRORS/MISCONCEPTIONS/PROBLEM AREAS					
• Not applying the properties of quadrilaterals to solve for missing angles • Not knowing the rules of equations to solve for unknown angles					
METHODOLOGY					
TEST PROPERTIES OF QUADRILATERAL PROPERTIES RECAP RECAP RULES FOR EQUATIONS					
					
ACTIVITIES/ASSESSMENTS					
ACTIVITY ONE :					

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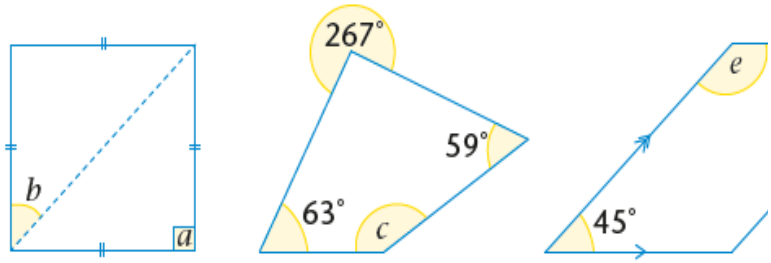
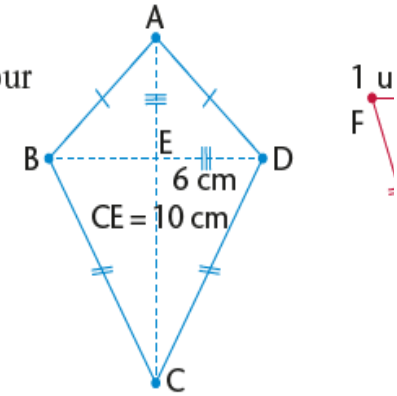
UNKNOWN SIDES AND ANGLES IN QUADRILATERALS

1. Determine the sizes of angles *a* to *e* in the quadrilaterals below. your answers.



2. Calculate the perimeters of the quadrilaterals on the right. Give your answers to two decimal places.



ACTIVITY TWO: HOMEWORK

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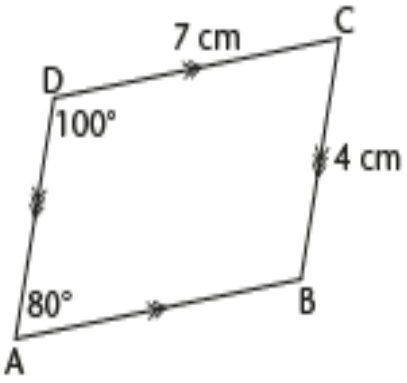
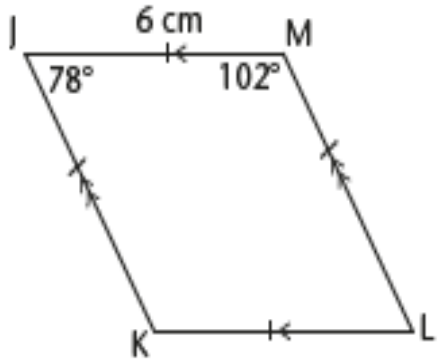
Find the length of all the **unknown sides** and **angles** in the f
Give reasons to justify your statements. (Also recall that the sur
quadrilateral is 360°.)

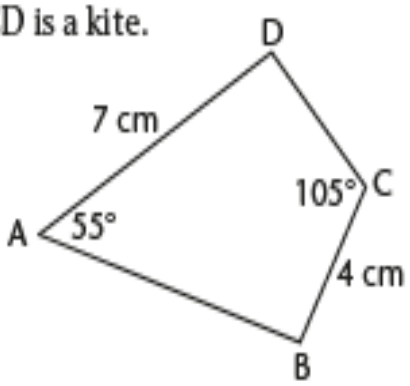
1.



2.



3. ABCD is a kite.



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TOPIC : GEOMETRIC OF 2D SHAPES (APPLICATIONS OF PROBLEM SOLVING)					
LESSON 6					
Term	THREE	**Week**	NINE	**Grade**	NINE
Duration	ONE HOUR			**Date**	
CONCEPTS AND SKILLS:	Application of all knowledge; of geometric shapes; Triangles interior and exterior angles, parallel lines				
RELATED CONCEPTS/ TERMS/VOCABULARY					
Isosceles Triangle; Equilateral Triangle; Right Angle Triangle; Parallel Lines					
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE					
Properties Of Triangles; Properties Of Interior And Exterior Angle Of Triangles; Properties Of Parallel Lines					
RESOURCES					
Mind Action Series Grade 9; Answer Series Grade 9; Siyavula Grade 9					
ERRORS/MISCONCEPTIONS/PROBLEM AREAS					
Not applying properties of triangles, parallel lines to solve problems; Not understanding the question; Not using algebraic equations					
PRACTICE PROBLEM SUMS Remember, Recall And Repeat Properties Application Of Problem To Enrich Ones Cognitive Level Of Thinking					
ACTIVITIES/ASSESSMENTS					

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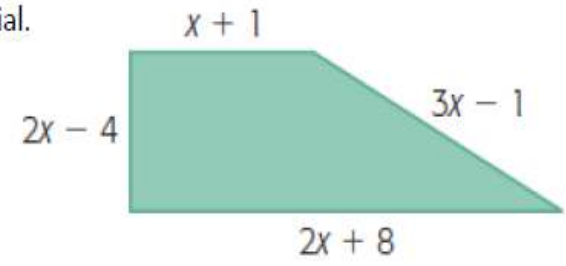
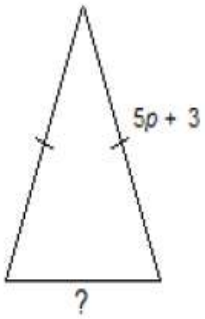
ACTIVITY ONE:
CLASSWORK

Express the perimeter as a simplified polynomial.



The perimeter of this isosceles triangle is represented by the polynomial $15p + 12$.
Write a simplified polynomial for the length of the unknown side.



a. $25p + 18$ b. $5p + 6$ c. $10p + 9$ d. $5p + 3$

ACTIVITY TWO:
PROBLEM SOLVING

The perimeter of a football field can be represented by $10x^2 - 6x + 14$ .The width of the football field is $2x^2 - 4x - 2$. What is the length of the football field ?

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Topic: Geometry of 2D shapes & Construction of geometric figures (Properties of triangles and quadrilaterals)

Name: **Surname:**

Marks: 17
Time: 20 minutes

Instructions

Read the following instructions carefully before answering the questions.

1. This paper consists of 3 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations in the spaces provided.
4. You may use a non-programmable scientific calculator.
5. Write neatly and legibly.

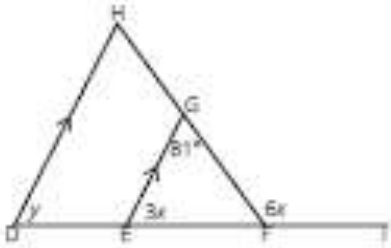
1. Find, giving reasons, the values of:

1.1 x (3)

1.2 y. (4)

[7]

2. Determine the value of:



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Question 6

In the diagram, the area of $\triangle STU$ is 150 cm².

6.1 Calculate the length of TU. (4)

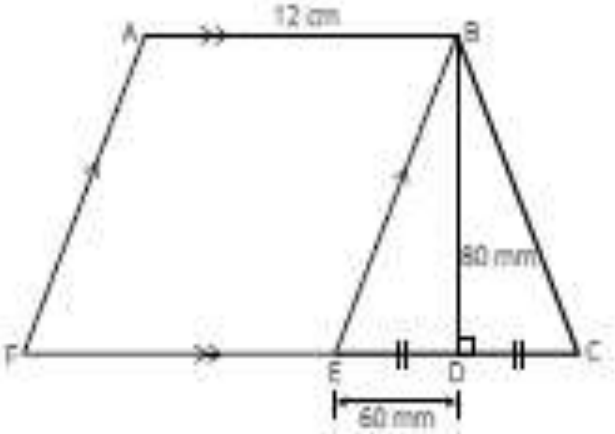
6.2 Determine the value of x. (4)

[8]

Question 7

7.1 Write down the formula for the area of a square. (1)

7.2 Calculate the area of ABCF and give your answer in cm. (5)



[6]

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TOPIC: GEOMETRIC OF 2D SHAPES (APPLICATIONS OF GEOMETRIC FIGURES WITH QUADRATICS)					
LESSON 7					
Term	3	**Week**	9	**Grade**	9
Duration	1 Hour			**Date**	
CONCEPTS AND SKILLS	Applications of quadratics; problem solving sums Applications properties of quads to solve problems				
RELATED CONCEPTS/ TERMS/VOCABULARY					
Rhombus; Parallelogram; Kite; Diagonals					
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE					
Properties of quadrilaterals; properties of triangles; sum of interior angle equal to sum of exterior angle of triangle; parallel lines; perpendicular angles; Equations					
RESOURCES					
DBE Workbook Answer Series Mind Action Series Grade 9					
ERRORS/MISCONCEPTIONS/PROBLEM AREAS					
Not using the properties of quadrilaterals, parallel lines, equations to solve problematic sums					
METHODOLOGY Remember, repeat and revise all properties of quadrilaterals; Parallel lines, and equations before attempting problem sums					

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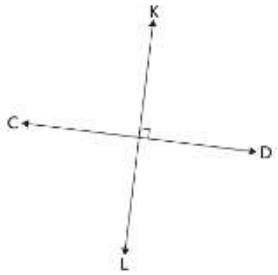
PERPENDICULAR LINES

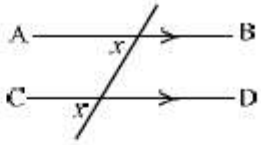
Lines CD and KL below are perpendicular to each other. The symbol ⊥ is used to indicate perpendicular lines. We write: CD ⊥ KL.



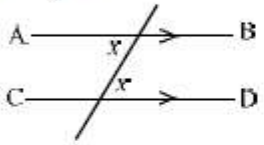
1. How many angles are formed at the point where the above two lines meet?

Vertically opposite angles
Vertically opposite angles are equal.

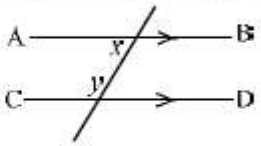
Corresponding angles
If AB||CD, then the corresponding angles are equal.



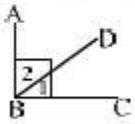
Alternate angles
If AB||CD, then the alternate angles are equal.



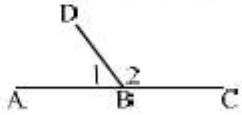
Co-interior angles
If AB||CD, then the co-interior angles add up to 180°, i.e. $x + y = 180°$



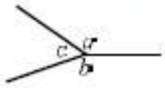
Complementary angles
In the diagram, $\hat{B}_1 + \hat{B}_2 = 90°$



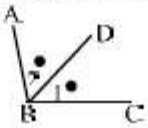
Adjacent supplementary angles
In the diagram, $\hat{B}_1 + \hat{B}_2 = 180°$



Angles round a point
In the diagram, $a + b + c = 360°$



Bisectors of angles
BD bisects $A\hat{B}C$ since $\hat{B}_1 = \hat{B}_2$



ACTIVITIES/ASSESSMENTS

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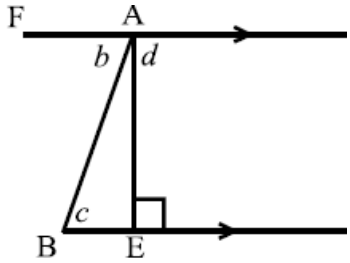
ACTIVITY ONE

ABCD is a parallelogram with $AE \perp BC$. Calculate, with reasons, the value of a, b, c and d.

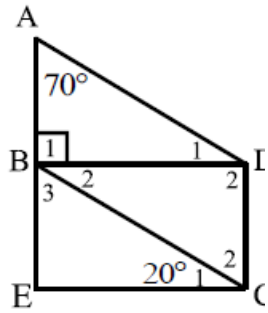


ABCD is a parallelogram with $\hat{B}_1 = 90°$ and $\hat{A} = 70°$.

(1) Calculate, with reasons, the size of $\hat{D}_1$, $\hat{D}_2$, $\hat{B}_2$ and $\hat{B}_3$.

(2) Prove that BECD is a parallelogram.

(3) Prove that BCED is a rectangle.



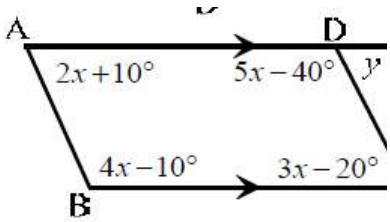
ACTIVITY TWO

In trapezium ABCE, AE||BC with $\hat{E} = 70°$.

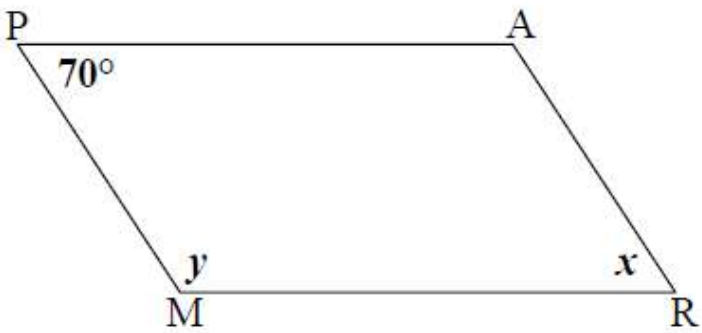
(1) Calculate the value of x.

(2) Show that ABCD is a parallelogram.

(3) Show that $AB = CE$.



In the following diagram, PARM is a parallelogram.



Determine the values of x and y.

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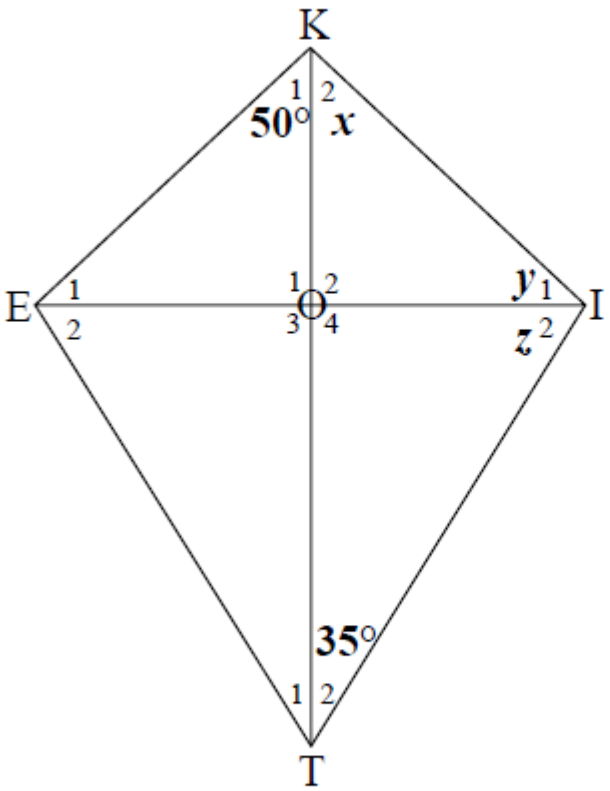
ACTIVITY THREE

KITE is a kite.



Determine the values of x, y and z.

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TOPIC: SURFACE AREA AND VOLUME OF 3D SHAPES					
LESSON 1					
Term	4	**Week**	5	**Grade**	9
Duration	1Hour	**Date**			
Concepts Skills	By the end of the lesson learner should know and able to use appropriate formulae and conversions between SI units to solve problems and calculate the surface Area and volume of cubes and the effects of doubling any or all dimensions.				

RELATED CONCEPTS/ TERMS/VOCABULARY/EAC

Perimeter, Area, tessellation, SI unit, Volume, Capacity

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Area, Volume, Surface Area, Perimeter, transformation.

RESOURCES

Inzalo, Workbook, Textbook, Playfield, Measuring instruments (ruler, metre stick, measuring tape and truddle wheel)

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Conversions, confusion of formulae, tessellation, face, vertices and edges

METHODOLOGY

The teacher asks learners to define Volume, Capacity. Revision of the SI units and conversions between the units of length, area and volume.

The teacher will demonstrate the activity below and allow learners to do their own activity.

Example 1

Convert the following:

(i) $45cm^2$ to m^2

$10\ 000\ cm^2 = 1\ m^2$

$\therefore 45\ cm^2 = 4{,}5 \times 10^{-3} m^2$

(ii) $0{,}002\ m^3$ $to\ cm^3$

$1m^3 = 10^6 cm^3$

$\therefore 0{,}002\ m^3 = 2000$

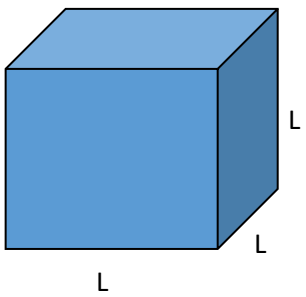
(iii) 75ml to l

$1000\ ml = 1\ l$

$\therefore 75\ ml = 0{,}075l$

Example 2

Show learners how to derive the formular of surface area and volume of a cube and allow learners to do activity 2.



Guided Practice 1

Convert the following:

(i) $65\ 000\ mm^2$ to km^2

(ii) $4\ cm^3$ to mm^3

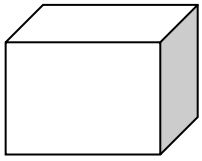
(iii) $0{,}123\ m^3$ to l

Guided Practice 2

Calculate the surface area, volume and capacity of cube with dimensions of 3 cm.

activity 3

Work out the volume of a cube below when all three dimensions are doubled.



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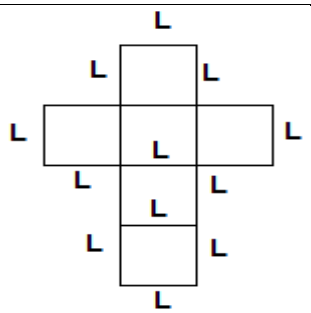

- Total surface area = $2\,L \times L + 2\,L \times L + 2\,L \times L$
  $= 6\,L^2$

- Volume = Base area x height
  = (L x L) x L
  $= L^3$

Example 3

Complete the following:

(a) When one dimension of a cube is doubled, the volume <u>would not be that of a cube.</u>

(b) When all three dimensions of a cube are doubled, the volume increases by **<u>8</u>** times the original figure.

Example 4

A textbook in shape of a cube has a volume of 638, 25cm^3. What is the maximum number of textbooks that can fit into a box that has a capacity of 2,5 m^3? Round to the nearest whole number.

Solution

$1m^3 = 10^6 cm^3$

$2{,}5\ m^3 = 2{,}5 \times 10^6\ \ cm^3$

$\therefore$ number of textbooks $= \frac{2{,}5\times10^6}{638{,}25}$

$= 3917$

ACTIVITIES/ASSESSMENTS: Homework (informal)

Activity 10 DBE workbook page 92 activity 101, in their books learners will draw a rectangular prism with:

10.1. height of 40mm, length of 5cm and width of 3,5mm

10.2. calculate the surface area (answer in mm).

10.3. the volume. (answer in mm).

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TOPIC: SURFACE AREA AND VOLUME OF 3D SHAPES					
LESSON 2:					
Term	4	**Week**	5	**Grade**	9
Duration	1 hour	**Date**			

1. Concepts and Skills	Calculation of the surface area and volume using the correct formulae and Doubling of 3D objects.

2. RELATED CONCEPTS/ TERMS/VOCABULARY

Cube, prism

3. PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Surface area, Volume, Capacity, Properties of 3D objects, Measurement.

4. RESOURCES

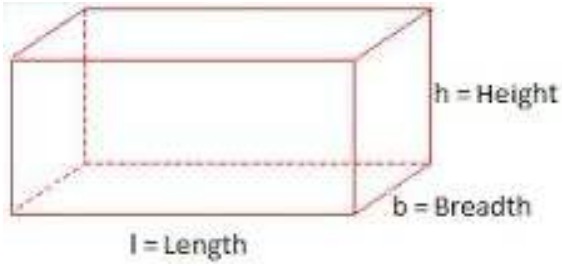
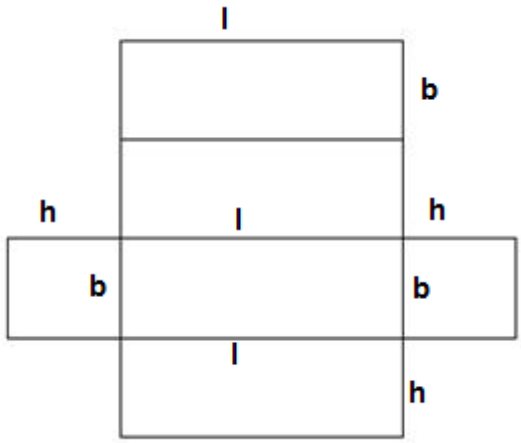
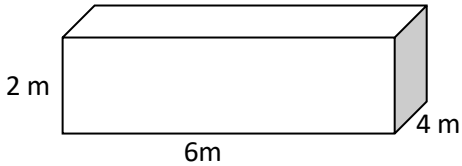
Textbook, DBE workbook 2, rectangular box, ruler

5. ERRORS/MISCONCEPTIONS/PROBLEM AREAS

SI units,

6. METHODOLOGY

7. LESSON PRESENTATION/DEVELOPMENT(Suggested time: 20 minutes)

Teaching activities	**Learning activities** (Learners are expected to:)
Show learners how to derive the formula of the surface area and volume of a rectangular prism and allow them to do activities in the learner activity column Example 1   Surface Area = sum of area of all faces	do activities below activity 1 Draw net and calculate the surface area and volume of the figure below  activity 2 The volume of a prism is $80cm^3$. What is its volume if: (a) its length and breadth are doubled? (b) its length, breadth and height are doubled?

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$= 2(l \times h) + 2(l \times b) + 2(b \times h)$
$= 2(lh + lb + bh)$

Volume $= l \times b \times h$
$= lbh$
$= (lb) \times h$
= area of base × height

Example 2
If the volume of a rectangular prism is 30 cm^3 and its height is $5cm$, its length is 2 cm, what is its width?

Solution
$Volume = l \times b \times h$
$30\ cm^3 = 2\ cm \times b \times 5\ cm$
$b = \frac{30}{10}\ cm$
$b = 3\ cm$

Activity 3
The volume of a prism is 80 cm^3. What is its volume if its length is doubled?

Solution
$V_{original} = l \times b \times h = 80\ cm^3$
$V_{new} = 2\ l \times b \times h$
$= 2V_{original}$
$V_{new} = 2(80\ cm^3)$
$V_{new} = 160\ cm^3$

8. ASSESSMENT/ ACTIVITIES

CLASSWORK(Suggested time: 15 minutes)

The volume of a rectangular prism is 125 cm^3 and its height is 5 cm.Is it possible for all 3 of its dimensions (base, height, width) to be the exact same measurement? Explain.

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TOPIC: SURFACE AREA AND VOLUME OF 3D SHAPES					
LESSON 3:					
Term	4	**Week 5**		**Grade**	7
Duration		**Date**			
Concepts and Skills	Learners should be able to derive the formula and calculate the volume of a Triangular prism.				

RELATED CONCEPTS/ TERMS/VOCABULARY

Trio, angle, perpendicular,

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Learners can define the following:
Volume; Surface area; Have understanding of the properties of 3D.

RESOURCES

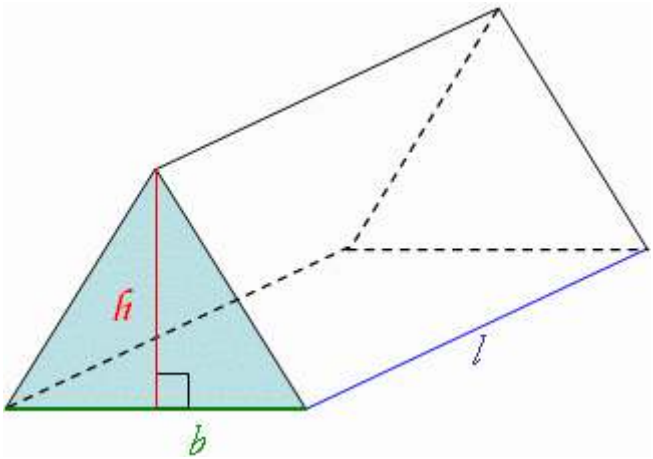
Textbooks, DBE book 2, Learners book

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

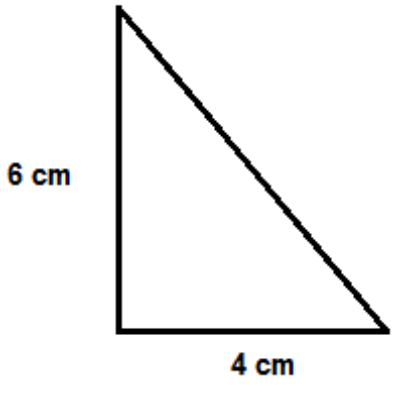
Height vs other parts of the 3D objects.

METHODOLOGY

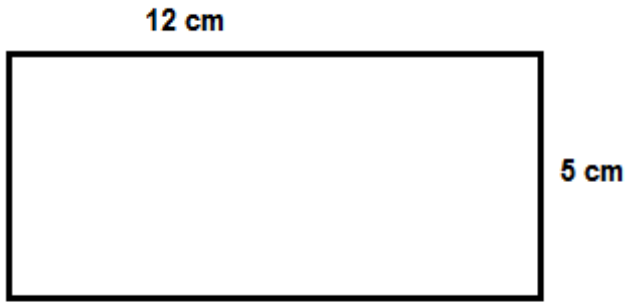
The teacher uses a model of triangular prism to remind learners that in a triangular prism, surface area is made up of rectangles and bases are triangles.



Learners calculate the area of each figure below.



(a)



(b)

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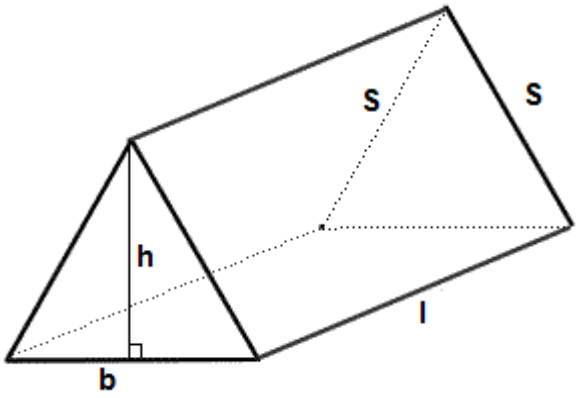
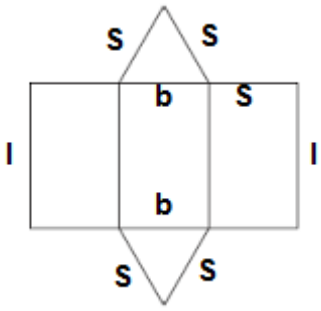
Show learners how to derive the formula of the surface area and volume of a triangular prism and allow them to do activities under learning activities column

Example 1





Surface area = sum of the area of all faces

$$= 2 \times \left(\frac{1}{2} \times b \times h\right) + 2(S \times l) + (b \times l)$$

$$= b \times h + 2(S \times l) + b \times l$$

NB: triangles may not always be isosceles and if not isosceles rectangles will be different.

Volume = $(\frac{1}{2} \times b \times h) \times l$

$= area\ of\ base \times height$

Note that letter h is the height of a triangle and l is the height of the prism. Capital Letter H may be used for the height of the prism.

Example 2

(i) Calculate the surface area, volume and capacity of a figure below.

(ii) Calculate the new volume of the triangular prism if both dimensions of a triangle are doubled.

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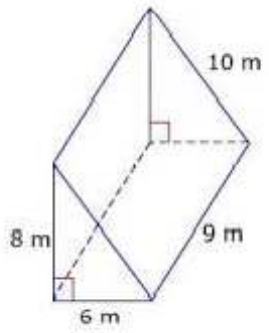

(i) Surface area = $2\left(\frac{1}{2} \times 6\ m\ \times 8\right) + (10\ m \times 9\ m) + (8\ m \times\ 9\ m) + (9m \times 6m)$

$= 48 + 90 + 72 + 54$

$= 264\ cm^2$

Volume = $\left(\frac{1}{2} \times 6\ m \times 8\ m\right) \times 9\ m$

$= 216\ m^3$

Capacity = $216 \times 10^6\ cm^3$

$= 216\ \times 10^6\ ml$

$V_{new} = (\frac{1}{2} \times b \times h) \times l$

$= (\frac{1}{2} \times 2b \times 2h) \times l$

$= 2(\frac{1}{2} \times b \times h) \times l$

$= 2 \times V_{original}$

$= 2 \times 216\ m^3$

$= 432\ m^3$

ACTIVITIES/ASSESSMENTS: Classwork, Homework (informal)

Homework:

Activity 1(learner book)

(i) Calculate the surface area , volume and capacity of a figure below:

(ii) Calculate the new volume of the triangular prism if dimensions 2 cm and 5 cm are doubled.

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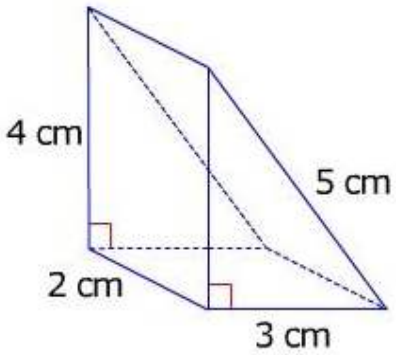
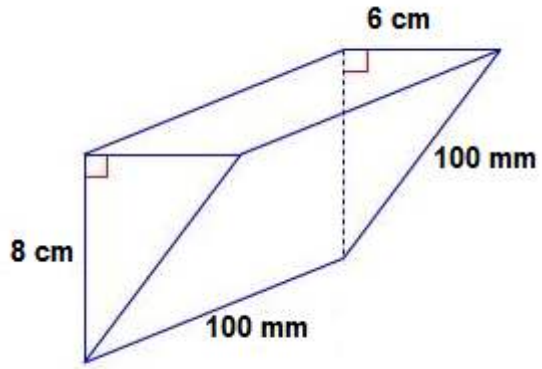


(iii) Calculate the surface area, volume and capacity of a figure below.

(iv) Calculate the new volume of the triangular prism if all dimensions are doubled



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TOPIC : SURFACE AREA AND VOLUME OF 3D OBJECTS					
LESSON 4:					
Term	4	**Week**	6	**Grade**	9
Duration	IHOUR	**Date**			
Concepts and Skills	Learners should know and be able to recognize and describe the properties of a cylinder.				

RELATED CONCEPTS/ TERMS/VOCABULARY, EAC

Net, curved, straight, congruent, similar, circular

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Types of 3D, Properties of 2D,

RESOURCES

Textbooks, DBE workbooks

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

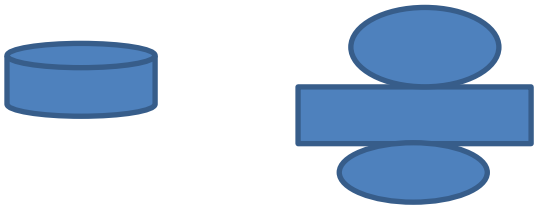
Unable to differentiate between a circle and oval.

Confusing a circumference for radius.

METHODOLOGY

Present the following activity as a worksheet

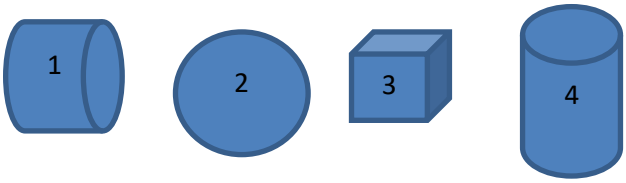
Activity 1 Work in pairs and report to the whole class



a. How many faces does a cylinder have?
b. Name the shape of the faces.
c. What is the length of the rectangle in terms of π and r.
d. What is the breadth of the rectangle.

NB.Practical example may be used to explain c and d.

Activity 2



1. Name each of the solids.

If number 4 has a height of 2cm and a radius of 1cm, construct an accurate net for this figure.

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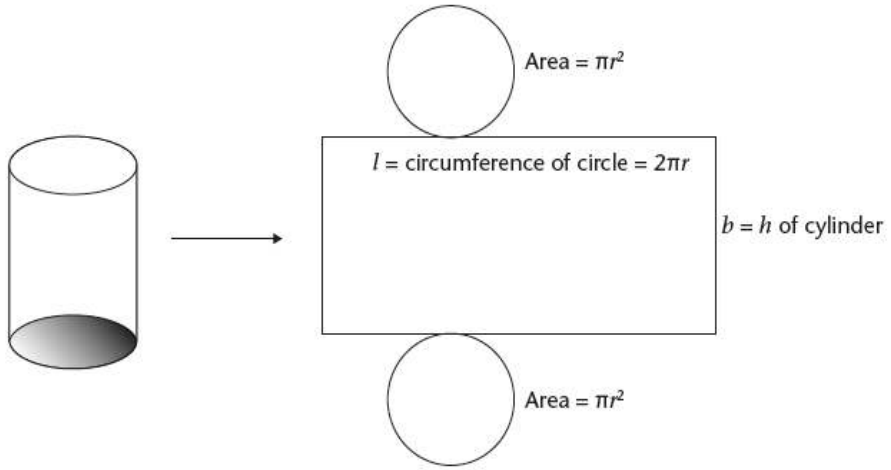
TOPIC : SURFACE AREA AND VOLUME OF 3D OBJECTS					
LESSON 5:					
Term	1	**Week**	5 and 6	**Grade**	9
Duration		**Date**			
Concepts and Skills	Calculate the capacity, area and volume of a cylinder				
RELATED CONCEPTS/ TERMS/VOCABULARY					
Circle, circumference, radii, centre, straight, curved.					
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE					
Capacity, Surface area, the value of π rounded off to two decimal places 3,14					
RESOURCES					
Textbooks, DBE workbooks, A4 paper, pair of scissors, sticky tape, ruler					
ERRORS/MISCONCEPTIONS/PROBLEM AREAS					
Value of pie; Height; Addition and place values of decimals					
METHODOLOGY					

Example 1

The teacher shows learners how to derive the formula of the surface area and volume of a cylinder.



Surface area of a cylinder = Area of all its surfaces

= Area of top circle + Area of base (bottom circle + Area of curved surface

$$= \pi r^2 + \pi r^2 + (l \times b)$$
$$= 2\pi r^2 + (2\pi r \times h)$$
$$= 2\pi r(r + h)$$

Volume of a cylinder = $area\ of\ base \times h$

$= \pi r^2 \times h$

Example 2

(i) Calculate the surface area , volume and capacity of a figure below:

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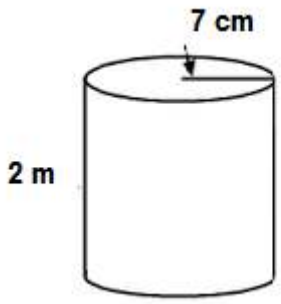


(ii) Calculate the new volume of the cylinder if the height dimension is doubled.

Solution

(i) Surface area $= 2\pi r(r + h)$

$= 2\pi(7cm)(7cm + 200cm)$

$= 9104\ cm^2$

Volume $= \pi r^2 \times h$

$= \pi(7cm)^2 \times 200cm$

$= 30787\ cm^3$

Capacity $= 30787\ cm^3 = 30787\ ml$

(ii) $V_{original} = \pi r^2 h\pi = 30\ 787\ cm^3$

$V_{new} = \pi r^2 \times 2h$

$= 2\pi r^2 h$

$= 2V_{original}$

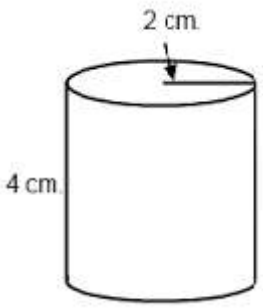
$= 2(30\ 787\ cm^2)$

$= 61\ 574\ cm^2$

Assessments and activities

Activity 1

(i) Calculate the surface area, volume and capacity of a figure below:



(ii) Calculate the new volume of the cylinder above if the dimension of the radius is doubled.

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Activity 2
Homework: DBE workbook 104b page 106

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TOPIC : SURFACE AREA AND VOLUME OF 3D OBJECTS					
LESSON 6:					
Term	4	**Week**	6	**Grade**	9
Duration	1hour	**Date**			
Concepts and Skills	Recognizes and able to create models of cubes using nets.				

RELATED CONCEPTS/ TERMS/VOCABULARY, EAC

Models, hexahedron.

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Geometric object, Nets of 3D

RESOURCES

Textbooks, DBE workbooks, pair of scissors, worksheets, mathematical instruments and glue

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

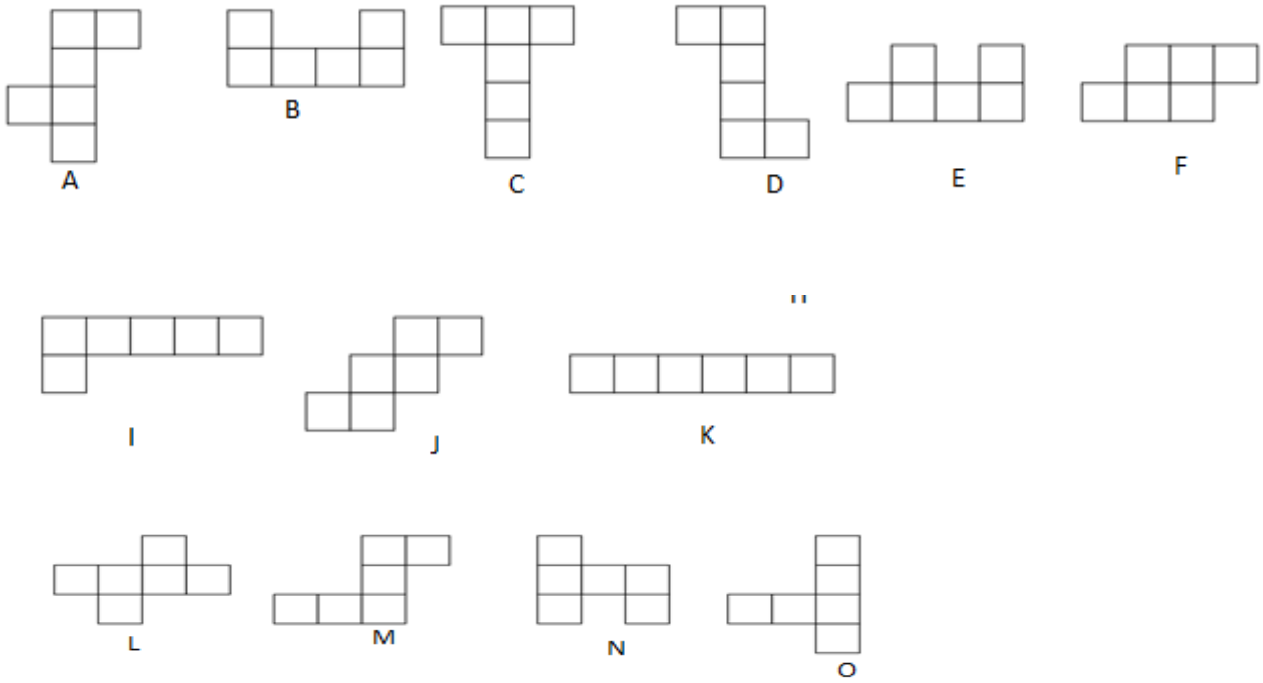
Inability to distinguish between the nets of a cube and that of a rectangular prism.

METHODOLOGY

Working in small groups learners will:

- Construct a square with each side of $6cm$.
- Trace the square to make 5 more.
- Arrange them to make a net of cube
- Use the net to make a model of a cube.

The teacher will then present learners with the worksheet below ask them to identify the correct nets of a cube from the given nets.



The teacher further explains that from a 2D with six sides being called a hexagon, for its six equal plane faces a cube is called a hexahedron.

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ASSESSMENT/ACTIVITIES

Activity 1 (classwork)

Learners' books

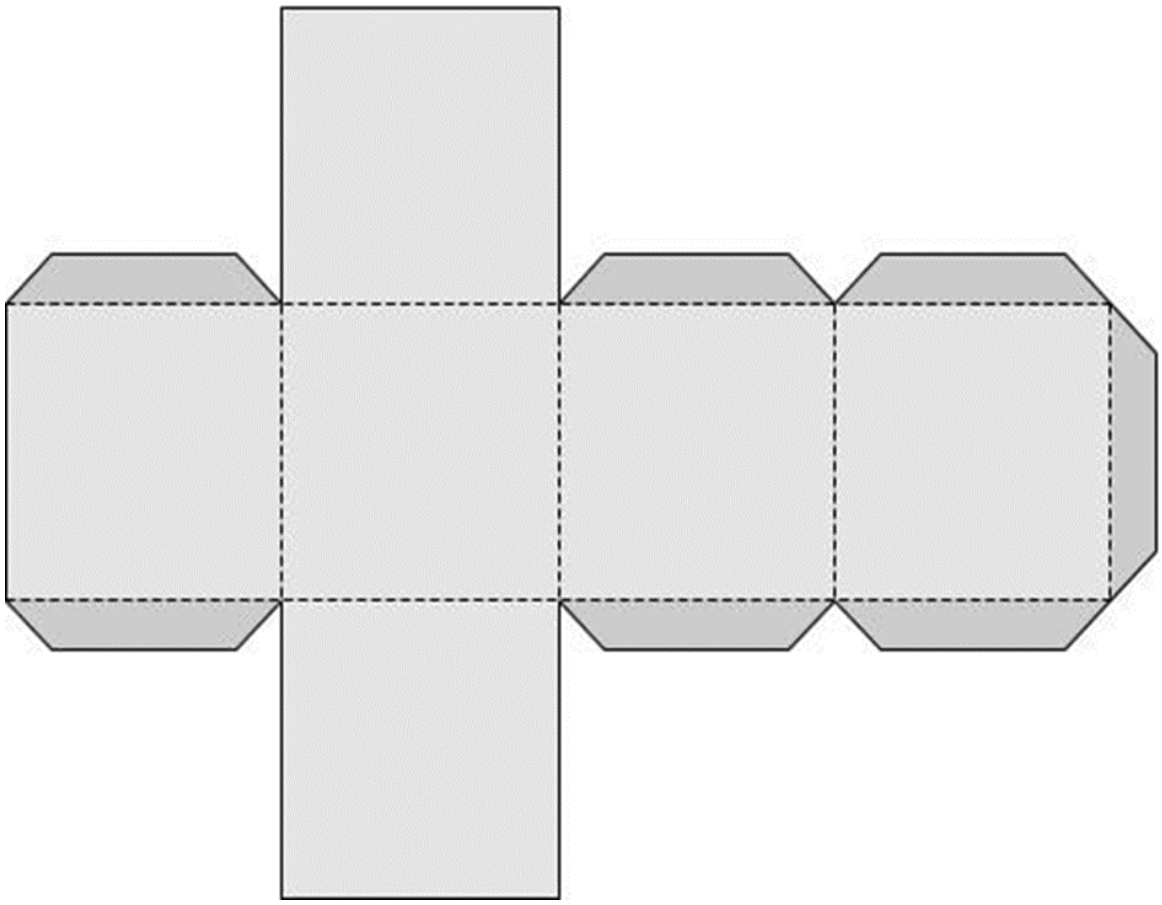
Having been able to identify the correct net a cube, learners will now draw their own nets of a cube with each side equals to 2cm.

Activity 2 (homework)

DBE workbooks activity 56, page 123

Activity 3 (Project)

In consolidation of the concept the following net will be made available for learners to engage on it (may take a day or two to submit).



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TOPIC : SURFACE AREA AND VOLUME OF 3D OBJECTS					
LESSON 7:					
Term	4	**Week**	6	**Grade**	9
Duration	1 HOUR	**Date**			
Concepts and Skills	Ability to use nets to create model prisms				

RELATED CONCEPTS/ TERMS/VOCABULARY, EAC

Similar, Congruent, Pyramids, Apex, Bases.

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Can construct the cube models using nets; Ability to recognize the nets of hexahedrons; Should have acquired knowledge on properties of cubes, squares and rectangles

RESOURCES

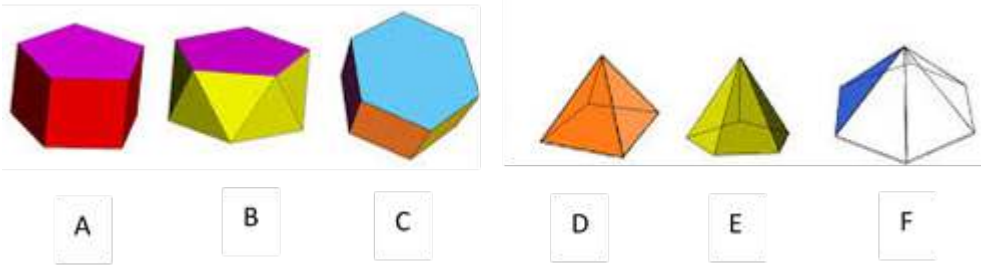
Textbooks, DBE Workbooks, pair of scissors, rulers ,glue-stick, worksheets with nets of prisms

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Distinguishing between a prism and pyramids.

METHODOLOGY

- Ask learners to define the **prism** using their own understanding.
- Allow learners some time to study the 3D below.



- Ask learners to identify objects with faces that are parallel.
- Explain to them what a polyhedral prism is.
- Ask the now to identify polyhedral prism.
- Explain the difference between prisms and pyramids.
- Let them sort the prisms and pyramids.
- Some of the answers that may be expected:

  Prism definition: A prism is a polyhedral with two identical and parallel faces called bases.
  Prism: A, B and C
  Pyramids: D, E and F
- Working in groups learners will be provided with the figures below to study them:

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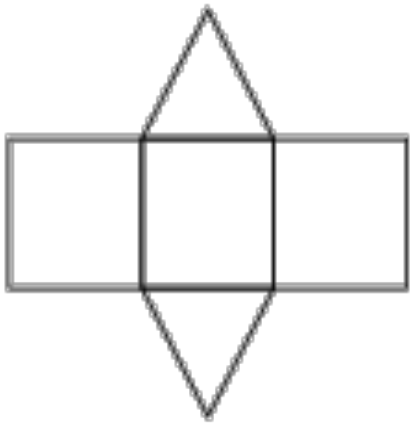

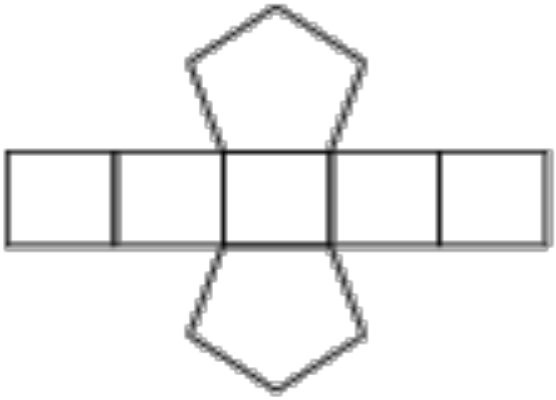

- Ask learners to identify the object model that can be made from the above nets.
- Learners cut out similar nets (ensure that nets have flaps to stick the glue-stick).
- Use the cutout nets to model the 3D objects and give the properties of each.
- Emphasize the importance of the bases of prisms as they are named according to their bases.

Assessment/ Activities

Activity 1: Classwork
Working individually
Learners will construct with flaps in appropriate places, an accurate net for a rectangular prism. If the square face has sides of 2*cm* and the distance between the square faces is 5*cm*.Cut the net out and constructs the solid.
Activity 2: Classwork
Construct with tabs(flaps) in appropriate places, an accurate net for a triangular prism. If the equilateral has sides of 5cm and the distance between the triangular faces is 7cm.Cut the net out and constructs the solid.
Activity 3: Homework
In addressing the issue of all cognitive levels learners will be assigned the activity from the **DBE workbook page 115 activity 1 to 5.**

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TOPIC : SURFACE AREA AND VOLUME OF 3D OBJECTS					
LESSON 8:					
Term	4	**Week**	6	**Grade**	9
Duration	1 hour	**Date**			
Concepts and Skills	Ability to use nets to create geometric solids- pyramids				

RELATED CONCEPTS/ TERMS/VOCABULARY, EAC

Apex , irregular, regular

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Knowledge of polygons; Types and properties of 3D; Difference between Pyramids and Prisms

RESOURCES

Textbooks, DBE workbooks, Protractors.

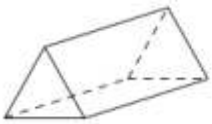
ERRORS/MISCONCEPTIONS/PROBLEM AREAS

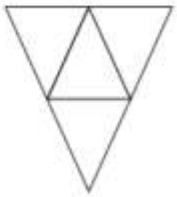
METHODOLOGY

As a form of revision, the teacher will pair learners and provide the worksheet below: (Pairs)

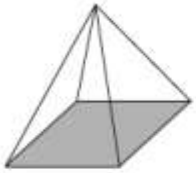
1. Name each object below and draw an arrow to match it with its net.

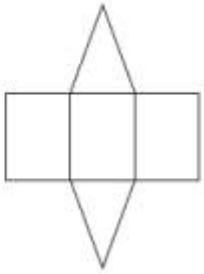
(a)



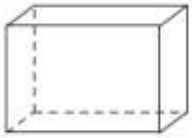
..... 

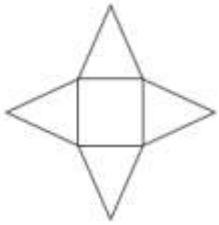
(b)



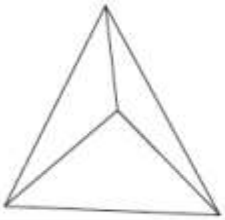
..... 

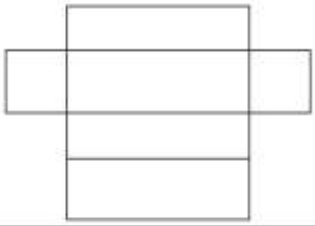
(c)



..... 

(d)



..... 

- While correct the pair activity above learners will be engaged in the group activity below:

Step 1

construct an equilateral triangle with dimensions 4 cm

Step 2

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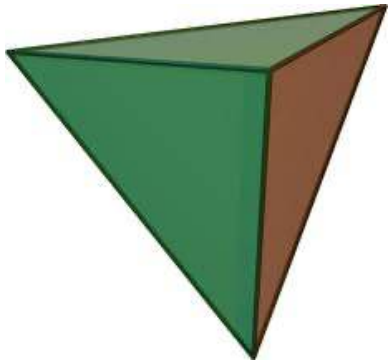
Trace the constructed triangle to make three more triangles.

Step 3

Cut out the triangles and leave flabs where necessary.

Step 4



Join the triangles to make 3D object like the one below.

Guiding question to learners:

What type of 3D object is formed by the four equilateral triangles joined together?

Expected information by learners and the teacher:

It is called tetrahedron or triangular pyramid.

Right pyramid: the apex of the pyramid is directly above the center of its base

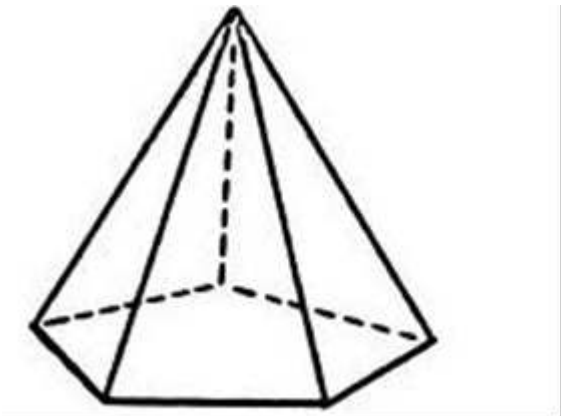
Regular pyramid: the base of this pyramid is a regular polygon (equal sides on the base)

Irregular pyramid: this type of pyramid has an irregular polygon as its base (sides are not equal).

Assessment/ Activities:

Activity 1

- Provide learners with the model below and they paste it in their books.
- Learners expected to study and answer the question.



a) What is the name of the pyramid above?

b) How many faces does it have?

c) Draw the net of the pyramid above.

Activity 2

- Learners are instructed to bring along a list of five real life object that looks like the pyramids and they could also bring along the pictures.

Activity 3

DBE workbook page 132, activity 72

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