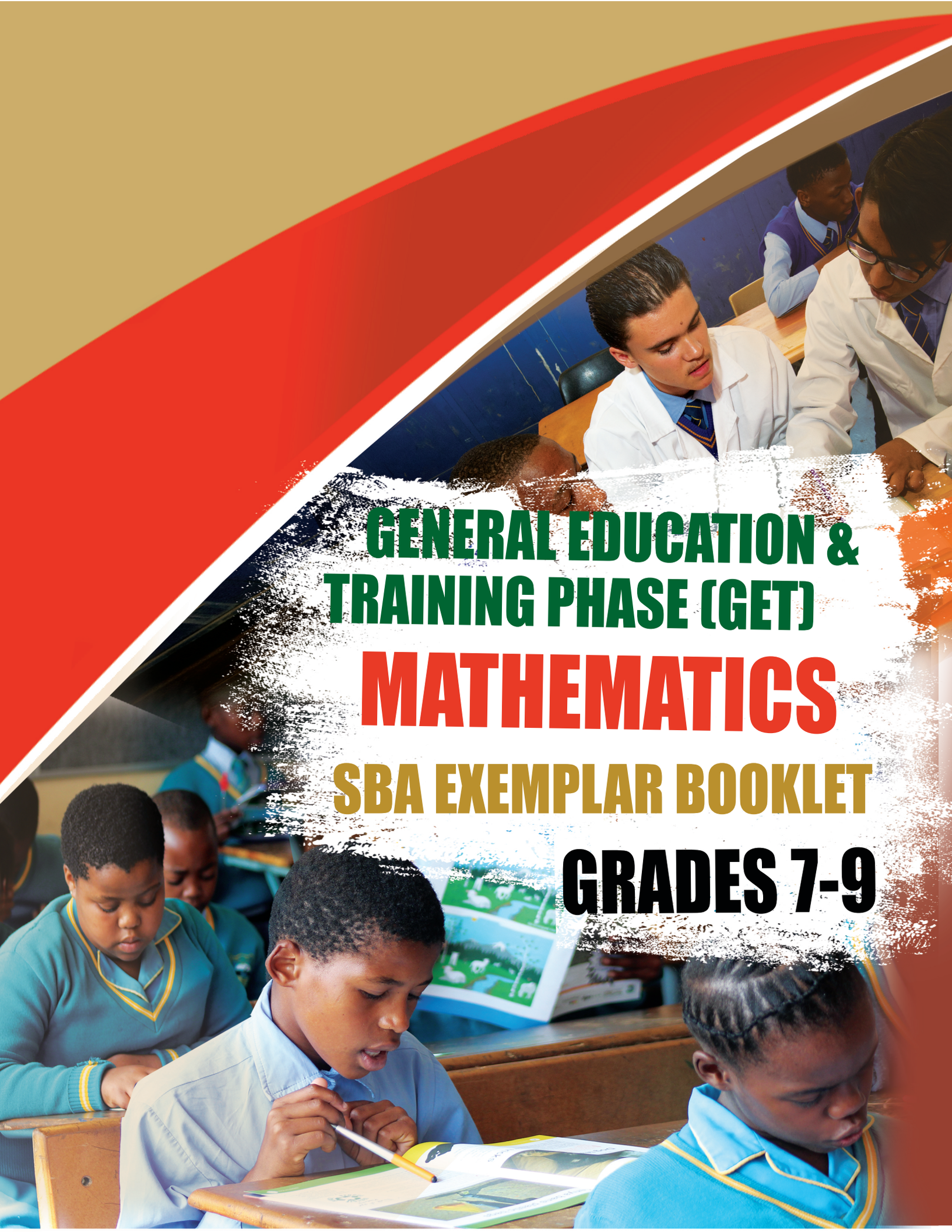


GENERAL EDUCATION & TRAINING PHASE (GET)

MATHEMATICS

SBA EXEMPLAR BOOKLET

GRADES 7-9

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

Read to Lead
A Reading Nation is a Leading Nation

2030 NDP

FOREWORD

The Department of Basic Education has pleasure in releasing a subject exemplar booklet for School Based Assessment (SBA) to assist and guide teachers with the setting and development of standardised SBA tasks and assessment tools. The SBA booklets have been written by teams of subject specialists to assist teachers to adapt teaching and learning methods to improve learner performance and the quality and management of SBA.

The primary purpose of this SBA exemplar booklet is to improve the quality of teaching and assessment (both formal and informal) as well as the learner's process of learning and understanding of the subject content. Assessment of and for learning is an ongoing process that develops from the interaction of teaching, learning and assessment. To improve learner performance, assessment needs to support and drive focused, effective teaching.

School Based Assessment forms an integral part of teaching and learning, its value as a yardstick of effective quality learning and teaching is firmly recognised. Through assessment, the needs of the learner are not only diagnosed for remediation, but it also assists to improve the quality of teaching and learning. The information provided through quality assessment is therefore valuable for teacher planning as part of improving learning outcomes.

Assessment tasks should be designed with care to cover the prescribed content and skills of the subject as well as include the correct range of cognitive demand and levels of difficulty. For fair assessment practice, the teacher must ensure that the learner understands the content and has been exposed to extensive informal assessment opportunities before doing a formal assessment activity.

The exemplar tasks contained in this booklet, developed to the best standard in the subject, is aimed to illustrate best practices in terms of setting formal and informal assessment. Teachers are encouraged to use the exemplar tasks as models to set their own formal and informal assessment activities.

MR HM MWELI

DIRECTOR-GENERAL

DATE: 13/09/2017

Table of Contents

1. INTRODUCTION

Assessment in the National Curriculum Statement Grades R – 12 comprises School-Based Assessment (SBA) for subjects offered in the General Education and Training band (GET) and a final end-of-year examination.

School-Based Assessment is designed to address the content competencies, skills, values and attitudes of the subject, and to provide learners, parents and teachers with results that are meaningful indications of what the learners know, understand and can do at the time of the assessment.

School-Based Assessment allows for learners to be assessed on a regular basis during the school year. This assessment is a compulsory component for progression and promotion in all the different school phases and includes a variety of forms of assessment as contemplated in Chapter 4 of the Curriculum and Assessment Policy Statements. Moderation should ensure that the quality and standard of the School-Based Assessment, as contemplated in Chapter 4 of the Curriculum and Assessment Policy Statements, have been met.

2. AIMS AND OBJECTIVES

When the Department of Basic Education (DBE) engaged with the provinces and districts to strengthen the SBA, it was revealed that many schools across the country grapple to understand and develop good quality examinations, investigations and projects.

The purpose of this document is to provide both teachers and learners with a set of quality-assured SBA tasks. This document was also developed with an intention to engage Provincial Education Departments (PEDs) on aspects to be considered when capacitating their teachers on the setting of quality SBA tasks.

This document provides exemplar tasks that reflect the depth of Mathematics curriculum content appropriate for Grades 7, 8 and 9. Every effort has been taken to ensure that the distribution of marks in the tasks is in accordance with the cognitive levels of the taxonomy used in the Mathematics CAPS document.

3. EXEMPLAR ASSESSMENT TASKS

The exemplar assessment tasks in this booklet are presented according to the forms of assessment that include *Assignments, Examinations, Investigations* and *Projects* for the Senior Phase. Exemplars of each of these forms of assessment are meant to demonstrate to subject advisors and teachers how they should be developed. Detailed descriptions of these forms of assessment and issues to consider when developing them are presented prior to the actual exemplars. It is anticipated that PEDs will continue to mediate the exemplars and ensure that teachers acquire the skills of developing the SBA tasks for their learners.

4. COGNITIVE LEVELS IN MATHEMATICS

Effort was taken to ensure that the assessment tasks, especially examinations, comply with the following distribution of marks according to the cognitive levels as contemplated in Chapter 4 of CAPS for Mathematics:

Knowledge	Routine procedures	Complex procedures	Problem solving
25%	45%	20%	10%

In determining the level of complexity and cognitive demand of a task, consideration should be given to the extent to which the task requires the use of integrated content and skills drawn from different topics, the complexity of the context in which the problem is posed, the influence of non-mathematical considerations on the problem, and the extent to which the learner is required to make sense of the problem without guidance or assistance.

5. ASSIGNMENTS

(a) Purpose of a mathematics assignment

A Mathematics **assignment**, as is the case with tests and examinations, is mainly an individualised task. It can be a collection of past questions, but should focus on more demanding work as any resource material can be used, which is not the case in a task that is done in class under supervision. An assignment could provide learners with the opportunity to consolidate a topic or section that has been covered in class, or to apply an approach or method studied in class to a new context, or to revise for tests and/or examinations. Both the content and contexts of the assignment are likely to be familiar to the learner.

(b) Developing a mathematics assignment

Since an assignment is primarily meant to consolidate the mathematics topics learnt and to prepare learners adequately for the test/examination, the questions constituting an assignment could be selected from the appropriate questions in the previous question papers. However this does not preclude teachers from developing their own questions that are pitched at different cognitive levels as it is done when developing the examination questions.

(c) Administering a mathematics assignment

To ensure that the assignment serves its intended purpose of preparing learners for an examination, the timing of administering should be opportune. In other words, an assignment should be administered just before an examination is administered.

5.1. Grade 7 Assignment exemplar

Name: _____

Class: _____ Date: _____

Section: Content area	**Topic**	**Mark**	**Learner's mark**	
Section A Content area 1: Numbers, operations and relationships	• Whole numbers • Exponents	22		
Section B Content area 3: Space and shape	• Construction of geometric figures • Geometry of 2D shapes • Geometry of straight lines	28		
Total		50		= %

Total: 50 Marks **Time: 1 hour** **Date: ……..**

Instructions:

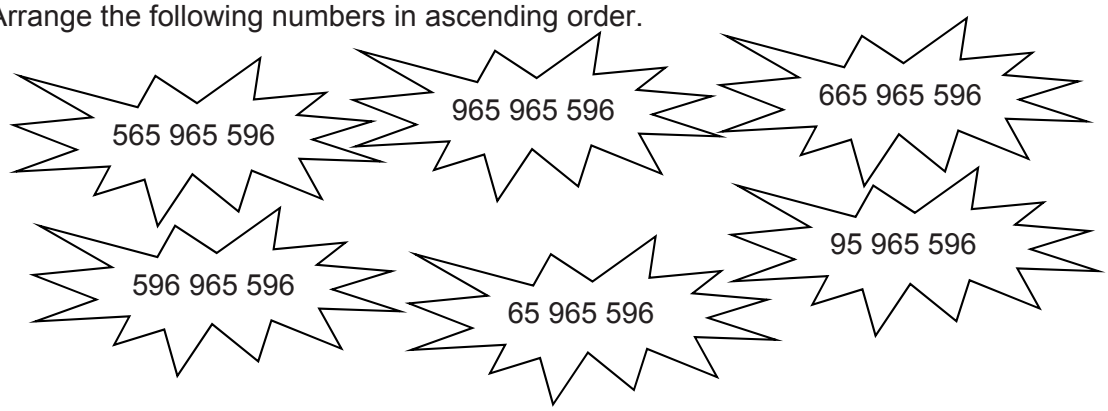
1) Answer all questions on the paper.
2) Write your name and date in the spaces provided.
3) No calculators are allowed.
4) Show calculations as requested on the question paper.
5) The marks allocated are an indication of the number of steps per calculation.
6) Check your answers.

Section A: Content area 1

Numbers, operations and relationships

Question 1: Whole numbers

1.1 Arrange the following numbers in ascending order. 1



_____

1.2 Which one of the following numbers is NOT a prime number? 1

2 ; 7 ; 3 ; 11 ; 9 ; 19

_____

1.3 Insert brackets in the following equation to make it true: 1

60 ÷ 3 + 5 × 4 = 40

1.4 Calculate the prime factors of 45: _____ 1

1.5 Calculate the following. Show your method.

1.5.1 9 427 × 28 2

1.5.2 6 783 ÷ 23 2

1.6 Determine the lowest common multiple of 6 and 15. _____ 1

1.7 Determine the highest common factor of 12; 16 and 48. _____ 1

1.8 A tank contained 660 litres of water. Through evaporation, the water was reduced by $\frac{1}{6}$. How much water was left in the tank? _____ 1

Question 2: Exponents

2.1 Circle the correct answer. 1

(A) $3 \times 3 \times 3 = 9$

(B) $3 \times 3 \times 3 = 33$

(C) $3 \times 3 \times 3 = 3^3$

2.2 Choose the cube numbers from the list below: 1

81 ; 9 ; 8 ; 1 ; 27 ; 4 ; 16 ; 64 ; 100

_____

2.3 Between which two numbers will you find the square root of 49? 1

_____

2.4 Arrange the following in descending order: 1

$\sqrt{25}$; 2^2 ; $\sqrt[3]{8}$; 9^2; $\sqrt{49}$; $\sqrt{100}$

_____

2.5 A number is a square of 2 and a cube root of 64. What is the number? 1

_____

2.6 Calculate the following: 3

(i) $(\sqrt[3]{27})3$ = _____

(ii) $2 \times 10^2 + 9 \times 10 + 6$ = _____

(iii) $12^2 \div 2^3$ =

_____

2.7 Say if the following is true or false and give a reason for your answer. 1

$\sqrt{169} - \sqrt{25} = 8$

_____

2.8 Calculate the following: 2

$$\frac{28 - 24 \div \sqrt{4}}{(\sqrt[3]{27} + 1)^{2}}$$

_____

_____

Section B: Content Area 3

Space and shape

Question 3: Construction of geometric figures

3.1 Write the following angles in descending order: 1
obtuse angle, reflex angle, right angle, acute angle, revolution, straight angle

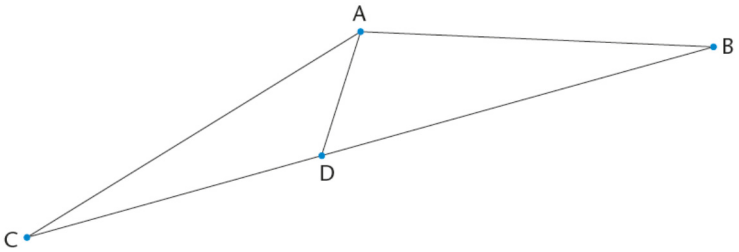
_____

_____

_____

3.2 Use a protractor to accurately measure the following angles and write the answers in the table provided: 4

Angle	Size	TYPE OF ANGLE
$A\hat{D}B$		
$C\hat{D}B$		

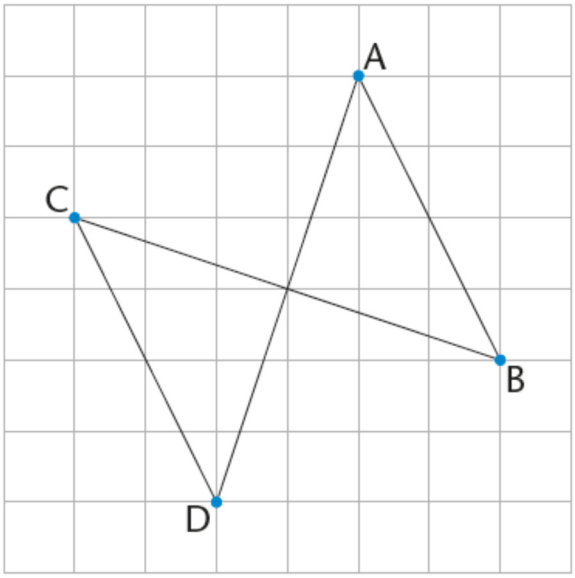


3.3 Construct a semi-circle with a radius of 3 cm 2

3.4 Use a ruler and protractor to construct $X\hat{Y}Z = 289^{0}$ (Label the angle) 3

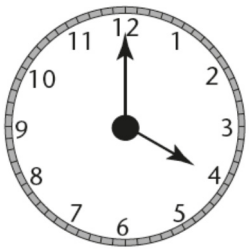
3.5 Consider the diagram below. Write down the names of the pair of perpendicular lines. Use the correct symbols. 2

_____



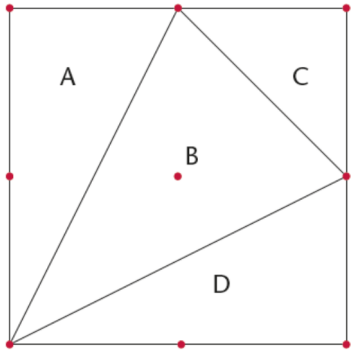
3.6 Look at the analogue clock face. The minute hand and the hour hand make an angle. Focus on the smaller angle for now. 1
Explain why the angle between the hands of 8 o'clock is the same size as the angle at 4 o'clock.

_____
_____
_____
_____
_____
_____



Question 4: Geometry of 2D shapes

4.1 The square below is divided into four triangles, namely A, B, C and D. Study the diagram and answer the questions that follow. 3



4.1.1 Write down the letters of the two congruent triangles.

_____

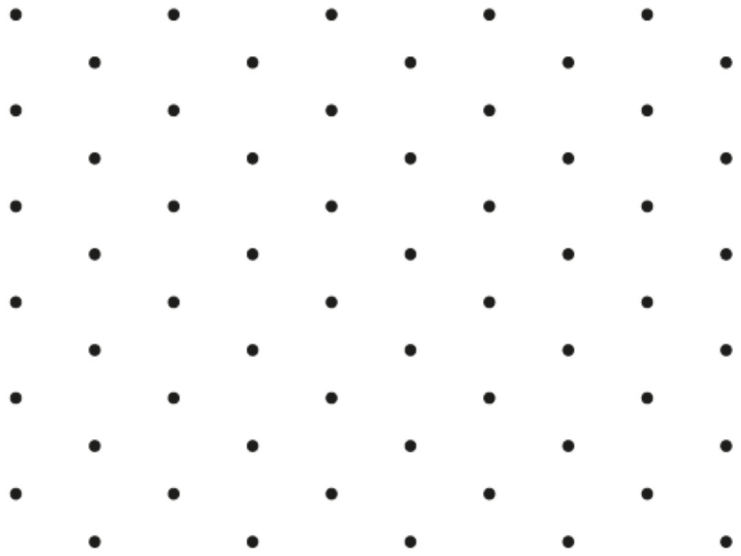
4.1.2 Write down the letters of all the right-angled triangles.

_____

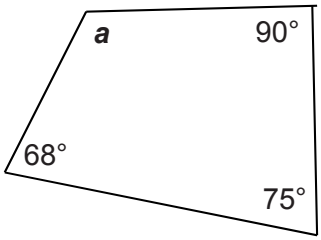
4.1.3 Write down the letters of all the isosceles triangles.

_____

4.2 Draw a rhombus of any size on the grid below. Add appropriate symbols on the diagram to show that the opposite sides of a rhombus are parallel. 2



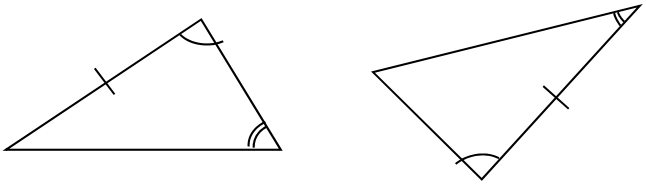
4.3 Calculate the size of angle *a*. 2



4.4 Indicate with a tick (✓) whether the following statements are always true, sometimes true or never true. 3

	Statement	Always true	Sometimes true	Never true
4.4.1	An equilateral triangle is also an acute-angled triangle.			
4.4.2	A right-angled triangle is also an isosceles triangle.			
4.4.3	The longest side of a scalene triangle will always be opposite the largest angle.			

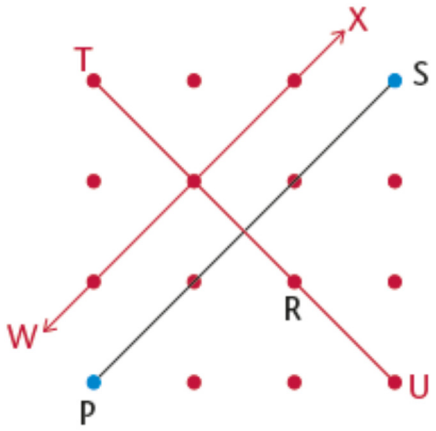
4.5 Is this pair of triangles congruent? Give a reason for your answer. 2



4.6 Give <u>one word</u> for the perimeter of a circle. 1

Question 5: Geometry of straight lines

5.1 Is PS a line, ray or line segment? _____ 1



5.2 Draw a ray and a line that will never meet. 1

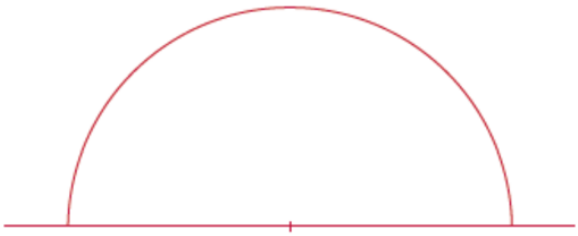
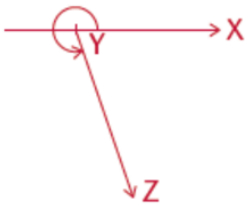
TOTAL: 50

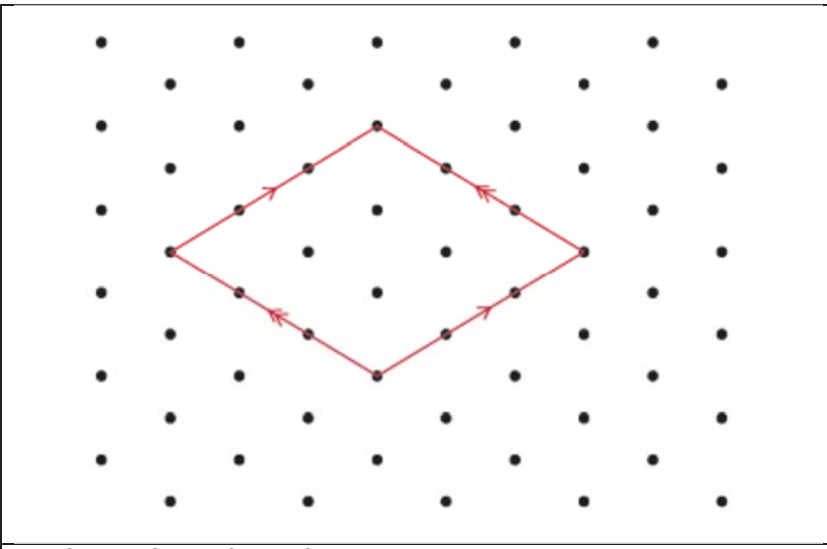
ASSIGNMENT
GRADE 7 MATHEMATICS
Memorandum

Marks: 50
This memorandum consists of 5 pages.
General marking note:

1. Give full marks for answers only, unless otherwise stated.
2. Accept alternative mathematically correct solutions that are not included in the memorandum.
3. CA refers to consistent accuracy.

Question 1: Whole numbers			
1.1	65 965 596 ; 95 965 596 ; 565 965 596 ; 596 965 596 ; 665 965 596 ; 965 965 596 ✓		1
1.2	9 ✓		1
1.3	(60 ÷ 3) + (5 × 4) = 40 ✓		1
1.4	3 and 5✓		1
1.5.1	263 956 ✓ ✓		2
1.5.2	294 r 21 ✓ ✓		2
1.6	30 ✓		1
1.7	4 ✓		1
1.8	550 ℓ ✓		1
Question 2: Exponents			
2.1	(C) 3 × 3 × 3 = 3^3 ✓		1
2.2	8 ; 1 ; 27 ; 64 ✓		1
2.3	6 and 8 ✓		1
2.4	9^2 ; $\sqrt{100}$; $\sqrt{49}$; $\sqrt{25}$; 2^2 ; $\sqrt[3]{8}$ ✓		1
2.5	4 ✓		1
2.6	(i) 27 ✓ (ii) 296 ✓ (iii) 18 ✓		3
2.7	True, the square root of 169 = 13 and the square root of 25 = 5 13 – 5 = 8 ✓		1
2.8	$\frac{28-24 \div 2}{(3+1)^2}$ ✓ $\frac{28-12}{4^2}$ $\frac{16}{16}$ = 1 ✓		2
Section B: Content area 3 **Space and Shape**			
Question 3: Construction of geometric figures			
3.1	revolution, reflex angle, straight angle, obtuse angle, right angle, acute angle ✓		1

3.2	<table><tr><th>Angle</th><th>Size</th><th>Type of angle</th></tr><tr><td>$A\hat{D}B$</td><td>57^0</td><td>Acute angle</td></tr><tr><td>$C\hat{D}B$</td><td>180^0</td><td>Straight angle</td></tr></table> *Teachers should measure the size of angles after printing for accurate answers. Allow learners a 1° inaccuracy.*		4
3.3	 ✓✓		2
3.4	 ✓✓✓		3
3.5	AD⊥ BC or DA ⊥ CB *1 mark for the correct lines and one mark for the correct symbol.*		2
3.6	The clock face is divided into 12 equal sections (30^0 each). Both angles are 4 sections big (or $4 \times 30^0 = 120^0$)		1
Question 4: Geometry of 2D shapes			
	4.1.1 A and D ✓ 4.1.2 A, C and D ✓ 4.1.3 B and C ✓		3

<table>
<tr><td>4.2</td><td>  </td><td></td><td>2</td></tr>
<tr><td>4.3</td><td>$360^0 – (90^0 + 75^0 + 68^0) = a$ ✓
$A = 127^0$ ✓</td><td></td><td>2</td></tr>
<tr><td>4.4</td><td>
<table>
<tr><th></th><th>Statement</th><th>Always true</th><th>Sometimes true</th><th>Never true</th></tr>
<tr><td>4.4.1</td><td>An equilateral triangle is also an acute-angled triangle.</td><td>✓</td><td></td><td></td></tr>
<tr><td>4.4.2</td><td>A right-angled triangle is also an isosceles triangle.</td><td></td><td>✓</td><td></td></tr>
<tr><td>4.4.3</td><td>The longest side of a scalene triangle will always be opposite the largest angle.</td><td>✓</td><td></td><td></td></tr>
</table>
</td><td></td><td>3</td></tr>
<tr><td>4.5</td><td>No. ✓ The equal sides (or angles) are not corresponding.✓</td><td></td><td>2</td></tr>
<tr><td>4.6</td><td>circumference ✓</td><td></td><td>1</td></tr>
<tr><td colspan="4"><u>Question 5: Geometry of straight lines</u></td></tr>
<tr><td>5.1</td><td>line segment ✓</td><td></td><td>1</td></tr>
<tr><td>5.2</td><td>  </td><td></td><td>1</td></tr>
</table>

5.2. Grade 8 Assignment exemplar

MARKS: 50 **Time : 1 hour**

INSTRUCTIONS

Read the following instructions carefully before answering the questions.

1. This assignment consists of 4 questions.
2. **Answer ALL questions on these task sheets.**
3. Write your name and surname as well as your class section in the spaces provided and hand in the whole answer sheet.
4. Clearly show all steps of calculations.
5. Answers only will not necessarily be awarded full marks.
6. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
7. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
8. Write legibly, neatly and use black or blue ink.

QUESTION 1:

1.1 Write down the factors of 30. (1)

1.2 The following sum was answered by a Grade 8 learner:

$$5 \times 9 + 6 = 75$$

State if the answer is correct or incorrect. Give reasons. (3)

1.3 Answer the following questions:

1.3.1 List all the prime factors of 60. (1)

1.3.2 List the factors of 60 that are even numbers. (1)

1.3.3 Make a list of the even, compound factors of 60. (1)

1.4 Determine the HCF of 36 and 96. (1)

1.5 Write 75 as a product of its prime factors. (3)

[11]

QUESTION 2:

2.1 The Grade 8 learners decided to start living more healthily. They will either jog or cycle. There are 125 Grade 8 learners and they jog and cycle in the ratio 3:2. Calculate how many learners participate in each sport? (3)

2.2 Jannie receives R150 pocket money per month. In the new year his mother decided to increase his pocket money in the ratio 6:5. Calculate Jannie's adjusted monthly pocket money. (2)

2.3 Khaya is delivering groceries to his mother who stays 8 km from the shop. How long will it take him to cover this distance if he drives at an average speed of 65 km/h? Give your answer rounded off to the nearest minute. (3)

2.4 Calculate:

2.4.1 $\frac{(-5)(2^8)}{-6+1} \times 5$ (5)

2.4.2 Write 0,000000357 in scientific notation. (2)

[15]

QUESTION 3:

3.1 The temperature in Austria one morning is -5°C at 08:00 and increases by 2°C every hour until 12:00. What will the temperature be at 11:30? (1)

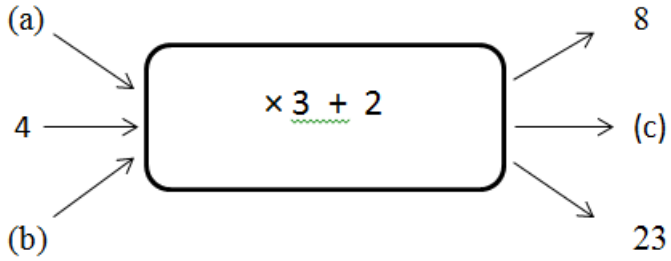
3.2 Calculate, showing steps (without calculator):

3.2.1 $60 - (-15) + (-13)$ (1)

3.2.2 $-3^2 + 5^2$ (2)

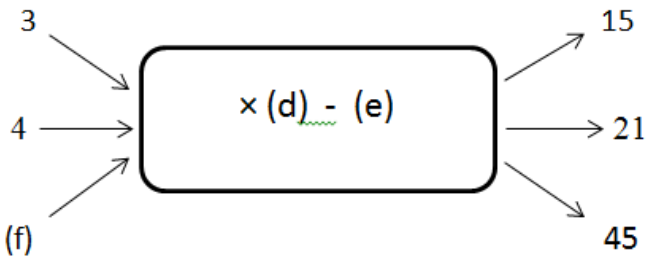
3.3 Give the missing input and output values from (a) to (f) in the flow diagrams below.

3.3.1



(3)

3.3.2



(3)

3.4 Michael, a farmer, wants to buy a new tractor. The price of the tractor is R160 000, VAT excluded. He can afford a deposit of R20 000. He decides to buy the tractor on hire purchase over a period of 60 months with simple interest of 10%. What would he pay in total after 60 months? (4)

[14]

QUESTION 4

4.1 Fill in the next two terms/numbers/shapes in the following patterns:

4.1.1 1; 3; 9; ……. ; ……. (2)

4.1.2 -15; -8; -1; ……; …….. (2)

4.1.3 $\frac{1}{2}; \frac{1}{4}; \frac{1}{8}; \ldots\ldots; \ldots\ldots$ (2)

4.1.4  (2)

; ..... ; .....

[8]

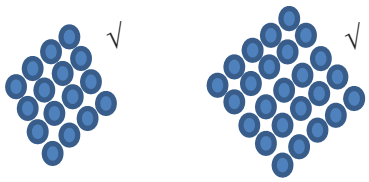
TOTAL – 50 MARKS

Grade 8 Assignment exemplar (Memorandum)

MARKS: 50 **Time : 1 hour**

Question 1		
1.1	$F_{30} = \{1, 2, 3, 5, 6, 10, 15, 30\}$ √	(1)
1.2	No. According to BODMAS he/she has to multiply first√ then add√. The answer should thus be (5×9) + 6 and the answer 51 √	(3)
1.3	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60	
1.3.1	$PF_{60} = \{2, 3, 5\}$ √	(1)
1.3.2	$EF_{60} = \{2, 4, 6, 10, 12, 20, 30, 60\}$ √	(1)
1.3.3	$Even\ compound\ factors\ of\ 60 = \{4, 6, 10, 12, 15, 20, 30, 60\}$ √	(1)
1.4	$F_{36} = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$ $F_{96} = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 96\}$ $\therefore HCF = 12$ √	(1)
1.5	3 | 75 √ **(Identify 3 as a prime factor)** 5 | 25 √ **(Identify 5 as a prime factor)** 5 | 5 1 $\therefore 3 \times 5 \times 5 = 75$ √ **(Multiplication of prime factors)**	(3) **[10]**
Question 2		
2.1	Jogging : Cycling 3 : 2 $125 \div (3 + 2) = 25$ √ **(Divide the sum total of the ratio by the total number of learners)** $Jogging: 25 \times 3 = 75\ learners$ √ $Cycling: 25 \times 2 = 50\ learners$ √	(3)

2.2	New : Old 6 : 5 ? : R150 $R150 \div 5 = 30$ √ $\therefore New\ amount: 6 \times 30 = R180$ √		(2)
2.3	$Time = distance \div speed$ $Time = 8km \div 65\ km/h$ √ **(Correct values DIVIDED)** $Time = 0{,}12307692\ hour$ $Time = 0{,}12307692\ hour \times 60 = 7\ minutes$ √ **(Conversion from hours to minutes)** √ **(Correct answer)**		(3)
2.4			
	2.4.1	$\frac{(-5)(256)}{-5} \times 5$ ✓ $\frac{-1280}{-5} \times 5$ ✓ 256×5 ✓ =1280 ✓✓ √ **(Simplify 2^8);** √√ **(Correct simplification)** √√ **(Final answer)**	(5)
	2.4.2	$3{,}57 \times 10^{-7}$ √ **(First decimal)** √ **(Correct (-)exponent)**	(2)
			[15]

Question 3:			
3.1	08:00 → -5°C 10:00 → -1°C 11:30 → 2°C √	09:00 → -3°C 11:00 → 1°C	(1)
3.2			
	3.2.1	$60 + 15 - 13 = 62$ √	(1)
	3.2.2	$-9 + 25 = 16$ √ **(Not 9, but -9)** √ **(Correct answer)**	(2)
3.3			
	3.3.1	a) 2 √ b) 7 √ c) 14 √	(3)
	3.3.2	d) 6 √ e) 3 √ f) 8 √	(3)
Question 4:			
4.1			
	4.1.1	27; 51 √√	(2)
	4.1.2	6; 13 √√	(2)
	4.1.3	$\frac{1}{16}$; $\frac{1}{32}$ √√	(2)
	4.1.4	 √ √	(2)

Name: _____

Class: _____ Date: _____

	Activity/Form	Learner's mark	Learner's %
	ASSIGNMENT		
TOTAL:		**50**	

INSTRUCTIONS

Read the following instructions carefully before answering the questions.

1. This assignment consists of 3 questions.
2. Answer ALL questions on these task sheets.
3. Write your name and surname as well as your class section in the spaces provided and hand in the whole answer sheet.
4. Clearly show all steps of calculations.
5. Answers only will not necessarily be awarded full marks.
6. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
7. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise
8. Write legibly, neatly and use black or blue ink.

QUESTION 1

1.1	Write 0.000 000 000 098 in scientific notation	(2)
1.2	Simplify and leave answer in decimal form: $(3{,}6 \times 10^6) - (5{,}2 \times 10^5)$ – show your calculation steps	(2)
1.3	Simplify, without the use of a calculator. Show all steps of calculation in each case.	
1.3.1	$1\frac{2}{3} : 2\frac{2}{3}$	(2)
1.3.2	$2(\sqrt[3]{64} + \sqrt{25})$	(3)
1.3.3	$3^{-1} - 4^{-1}$	(2)
1.3.4	$\frac{1}{2} + 2\frac{3}{4} - \frac{3}{8}$	(3)
1.4	Between which two consecutive integers does $\sqrt{150}$ lie?	(3)
1.5	Determine the sum of all the factors of 100.	
1.6	Show through factorising that 899 is not a prime number.	(2)
1.7	Divide 240 g in the ratio 5 : 3 : 4	(3)
1.8	Allan's car uses 1 litre of fuel to travel 12 km. How much fuel will be needed to travel 420km?	(2)
		[26]

QUESTION 2

2.1	Simplify, without using a calculator:	
2.1.1	$\left(2\frac{1}{2}\right)^2 + (0{,}5)^2$	(3)
2.1.2	$\frac{2^{x+1}.4.8^x}{16^{x+1}}$	(5)
2.2	Consider the figures below which were built using black and white tiles:	

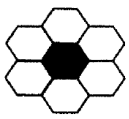


Figure 1

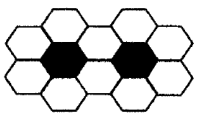


Figure 2

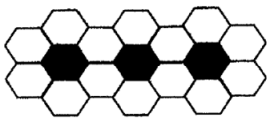


Figure 3

2.2.1 Complete the following table:

Figure	1	2	3	4
Number of black tiles	1	2	3	4
Number of white tiles	6	10		

(2)

2.2.2 Write down an expression for the general term, T_n, showing the number of white tiles in the *n*-th figure. (2)

2.2.3 How many white tiles will be in figure 15? (2)

[14]

QUESTION 3

3.1

SA Credit Bank

Mia Parker

P. O. Box 472

Kensington

Maitland

7405

Dear Ms Parker

We know it is important to you to manage your finances responsibly.

Here's an offer you would want to use.

R9 000,00 cash already approved

YOUR LOAN OFFER

AMOUNT ALREADY APPROVED

R 9 000,00

- Payable over 48 months
- Monthly instalments R 318,92

EXPIRY DATE: 16 January

3.1.1 Calculate the TOTAL amount that Mia has to pay back if she takes the loan. (2)

3.1.2 Why, do you think, do banks and other financial institutions offer cash loans to people that did not apply for it? (1)

3.2	Which investment is the most profitable? Show all calculations.		
	(i)	R560 invested at 8% p.a. simple interest for 3 years **OR** (ii) R560 invested at 7% p.a. compound interest for 3 years	(7)

Name: _____

Class: _____ Date: _____

	Activity/Form	Learner's mark	Learner's %
	ASSIGNMENT		
TOTAL:		**50**	

The principle of CA marking must be applied throughout this memo.

CA – Consistent accuracy
M – Method
A – Accuracy

QUESTION 1

1.1	Write 0,000 000 000 098 in scientific notation.		
	$\mathbf{9,8 \times 10^{-11}}$ **✓✓A**		(2)
1.2	Simplify and leave answer in decimal form: $(3{,}6 \times 10^6) - (5{,}2 \times 10^5)$ – show steps of calculations		
	$= \mathbf{(36 \times 10^5) - (5,2 \times 10^5)}$ **✓A** $= \mathbf{(36 - 5,2) \times 10^5}$ $= \mathbf{30,8 \times 10^5}$ $= \mathbf{3,08 \times 10^6}$ **✓CA**		(2)
1.3	Simplify, without the use of a calculator. Show all steps of calculation in each case.		
1.3.1	$1\frac{2}{3} : 2\frac{2}{3}$	= $\frac{5}{3} : \frac{8}{3}$ **✓A** = 5 : 8 **✓CA**	(2)
1.3.2	$2(\sqrt[3]{64} + \sqrt{25})$	$\mathbf{2\ (\sqrt[3]{64} + \sqrt{25}) = 2\ (\sqrt[3]{4^3} + \sqrt{5^2})}$ **✓A** $= \mathbf{2\ (4 + 5)}$ **✓A** $= \mathbf{2\ (9)}$ $= \mathbf{18}$ **✓CA**	(3)
1.3.3	$3^{-1} - 4^{-1}$	$\mathbf{3^{-1} - 4^{-1}} = \frac{1}{3} - \frac{1}{4}$ **✓M/A** $= \frac{4}{12} - \frac{3}{12}$ $= \frac{1}{12}$ **✓CA**	(2)
1.3.4	$\frac{1}{2} + 2\frac{3}{4} - \frac{3}{8}$	$\frac{1}{2} + \frac{11}{4} - \frac{3}{8}$ **✓A** $\frac{4}{8} + \frac{22}{8} - \frac{3}{8}$ **✓A**	

		$\frac{23}{8} = 2\frac{7}{8}$ ✓ **CA**	(3)
1.4	Between which two consecutive integers does $\sqrt{150}$ lie?		
	$\sqrt{144} < \sqrt{150} < \sqrt{169}$ ✓**A** ✓**A** $12 < \sqrt{150} < 13$ ✓**CA**		(3)
1.5	Determine the sum of all the factors of 100		
	$\sum F_{100}$ = **1 + 2 + 4 + 5 + 10 + 20 + 25 + 50 + 100** ✓**A** = **217** ✓**CA**		(2)
1.6	Show through factorising that 899 is not a prime number.		
	899 = 29 × **31** OR Factors of **899 = 1; 29; 31; 899** OR **899 = 900 – 1 = (30 + 1)(30 -1) = 31** × **29** ∴ **NOT PRIME** ✓**A**	any one ✓**A**	(2)
1.7	Divide 240 g in the ratio 5 : 3 : 4		
	Total parts = 12 ⇒ 1 part = 20 ∴ $\frac{5}{12} \times 240 = 100$; $\frac{3}{12} \times 240 = 60$; $\frac{4}{12} \times 240 = 80$ ∴ 100 : 60 : 80 ✓**A** ✓**A** ✓**A**		(3)
1.8	Allan's car uses 1 litre of fuel to travel 12 km. How much fuel will be needed to travel 420km?		
	Number of litres = $\frac{420}{12}$ ✓**A** = 35 litres ✓ **CA**		(2
			[26]

QUESTION 2

2.1	Simplify, without using a calculator:		
2.1.1	$\left(2\frac{1}{2}\right)^2 + (0{,}5)^2$	$6\frac{1}{4} + \frac{1}{4}$ OR 6,25 + 0,25 ✓**A**✓**A** $= 6\frac{1}{2}$ OR 6,5✓ **CA**	(3)
2.1.2	$\frac{2^{x+1}.4.8^x}{16^{x+1}}$	$= \frac{2^{x+1}.2^2.2^{3x}}{2^{4(x+1)}}$ ✓**A** (numerator) $= \frac{2^{x+1}.2^2.2^{3x}}{2^{4x+4}}$ ✓**A**✓**A** (denominator) $= 2^{x+1+2+3x-4x-4}$ ✓ **CA** (exponent law) $= 2^{-1}$ = ½ ✓ **CA**	(5)
2.2	Consider the figures below which were built using black and white tiles:		

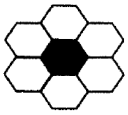


Figure 1

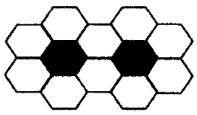


Figure 2

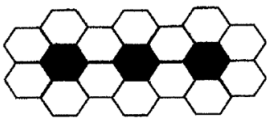


Figure 3

2.2.1 Complete the following table:

Figure	1	2	3	4
Number of black tiles	1	2	3	4
Number of white tiles	6	10	**14** ✓**A**	**18**

(2)

2.2.2 Write down an expression for the general term, T_n, showing the number of white tiles in the *n*-th figure.

$T_n = 4n + 2$ ✓**A** ✓**A** (2)

2.2.3 How many white tiles will be in figure 15?

$T_{15} = 4(15) + 2$ ✓**CA**
$= 62$ ✓**CA** (2)

[14]

QUESTION 3

3.1

SA Credit Bank Mia Parker P. O. Box 472 Kensington Maitland 7405 Dear Ms Parker We know it is important to you to manage your finances responsibly. Here's an offer you would want to use.	R9 000,00 cash already approved YOUR LOAN OFFER AMOUNT ALREADY APPROVED R 9 000,00 • Payable over 48 months • Monthly instalments R 318,92 EXPIRY DATE: 16 January

3.1.1	Calculate the TOTAL amount that Mia has to pay back if she takes the loan.	$\boldsymbol{R318,92 \times 48 = R15308,61}$ ✓✓**A** (2)
3.1.2	Why, do you think, do banks and other financial institutions offer cash loans to people that did not apply for it?	Part of their marketing strategy/ **to attract clients.** ✓**A** *Any relevant answer* (1)
3.2	Which investment is the most profitable? Show al calculations.	
	(iii) R560 invested at 8% p.a. simple interest for 3 years OR (iv) R560 invested at 7% p.a. compound interest for 3 years	<u>Simple interest:</u> $A = P(1 + in)$ ✓ ***M*** $\mathrm{A} = 560\ (1 + 0{,}08 \times 3)$✓**A** $\mathrm{A} = \mathrm{R}\ 694{,}40$ ✓**CA** <u>Compound interest:</u> $A = P(1 + i)^n$ ✓ ***M*** $\mathrm{A} = 560\ (1 + 0{,}07)^3$✓**A** $\mathrm{A} = \mathrm{R}\ 686{,}02$ ✓**CA** **Simple interest** option is the most profitable. ✓**CA** (7)

6. EXAMINATION

(a) Purpose of a mathematics examination

Examinations (and tests) are individualised assessment tasks and should be carefully designed to ensure that learners demonstrate their full potential in Mathematics content (knowledge and skills). The questions should be carefully spread to cater for different cognitive levels as contemplated in Chapter 4 of CAPS. Examinations and tests are predominantly assessed using a memorandum.

(b) Developing a mathematics examination

It is best practice to start by developing an examination framework before developing the actual examination. An example of an examination framework is provided for Grade 6 and the same approach can be adopted when developing an examination for any grade. The examination framework assists the examiner to carefully identify the important concepts and skills to be assessed as well as to spread the cognitive levels appropriately. The purposeful choices of concepts and skills as well as appropriate spread of the cognitive levels are the key ingredients of the balanced examination or test. In addition the examination should be grade appropriate to ensure fairness.

In order to enable learners to easily acclimatise to taking an examination especially learners who experience examination anxiety, start the examination with questions that are fairly easy and that require knowledge and routine procedures.

One of the seemingly easy but complicated questions to set is the multiple-choice questions. Very often poor or weak distractors which do not serve a meaningful purpose are included in the multiple-choice questions. In order to improve the quality of the multiple-choice questions the following elements should be considered:

- The actual question (also called stem) should:
    - specify what the question is asking for;
    - be clear and concise;
    - include common information rather than repeating it in the options;
    - be in a question format wherever possible;
    - be stated in positive form wherever possible (else negative wording should be emphasised in bold or by underlining)
- The options should:
    - be free from clues to the correct answer

- have the distractors that are plausible and attractive to the learners. Distractors should be guided or informed by the common misconceptions. For instance when asked to simplify $a^3 \times a^2$ it is common that learners are likely to give a^6 instead of a^5. Therefore a^6 could make a good distractor, which is informed by the common misconceptions and could be plausible for some learners.
- be of approximately the same length;
- have only one correct answer (also called the **key**);
- not be positioned in any particular pattern, especially the position of the correct answer (or **key**). For instance if there are four possible answers in each of the ten multiple-choice questions, the correct answer (or key) should NOT always be the first option.

(c) Administering a mathematics examination

Since the examination is an individualised assessment, it is normally administered in a controlled environment. A controlled environment through invigilation assists Intermediate Phase learners to get used to the examination conditions and cope fairly well with the more stringent examination conditions in Grade 12.

The controlled environment/condition of the examination can be quite threatening to the majority of learners. In order to ensure that they get accustomed to these conditions, tests should be administered regularly in fairly similar conditions that resemble the examination conditions.

Assignments should be administered to prepare learners adequately before the examinations are administered.

6.1. Grade 7 Examination exemplar

TIME: 120 MINUTES **MARKS: 100** **DATE: _____**

SURNAME:			____
NAMES:			
GRADE 7	**BOY:** **(Mark with an X)**	**GIRL:** **(Mark with an X)**	**100**

INSTRUCTIONS:

1. Calculators are NOT allowed.
2. Answer all questions in the spaces provided.
3. Do your best to answer all the questions, even if you are not sure about your answer.
4. Please write the answer that you think is the best and move to the next question.
5. The teacher will lead you through the practice exercise before you start the examination.

Practice exercise: Multiple-choice questions.

Circle the letter of the correct answer.

Question: Which number comes next in the following pattern?

81 ; 27 ; 9 ; 3 ; ___

A. **0**

B. **1**

C. $\frac{1}{3}$

D. $\frac{2}{3}$

You have answered correctly if you have circled **B** above and you may proceed.

Question 1: Choose the correct answer by reading each statement carefully.

1.1 2 017 – 2 004 + 2 010 is equal to… (1)

A. 4 000 + 17 + 10 + 4
B. 2 000 + 17 + 10 + 4
C. 4 000 – 2 000 + 17 + 10 + 4
D. 4 000 – 2 000 + 17 + 10 – 4

1.2 2 015 – 20,9 x 10 is equal to… (1)

A. 1 806
B. 180,6
C. 18 006
D. 18 000,6

1.3 3(2 017 – 10,09) is equal to… (1)

A. 6 051 – 10,09
B. 6 051 – 30,27
C. 2 006,91 – 30,27
D. 6 051 – 302,7

1.4 $4(12 + 9) = 84$, therefore… (1)

A. 12 = 84 $\div (9 + 4)$
B. 12 = 84 - (9×4)
C. 12 = 84 - $(9 \times 4 \times 12)$
D. 12 = 84 - $(9 \times 4 + 12 \times 3)$

1.5 $\frac{1}{2} \times \frac{3}{4}$ is equal to… (1)

A. $\frac{6}{4}$

B. $\frac{4}{6}$

C. $\frac{3}{4}$

D. $\frac{3}{8}$

1.6 Which fraction is the largest? (1)

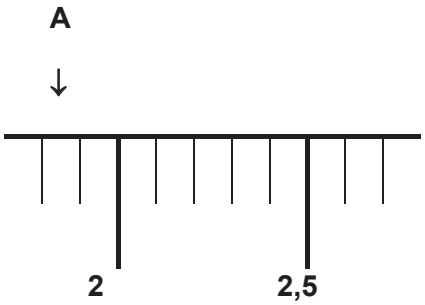
A. $\frac{3}{4}$

B. $\frac{4}{5}$

C. $\frac{5}{6}$

D. $\frac{6}{7}$

1.7 What is the number indicated by A on the ruler? (1)



A. 1,8
B. 1,9
C. 1,85
D. 1,95

1.8 The number 127 333 rounded off to the nearest 5 is…
(1)

A. 127 400
B. 127 300
C. 127 335
D. 127 330

1.9 $\frac{2}{5} + \frac{3}{8}$ is equal to… (1)

A. $\frac{5}{13}$

B. $\frac{5}{40}$

C. $\frac{16}{15}$

D. $\frac{31}{40}$

1.10 $(7 - 4)^3$ is equal to… (1)

A. $7^3 - 4^3$
B. 3^3
C. 21 - 12
D. 343 - 64

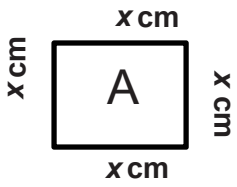
1.11 $\sqrt{16 + 9}$ is equal to… (1)

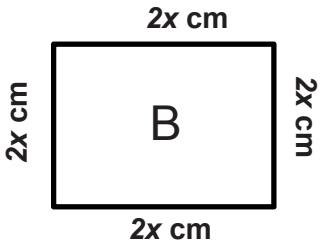
A. $\sqrt{16} + \sqrt{9}$
B. $\sqrt{25}$
C. 4 + 3
D. 5^2

1.12 60% of R60,00 is the same as… (1)

A. 0,6 × R60,00
B. 0,06 × R60,00
C. R60,00 ÷ 60
D. (R60 × 100) ÷ 60

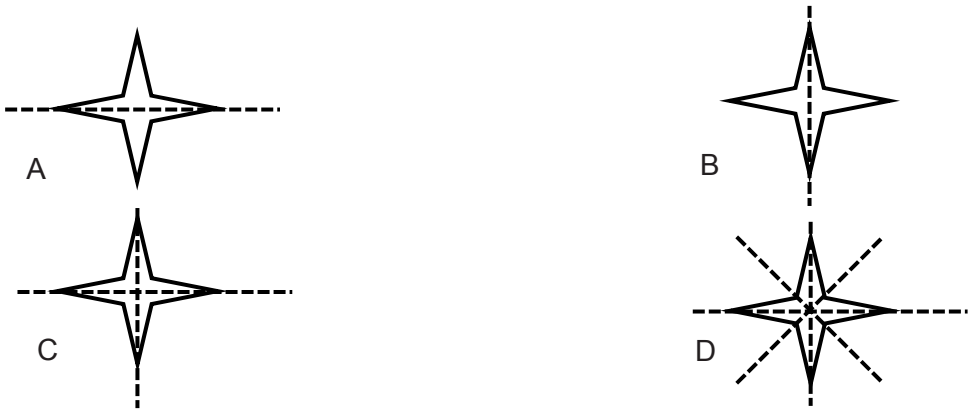
1.13 The sides of square A are x cm each and the area is x^2 cm. The sides of square B are $2x$ cm each. The area of square B will be… (1)



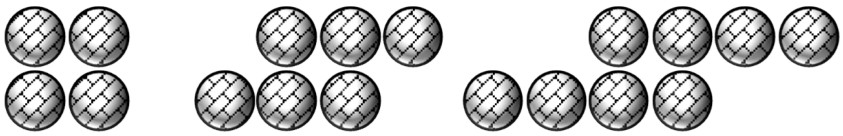


A. $4x^2$ cm
B. $2x^2$ cm
C. $8x^2$ cm
D. $6x^2$ cm

1.14 Which one of the following diagrams illustrates <u>all the correct lines of symmetry</u> of the following figure? (1)



1.15 Study the following pattern. The number of buttons in **STEP** 10 is… (1)



A. 19

B. 20

C. 21

D. 22

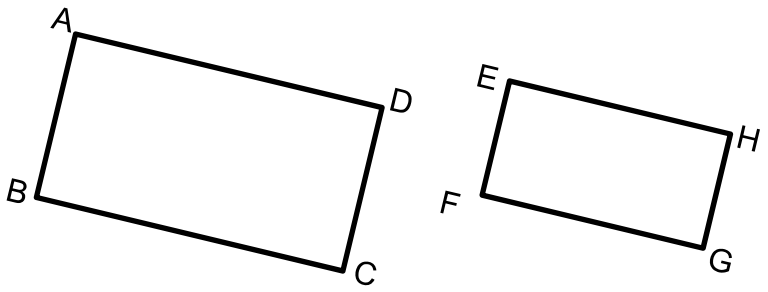
1.16 What is the missing number ***a*** in the table? (1)

1	2	3	4	…	12
3	6	11	18	…	***a***

A. 19
B. 21
C. 136
D. 146

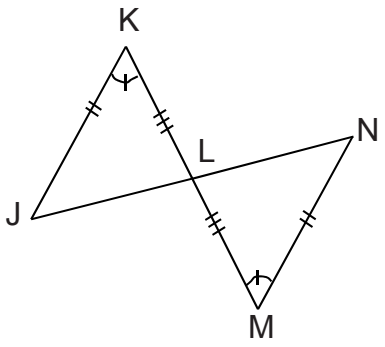
1.17 Rectangle ABCD is 3 times larger than rectangle EFGH. The size of angle DCB is 90^0 (1)

What will the size of angle HGF be?



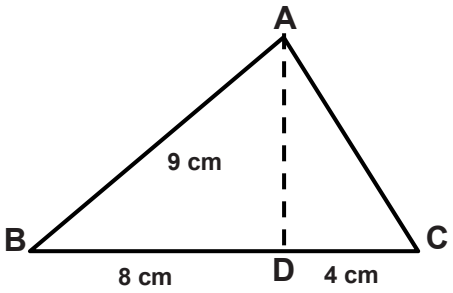
A. 30^0
B. 60^0
C. 90^0
D. 120^0

1.18 Triangles KJL and MNL are… (1)



A. Congruent
B. Similar
C. Perpendicular
D. Common

1.19 In triangle ABC, AD = 9 cm and BC = 12 cm. The area of triangle ABC is equal to… (1)



A. 54 cm^2
B. 72 cm^2
C. 36 cm^2
D. 108 cm^2

1.20 The formula used to calculate the perimeter of a rectangle is… (1)

A. 4 × length
B. 2 × length + 2 × breadth
C. length × breadth
D. $\frac{1}{2}$ × length × breadth

[20]

Question 2: Complete the following number patterns:

2.1 The next four whole numbers in the sequence, 2 500 ; 2 525 ; 2 550 ; …

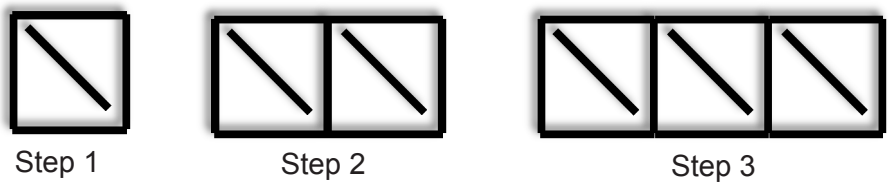
_____ ; _____ ; _____ ; _____ (4)

2.2 The following number in the number pattern, 1 ; 3 ; 9 ; 27 ; 81 ; 243 ; … (2)

2.3 The missing number in the following number pattern:

110 ; 122,5 ; 135 ; 147,5 ; _____ ; 172,5 (2)

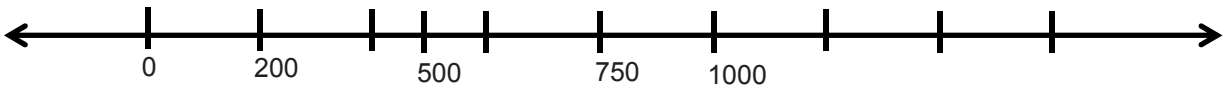
2.4 How many sticks will there be in step TEN? _____(3)



[10]

Question 3:

3.1 Which number on the number line (0 through 1 000), below, is in the wrong position? (1)



3.2 Which number is exactly halfway between 126 and 250 ? (Show your calculations). (2)

3.3 Determine the sum of $(1 + 3^3) + (1 + \sqrt{169})$ (3)

3.4 Write down the multiples of 5 and 6 and determine the lowest common multiple of the two number (3)

[9]

Question 4: (Show ALL your calculations.)

4.1 $7\frac{1}{3} - 6\frac{1}{2} + 2\frac{1}{3}$ (4)

4.2. What is the value of: $\frac{2}{3}$ of 252 g (2)

4.3 $307 + 703 \times 5 - 12\,642 \div 147$ (5)

4.4 $11 \times 5(6^2 + \sqrt[3]{64})$ (4)

4.5. $\sqrt{121} + \sqrt{64} - (\sqrt{100 - 64}) \div 12$ (6)

4.6 On the chessboard there are eight rows of squares and eight columns of squares. Calculate using exponential form how many squares there are on the board. (2)

[23]

QUESTION 5: (Show ALL your calculations)

5.1 The price of a school bag increases from R200 to R250. Calculate the percentage increase in the price. (4)

5.2 The ratio of boys to girls at the party is 3:2. If there are 60 children at the party, how many girls are there? (3)

5.3 Mr Jones wants to buy a flat screen television that costs R14 000, 00. He has to pay a deposit of 12% and the balance of the outstanding amount in 6 months to avoid paying interest.

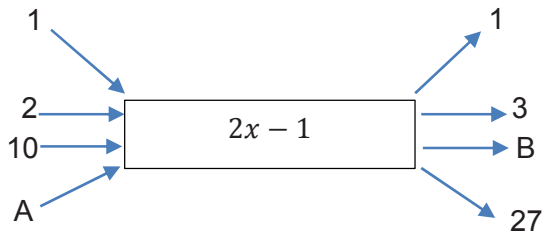
5.3.1 Calculate the amount he has to pay as a deposit on the flat screen television. (3)

5.3.2 How much must Mr Jones pay per month to settle the outstanding amount? (3)

[12]

QUESTION 6:

6.1 Consider the flow diagram below and fill in the values of **A** and **B**.



(2)

6.2 Complete the table below.

Input (x)	1	2	.....	4		.....
Output (y)	1	8	27	.....		343

(3)

6.3 Determine the rule (y =?) for the following set of values of x and y.

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

y = _____ (3)

6.4 Determine the value of **C** and **D** in the following table and answer the question below:

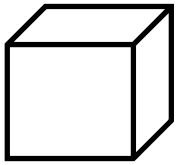
x	1	2	3		**C**		10
y	5	11	17		41		**D**

C + D = _____ + _____ = _____ (3)

[11]

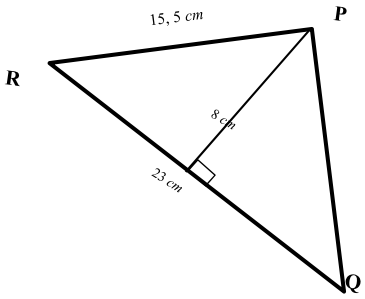
QUESTION 7: (Show ALL calculations)

7.1 Look at the cube alongside and complete the following:



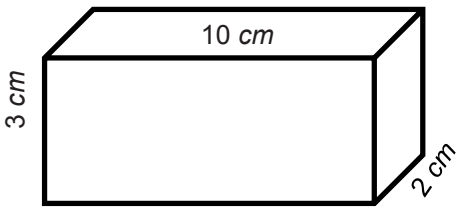
A cube has ____ faces, ____ vertices and ____edges. (3)

7.2 Triangle PQR is an isosceles triangle. Side PR=15,5 *cm*, QR=23 *cm*, PR=PQ and the height of the triangle is 8 *cm*. Determine the **perimeter** and the **area** of the triangle.



(5)

7.3 Study the rectangular prism given below and use it to calculate its **surface area** and **volume**



(6)

[14]

TOTAL: 100

Q.NO	ANSWER	WORKING	MARKS
1.1	D		(1)
1.2	A		(1)
1.3	B		(1)
1.4	D		(1)
1.5	D		(1)
1.6	D		(1)
1.7	B		(1)
1.8	C		(1)
1.9	D		(1)
1.10	B		(1)
1.11	B		(1)
1.12	A		(1)
1.13	A		(1)
1.14	D		(1)
1.15	D		(1)
1.16	D		(1)
1.17	C		(1)
1.18	A		(1)
1.19	A		(1)
1.20	B		(1)
			[20]
2.1	2 575 ; 2 600 ; 2 625 ; 2 650	2 550 + 25 = 2 575 ; √ 2 575 + 25 = 2 600; √ 2 600 + 25 = 2 625 ; √ 2 625 + 25 = 2 575; √	(4)
2.2	729	$3^0 = 1$; $3^1 = 3$; $3^2 = 9$; $3^3 = 27$; $3^4 = 81$; $3^5 = 729$√√	(2)
2.3	160	Constant is 12,5 √√	(2)
2.4	41	$T_{10} = 5 \times (n-1) \times 4$ √√√	(3)
			[10]
3.1	750	Count even spaces √	(1)
3.2	183	(126 + 250) ÷ 2 = 183 √√	(2)
3.3	24	$(1 + 3^3) + (1 + \sqrt{169}) = 10 + 1 + 13$ √√ = 24 √	(3)
3.4	250	Multiples of 5: 5 ; 10 ; 15 ; 20 ; 25 ; 30√ Multiples of 6: 6 ; 12 ; 18 ; 24 ; 30 √ LCM: 30 √	(3) **[9]**

Q.NO	ANSWER	WORKING	MARKS
4.1	$3\frac{1}{6}$	$7\frac{1}{3} - 6\frac{1}{2} + 2\frac{1}{3}$ $=(7-6+2)+(\frac{1}{3} - \frac{1}{2} + \frac{1}{3})$ √√ $= 3 + \frac{1}{6}$ √ $= 3\frac{1}{6}$ √	(4)
4.2	168 g	$\frac{2}{3}$ of 252 g $= \frac{2}{3} \times 252$ g = 168 g √√	(2)
4.3	3 736	307+703×5−12 642÷147 √√ √√ =307+ 3515 – 86 =3 736√	(5)
4.4	2 200	$11\times 5(6^2 + \sqrt[3]{64})$ √ √ $=11\times 5(36+4)$ =2 200√√	(4)
4.5	$17\frac{1}{2}$	$1\sqrt{121} + \sqrt{64} - (\sqrt{100-64}) \div 12$ √ √ √√ = 11 + 8 − (6) ÷ 12 = 17 $\frac{6}{12}$ √ $=17\frac{1}{2}$ √	(6)
4.6	64 squares	$8 \times 8 = 8^2$ √ = 64√	(2)
			[23]

<table>
<tr><th>Q.NO</th><th>ANSWER</th><th colspan="2">WORKING</th><th>MARKS</th></tr>
<tr><td>5.1</td><td>25%</td><td></td><td>R 250−R200=R50 √
$= \frac{R50}{R200}$ √
= $\frac{1}{4} \times 100\%$√
= 25%√</td><td>(4)</td></tr>
<tr><td>5.2</td><td>24 girls</td><td></td><td>$\frac{2}{5} \times 60$ √
=24√
Therefore, there will be twenty four girls.√</td><td>(3)</td></tr>
<tr><td>5.3.1</td><td>$Deposit = R1\,650$</td><td></td><td>$\frac{R14\,000}{1} \times \frac{12}{100}$√
R1 680√
Therefore, he paid R1 680 as a deposit.√</td><td>(3)</td></tr>
<tr><td>5.3.2</td><td>R 2 053,33</td><td></td><td>Payment per month = (R14 000 – R1 680) = R12 320 √
= R12 320 ÷ 6√ = R2 053,33 √</td><td>(3)</td></tr>
<tr><td></td><td></td><td></td><td></td><td>[13]</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.1</td><td>A=14;
B=19</td><td></td><td>B : 2(10)−1=19√ A : 2x − 1=27
2x = 28
x = 14√</td><td>(2)</td></tr>
<tr><td>6.2</td><td>x-values 3;7
y-value 64</td><td></td><td><table><tr><td>Input (x)</td><td>1</td><td>2</td><td>3√</td><td>4</td><td></td><td>7√</td></tr><tr><td>Output (y)</td><td>1</td><td>8</td><td>27</td><td>64√</td><td></td><td>343</td></tr></table></td><td>(3)</td></tr>
<tr><td>6.3</td><td>$y = \frac{1}{2}x + 4$</td><td></td><td>$y = \frac{1}{2}x+4$√√√</td><td>(3)</td></tr>
<tr><td>6.4</td><td>C + D = 7 + 59
= 66</td><td></td><td>$Rule$: 6n−1
C: 41=6n−1 D=6n−1
6n=42 D=6(10)−1
n=7 D=59
C = 7
√ √ √
C+D= 7+ 59 = 66</td><td>(3)</td></tr>
<tr><td></td><td></td><td></td><td></td><td>[11]</td></tr>
</table>

Q.NO	ANSWER	WORKING		MARKS
7.1	6; 8; 12		√ √ **6** faces; **8** vertices **12** edges√	(3)
7.2	Perimeter = 54 cm Area = 92 cm^2		Perimeter : P = (15,5+15,5+23) cm√ P = 54 cm√ Area : A = $\frac{1}{2}$ b×h√ A = $\frac{1}{2}$ 23 cm × 8 cm√ A = 92 cm^2√	(5)
7.3	Surface area= 112 cm^2 Volume= 60 cm^3		SA=2lb+2lh+2bh√ = 2(10)(2)+2(10)(3)+2(2)(3)√ = 112 cm^2√ V = l×b×h√ = 10×3×2√ = 6 cm^3√	(6)
				[14]
TOTAL: 100				

6.2. Grade 8 Examination exemplar

MATHEMATICS EXAMINATION: JUNE 2017

GRADE 8

MARKS : 100

DURATION : 2 hours

Instructions and information to the learner

1. Read the questions carefully.
2. Answer **ALL** the questions.
3. Write neatly and legibly.
4. Number your answers exactly as the questions are numbered.
5. Clearly show **ALL** the calculations, diagrams, graphs, etc. you have used in determining the answers.
6. You may use an approved scientific calculator (non-programmable and non-graphical).
7. This question paper consists of **6** questions.
8. Diagrams are **NOT** drawn to scale.

QUESTION 1

In this question, write only the letter for the **correct answer** next to the corresponding number, e.g. if the correct answer in 1.1 is D, you should only write 1.1 D.

1.1 What is the HCF of 120 and 300? (1)

A $5 \times 3 \times 3 \times 2 \times 2$

B $5 \times 3 \times 3 \times 2$

C $5 \times 3 \times 2 \times 2$

D $5 \times 3 \times 2$

1.2 Which of the following statements is correct about an equilateral triangle? (1)

A Two angles opposite to equal sides are equal.

B All angles and all sides are NOT equal.

C All angles and all sides are equal

D Any two angles are equal.

1.3 What is $\frac{3y^3-6y^2-3y}{3y}$ when simplified? (1)

A. $3y^3 + 6y^3 - 1$

B. $y^2 - 2y - 1$

C. $7y^2 - 3y$

D. $3y^2 - y$

1.4 When two parallel lines are cut by a transversal,_____. (1)

A alternate angles are supplementary.

B alternate angles are complementary.

C co-interior angles are supplementary.

D co-interior angles are complementary.

1.5 What is the coefficient of x in $\frac{x^2-2x+3}{3}$?

A 1

B $\frac{1}{3}$

C -2

D $\frac{-2}{3}$

1.6 From 8:30, bell A rings every 8 minutes and bell B rings every 32 minutes. After how many minutes will they ring again at the same time, for the second time? (1)

A 136

B 64

C 40

D 24

1.7 What is the missing number in _____; 22; 29; 37? (1)

A. 17

B. 16

C. 15

D. 14

1.8 Which of the following property of numbers is correct? (1)

A $\frac{a}{b} = \frac{b}{a}$, for $a \neq b$

B $a - b = b - a$

C $\frac{0}{1} = \frac{1}{0}$

D $a \times b = b \times a$

1.9 Which of the following is a property of a parallelogram? (1)

A Both pairs of opposite sides are parallel and equal.

B Only one pair of opposite sides is parallel.

C Two pairs of adjacent sides are equal.

D All sides are not equal.

1.10 What is the sum of the angles of a quadrilateral?

A 60°

B 90°

C 180°

D 360°

[10]

QUESTION 2

2.1 Write 568 000 000 in scientific notation. (2)

2.2 Calculate without using a calculator. Show all the calculation steps.

2.2.1 $1{,}3 \times 40\,000\,000$ (leave your answer in scientific notation) (2)

2.2.2 $-5 \times (-3 + 7) + 20 \div (-4)$ (2)

2.2.3 $1^{10} + 10^{0}$ (2)

2.2.4 $\sqrt[3]{\sqrt{144} + 2^3 + 7}$ (3)

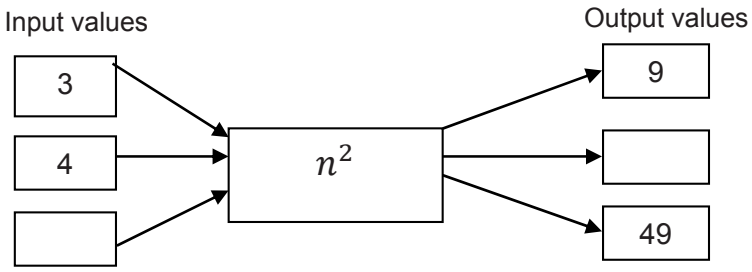
[11]

QUESTION 3

3.1 Numbers are arranged in the following pattern. If the pattern is extended, what will the third number in row 81 be? (3)

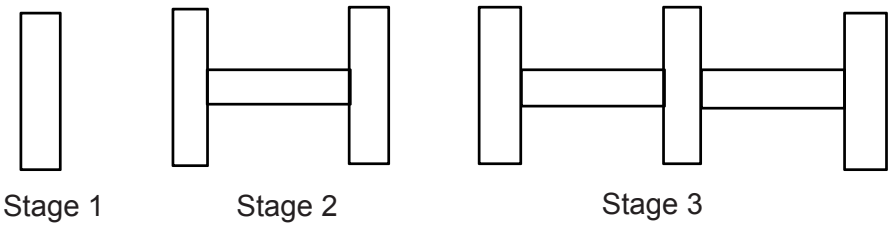
1	2	3	4	5	6	**ROW 1**
7	8	9	10	11	12	**ROW 2**
13	14	15	16	17	18	**ROW 3**

3.2.1 Complete the flow diagram below. (2)



3.2.2 What is the verbal description of the rule in Question 3.2.1 above? (1)

3.3 The pattern below is formed by rectangles.



3.3.1 Complete the table to illustrate the number of rectangles per stage. (1)

Stage number	1	2	3	4
No. of rectangles	1	3	5	

3.3.2 Write the general rule that describes the relationship between the stage number and the number of rectangles used, in the form of $T_n = \ldots\ldots\ldots$ (2)

3.3.3 How many rectangles will be in stage 10 if the pattern is extended? (2)

3.4 Simplify:

3.4.1 $\sqrt{16y^2 + 9y^2}$ (2)

3.4.2 $3\,(x^2 + 2x + 3) - 3\,(x^2 + 4x)$ (3)

3.4.3 $(-2a^2bc^3)^2 \div 4abcd$ (3)

3.5 Solve for x:

3.5.1 $5x = 40 + 3x$ (3)

3.5.2 $8^x = 32$ (3)

3.5.3 $x = 2y^2 + 1$, if $y = -4$ (2)

[27]

QUESTION 4

4.1 Increase 140 in the ratio 7:5. (2)

4.2 Which is the fastest? 264 km travelled in 2 hours or 585 km travelled in 5 hours? (3)

4.3 Thobeka wants to order a book that costs \$56,67. If 1 dollar = R7,90, what is the price of the book in rands? Round off your answer to the nearest rands. (2)

4.4 Calculate the simple interest on R3 750 at 8% per annum for 3 years. (3)

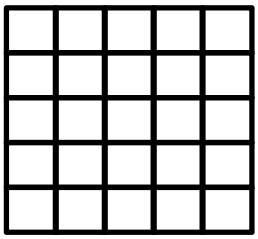
4.5 Ben drives a car and covers a distance of 120 km in 2 hours. How far will he travel in 2 hours if the speed is reduced by 15 km/h? (4)

4.6 There are 60 marbles of 3 different colours in a packet, namely, red, green and yellow. There are 2 more red than green and 4 more yellow than green. How many marbles of each colour are there in the packet? (4)

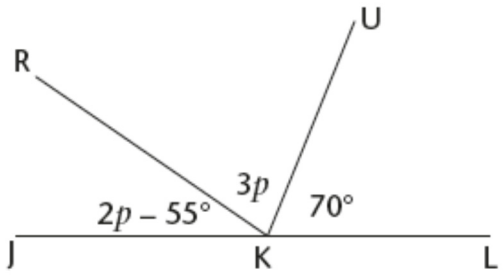
[18]

QUESTION 5

5.1 What is the total number of squares in the figure below? (2)



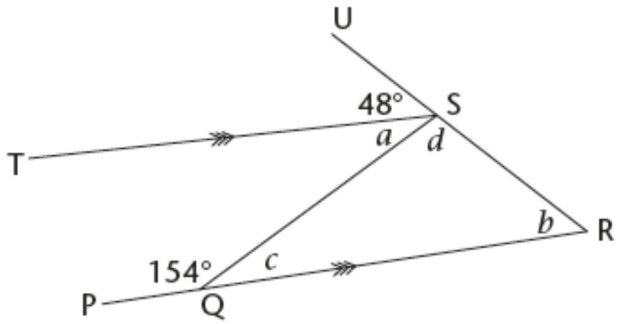
5.2 Study the figure below and answer the questions that follow.



5.2.1 Calculate the size of *p*. Give a reason for your statement. (3)

5.2.2 Calculate the actual size of ∠ JKR. (2)

5.3 Use the figure below to answer the questions that follow.



5.3.1 Determine the size of b. Give a reason for your answer. (2)

5.3.2 Calculate the size of c. Give a reason for your answer. (3)

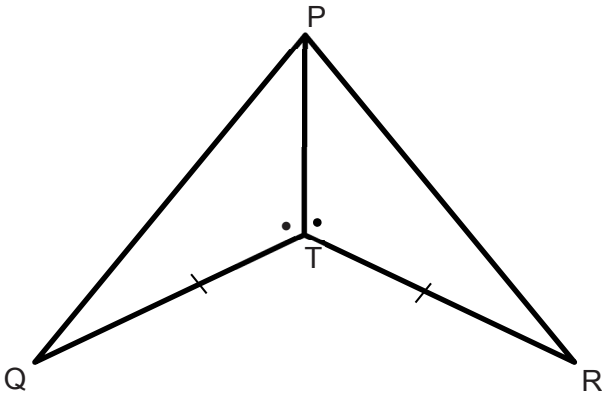
5.3.3 Determine the size of a. Give a reason for your answer. (2)

5.3.4 Calculate the size of d. Give a reason for your answer. (3)

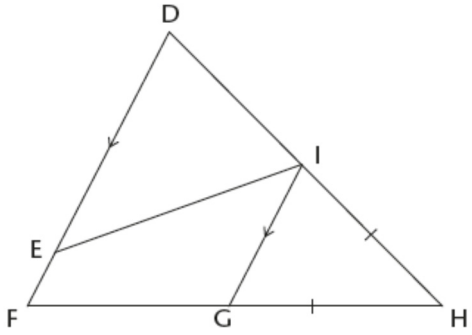
[17]

QUESTION 6

6.1 State, giving reasons, whether ΔPTQ and ΔPTR are congruent or not. (2)



6.2 Consider the following diagram in which ∠DEI =30°, DE = EI, DF ∥ IG and GH = IH.



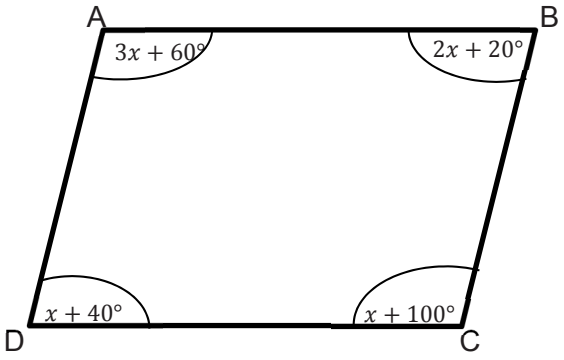
6.2.1 Determine the size of ∠GIE. Give a reason for your answer. (2)

6.2.2 If ∠ D is 75°, what is the size of ∠ HG? Give a reason for your answer. (2)

6.2.3 Calculate the size of ∠ H. Give a reason for your statement. (3)

6.2.4 Name two triangles that are similar to ΔDEI. (2)

6.3 Study the diagram below and answer the questions that follow.



6.3.1 Calculate the value of x, give a reason for your statement. (3)

6.3.2 What type of quadrilateral is ABCD? Justify your answer. (3)

[17]

100 MARKS

Memorandum

Important Information

- This is a marking guideline. In instances where learners have used different mathematically sound strategies to solve the problems, they should be credited.
- Underline errors committed by learners and apply consistent accuracy (CA) marking.

KEY	
M	Method mark
CA	Consistent Accuracy mark
A	Accuracy mark
S	Statement
R	Reason
S/R	Statement and reason

QUESTION 1 [10 Marks]					
1.1	A ✓	1.6	B ✓	1 mark for each correct answer	(10)
1.2	C ✓	1.7	B ✓		
1.3	B ✓	1.8	D ✓		
1.4	C ✓	1.9	A ✓		
1.5	D ✓	1.10	D ✓		

Ques.	Solution	Mark Allocation	Total
QUESTION 2 [11 Marks]			
2.1	✓A ✓ A $5{,}68 \times 10^8$	5,68: 1 mark 10^8 : 1 mark	2
2.2.1	$1{,}3 \times 4 \times 10^7$ ✓ M $=5{,}2 \times 10^7$ ✓ A	$\times 4 \times 10^7$: 1 mark Answer: 1 mark	2
2.2.2	$-5 \times (-3 + 7) + 20 \div (-4)$ $= -20 - 5$ ✓ M $= -25$ ✓ A	$-20 - 5$: 1 mark Answer: 1 mark	2
2.2.3	$1^{10} + 10^0$ $= 1 + 1$ ✓ A $= 2$ ✓C A	$1 + 1$: 1 mark Answer: 1 mark	2
2.2.4	$\sqrt[3]{\sqrt{144} + 2^3 + 7}$ $= \sqrt[3]{12 + 8 + 7}$ ✓ M $= \sqrt[3]{27}$ ✓ A $=3$ ✓C A	$\sqrt[3]{12 + 8 + 7}$: 1 mark $\sqrt[3]{27}$: 1 mark Answer : 1 mark	3
QUESTION 3 [27 Marks]			
3.1	3 ; 9 ; 15 $T_n = 6n - 3$ ✓ M $T_{81} = 6(81) - 3$ ✓ A $T_{81} = 483$ ✓C A	6n – 3 : 1 mark 6(81) – 3: 1 mark Answer: 1 mark	3
3.2.1	Output value =16 ✓ A Input value =7 ✓ A	16: 1 mark 7: 1 mark	2
3.2.2	Multiply the input value by itself OR square the input value OR the square root of output value to get the input value ✓ A	Answer: 1 mark	1
3.3.1	7 ✓ A	Answer: 1 mark	1
3.3.2	✓ A ✓ A $T_n = 2n - 1$	$2n$: 1 mark -1: 1 mark	2
3.3.3	✓ **M** $2(10) - 1 = 19$ ✓ A	$2(10) - 1$: 1 mark Answer: 1 mark	2

3.4.1	$\sqrt{16y^2+9y^2}$ $=\sqrt{25y^2}$ ✓ **A** $=5y$ ✓ **CA**	$\sqrt{25y^2}$: 1 mark Answer: 1 mark	2
3.4.2	$3\,(x^2+2x+3)-3\,(x^2+4x)$ ✓ **A** ✓ **A** $=3x^2+6x+9-3\,x^2-12x$ $=\ -6x+9$ ✓ **CA**	$3x^2+6x+9$: 1 mark $-\ 3x^2-12x$: 1 mark Answer: 1 mark	3
3.4.3	$(-2a^2bc^3)^2 \div 4abcd$ ✓**A** $=4a^4b^2c^6 \div 4abcd$ ✓**M** $\frac{=1a^{4-1}b^{2-1}c^{6-1}}{d}$ $\frac{=a^3bc^5}{d}$ ✓**CA**	$4a^4b^2c^6$: 1 mark $\frac{1a^{4-1}b^{2-1}c^{6-1}}{d}$: 1 mark Answer: 1 mark	3
3.5.1	$5x=40+3x$ $5x-3x=40+3x-3x$ ✓ **M** $\frac{2x}{2}=\frac{40}{2}$ ✓ **A** $x=20$ ✓ **CA**	$-3x$ on both sides: 1 mark $2x=40$: 1 mark Answer: 1 mark	3
3.5.2	$8^x=32$ ✓**M** $2^{3x}=2^5$ $\frac{3x}{3}=\frac{5}{3}$ ✓ **A** $x=\frac{5}{3}$ ✓ **CA**	$2^{3x}=2^5$: 1 mark $3x=5$: 1 mark Answer: 1 mark	3
3.5.3	$x=2y^2+1$, if $y=-4$ ✓**M** $x=2(-4)^2+1$ $x=2(16)+1$ ✓ **CA** $x=33$	$2(-4)^2+1$: 1 mark Answer: 1 mark	2
QUESTION 4 [18 Marks]			
4.1	$140\times\frac{7}{5}$ ✓**A** $=196$ ✓**A**	$140\times\frac{7}{5}$: 1 mark Answer: 1 mark	2

4.2	✓A ✓A $\frac{585\ km}{5\ hrs} = 146\ km/h$ and $\frac{264\ km}{2\ hrs} = 132\ km/h$ 585 km travelled in 5 hours is the fastest✓CA	$146\ km/h$: 1 mark $132\ km/h$: 1 mark Answer: 1 mark	3
4.3	56,67 × 7,90 =R447,69 ✓A	56,67 × 7,90: 1 mark Answer: 1 mark	2
4.4	✓M ✓A $\frac{8}{100} \times 3\ 750 = 300$ $300 \times 3 = 900$ ✓CA	$\frac{8}{100} \times 3\ 750$: 1 mark 300: 1 mark Answer: 1 mark	3
4.5	Av. Speed $= \frac{120\ m}{2\ hrs}$ $= 60\ km/h$ ✓A Speed $= 60\ km/h - 15\ km/h$ $= 45\ km/h$ ✓A D= speed × time $= 45\frac{km}{h} \times 2h$ ✓M $= 90\ km$ ✓CA	$60\ km/h$: 1 mark $45\ km/h$: 1 mark $45\frac{km}{h} \times 2h$: 1 mark Answer : 1 mark	4
4.6	<table><tr><td>Red</td><td>Green</td><td>Yellow</td></tr><tr><td>$x+2$</td><td>x</td><td>$x+4$</td></tr></table> $x + 2 + x + x + 4 = 60$ $3x + 6 = 60$ ✓M $\frac{3x}{3} = \frac{54}{3}$ $x = 18$ (green) ✓A $18 + 2 = 20$ (red) ✓A $18 + 4 = 22$ (yellow) ✓A	Method: 1 mark Red = 20: 1 mark Green = 18: 1 mark Yellow = 22: 1 mark	4
QUESTION 5 [17 Marks]			
5.1	✓M $5^2+4^2+3^2+2^2+1^2 = 55$ ✓A	More than 30 but less than 55 : 1 mark Answer: 2 marks	2
5.2.1	$2p - 55° + 3p + 70° = 180°$($\angle s$ on a str. line) $5p + 15° = 180°$ ✓A ✓S/R $\frac{5p}{5} = \frac{180°-15°}{5}$ $p = 33°$ ✓A	Statement and reason: 1 mark $5p + 15° = 180°$: 1 mark Answer: 1 mark	3
5.2.2	$\angle$ JKR= $2p - 55°$ ✓M $= 2(33°) - 55°$ $= 11°$ ✓A	Substitution: 1 mark Answer: 1 mark	2

5.3.1	✓S $b = \angle UST = 48°$ (Cor. $\angle s$, TS∥PR) ✓R	Statement: 1 mark Reason: 1 mark	2
5.3.2	✓S/R $\angle PQS + c = 180°$ ($\angle s$ on a str. line) ✓M $c = 180° - 154°$ ✓A $c = 26°$	Statement with reason : 1 mark $c = 180° - 154°$: 1 mark Answer: 1 mark	3
5.3.3	✓S ✓R $a = c = 26°$ (Alt. $\angle s$, PR ∥ TS	Statement: 1 mark Reason: 1 mark	2
5.3.4	$b + c + d = 180°$ (sum of the $\angle s$ of a Δ) ✓S/R ✓M $d = 180° - 26° - 48°$ ✓A $d = 106°$ OR ✓S/R $\angle UST + a + d = 180°$ ($\angle s$ on a str. line) ✓M $d = 180° - 26° - 48°$ ✓A $d = 106°$ OR $(a + d) + b = 180°$ [co-interior angles, PR ∥ TS]	Statement with reason : 1 mark $d = 180° - 26° - 48°$: 1 mark Answer: 1 mark OR Statement with reason : 1 mark $d = 180° - 26° - 48°$: 1 mark Answer: 1 mark	3

QUESTION 6 [17 Marks]			
6.1	✓S ✓R $\therefore \Delta PTQ \equiv \Delta PTR$ ($S\angle S$)	Correct statement: 1 mark Reason: 1 mark	2
6.2.1	✓S ✓ R $\angle GIE = \angle DEI = 30°$ (Alt. $\angle s$, DF∥GI)	Statement: 1 mark Reason: 1 mark	2
6.2.2	✓S/R $\angle D = \angle HIG = 75°$ (Cor. $\angle s$, DF∥GI) ✓S/R $\angle HIG = \angle HGI = 75°$ ($\angle s$ opp. to = sides of a Δ)	Correct statement with reason: 1 mark Correct statement with reason: 1 mark	2

6.2.3	✓**S/R** ∠ H +∠HIG +∠HGI = 180° (sum of the ∠s of a Δ) ∠ H = 180° − 75° − 75° ✓**M** ∠ H = 30° ✓**A**	Correct statement with reason: 1 mark 180° − 75° − 75°: 1 mark Answer: 1 mark	3
6.2.4	✓**A** ✓**A** ΔDEI ||| ΔIGH ||| ΔDFH	ΔIGH: 1 mark ΔDFH: 1 mark	2
6.3.1	$3x + 60° + 2x + 20° + x + 40° + x + 100°$ $= 360°(\angle s$ of a quad.) ✓**S/R** ✓**A** $7x + 220° = 360°$ $\frac{7x}{7} = \frac{360° - 220°}{7}$ $x = 20°$ ✓**A**	Correct statement with reason: 1 mark each $7x + 220° = 360°$: 1 mark Answer: 1 mark	3
6.3.2	∠ A = $3x + 60° = 3(20°) + 60° = 120°$ ✓**M** ∠ C = $x + 100° = 20° + 100° = 120°$ ✓**R** ✓**A** ∴ ABCD is a ∥m or rhombus (∠ A = ∠ C) OR ∠B = $2x + 20° = 2(20°) + 20° = 60°$ ✓**M** ∠ D = $x + 40° = 20° + 40° = 60°$ ✓**R** ✓**A** ∴ ABCD is a ∥m or rhombus (∠ B = ∠ D) ∠ D = $x + 40° = 20° + 40° = 60°$ ✓**R** ✓**A** ∴ ABCD is a ∥m or rhombus (∠ B = ∠ D)	Method: 1 mark Statement: 1 mark Reason: 1 mark	3
100 MARKS			

6.3. Grade 9 Examination exemplar (Framework)

GRADE 9 MATHEMATICS FRAMEWORK

Time: 2 hours
Total marks: 100

Content Area	Topics	Concepts and skills	Concepts and skills	Proportion (%) of total marks in the test (Weighting)[1]	Item number	Total Marks
Numbers, operations and relationships. 30% ± 30 marks	Whole numbers	Properties of numbers	Describe the real number system by defining, recognising real number system and distinguishing their properties	30%	1.1	1
		Calculations using whole numbers	Calculations using all four operations on whole numbers		2.3.2	2
		Multiples and factors	Use prime factorisation to find LCM and HCF of numbers		1.2	1
		Solving problems	Solve problems in context involving ratio and rate		4.3	4
			Solve problems in context involving direct and indirect proportion		4.1.2	2
			Solve problems that involve whole numbers, percentages and decimal fractions in financial context such as compound interest		4.2	3
			Solve problems in context involving whole numbers and common fractions			
	Integers	Properties of integers	Use commutative, associative and distributive properties of addition and multiplication of integers			
		Calculations with integers	Perform calculations involving all four operations using numbers that involve the squares, cubes, square roots and cube roots of integers			

		Solving problems	Solve problems in context involving multiple operations with integers			
	Exponents	Comparing and representing numbers in exponential form	Representing numbers in scientific notation		2.1	2
		Calculations using numbers in exponential form	Perform calculations involving all four operations using numbers in exponential form and using laws of exponents		2.2.1 2.3.1 3.2.4	2 2 3
		Solving problems	Solve problems in context involving numbers in exponential form and in scientific notation			
	Common fractions	Calculations using fractions	Calculations with common fractions involving all four basic operations			
			Perform all four operations with numbers that involve squares, cubes, square roots and cube roots of common fractions		2.2.2	3
		Solving problems	Solve problems in context involving common fractions, mixed numbers and percentages			
		Equivalent forms	Finding equivalent forms between common fractions, decimal fractions and percentages of the same number			
	Decimal fractions	Calculations with decimal fractions	Perform multiple calculations with decimal fractions using a calculator where appropriate			
			Perform all four operations with numbers that involve squares, cubes, square roots and cube roots of decimal fractions		1.5	1
		Solving problems	Solve problems in context involving decimal fractions, mixed numbers and percentages		4.4	3
		Equivalent forms	Finding equivalent forms between common fractions, decimal fractions and percentages of the same number			
Patterns, functions and algebra 22%	Numeric and geometric patterns	Investigating and extending patterns	Investigate and extend numeric and geometric patterns looking for rules of patterns • represented in physical or diagram form		1.8	1

± 22 marks			• not limited to sequences involving a constant difference or ratio • represented in tables • represented algebraically		4.1.1	1
			Describe and justify the general rule for observed relationships between numbers in own words or in algebraic language		3.1.2	2
	Functions and relationships	Input and output values	Determine the input, output values or rules for patterns and relationships using: • flow diagrams • tables • formulae • equations			
		Equivalent forms	Determine, interpret and justify equivalence of different descriptions of the same relationship or rule presented: • verbally • in flow diagrams • in tables • by formulae • by equations • by graphs on a Cartesian plane		3.1.1	1
	Algebraic expressions	Algebraic language	Recognise and differentiate between monomials, binomials and trinomials			
		Expand and simplify algebraic expressions	Use the commutative, associative and distributive laws for rational numbers and laws of exponents to: • add and subtract like terms in algebraic expressions • multiply integers and monomials by: ✓ monomials ✓ binomials ✓ trinomials • divide the following by integers or monomials: ✓ monomials		1.4 3.2.3	1 2

			✓ binomials ✓ trinomials • simplify algebraic expressions involving the above operations • determine the squares, cubes, square roots and cube roots of single algebraic terms or like algebraic terms • determine the numerical value of algebraic expressions by substitution		3.2.1	2
			Extend the above algebraic manipulations to include: • multiplying integers and monomials by polynomials • dividing polynomials by integers or monomials • the product of two binomials • the square of a binomial		3.2.2	4
	Algebraic equations		Set up equations to describe problem situations		4.4	3
			Analyse and interpret equations that describe a given situation			
		Equations	Solve equations by: • inspection • using additive and multiplicative inverses • using laws of exponents	22	3.3.2 3.3.3	3 2
			Determine the numerical value of an equation by substitution		3.3.4	2
			Use substitution in equations to generate tables of ordered pairs			
			Extend solving equations to include using • factorisation • equations of the form: a product of factors = 0		3.3.1	1

Space and shape 35% ± 35 marks	Geometry of 2-D shapes	Classifying 2-D shapes	Use properties and definitions of triangles in terms of their sides and angles to distinguish between: • equilateral triangles • isosceles triangles • right-angled triangles		1.3 5.2.3	1 3
			Write clear definitions of quadrilaterals in terms of their sides, angles and diagonals, distinguishing between: • parallelogram • rectangle • square • rhombus • trapezium • kite		1.10	1
		Similar and congruent triangles	Through investigation, establish the minimum conditions for congruent triangles		6.1	4
			Through investigation, establish the minimum conditions for similar triangles		6.2	4
		Solving problems	Solve geometric problems involving unknown sides and angles in triangles and quadrilaterals, using known properties of triangles and quadrilaterals, as well as properties of congruent and similar triangles		6.3	4
		Investigating properties of geometric figures	Investigate the angles in a triangle, focusing on the relationship between the exterior angle of a triangle and its interior angles		5.1.3	4
			Explore the sum of the interior angles of polygons		1.9	1
	Geometry of straight lines	Angle relationship	Revise and write clear descriptions of the relationship between angles formed by: • perpendicular lines • intersecting lines • parallel lines cut by a transversal	35%	5.1.1 5.1.2 5.2.1 5.2.2	2 2 2 2
		Solving problems	Solve geometric problems using the relationships between pairs of angles described above		5.3.1 5.3.2	3 2

Measurement 13% ± 13 marks	The theorem of Pythagoras	Solving problems	Use the theorem of Pythagoras to solve problems involving unknown lengths in geometric figures that contain right-angled triangles	13%	1.6	1
	Area and perimeter of 2-D shapes	Area and perimeter	Use appropriate formulae and conversions between SI units to solve problems and calculate perimeter and area of: • polygons • circles		7.1 7.2 7.3	3 5 3
			Investigate how doubling any or all of the dimensions of a 2-D figure affects its perimeter and its area		1.7	1
				100		

Test Specifications

Item	Content Area	Topics	Concepts and skills The learner must be able to (i.e. do or know):	Cognitive Level	Type of Ques.	Score
1.1	Numbers, operations and relationships	Whole numbers	Describe the real number system by recognising irrational numbers	K	MCQ	1
2.3.2			Calculations using all four operations on whole numbers	P	CR	2
1.2			Use prime factorisation to find HCF of numbers	R	MCQ	1
4.3			Solve problems in context involving ratio and rate	C	CR	4
4.1.2			Solve problems in context involving direct and indirect proportion	C	CR	2
4.2			Solve problems that involve whole numbers, percentages and decimal fractions in financial context such as compound interest	R	CR	3
2.1		Exponents	Represent numbers in scientific notation	K	CR	2
2.2.1			Solve problems involving numbers in exponential form and in scientific notation	R	CR	2

Item	Content Area	Topics	Concepts and skills The learner must be able to (i.e. do or know):	Cognitive Level	Type of Ques.	Score
2.3.1 3.2.4			Perform calculations involving all four operations using numbers in exponential form and using laws of exponents	P	CR	2
2.2.2		Common fractions	Perform all four operations with numbers that involve squares, cubes, square roots and cube roots of common fractions	R	CR	3
1.5		Decimal fractions	Perform all four operations with numbers that involve squares, cubes, square roots and cube roots of decimal fractions	R	MCQ	1
4.4			Solve problems in context involving decimal fractions, mixed numbers and percentages	P	CR	3
						30
1.8 4.1.1	Patterns, functions and algebra	Numeric patterns	Investigate and extend numeric patterns looking for rules of patterns not limited to sequences involving a constant difference or ratio	R K	MCQ CR	1 1
3.1.2			Describe and justify the general rule for observed relationships between numbers in own words or in algebraic language	C	CR	2
3.1.1			Determine, interpret and justify equivalence of different descriptions of the same relationship or rule presented in tables	R	CR	1
1.4		Expand and simplify algebraic expressions	Divide the following polynomials by integers or monomials	R	MCQ	1
3.2.1			Determine the squares, cubes, square roots and cube roots of single algebraic terms or like algebraic terms	K	CR	2
3.2.3			Simplify algebraic expressions with fractions	R	CR	2
3.2.2			Extend and simplify algebraic expressions involving binomials and a square of a binomial	R	CR	4
3.3			Simplify algebraic expressions including dividing a polynomial by integer or monomial	R	CR	3
4.4		Algebraic equations	Set up equations to describe problem situations	P	CR	3
3.3.1			Solve equations of the form: a product of two factors = 0	K	CR	1
3.3.2			Solve algebraic equations involving fractions using additive and multiplicative inverse	R	CR	3
3.3.3			Solve equations using laws of exponents	K	CR	2
3.3.4			Determine the numerical value of an equation by substitution	R	CR	2

Item	Content Area	Topics	Concepts and skills The learner must be able to (i.e. do or know):	Cognitive Level	Type of Ques.	Score
1.3	Space and shape	Properties of 2-D shapes	Use properties and definitions of triangles in terms of their sides and angles to distinguish between equilateral triangles	K	MCQ	1
1.10			Write clear definitions of quadrilaterals in terms of sides, angles and their diagonals	K	MCQ	1
5.2.3			Solve geometric problems involving unknown sides and angles in triangles and quadrilaterals using known properties as well as properties of congruent and similar figures	R	CR	3
6.1		Similar and congruent triangles	Investigate the minimum conditions for congruent triangles	C	CR	4
6.2			Investigate the minimum conditions for similar triangles	C	CR	4
6.3		Solving problems	Solve geometric problems involving unknown sides and angles in triangles and quadrilaterals, using known properties of triangles and quadrilaterals, as well as properties of congruent and similar triangles.	R	CR	4
5.1.1		Investigating properties of geometric figures	Investigate the angles in a triangle, focusing on the relationship between the exterior angle of a triangle and its interior angles	R	CR	4
1.9			Explore the sum of the interior angles of polygons	K	MCQ	1
5.1.2 5.1.3 5.2.1 5.2.2 5.3.1 5.3.2		Geometry of straight lines	Solve geometric problems using the relationships between pairs of angles formed by parallel lines cut by a transversal line.	R	CR	2 2 2 2 3 2
						35
1.6	Measurement	The theorem of Pythagoras	Use the theorem of Pythagoras to solve problems involving unknown lengths in geometric figures that contain a right-angled triangle	C	MCQ	1
7.1		Area and perimeter of 2-D shapes	Solve problems with or without a calculator involving perimeter and area of polygons	R	MCQ	3
7.2			Use appropriate formulae and conversions between SI units to solve problems and calculate the area and perimeter of polygons	C	CR	5
7.3			Use appropriate formulae and conversions between SI units to solve problems involving the area and perimeter of polygons	P	CR	3

Item	Content Area	Topics	Concepts and skills The learner must be able to (i.e. do or know):	Cognitive Level	Type of Ques.	Score
1.7			Investigate how doubling any or all the dimensions of a 2-D figure affects its perimeter and its area	K	MCQ	1
						13

Key:

K:	Knowing facts and procedures
R:	Routine questions
C:	Complex procedures
P:	Problem solving (Unseen, non-routine, higher-order questions)
MCQ:	Multiple-choice questions
CR:	Constructive response

Summary: Type of item

Type of item	Number of items	Total marks	Proportion (%) of total test mark (Weighting)
MCQ	10	10	10
CR	34	90	90
Grand Total	44	100	100%

Content Area	Number of items	Total marks	Proportion (%) of total test mark (Weighting)
Numbers, operations and relationships. (30%)	13	30	30%
Patterns, functions and algebra. (22%)	12	22	22%
Space and shape (35%)	14	35	35%
Measurement (13%)	5	13	13%
Grand Total	44	100	100%

Cognitive Level	Number of items	Total marks	Proportion (%) of total test mark (Weighting)
Knowledge (≈25%)	16	25	25
Routine procedures (≈45%)	18	45	45
Complex procedures (≈20%)	6	20	20
Problem solving (≈10%)	4	10	10
Grand Total	44	100	100%

MARKS: 100

DURATION : 2 hours

This examination paper consists of 10 pages, including the cover page.

Instructions and information to the learner

1. Read the questions carefully.
2. Answer **ALL** the questions.
3. Write neatly and legibly.
4. Number your answers exactly as questions are numbered.
5. Clearly show **ALL** the calculations, diagrams, graphs, etc. you have used in determining the answers.
6. You may use an approved scientific calculator (non-programmable and non-graphical).
7. This question paper consists of **7** questions.
8. Diagrams are **NOT** drawn to scale.

QUESTION 1

In this question, write only the letter for the **correct answer** next to the corresponding number, e.g. if the correct answer to 1.1 is D, you should only write 1.1 D.

1.1 Complete: $\frac{1}{3}$ is… (1)

A. neither a real nor rational number

B. both a real and rational number
C. only a rational number
D. only a real number

1.2 What is the HCF of 162 and 270? (1)

A $5 \times 3 \times 3 \times 3 \times 3 \times 2$
B $5 \times 3 \times 3 \times 3 \times 2$
C $3 \times 3 \times 3 \times 3 \times 2$
D $3 \times 3 \times 3 \times 2$

1.3 Which of the following statements is correct about an equilateral triangle? (1)

A Two angles opposite to equal sides are equal.
B All angles and all sides are NOT equal.
C All angles and all sides are equal.
D Any two angles are equal.

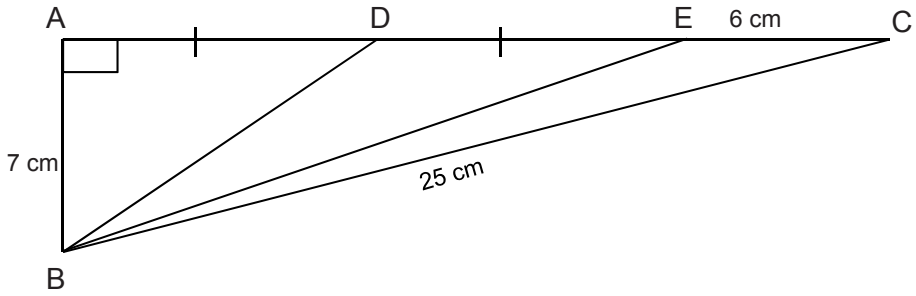
1.4 What is $\frac{12x^2y-6xy^2}{3xy}$ when simplified? (1)

A. $4x - 2y$
B. $9x - 3y$
C. $6xy$
D. $2xy$

1.5 Complete: $\sqrt{\frac{1\,600}{0{,}1\times 0{,}1}} = \ldots..$ (1)

A 4 000
B 400
C 40
D 4

1.6 What is the length of AD in the figure below? (1)



A 24 cm
B 18 cm
C 9 cm
D 7 cm

1.7 What would be the perimeter of a rectangle if both dimensions are doubled? (1)

A $4 \times$ the original perimeter
B $3 \times$ the original perimeter
C $2 \times$ the original perimeter
D $1 \times$ the original perimeter

1.8 What is the next term in 2; 5; 10; 17;...? (1)

A. 19
B. 26
C. 32
D. 34

1.9 What is the sum of the angles of a hexagon? (1)

A 900°
B 720°
C 540°
D 360°

1.10 Which of the following is a property of a parallelogram?

A Diagonals bisect each other at 90°.
B Diagonals bisect the angles.
C Diagonals bisect each other.
D Diagonals are equal.

[10]

QUESTION 2

2.1 Write 0,000000568 in scientific notation. (2)

2.2 Calculate without using a calculator. Show all the calculation steps.

2.2.1 $5{,}8 \times 10^{3} \times 2{,}3 \times 10^{-7}$ (leave your answer in scientific notation) (3)

2.2.2 $\sqrt{\sqrt{\frac{625}{10\,000}}+\frac{1}{2}}$ (3)

2.3 Evaluate:

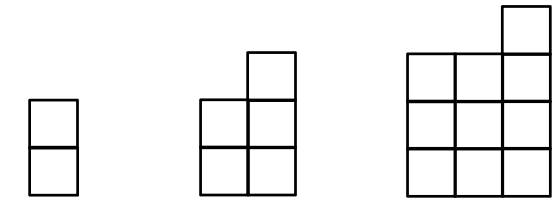
2.3.1 $2^{2017}-\frac{2^{2018}}{2}$ (2)

2.3.2 $(1234565 \times 1234563)-(1234561 \times 1234567)$ (2)

[12]

QUESTION 3

3.1 The pattern below is formed by squares.



Stage 1 Stage 2 Stage 3

3.1.1 Complete the table to illustrate the number of squares per stage (1)

Stage number	1	2	3	4
No. of squares	2	5	10	

3.1.2 Write the general rule that describes the relationship between the stage number and the number of squares used in the form of $T_n = \ldots\ldots..$ (2)

3.2 Simplify :

3.2.1 $\sqrt{34y^6-9y^6}$ (2)

3.2.2 $(2x-3)^2-4(x-1)(x+1)$ (4)

3.2.3 $\frac{2(x+4)}{2}-2$ (2)

3.2.4 $\frac{p^2q^2 \times (p^{-2})^2}{p^{-2}}$ (3)

3.3 Solve for x.

3.3.1 $(x-2)(x-2)=0$ (1)

3.3.2 $\frac{2x}{3}-\frac{x+1}{4}=1$ (3)

3.3.3 $2^{-x}=64$ (2)

3.3.4 $x = a - b$, if $a = 2 + x$ and $b = x - 2$ (2)

[22]

QUESTION 4

4.1 The table below shows the length of the side of square in m and its area in m^2. Study the table and answer the questions that follow:

The length of the side of square in m	1	2	3	4		p
The area of a square in m^2	1	4	9	t		144

4.1.1 Write down the numerical value of p. (1)

4.1.2 Is the area of a square proportional to its side? Give a reason for your answer. (2)

4.2 Calculate the compound interest on R12 750 at 15% per annum for 3 years. Round off your answer to the nearest cents. (3)

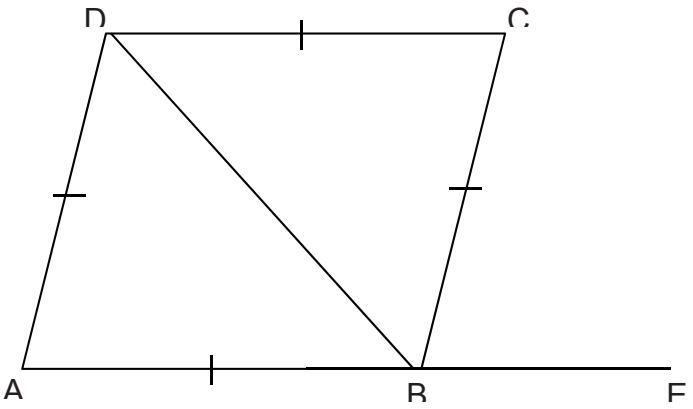
4.3 Ben drives a car and covers a distance of 420 km in 4 hours. How far will he travel in 3 hours? (4)

4.4 The cost of 2 pencils and 3 rulers is R13,50. If a pencils costs 50 cents more than a ruler, what is the cost of 1 pencil and 1 ruler in rands? (3)

[13]

QUESTION 5

5.1 In the diagram below, $\hat{A} = 70°$.

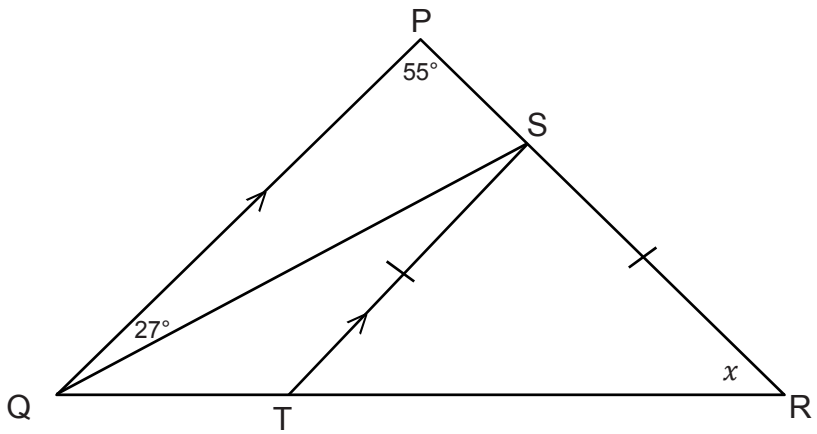


5.1.1 Determine the size of $B\hat{C}D$. Give a reason for your answer. (2)

5.1.2 Determine the size of $C\hat{B}E$. Give a reason for your answer. (2)

5.1.3 Calculate the value of $D\hat{B}E$. Give reasons for your answer. (4)

5.2 In the diagram below, PQ ∥ ST, SR= ST, $Q\hat{P}R = 55°$ and $P\hat{Q}S = 27°$.

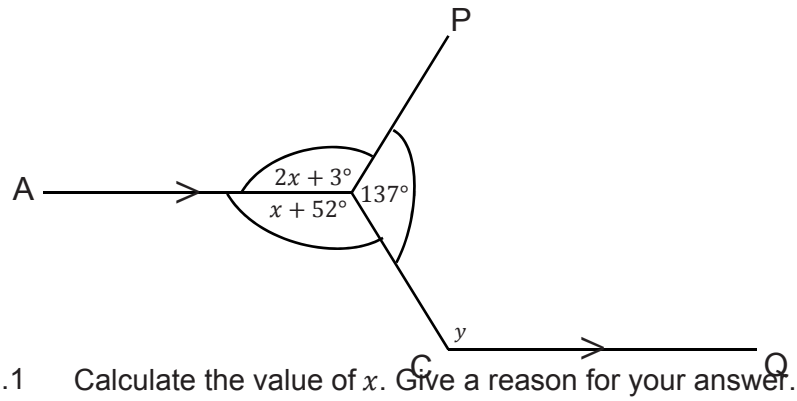


5.2.1 Determine the size of $Q\hat{S}T$. Give a reason for your answer. (2)

5.2.2 Determine the size of $T\hat{S}R$. Give a reason for your answer. (2)

5.2.3 Calculate the value of x. Give a reason for your answer. (3)

5.3 In the diagram below, AB, CB and PB meet at B, $A\hat{B}P = 2x + 3°$, $A\hat{B}C = x + 52°$ and $P\hat{B}C = 137°$.

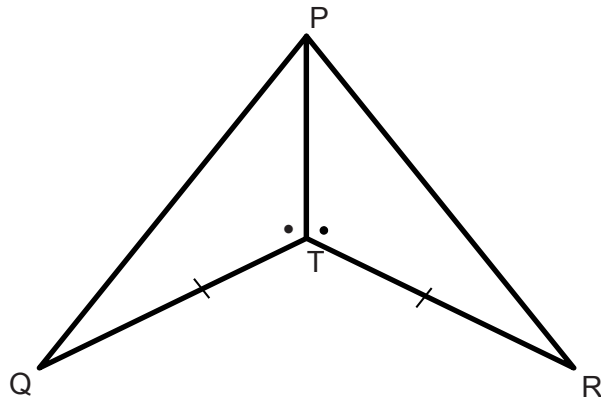


5.3.1 Calculate the value of x. Give a reason for your answer. (3)

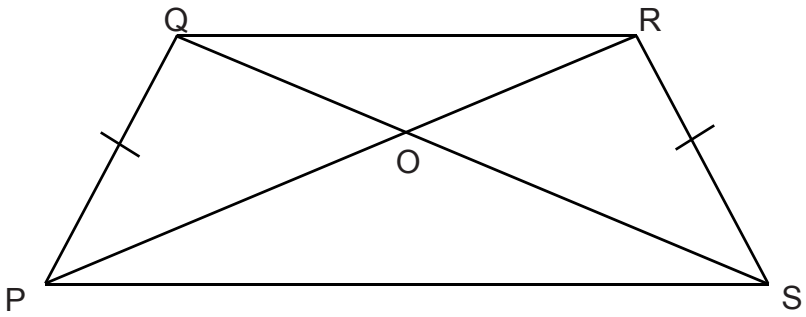
5.3.2 Determine the actual size of $\angle y$. Give a reason for your answer. (2)

QUESTION 6

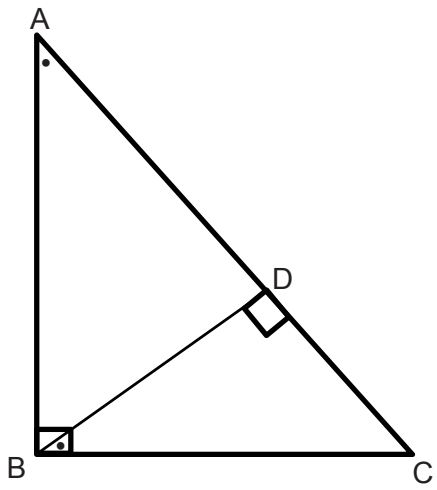
6.1 In the diagram below, prove that ΔPTQ≡ ΔPTR. Give reasons for your answer. (4)



6.2 PQRS below is a trapezium. Prove that △QOR ||| △POS. (4)



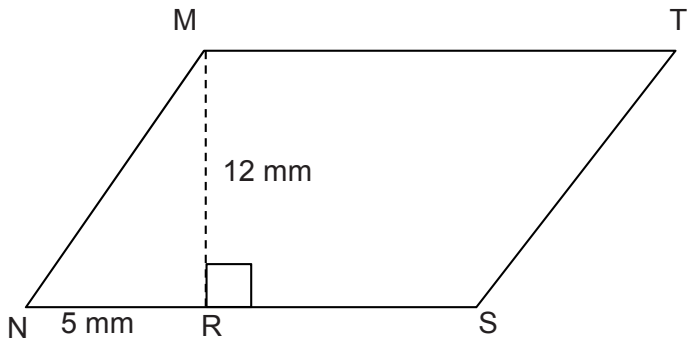
6.3 In the figure below ΔABC ||| ΔBDC, AB = 12 cm, BC = 5 cm and AC = 13 cm. Calculate the length of BD rounded off to 1 decimal place. (4)



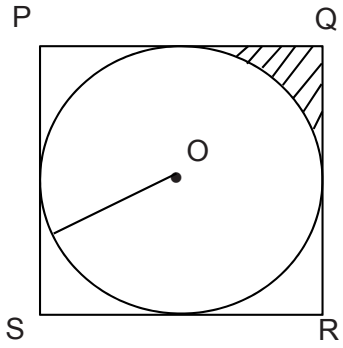
[12]

QUESTION 7

7.1 The area of a parallelogram below is 432 mm^2, MR=12 mm and NR= 5 mm. Calculate the length of NS (3)



7.2 PQRS is a square with circle O where r = 7 mm. Calculate the area of the shaded part correct to one decimal place. Note:$\pi = \frac{22}{7}$ (5)



7.3 The perimeter of the hexagon in Figure 1 is 24 cm. If the shape in Figure 2 is made of the hexagons of the same size as in Figure 1, what is the perimeter of the shape drawn in Figure 2? (3)

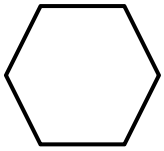


Figure 1

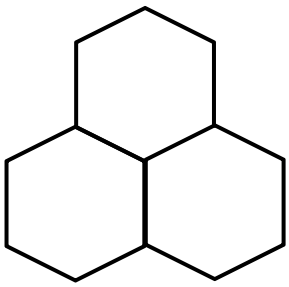


Figure 2

[11]

TOTAL = 100

MEMORANDUM

MARKS: 100

Important information

- This is marking guideline. In instances where learners have used different mathematically sound strategies to solve the problems, they should be credited.
- Underline errors committed by learners and apply Consistent Accuracy (CA) marking.

KEY	
M	Method mark
CA	Consistent accuracy mark
A	Accuracy mark
S	Statement
R	Reason
S/R	Statement and reason

QUESTION 1 [10 Marks]					
1.1	B	1.6	C	1 mark for each correct answer	(10)
1.2	D	1.7	C		
1.3	C	1.8	B		
1.4	A	1.9	B		
1.5	B	1.10	C		

Ques.	Solution	Mark Allocation	Total
QUESTION 2 [12 Marks]			
2.1	✓ **A** ✓ **A** $5{,}68 \times 10^{-7}$	5,68: 1 mark 10^{-7} : 1 mark	2
2.2.1	$5{,}8 \times 10^{3} \times 2{,}3 \times 10^{-7}$ $=13{,}34 \times 10^{-4}$ ✓ **M** ✓ **M** $=1{,}334 \times 10^{-3}$ ✓ **A**	13,34: 1 mark $\times 10^{-4}$: 1 mark Answer: 1 mark	3
2.2.2	$\sqrt{\sqrt{\frac{625}{10\,000}}} + \frac{1}{2}$ $= \frac{5}{10} + \frac{1}{2}$ ✓ **M** $= \frac{1}{2} + \frac{1}{2}$ ✓ **M** $= 1$ ✓ **CA**	$\frac{5}{10}$: 1 mark $\frac{1}{2}$: 1 mark Answer: 1 mark	3
2.3.1	$2^{2017} - \frac{2^{2018}}{2}$ $= 2^{2017} - 2^{2018} \times 2^{-1}$ ✓ **M** $= 2^{2017} - 2^{2017}$ $=0$ ✓ **A**	Method: 1 mark Answer: 1 mark	2
2.3.2	$(1234565 \times 1234563) - (1234561 \times 1234567)$ $= (x+4) \times (x+2) - (x) \times (x+6)$ ✓ **M** $= x^2 + 6x + 8 - (x^2 + 6x)$ $= x^2 + 6x + 8 - x^2 - 6x$ $= 8$ ✓ **A**	Method: 1 mark Answer: 1 mark	2

QUESTION 3 [22 marks]			
3.1.1	17 ✓A	Answer: 1 mark	1
3.1.2	✓A ✓A $T_n = n^2 + 1$	n^2: 1 mark -1: 1 mark	2
3.2.1	$\sqrt{34y^6 - 9y^6}$ $= \sqrt{25y^6}$ ✓A $= 5y^3$ ✓CA	$\sqrt{25y^6}$: 1 mark Answer: 1 mark	2
3.2.3	$(2x-3)^2 - 4(x-1)(x+1)$ ✓M ✓M $= 4x^2 - 12x + 9 - 4(x^2 - 1)$ $= 4x^2 - 12x + 9 - 4x^2 + 4$ ✓A $= -12x + 13$ ✓CA	$4x^2 - 12x + 9$: 1 mark $x^2 - 1$: 1 mark $-4x^2 + 4$: 1 mark Answer: 1 mark	4
3.2.3	$\frac{2(x+4)}{2} - 2$ $= x + 4 - 2$ ✓M $= x + 2$ ✓CA	$x + 4 - 2$: 1 mark Answer: 1 mark	2
3.2.4	$\frac{p^2q^2 \times (p^{-2})^2}{p^{-2}}$ $= \frac{p^2q^2 \times p^{-4}}{p^{-2}}$ ✓M $= p^{2-4+2}q^2\ q^2$ ✓A $= p^0q^2$ $= q^2$ ✓CA	p^{-4}: 1 mark $p^{2-4+2}q^2\ q^2$: 1 mark Answer: 1 mark	3
3.3.1	$(x-2)(x-2) = 0$ $x = 2$ ✓A	Answer: 1 mark	1
3.3.2	$\frac{2x}{3} - \frac{x+1}{4} = 1$	× LCD: 12: 1 mark	3

	$12 \times \left(\frac{2x}{3}\right) - 12 \times \left(\frac{x+1}{4}\right) = 12 \times 1$ ✓ **M** $8x - 3x - 3 = 12$ ✓**A** $5x = 15$ $x = 3$ ✓ **CA** Or $\frac{2x}{3} - \frac{x+1}{4} = 1$ $\frac{4(2x) - 3(x+1)}{12} = 1$ $12 \times \left(\frac{8x-3x-3}{12}\right) = 12 \times 1$ ✓ **M** $8x - 3x - 3 = 12$ ✓ **A** $5x = 15$ $x = 3$ ✓ **CA**	$8x - 3x - 3 = 12$: 1 mark Answer: 1 mark	
3.3.3	$2^{-x} = 64$ $2^{-x} = 2^6$ ✓**M** $x = -6$ ✓ **A** OR $\frac{1}{2^x} = 2^6$ ✓**M** $1 = 2^x \times 2^6$ $2^0 = 2^{x+6}$ ✓**A** $x + 6 = 0$ $\therefore x = -6$	$2^{-x} = 2^6$: 1 mark Answer: 1 mark Method: 1 mark Answer: 1 mark	2

3.3.4	$x = a - b$, if $a = 2 + x$ and $b = x - 2$ $x = (2 + x) - (x - 2)$ ✓**M** $x = 2 + x - x + 2$ $x = 4$ ✓ **CA**	$2 + x - x + 2$: 1 mark Answer: 1 mark	2
QUESTION 4 [13 Marks]			
4.1.1	$p = 12$ ✓**A**	Answer: 1 mark	1
4.1.2	It is **neither** directly **nor** inversely proportional ✓**A** OR It is NOT proportional ✓**M** $\frac{y}{x} \neq k$ or $\frac{x}{y} \neq k$ ✓**R**	Answer: 1 mark $\frac{y}{x} \neq k$ or $\frac{x}{y} \neq k$: 1 mark	2
4.2	$A = P(1 + i)^n$ ✓**M** $=$ R12 750$(1 + 0.15)^3$ $=$ R12 750$(1.15)^5$ $=$ R19 391,16 CI $=$ R19 391,16– R12 750 ✓**M** $=$ R6 641,16 ✓**A** Or $A = P\left(1 + \frac{r}{100}\right)^n - P$ ✓**M** $=$ 12 750$(1 + 0.15)^5 -$ R12 750 $=$ 12 750$(1.15)^5 -$ R12 750 $=$ R19 391,16 $-$ R12 750 ✓**M** $=$ R6 641,16 ✓**A**	Formula: 1 mark R19 391,16– R12 750: 1 mark Answer: 1 mark	3
4.3	Av. Speed $= \frac{420km}{4hrs}$ ✓**M** $= 105\ km/h$ ✓**A** D= speed × time $= 105km/h \times 3h$ ✓**M** $= 315\ km$ ✓**CA**	$\frac{420km}{4hrs}$: 1 mark $105\ km/h$: 1 mark $105\ km/h \times 3h$: 1 mark Answer :1 mark	4
4.4	Let the number of pencils be x and the number of rulers be y $2x + 3y = 13{,}50$	Method: 1 mark Ruler = R2,50: 1 mark Pencil = R3: 1 mark	3

	$x = y + 0{,}50$ $2(y + 0{,}50) + 3y = 13{,}50$ ✓**M** $2y + 1 + 3y = 13{,}50$ $5y = 12{,}50$ y =R2,50 (ruler) ✓**A** $x = R2{,}50 + 0{,}50 = R3$ (pencil) ✓**A** OR Let the number of pencils be x and the number of rulers be y 2 pencils + 3 rulers = 13.50 – 1 ✓**M** 5 rulers = R12,50 (price of pencil = price of ruler) 1 ruler = R2,50 ✓**A** 1 pencil = R3 ✓**A**		
QUESTION 5 [20 marks]			
5.1.1	✓**S** ✓**R** ∠BCD= ∠A=70° (Opp. ∠s of a rhombus)	Statement: 1 mark Reason: 1 mark	2
5.1.2	✓**S** ✓**R** ∠CBE= ∠DBE=70° (Corres ∠s , AD∥BC) Or ✓**S** ✓**R** ∠CBE = ∠BCD =70° (Alt ∠s , CD∥AE)	Statement: 1 mark Reason: 1 mark	2
5.1.3	✓**S/R** ∠ADB= ∠ABD= $\frac{180°-70°}{2}$ (Isosc. ΔABD, AD= AB) ∠ADB= ∠ABD = 55° ✓**A** ∠DBE= ∠A+ ∠ADB (Ext. ∠ of a Δ) ✓**S/R** ∠DBE=70° +55° =125° ✓**A** Or ✓**S** ✓**R** ∠DBE= 180° − ∠ABD (Adj Supp. ∠s.) ∠DBE= 180° − 55° ✓**A** = 125° ✓**A** Or ✓**S** ✓**R** ∠DBC = $\frac{180°- \angle BCD}{2}$ (DC=BC) ∠DBC= $\frac{180° - 70°}{2}$ ✓**A** = 55° ∠DBE= ∠CBE + ∠DBC ∠DBE= 70° + 55° = 125° ✓**A**	Statement and reason:1 mark ∠ADB= ∠ABD = 55°: 1 mark Statement and reason: 1 mark Answer: 1 mark Or Statement: 1 mark Reason: 1 mark ∠DBE= 180° − 55° : 1 mark Answer: 1 mark Or Statement: 1 mark Reason: 1 mark ∠DBC= $\frac{180° - 70°}{2}$: 1 mark : Answer: 1 mark	4

5.2.1	✓S ✓R ∠QST= 27° (Alt. ∠s, QP∥TS	Statement: 1 mark Reason: 1 mark	2
5.2.2	✓S ✓R ∠TSR = 55° (Cor. ∠s, QP∥TS)	Statement: 1 mark Reason: 1 mark	2
5.2.3	∠TSR+∠STR+ $x = 180°$ (sum of the ∠s of a Δ) ✓S/R $x = \frac{180^\circ - 55^\circ}{2}$ (∠s opp. to equal sides) ✓M $x = 62{,}5°$ ✓A	Statement with reason: 1 mark $x = \frac{180^\circ - 55^\circ}{2}$: 1 mark Answer: 1 mark	3
5.3.1	$2x + 3° + 137^\circ + x + 52° = 360^\circ$ (Rev. ∠) ✓S/R $3x = 360^\circ - 192^\circ$ $3x = 168°$ ✓M $x = 56^\circ$ ✓A	Statement with reason: 1 mark $3x = 168°$: 1 mark Answer: 1 mark	3
5.3.2	$\angle y = \angle x + 52°$ (alt. ∠'s, AB∥CQ) ✓ S/R $y = 108^\circ$ ✓ A	Statement with reason: 1 mark Answer: 1 mark	2

QUESTION 6 [12 Marks]

6.1

STATEMENT	REASON
PT=PT	Common ✓A
QT=TR	Given ✓A
∠QTP = ∠PTR	Given ✓A
∴ ΔPTQ ≡ ΔPTR	$S\angle S$ ✓ A

Correct statement with reason: 1 mark each — 4

<table>
<tr><td>6.2</td><td><table>
<tr><td>STATEMENT</td><td>REASON</td></tr>
<tr><td>∠RQS = ∠PSQ</td><td>At. ∠s, QR∥PS ✓A</td></tr>
<tr><td>∠QRP = ∠SPR</td><td>At. ∠s, QR∥PS ✓A</td></tr>
<tr><td>∠QOR = ∠POS</td><td>Vert. opp.∠s ✓A</td></tr>
<tr><td>∴△QOR ||| △SOP</td><td>∠∠∠ ✓A</td></tr>
</table></td><td>Correct statement with reason: 1 mark each</td><td>4</td></tr>
<tr><td>6.3</td><td>$\frac{BD}{BC} = \frac{AB}{AC}$ ✓A (△ABC ||| △BDC) ✓A
$\frac{BD}{5\ mm} = \frac{12\ mm}{13\ mm}$ ✓A
$BD = 4{,}6\ mm$ ✓CA</td><td>Statement: 1 mark
Reason: 1 mark
$\frac{BD}{5\ mm} = \frac{12\ mm}{13\ mm}$: 1 mark
Answer: 1 mark</td><td>4</td></tr>
<tr><td colspan="4">QUESTION 7 [11 Marks]</td></tr>
<tr><td>7.1</td><td>$Area_{MTSN} = NS \times MR$ ✓M
$432\ mm^2 = NS \times 12\ mm$ ✓S
$NS = 36\ mm$ ✓A</td><td>Formula: 1 mark
Substitution: 1 mark
Answer: 1 mark</td><td>3</td></tr>
<tr><td>7.2</td><td>Area of shaded part = ($Area_{PQRS}$ – Area of circle) ÷4 ✓M
$= \{14\ mm \times 14\ mm - (\frac{22}{7} \times 7\ mm^2)\} \div 4$ ✓M
$= (196\ mm^2 - 154\ mm^2) \div 4$ ✓M
$= 42\ mm^2 \div 4$ ✓A
$= 10{,}5\ mm^2$ ✓CA</td><td>Formula: 1 mark
÷4: 1 mark
$196\ mm^2 - 154 mm^2$: 1 mark
$42\ mm^2$: 1 mark
Answer: 1 mark</td><td>5</td></tr>
<tr><td>7.3</td><td>1 side = $\frac{24cm}{6}$
= 4 cm ✓A
P = 4 cm × 12 ✓M
= 48 cm ✓A</td><td>4 cm: 1 mark
4 cm × 12: 1 mark
Answer: 1 mark</td><td>3</td></tr>
</table>

	OR 1 side = $\frac{24cm}{6}$ $= 4$ cm ✓**A** P = 4 cm × (18−6) ✓**M** $=$ 48 cm ✓**A**	OR 4 cm: 1 mark 4 cm × (18−6): 1 mark Answer: 1 mark	

7. INVESTIGATIONS

(a) Purpose of a mathematics investigation

Investigations promote critical and creative thinking. They are primarily used to discover rules or concepts and may involve inductive reasoning, identifying or testing patterns or relationships, drawing conclusions, and establishing general trends.

(b) Developing a mathematics investigation

Since investigations are primarily used to discover rules or concepts, relevant mathematics content should be selected to enhance inductive reasoning. On the other hand, an investigation involves a guided discovery, where learners are led through a process of discovering a particular concept or idea through leading questions. This guided discovery may include the collection of data and/or information to solve a problem. In the CAPS the cue for the relevant concepts that are appropriate for the investigation are prefixed by "investigate…". For instance, in the Measurement topic *The Theorem of Pythagoras* learners are required to *"Investigate the relationship between the lengths of the sides of a right-angled triangle to develop the Theorem of Pythagoras"*.

Similarly, in Space & Shape in the topic Construction of geometric figures, learners are required to *"By construction, investigate the angles in a triangle, focusing on:*

- *the sum of the interior angles of triangles*
- *the size of angles in an equilateral triangle*
- *the sides and base angles of an isosceles triangle"*

The acquisition of the investigative skill in mathematics does not happen spontaneously; instead it happens as a result of the investigative teaching approach. In other words teachers must employ the investigative teaching approach to guide their learners to discover general rules in mathematics or establishing general trends. Learning through investigation is one of the meaningful ways to enhance conceptual understanding.

(c) Administering a project

To avoid having to assess work which is copied without understanding, it is recommended that whilst initial investigation could be done at home, the final write-up should be done in class, under supervision, without access to any notes.

Investigations are generally assessed using rubrics, which can be specific to the task, or generic, listing the number of marks awarded for each skill. These skills include:

- organising and recording ideas and discoveries using, for example, diagrams and tables
- communicating ideas with appropriate explanations
- calculations showing clear understanding of mathematical concepts and procedures.
- generalising and drawing conclusions

7.1. Grade 7 Investigation exemplar

GRADE 7	**MARK ALLOCATION:** 50
FORM OF ASSESSMENT: Investigation	**CONCEPT/TOPIC:** Number sentences ; area and perimeter of 2D shapes
DATE:	**TIME ALLOCATION:** 60 minutes

An investigation promotes critical and creative thinking. It can be used to discover rules or concepts and may involve inductive reasoning, identifying or testing patterns or relationships, drawing conclusions, and establishing general trends. To avoid having to assess work that is copied without understanding, it is recommended that whilst initial investigation could be done at home, the final write-up should be done in class, under supervision, without access to any notes. Investigations are assessed with rubrics, which can be specific to the task, or generic, listing the number of marks awarded for each skill. These skills include:

- organising and recording ideas and discoveries, e.g. diagrams and tables
- communicating ideas with appropriate explanations
- calculations showing clear understanding of mathematical concepts and procedures
- generalising and drawing conclusions.

The forms of assessment used should be appropriate to the age and cognitive level of learners. The design of these tasks should cover the content of the subject and be designed to achieve the broad aims of the subject.

INFORMATION AND INSTRUCTIONS:

1. This investigation consists of THREE activities.
2. Clearly show ALL calculations, diagrams, graphs that you have used in determining your answers.
3. **No** calculators may be used.

SECTION A

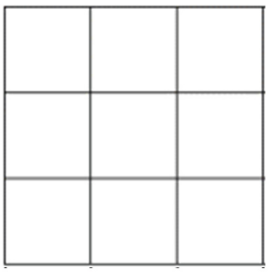
ACTIVITY 1

Area is the quantity of 2-D space occupied by a shape or the size of the flat surface surrounded by the border of the shape. Area (*A*) is measured in squared units, such as $mm^2, cm^2 \text{ or } m^2$

Perimeter of a shape is the total distance around the shape or the lengths of its sides added together, the boundary. Perimeter (*P*) is measured in units such as $mm. cm \text{ and } m$

1.1 Each of the following figures is divided into squares of equal size, namely $1\ cm \times 1\ cm$. Calculate the perimeter and area of each figure below.

1.1.1

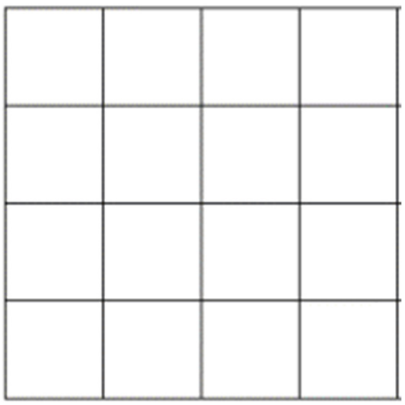


(2)

Perimeter = ... cm

Area = ... cm^2

1.1.2



(2)

Perimeter = ... cm

Area = ... cm^2

1.2 What type of quadrilaterals are in 1.1.1 and 1.1.2? (1)

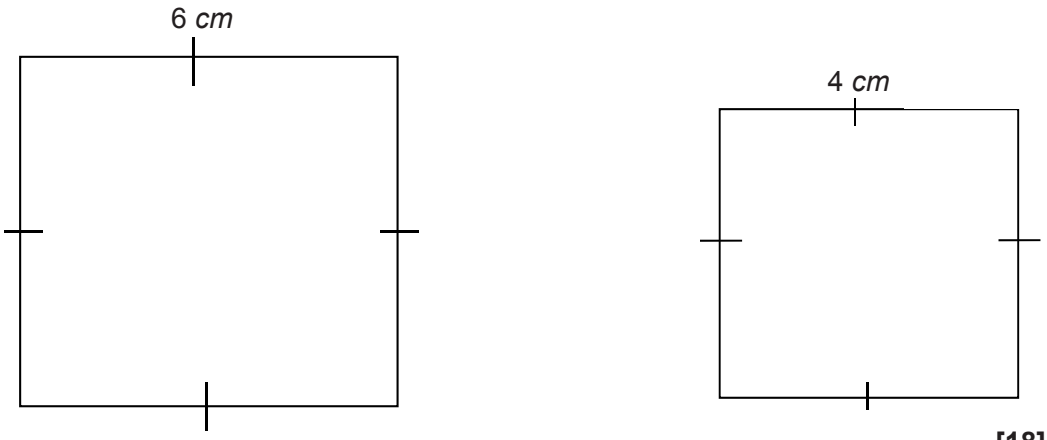
1.3 If the figures in 1.1.1 and 1.1.2 were not divided into smaller squares, explain how you would calculate the perimeter and area of the shape. (2)

1.4 Use a number sentence to show how you calculated the:

1.4.1 perimeter of the quadrilateral in 1.1.1 and 1.1.2 (2)

1.4.2 area of the shape in 1.1.1 and 1.1.2 (2)

1.5 Calculate the perimeter and area of the following two figures: (8)



[18]

ACTIVITY 2

2.1 The following figures are divided into smaller squares of equal size, namely $1\ cm\ by\ 1\ cm$.

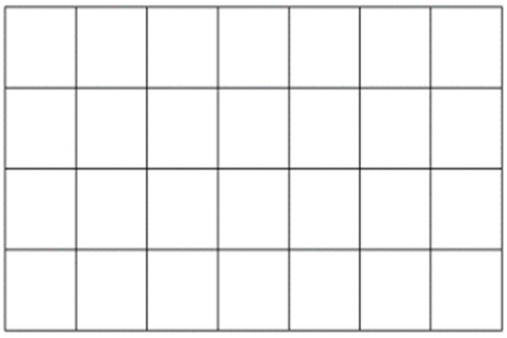
Write down the perimeter and area of each figure.

2.1.1

Perimeter = ... cm (1)

Area = ... $cm\ square$ (1)

2.1.2



Perimeter = ... cm (1)

Area = ... $cm\ square$ (1)

2.2 Write down the name of the quadrilateral in 2.1? (1)

2.3 If the figures in 2.1 were not divided into smaller squares, explain how you would calculate the perimeter and area of the shape. (2)

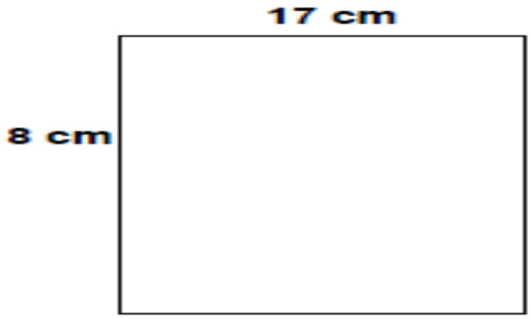
2.4 Use a number sentence to show how you calculated the:

2.4.1 perimeter of the shapes in 2.1.1 and 2.1.2 (4)

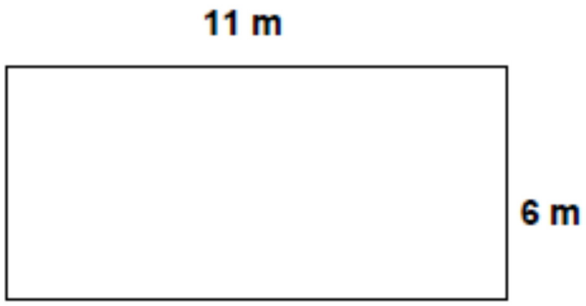
2.4.2 area of the shapes in 2.1.1 and 2.1.2 (4)

2.5 Use a similar number sentence as in 2.4 to calculate:

2.5.1 the perimeter (4)



2.5.2 the area (4)



[19]

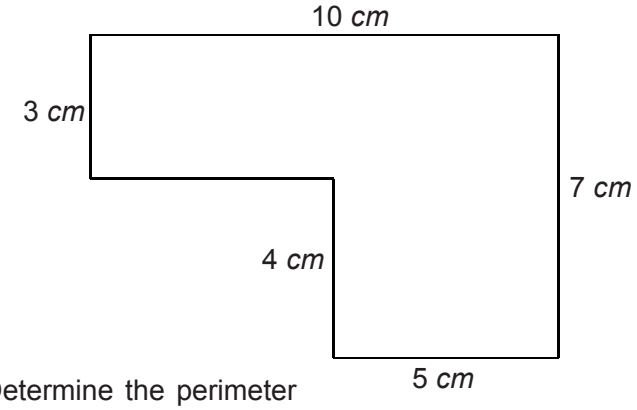
ACTIVITY 3

3.1 Work out the area of the following.

3.1.1 A rectangle measuring $7\ cm\ by\ 4\ cm$. (2)

3.1.2 A square with sides of $12\ cm$. (2)

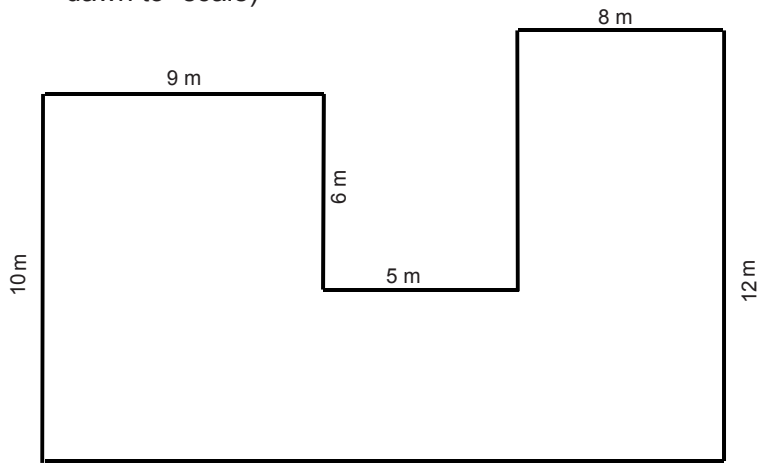
3.2 Study the figure below and answer the following questions:



3.2.1 Determine the perimeter (2)

3.2.2 Dertermine the area (2)

3.3 Calculate the perimeter and area of the following figure. (The figure is not dawn to scale) (4)



(4)

[16]

GRADE 7	MARK ALLOCATION: 50
MEMORANDUM: NC INVESTIGATION	INVESTIGATING RELATIONSHIP BETWEEN PERIMETER AND AREA OF 2-D SHAPES.
DATE:	TIME ALLOCATION: 60 minutes

ACTIVITY 1			Expected Answer	Clarification	Mark	Total
1	1.1	1.1.1	Perimeter = 12 cm✓	Calculate perimeter: 4s	1	
			Area = 9 cm^{2}✓	Calculate area: s^2	1	
		1.1.2	Perimeter = 16 cm✓	Calculate perimeter:4s	1	
			Area = 16 cm^{2}✓	Calculate area: s^2	1	(2)
	1.2		square✓		1	(1)
	1.3		Perimeter = s+s+s+s=4s✓	Calculate perimeter: 4s	1	(1)
			Area = s x s = s^{2}✓	Calculate area: s^2	1	
	1.4	1.4.1	$Perimeter_1$ = 3 x 4 = 12 cm✓	Calculate perimeter = 4s	1	
			$Perimeter_2$ = 4 x 4 = 16✓		1	
		1.4.2	Area = 3^2=9 cm^{2}✓	Area = s^2	1	
			Area = 4^2= 16✓		1	(4)
	1.5		P_1 = 4s✓ = 6x4 =24 cm✓	1 mark: formula 1 mark : substitution	2	
			Area = s^2=36 cm^{2}✓✓	1 mark formula 1 mark substitution	2	
			P_2 = 4s✓ 4(4) = 16 cm✓	1 mark formula 1 mark substitution	2	
			Area = 16 cm^{2}✓✓	1 mark formula 1 mark substitution	2	(8)
						[18]
ACTIVITY 2						
2	2.1	2.1.1	P=2(3) + 2(6) = 18 cm✓	1 mark: calculate perimeter	1	
			A = 6x3 = 18 cm^{2} ✓	1 mark: calculate area	1	
		2.1.2	P = 2(4) + 2(7) = 22 cm✓	1 mark: calculate perimeter	1	
			A = 7 x 4 = 28 cm^{2}✓	1 mark: calculate area	1	(4)
	2.2		rectangles✓	1 mark: correct answer	1	(1)

	2.3		P = 2l + 2b✓ A = lb✓	1 mark: correct formula for perimeter 1 mark: correct formula for area	1 1	(2)
	2.4	2.4.1	P_1= 2l + 2b✓ = 2(3) + 2(6) ✓ = 18 cm	1 mark formula 1 mark substitution	2	
			P_2=2l + 2b✓ =2(7) + 2(4) ✓ =22 cm	1 mark formula 1 mark substitution	2	
		2.4.2	A_1=lb✓ =6x3✓ =18 cm^2	1 mark formula 1 mark substitution	2	
			A_2=lb✓ =7x4✓ =28 cm^2	1 mark formula 1 mark substitution	2	(8)
	2.5	2.5.1	P= 2l +2b✓ = 2(17) + 2(18) ✓ = 50 cm	1 mark formula 1 mark substitution	2	
		2.5.2	A = lb✓ = 11 x 6✓ = 66 cm^2	1 mark formula 1 mark substitution	2	(4)
						[19]
ACTIVITY 3						
	3.1	3.1.1	Area = 7x4✓ = 28 cm^2	1 mark calculate area of rectangle	1	
		3.1.2	Area = 12 x 12✓ = 144 cm^2	1 mark calculate area of a square	1	(2)
	3.2	3.2.1	P = 3 + 10 + 7 + 5 + 4 = 29 cm	1 mark correct substitution 1 mark correct answer	2	
		3.2.2	A = 4(5) + 3(10)= 50 cm^2	1 mark correct substitution 1 mark correct answer	2	(4)
	3.3		P = 10 + 9 + 6 + 5 + 8 + 12 + 22✓ = 72 cm✓	1 mark correct substitution 1 mark correct answer	2	(2)
			A = sum of areas of three rectangles✓✓ = $l_1b_1+l_2b_2+l_3b_3$✓ = 4(22) + 6(9) + 8(8) = 88 + 54 + 64✓ = 206 cm^2 ✓	2 marks to identify rectangles correctly 1 mark correct formula 1 mark correct substitution 1 mark correct answer	5	(5) [13]

7.2. Grade 8 Investigation exemplar

INVESTIGATION

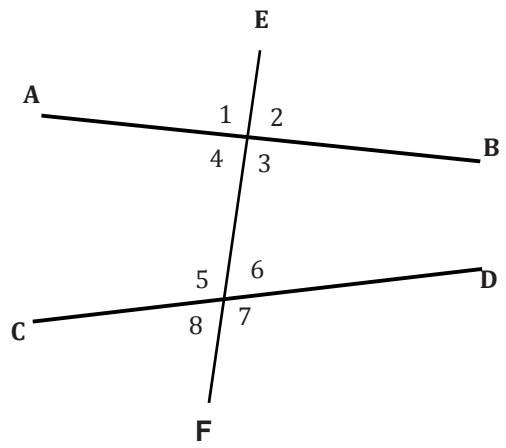
GRADE 8

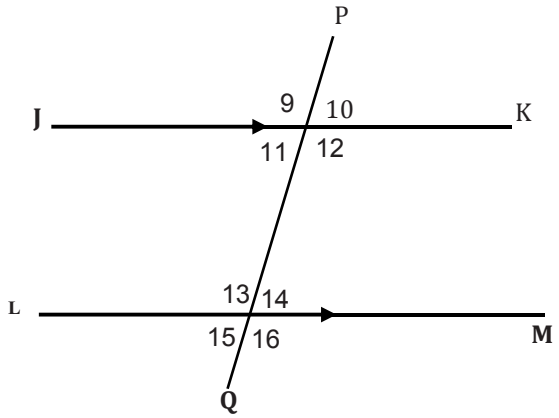
TOTAL: 50

Topic: Investigate angles associated with parallel lines

1. In the figures below, EF is a transversal to non-parallel lines AB and CD, PQ is a transversal to parallel lines JK and LM.

Non-parallel lines	Parallel lines
Diagram A	Diagram B





1.1 Use a protractor to measure the sizes of all the angles (1 – 16) and complete the table below. (You may extend the lines to measure easily.)

Non-parallel line		Parallel line
Vertically opposite angles	$\hat{1} =$ ____ $\hat{3} =$ ____	$\hat{9} =$ ____ $\hat{11} =$ ____
	$\hat{2} =$ ____ $\hat{4} =$ ____	$\hat{10} =$ ____ $\hat{12} =$ ____
	$\hat{5} =$ ____ $\hat{7} =$ ____	$\hat{13} =$ ____ $\hat{15} =$ ____
	$\hat{6} =$ ____ $\hat{8} =$ ____	$\hat{14} =$ ____ $\hat{16} =$ ____

(8)

Non-parallel line		Parallel line
Corresponding angles	$\hat{1} =$ ____ $\hat{3} =$ ____	$\hat{9} =$ ____ $\hat{11} =$ ____
	$\hat{2} =$ ____ $\hat{4} =$ ____	$\hat{10} =$ ____ $\hat{12} =$ ____
	$\hat{5} =$ ____ $\hat{7} =$ ____	$\hat{13} =$ ____ $\hat{15} =$ ____
	$\hat{6} =$ ____ $\hat{8} =$ ____	$\hat{14} =$ ____ $\hat{16} =$ ____

(8)

Non-parallel line		Parallel line
Interior alternate angles	$\hat{3} =$ ___ $\hat{5} =$ ____	$\hat{11} =$ ____ $\hat{13} =$ ____
	$\hat{4} =$ ____ $\hat{6} =$ ____	$\hat{12} =$ ____ $\hat{14} =$ ____

(4)

Non-parallel line		Parallel line
Exterior alternate angles	$\hat{1} =$ ____ $\hat{7} =$ ____	$\hat{9} =$ ____ $\widehat{15} =$ ____
	$\hat{2} =$ ____ $\hat{8} =$ ____	$\widehat{10} =$ ____ $\widehat{16} =$ ____

(4)

Non-parallel line		Parallel line
Co-interior angles	$\hat{4} =$ ____ $\hat{5} =$ ____	$\widehat{12} =$ ____ $\widehat{13} =$ ____
	$\hat{3} =$ ____ $\hat{6} =$ ____	$\widehat{11} =$ ____ $\widehat{14} =$ ____

(4)

[28]

1.2 Look at the completed table in QUESTION 1.1 and answer the related questions in the table below.

	Are the lines AB and CD parallel ?	Are the corresponding angles $\hat{1}$ and $\hat{5}$ equal?	Are the alternate angles $\hat{4}$ and $\hat{6}$ equal?	Are the co-interior angles $\hat{3}$ and $\hat{6}$ equal? If not, are they supplementary?	
				Equal	Supplementary
Diagram A					
	Are the lines JK and LM parallel ?	Are the corresponding angles $\hat{9}$ and $\widehat{13}$ equal?	Are the alternate angles $\widehat{12}$ and $\widehat{14}$ equal?	Are the co-interior angles $\widehat{12}$ and $\widehat{13}$ equal? If not, are they supplementary?	
				Equal	Supplementary
Diagram B					

[8]

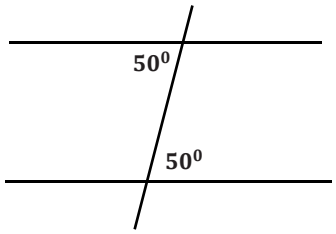
1.3 From the investigation, you should have discovered some important facts about angle pairs associated with parallel lines.

What can you conclude about the following angles when **parallel lines** are cut by a **transversal?**			
1.3.1	Corresponding angles		(1)
1.3.2	Alternate angles		(1)
1.3.3	Co-interior angles		(2)
1.3.4	Vertically opposite angles		(1)

[5]

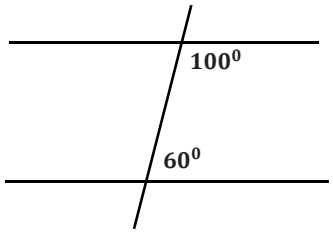
2.1 Decide if the following figures have parallel lines. Give a brief reason for your answer:

2.1.1 (1)



(1)

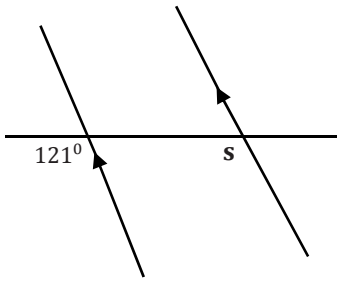
2.1.2



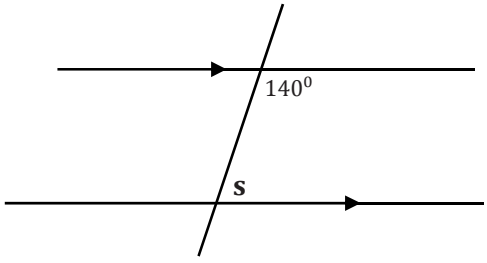
[2]

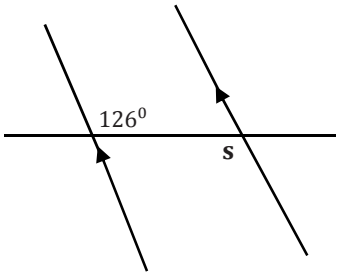
3.1 Find the value of the unknown, giving a brief reason for your answer:

3.1.1 (2)



3.1.2 (3)



3.1.3 

(2)

[7]

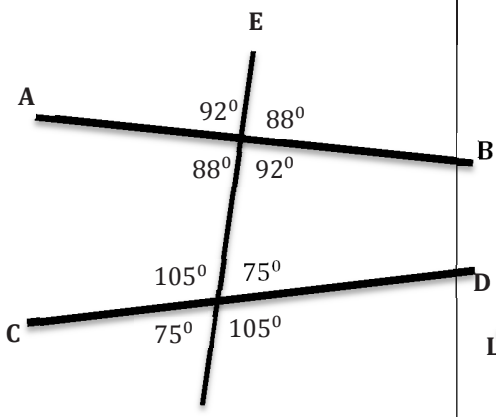
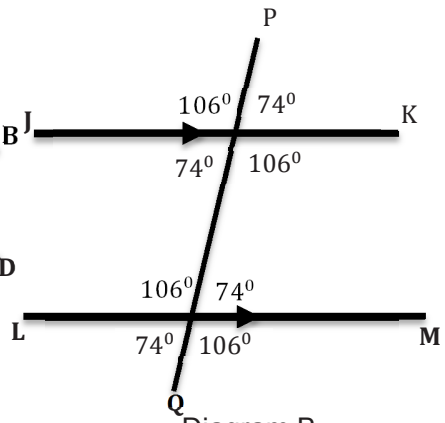
TOTAL : **[50]**

INVESTIGATION MEMORANDUM

GRADE 8

Investigate angles associated with parallel lines

1. In the figures below, EF is a transversal line to non-parallel lines AB and CD, PQ is a transversal line to parallel line JK and LM.

Non-parallel lines	Parallel line
 Diagram A	 Diagram B

1.1 Use a protractor to measure the sizes of all the angles (1 – 16) and complete the table below. (You may extend the lines to measure easily)

Non-parallel line		Parallel line
Vertically opposite angles	$\hat{1} = 92^0 \hat{3} = 92^0$✓	$\hat{9} = 106^0 \widehat{11} = 106^0$✓
	$\hat{2} = 88^0 \hat{4} = 88^0$✓	$\widehat{10} = 74^0 \widehat{12} = 74^0$✓
	$\hat{5} = 105^0 \hat{7} = 105^0$✓	$\widehat{13} = 106^0 \widehat{15} = 106^0$✓
	$\hat{6} = 75^0 \hat{8} = 75^0$✓	$\widehat{14} = 74^0 \widehat{16} = 74^0$✓

(8)

Non-parallel line		Parallel line
Corresponding angles	$\hat{1} = 92^0 \hat{3} = 92^0$✓	$\hat{9} = 106^0 \widehat{11} = 106^0$✓
	$\hat{2} = 88^0 \hat{4} = 88^0$✓	$\widehat{10} = 74^0 \widehat{12} = 74^0$✓
	$\hat{5} = 105^0 \hat{7} = 105^0$✓	$\widehat{13} = 106^0 \widehat{15} = 106^0$✓
	$\hat{6} = 75^0 \hat{8} = 75^0$✓	$\widehat{14} = 74^0 \widehat{16} = 74^0$✓

(8)

Non-parallel line		Parallel line
Interior alternate angles	$\hat{3} = 92^0 \hat{5} = 105^0$✓	$\widehat{11} = 106^0 \widehat{13} = 106^0$✓
	$\hat{4} = 88^0 \hat{6} = 75^0$✓	$\widehat{12} = 74^0 \widehat{14} = 74^0$✓

(4)

Non-parallel line		Parallel line
Exterior alternate angles	$\hat{1} = 92^0 \hat{7} = 105^0$✓	$\hat{9} = 106^0 \widehat{15} = 106^0$✓
	$\hat{2} = 88^0 \hat{8} = 75^0$✓	$\widehat{10} = 74^0 \widehat{16} = 74^0$✓

(4)

Non-parallel line		Parallel line
Co-interior angles	$\hat{4} = 88^0 \hat{5} = 105^0$✓	$\widehat{12} = 74^0 \widehat{13} = 106^0$✓
	$\hat{3} = 92^0 \hat{6} = 75^0$✓	$\widehat{11} = 106^0 \widehat{14} = 74^0$✓

(4)

[28]

1.2 Look at the completed table in QUESTION 1.1 and answer the related questions in the table below.

	Are the lines AB and CD parallel?	Are the corresponding angles $\hat{1}$ and $\hat{5}$ equal?	Are the alternate angles $\hat{4}$ and $\hat{6}$ equal?	Are the co-interior angles $\hat{3}$ and $\hat{6}$ equal? If not, are they supplementary?	
				Equal	Supplementary
Diagram A	No	No✓	No	No✓	$92^0 + 75^0 \neq 180^0$✓✓

	Are the lines JK and LM parallel?	Are the corresponding angles $\hat{9}$ and $\widehat{13}$ equal?	Are the alternate angles $\widehat{12}$ and $\widehat{14}$ equal?	Are the co-interior angles $\widehat{12}$ and $\widehat{13}$ equal? If not, are they supplementary?	
				Equal	Supplementary
Diagram B	Yes	Yes✓	Yes	No✓	$74^0 + 106^0 = 180^0$✓✓

[8]

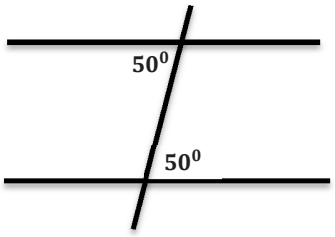
1.3 From the investigation, you should have discovered some important facts about angle pairs associated with parallel lines.

When **parallel lines** are cut by a **transversal:**			
1.3.1	Corresponding angles	Equal✓	(1)
1.3.2	Alternate angles	Equal✓	(1)
1.3.3	Co-interior angles	Add up to 180^0 / supplementary✓✓	(2)
1.3.4	Vertically opposite angles	Equal✓	(1)

[5]

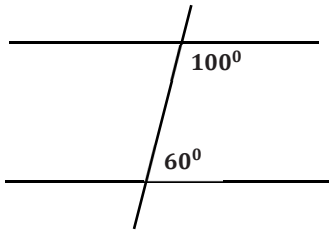
2.1 Decide if the figure contains parallel lines, giving a brief reason for your answer:

2.1.1 (1)



Yes, alternate angles are equal.✓

2.1.2



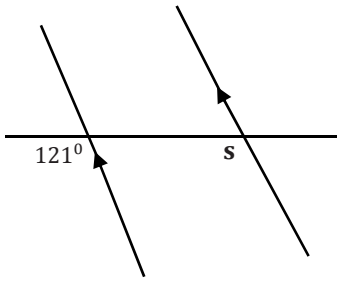
No, co-interior angles are not supplementary.✓ (1)

OR

No, $100^0 + 60^0 \neq 180^0$ **[2]**

3.1 Find the value of the unknown, giving a brief reason for your answer:

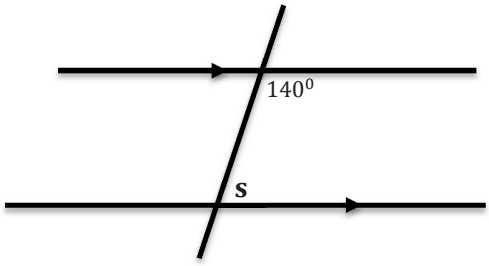
3.1.1



Statement	Reason
$s = 121^0$✓	Corr. $< s$, II lines✓

(2)

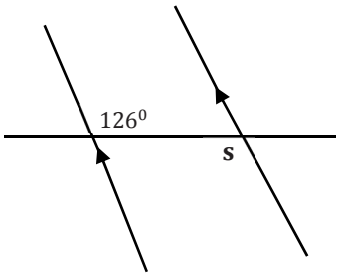
3.1.2



Statement	Reason
$s = 180^0 - 140^0$✓	Co-int.< s, II lines✓
$= 40^0$✓	

(3)

3.1.3



Statement	Reason
$s = 126^0$✓	Alt.< s, II lines✓

(2)

[7]

TOTAL : **[50]**

GRADE 9 MATHEMATICS INVESTIGATION

NAME: _____

MARKS: 50

TIME: 5 Days **SUBMISSION DATE:** _____

TOPIC: INVESTIGATING SPECIAL PROPERTIES OF REGULAR QUADRILATERALS

In this investigation, you will study a variety of quadrilaterals in order to discover some of their special properties. Work in groups of five. Each member of the group must choose one quadrilateral from the given table, and investigate its special properties. The group will then discuss together the properties of the five quadrilaterals, and the relationships between them.

PART 1: INSTRUCTIONS

Each member choose one diagram. Cut out and paste the diagram from the given table.

1.1 Identify all parallel sides, if any, and indicate them in the diagram with relevant symbols. (2)

1.2 Measure the sides and interior angles of the quadrilateral. Show these on the diagram. (4)

Diagram (cut out and paste from the table)	**Name of the Quad**	**Length of Side**	**Size of Interior Angle**
		AB = _____*cm* BC = _____*cm* CD = _____*cm* AD = _____*cm*	$\angle$A =_____ $\angle$ B =_____ $\angle$ C =_____ $\angle$D =_____

1.3 Calculate the sum of the interior angles of the quadrilateral. (2)

Sum of interior angles = _____ + _____ + _____ + _____ = _____

1.4 Draw the diagonals. Measure their lengths and their angles of intersection. Also measure the length from each vertex (A, B, C, D) to the point of intersection with the other diagonal.

Show all these measurements in the diagram of the quadrilateral you have chosen. (8)

1.5 As a group, discuss your findings. Be alert to similarities and differences in the properties of the quadrilaterals. Make notes of what you discuss and observe. These will be handed in as part of the project.

1.6 Based on your discussion, work together to complete the table below that summarises some of the special properties of quadrilaterals. A tick means the given quadrilateral has the property. Leave the space blank if the quadrilateral does not have that property. (10)

SPECIAL PROPERTIES OF QUADRILATERALS						
Property of Quadrilateral	Square	Parallelogram	Rhombus	Rectangle	Trapezium	Kite
Opposite sides equal	✓					
All sides equal	✓					
Number of adjacent sides equal	4					
Number of pairs of opposite sides parallel (2, 1 or 0)	2					
Number of pairs of opposite angles equal (2, 1 or 0)	2					
Interior angles all 90°	✓					
Sum of interior angles	360^0					
Diagonals equal	✓					
Diagonals bisect	✓					
Diagonals perpendicular	✓					

PART 2: INSTRUCTIONS

Each member is to answer the questions in PART II. Use your findings and the completed table to answer the questions. You may also want to study the definition of specific quadrilaterals.

2.1(a) How many adjacent sides does every quadrilateral have? (1)

(b) The sum of the interior angles of a shape add up to 540^0. Is the shape a quadrilateral? Why? (1)

2.2. The name of:

(a) quadrilaterals with only one pair of opposite sides equal. (1)

(b) parallelograms with only one pair of opposite sides equal. (1)

2.3. The name of:

(a) quadrilaterals that are not parallelograms, with perpendicular diagonals. (1)

(b) quadrilaterals having diagonals that are equal and bisect each other. (2)

(c) quadrilaterals having diagonals of unequal length. (2)

2.4. The name of:

(a) quadrilaterals with 2 pairs of adjacent angles equal. (3)

(b) parallelograms with 2 pairs of adjacent angles not equal. (2)

(c) quadrilaterals, both pairs of opposite angles equal and not a parallelogram. (1)

2.5(a) Is every rectangle also a parallelogram? Justify your answer using the properties. (2)

(b) Is every square also a rectangle? Justify your answer using the properties. (2)

2.6 a) What one property distinguishes a rectangle from a parallelogram? (1)

b) What one property distinguishes a square from a rectangle? (1)

c) What two properties distinguish a square from a parallelogram? (2)

d) If a square is a special kind of rectangle, and if a rectangle is a special kind of parallelogram, then a square is a special kind of _____ (1)

2.7 Write down the name the quadrilateral according to the properties given below:

a) both equilateral and right-angled _____. (1)

b) right-angled but not equilateral _____. (1)

c) equilateral but not right-angled _____. (1)

d) opposite sides and angles equal to one another, but is neither equilateral nor right-angled _____. (1)

2.8) a) Describe the two quadrilaterals not included in the answers to Question 2.8.

i)_____ (1)

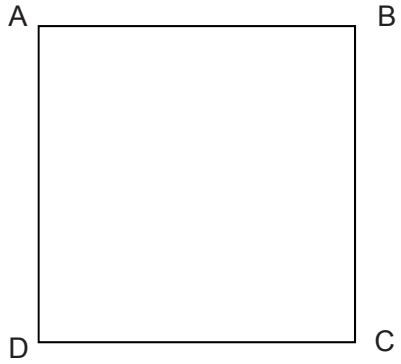
ii)_____ (1)

b) The diagram shows a trapezium with 2 right angles.

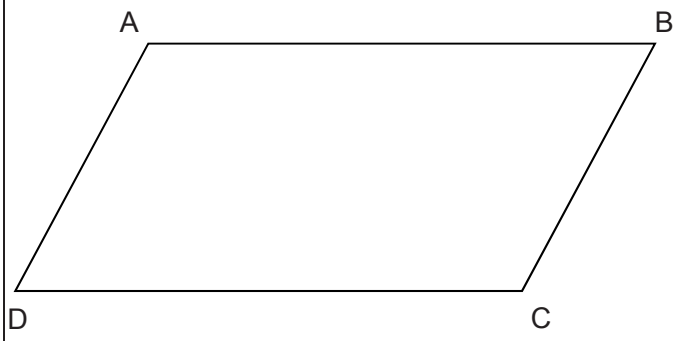
c) Can a trapezium have 4 right angles? Use the definition to justify your answer._____ (2)

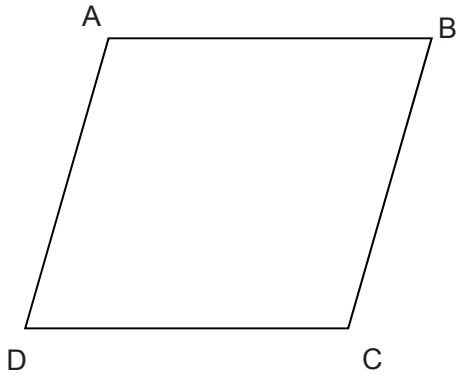
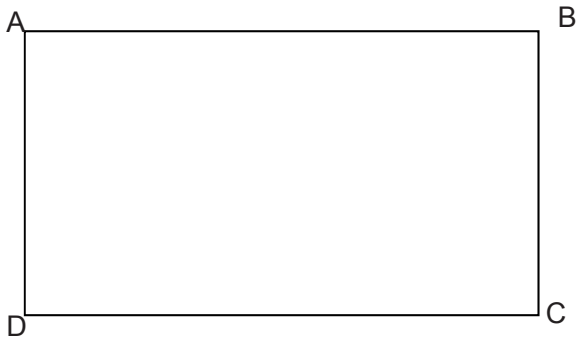
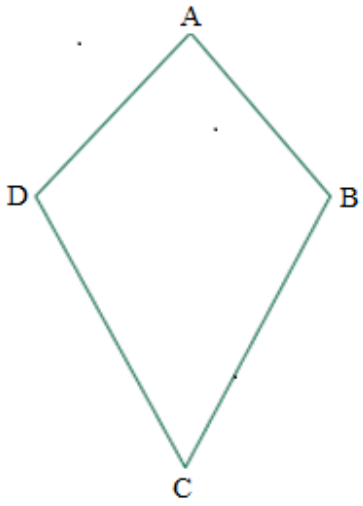
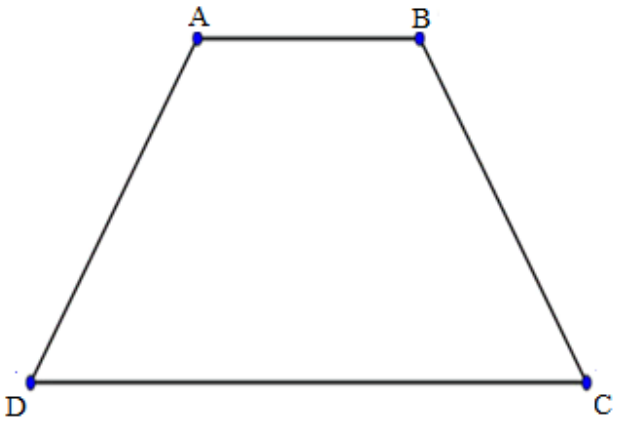
d) According to its definition, can a kite have all 4 sides equal? _____ (1)

Table of quadrilaterals: Do not choose the quadrilateral used as an example.



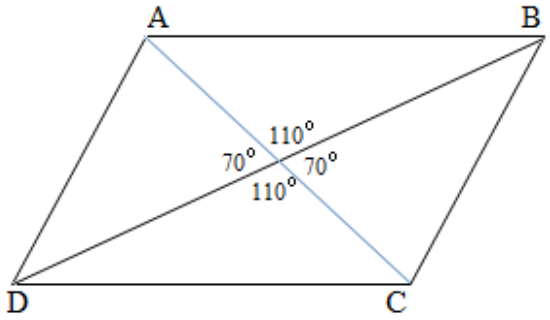
EXAMPLE (do not cut out)



 A B D C	 A B D C
 A D B C	 A B D C

MATHEMATICS INVESTIGATION MEMORANDUM- GRADE 9

PART 1

<table>
<tr><th>Diagram</th><th>Name of the Quadrilateral</th><th>Length of Side</th><th>Size of Angle</th></tr>
<tr><td rowspan="4"> 
</td><td rowspan="4">Parallelogram</td><td>AB = 5,5 cm</td><td>∠ A = 120°</td></tr>
<tr><td>BC = 3,8 cm</td><td>∠ B = 60°</td></tr>
<tr><td>CD = 5,5 cm</td><td>∠ C = 120°</td></tr>
<tr><td>AD = 3,8 cm</td><td>∠ D = 60°</td></tr>
<tr><td colspan="2"></td><td colspan="2">Diagonals</td></tr>
<tr><td colspan="2"></td><td colspan="2">AC = 4,9 cm
DB = 1,9 cm</td></tr>
</table>

<table>
<tr><th>Diagram</th><th>Name of the Quadrilateral</th><th>Length of Side</th><th>Size of Angle</th></tr>
<tr><td rowspan="3"></td><td rowspan="3">Rhombus</td><td>AB = 4,3 cm
BC = 4,3 cm
CD = 4,3 cm
AD = 4,3 cm</td><td>∠ A = 107°
∠ B = 73°
∠ C = 107°
∠ D = 73°</td></tr>
<tr><td colspan="2"></td><td colspan="2">Diagonals</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

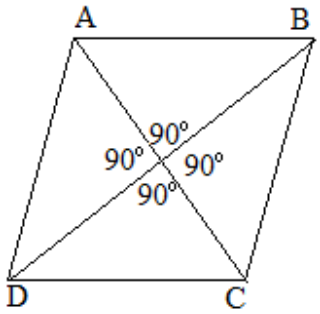
		AC = 5,3 cm DB = 7,0 cm

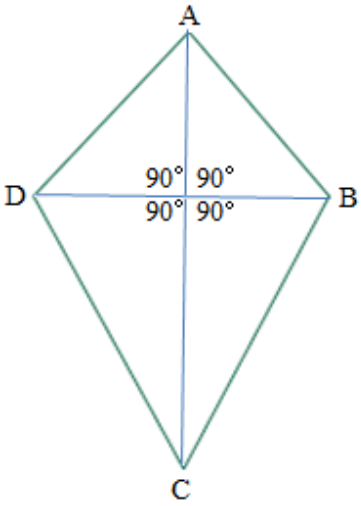
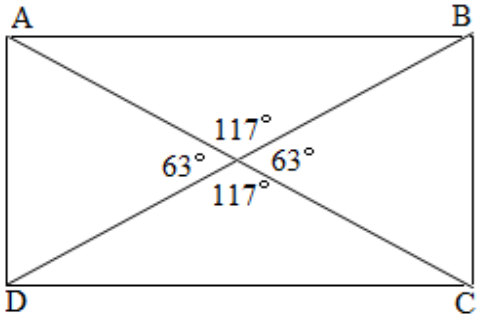
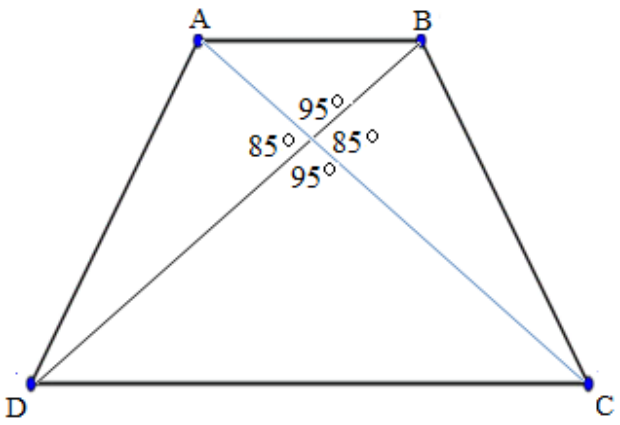
Diagram	Name of the Quadrilateral	Length of Side	Size of Angle
	Kite	AB = 3,0 cm BC = 4,2 cm CD = 4,2 cm AD = 3,0 cm	∠ A = 80° ∠ B = 110° ∠ C = 60° ∠ D = 110°
		Diagonals	
		AC = 5,9 cm DB = 3,9 cm	

Diagram	Name of the Quadrilateral	Length of Side	Size of Angle
	Rectangle	AB = 7,0 cm BC = 3,8 cm CD = 7,0 cm AD = 3,8 cm	∠ A = 90° ∠ B = 90° ∠ C = 90° ∠ D = 90°
		Diagonals	
		AC = 8,0 cm DB = 8,0 cm	

<table>
<tr><th>Diagram</th><th>Name of the Quadrilateral</th><th>Length of Side</th><th>Size of Angle</th></tr>
<tr><td rowspan="3"> 
</td><td rowspan="3">Isosceles Trapezium</td><td>AB = 3,0 cm
BC = 5,3 cm
CD = 7,5 cm
AD = 5,3 cm</td><td>∠A = 115°
∠ B = 115°
∠ C = 65°
∠ D = 65°</td></tr>
<tr><td colspan="2">Diagonals</td></tr>
<tr><td colspan="2">AC = 7,0 cm
BD = 7,0 cm</td></tr>
</table>

1.1 Allocate **2 marks** for parallel sides correctly indicated and symbolised. EXCEPT KITE.

1.2 Allocate **4 marks** for the sides and interior angles.

1.3 Allocate **4 marks** for the lengths and angle of intersection of the diagonals.

1.4 Calculate the sum of the interior angle of the quadrilateral. (1)

Sum of interior angles = ∠A+ ∠B + ∠C + ∠D = 360°

1.6 AWARD MAXIMUM OF **2 MARKS PER COLUMN**; 1 MARK IF 1 IS INCORRECT

The '√ ' in the table are not marks, they show the correct learners response.

SPECIAL PROPERTIES OF QUADRILATERALS						
Property of Quadrilateral	Square	Parallelogram	Rhombus	Rectangle	Trapezium	Kite
Opposite sides equal	✓	√	√	√		
All sides equal	✓		√			
Number of adjacent sides equal	4	0	0	4	2	0
Number of pairs of opposite sides parallel (2, 1 or 0)	2	2	2	2	1	0
Number of pairs of opposite angles equal (2, 1 or 0)	2	2	2	2	0	2
Interior angles all 90°	✓			√		
Sum of interior angles	360^0	360^0	360^0	360^0	360^0	360^0
Diagonals equal	✓		√	√	√	
Diagonals bisect	✓	√	√	√		
Diagonals perpendicular	✓		√			√

PART 2

2.1 a) 4 √

b) No, the interior angles of a quadrilateral add up to 360^0 √

2.2 a) Trapezium √

b) None √

2.3 a) Kite √

b) Square, rectangle, parallelogram, rhombus √√√√

c) Kite, parallelogram √ √

2.4 a) Square, rectangle, trapezium √√√

b) Square, rectangle √√

c) Kite √

2.5 a) Yes. Since all rectangles have 2 pairs of opposite sides equal, then all rectangles are parallelograms. √√

b) Yes. Since in all squares all angles are right angles, then all squares are rectangles √√

2.6 a) Angles are right angles √

b) All sides same length √

c) Angles are right-angled and all sides same length √√

d) Parallelogram √

2.7 a) Square √ b) Rectangle √ c) Rhombus √ d) Parallelogram √

2.8 a) i) A kite is a quadrilateral with two pairs of equal-length sides that are adjacent to each other. √

ii) A trapezium a quadrilateral with one pair of sides parallel. √

b) No. If it did, it would have 2 pairs of sides parallel. √√

c) If a kite had 4 sides equal, it would still have two pairs of equal-length sides that are adjacent to each other. √

8. PROJECT

(a) Purpose of a mathematics project

Projects are used to assess a range of skills and competencies. Through projects, learners are able to demonstrate their understanding of different Mathematics concepts and apply them in real-life situations. It is therefore essential that conceptual understanding should be emphasised in the teaching and learning of mathematics so that the concepts are applied meaningfully. Good projects involve the collection and display of real data, followed by deductions that can be substantiated. The assessment criteria should be clearly indicated on the project specification and should focus on the Mathematics involved and not on duplicated pictures and facts copied from reference material.

(b) Developing mathematics projects

Since projects are used to assess a range of skills and competencies, it is advisable to develop a project after a substantial amount of mathematics concepts are covered. It is for this reason that a project is administered in Terms 3 and 4 in Mathematics.

The following are some of the issues to be considered when developing a project:

- A theme or a focus of the project should be carefully conceptualised such that it is appropriate, relevant and appealing to the learners. In other words the theme/focus should speak to the learners' context.
- Although the project theme/focus may be used to create awareness of how mathematical relationships are applied in social, environmental, cultural and economic contexts, the choice of these contexts should be sensitive to issues of gender, disability, race, etc., and should generally contribute to social cohesion.
- The data to be collected should be accessible to the learners. For instance if the data to complete a project are exclusively obtainable from the Internet, learners who do not have access to the Internet will not be able to complete and present their project.
- If the project requires learners to collect data outside the school environment, the general welfare of learners should be considered.

(c) Administering a project

One mathematics project should be administered per grade per year. Although this is the case, teaching should be characterised by, *inter alia*, project-based learning to expose learners to and prepare them adequately on the subtleties of presenting good projects. In other words, learners should not be exposed to a project for the first time when they are assessed formally.

When administering mathematics projects, teachers are urged to explain the requirements and the process of carrying out the project. Projects are generally context-based and if not thoroughly explained, learners are likely to be distracted by the context and lose the essence of mathematics embedded in the project.

Unlike other forms of assessment such as tests/examinations, mathematics projects take longer to complete; therefore clear guidelines should be provided to learners on the timelines for submitting different sections of the project. In other words it is recommended that a Mathematics project should be presented and marked/evaluated in stages to: *firstly* ease the workload associated with marking long projects if they are not presented in stages; and *secondly* to identify learner mistakes earlier so that they can improve the next stages of the project, subsequently optimising the chances of overall performance in the project.

8.1. Grade 7 Project exemplar

GRADE 7 PROJECT MARKS: 45

During the 'Green Revolution' Conference by the Institute of Waste Management of Southern Africa (IWMSA) in 2013 in Port Elizabeth, it was noted that "…the cornerstone of effective waste management includes data collection and analysis, strategy development, collection systems planning and delivery …" (*Port Elizabeth Waste Management News, 2 April 2014*).

Your class wants to initiate a campaign to reduce and control household garbage in your community. Use the survey and collect data from at least ten different households in your area to assist your class to decide which method would be used during the campaign.

Survey number: _____

Date of the interview: -----/-----/------- (Day/Month/Year)

Name of area: _____

Interviewer: _____

Respondent selection: We need to speak to a member of the household aged 18 years and above.

Introduction

- "Hello. My name is _____ and I'm part of the survey team for _____ School. We are conducting a survey on waste management within the _____ area.

This questionnaire **focuses on waste (garbage) management issues.**

- The purpose of this survey is to gather **information** from residents like you about your current practices, concerns and opinions on waste management in our community. The survey will take about **10 minutes**.
- We request that you voluntarily participate in the completion of this questionnaire. You are not required to give your name, so you will not be connected to the answers provided.
- The answers you provide to the following questions will be able to direct the school in its efforts to educate learners on how to manage their garbage effectively. Thank you very much for your time.

QUESTIONNAIRE

Section A - The Natural Environment

*The **environment may be defined as** the whole world around us: the air, water, and land, forests, wetlands, and the sea, and all animals and plants around us.*

1. Knowing what the natural environment is, are you ***concerned*** *or* ***not concerned*** about the current state of the natural environment in your area? Make a cross (X) next to the your choice.

	I am **not concerned**
	I am **concerned**
	I have **no opinion**

2. What do you personally say is the **major issue** currently affecting our community/town/village/suburb/city about the natural environment? (One answer)

_____

3. What **other issues** concern you about the natural environment in our community/town/village/suburb/city? (Choose as many as you like from the list below by making a cross (x) next to your choice)

	Automobile exhaust fumes		Household garbage
	Sewage pollution from pits and toilets		Cutting down trees
	Fishing		Mining
	Plastic and paper		Dangerous solid waste such as chemicals, and medical waste
	Waste from factories		Pesticides and herbicides used in farming

4. How much effect do you think **you** have on the natural environment, do you have: *no effect, some effect, a lot of effect, or no opinion*?

	I have **no effect**
	I have **some** effect
	I have **a lot** of effect
	I have **no opinion**

Section B – Household Solid Waste Management

5. Please choose how your household **stores** the garbage from your house.

	Closed container, please describe:
	Open container, please describe:
	Plastic bags
	Pile in the yard
	Other, *specify*:
	Don't know

6. Indicate how your household **gets rid** of each of the following types of garbage from your house.

Types of garbage	Burn	Bury	Dump				Garbage truck	Recycle	Reuse	Compost	Other *(Specify)*
			River/ gully	In yard	On road	Garbage dumpsite					
Food waste											
Yard trimmings											
Paper/cardboard											
Plastics											
Metals											
Glass											

7. Which one of the above garbage removal ways do you think is best and why?

_____

_____

8. Can you think of any ways of reducing the amount of garbage that your household must burn, bury, dump, or leave for the garbage truck?

_____

_____

Section C – Concerns about solid waste management

To the following questions (9 – 17), please state whether you are: **Concerned, not concerned,** or you have **no opinion**.	**Concerned**	**Not concerned**	**No opinion**
9. How concerned are you about health risks related to **burning** garbage?			
10. How concerned are you about **illegal dumps** polluting rivers, streams and wells?			
11. How concerned are you about **diseases** that are related to improper storage and disposal methods, like leptospirosis and malaria?			
12. How concerned are you about **flooding** due to garbage blocking drains and gullies?			
13. How concerned are you about the **exploitation** of natural resources that are used to make the products we buy and use such as oil (for plastic bottles) and trees (for paper)?			
14. How concerned are you about the **service** provided by the garbage truck in your area?			
15. How concerned are you about **litter/garbage** in your area?			

16. How concerned are you about **illegal dumping** in this area?			
17. How concerned are you about the presence of **rats** in your area?			

18. Do you have any suggestions for improving the management (removal and disposal) of garbage in your area?

_____

_____

Rubric – For assessing survey (Section A to Section C)					
Criteria	Level descriptors				
	4	3	2	1	Score
Survey data collection	10 surveys were conducted with 10 different households	8-9 surveys were conducted with 8-9 different households	6-7 surveys were conducted with 6-7 different households	5 or less surveys were conducted with 5 or less different households	
Completion of surveys			7– 10 surveys fully completed (All questions responded to)	Less than 7 surveys fully completed (Not all questions responded to)	
TOTAL					

Subtotal: (6)

SECTION D

As a project, you are required to develop a questionnaire that will gather information on **recycling** of household waste. Develop **five questions**, the different question types must be responded to by either a **Yes/No** or **multiple choice** (with at least four choices). The survey will be assessed using the rubric below. Please submit your survey in the form it will be implemented.

Rubric: For assessing questionnaire				
Category	**Rating**			**Score**
	3	**2**	**1**	
Purpose		Purpose is stated clearly.	Purpose is stated vaguely.	
Balance of question types		5 questions are yes/no and multiple-choice types.	All 5 questions are yes/no or multiple-choice types.	

Choice of responses	Most people would be able to choose from the responses.	Few people would be able to choose from the responses.	No-one would be able to choose from the responses.	
Content	4-5 of the questions address recycling issues.	1-3 of the questions address recycling issues.	None of the questions addresses recycling issues.	
Total Score				

Subtotal: (10)

SECTION E Organise, summarise, interpret and analyse data

1. Use the tally chart to record your data collected (see Section A, Question 6). Work in groups of **four individuals** for 1 and 2 below.

Garbage disposal method	**Number of household tally**	**Frequency**
Burn		
Bury		
Dump		
Garbage truck		
Recycle		
Reuse		
Compost		
Other		
	TOTAL	

Rubric : For assessing frequency table				
Criteria	**Level descriptors**			
	1	2	3	Score
Tally marks	Tally marks are both partially and incorrectly completed on tally chart.	Tally marks are partially or incorrectly completed on tally chart.	Tally marks are correctly completed on tally chart.	
Frequencies	Frequencies are both partially and	Frequencies are partially or	Frequencies are correctly	

	incorrectly completed on tally chart.	incorrectly completed on tally chart.	completed on tally chart.	
Total number of tallies	Total is not completed on tally chart.	Total is incorrectly completed on tally chart.	Total is correctly completed on tally chart.	
Total score				

Subtotal: (9)

2. Use the grid below and draw a bar graph to illustrate the data shown in the tally chart. Name the axes and include all labels. **(13)**

Rubric: For assessing graph				
Category	**Level descriptors**			
	4	**3**	**2**	**1**
Graph title			Graph has appropriate title	Graph is titled but title is not appropriate
Axes labels		- Horizontal and vertical axes have appropriate labels - Units clearly marked on horizontal and vertical axes	- Horizontal and vertical axes have appropriate labels - Units not clearly marked on horizontal and vertical axes	Axes not labelled or units not indicated
Scale	- Graph fills most of the available space - Horizontal and vertical axes use regularly spaced appropriate divisions - Neatly drawn	- Graph does not fill most of the available space - Horizontal and vertical axes use regularly spaced appropriate divisions - Neatly drawn	- Graph does not fill most of the available space - Horizontal and vertical axes use regularly spaced appropriate divisions - Not neatly drawn	- Graph too small - Horizontal and vertical axes do not use regularly spaced divisions - Horizontal and vertical axes do not use appropriate divisions - Not clearly drawn
Data plotting **Bar drawing**	- 8 bars accurately plotted - Bars are neat with appropriate marker size	- 6-7 bars accurately plotted - Bars are neat with inappropriate marker size	- 3-5 bars accurately plotted - Bars have inappropriate marker size	- 1-2 bars accurately plotted - Bars are untidy with inappropriate marker size
TOTAL				

3.

3.1 What is the most popular way of garbage disposal? (1)

_____

3.2 Give a reason for your answer. (1)

_____

3.3 What is the least popular way of garbage disposal? (1)

_____

3.4 Why is the disposal method mentioned above the least popular choice? (1)

_____

3.5 What method of waste management would you advise your school mates to use in your community to help keep the natural environment safe? Briefly explain why you think the method is useful. (3)

_____

_____

TOTAL: 45

PROJECT MARKING GUIDELINE

SECTION A to SECTION C.

Rubric – For assessing survey (Section A to Section C)					
Criteria	Level descriptors				
	4	3	2	1	Score
Survey data collection	10 surveys were conducted with 10 different households	8-9 surveys were conducted with 8-9 different households	6-7 surveys were conducted with 6-7 different households	5 or less surveys were conducted with 5 or less different households	4
Completion of surveys			7– 10 surveys fully completed (All questions responded to)	Less than 7 surveys fully completed (Not all questions responded to)	2
TOTAL					**6**

Subtotal: (6)

SECTION D

Rubric: For assessing questionnaire				
Category	**Rating**			**Score**
	3	**2**	**1**	
Purpose		Purpose is stated clearly.	Purpose is stated vaguely.	2
Balance of question types		5 questions are yes/no and multiple-choice types	All 5 questions are yes/no or multiple-choice type.	2
Choice of responses	Most people would be able to choose from the responses.	Few people would be able to choose from the responses.	No one would be able to choose from the responses.	3

Content	4-5 of the questions address recycling issues.	1-3 of the questions address recycling issues.	None of the questions address recycling issues.	3
Total Score				**10**

Subtotal: (10)

SECTION E

1. Use the tally chart.

Example

Garbage disposal method	**Number of household tally**	**Frequency**
Burn	𝍸 /	6
Bury	𝍸	5
Dump	𝍸 ///	8
Garbage truck	𝍸 𝍸	10
Recycle	/// /	4
Reuse	///	3
Compost	///	3
Other	/	1
	TOTAL	**40**

Rubric : For assessing Tally chart				
Criteria	**Level descriptors**			
	1	2	3	Score
Tally marks	Tally marks are both partially and incorrectly completed on tally chart.	Tally marks are partially or incorrectly completed on tally chart.	Tally marks are correctly completed on tally chart.	3

Frequencies	Frequencies are both partially and incorrectly completed on tally chart.	Frequencies are partially or incorrectly completed on tally chart.	Frequencies are correctly completed on tally chart.	3
Total number of tallies	Total is not completed on tally chart.	Total is incorrectly completed on tally chart.	Total is correctly completed on tally chart.	3
Total score				**9**

2. Graph

Possible frequency graph (For tally chart in Section E 1 above)

Rubric: For assessing graph					
Category	**Level descriptors**				
	4	**3**	**2**	**1**	Max score
Graph title			Graph has appropriate title	Graph is titled but title is not appropriate	2
Axes labels		- Horizontal and vertical axes have appropriate labels - Units clearly marked on	- Horizontal and vertical axes have appropriate labels - Units not clearly marked	Axes not labelled or units not indicated	3

		horizontal and vertical axes	on horizontal and vertical axes		
Scale	- Graph fills most of the available space - Horizontal and vertical axes use regularly spaced appropriate divisions - Neatly drawn	- Graph does not fill most of the available space - Horizontal and vertical axes use regularly spaced appropriate divisions - Neatly drawn	- Graph does not fill most of the available space - Horizontal and vertical axes use regularly spaced appropriate divisions - Not neatly drawn	- Graph too small - Horizontal and vertical axes do not use regularly spaced divisions - Horizontal and vertical axes do not use appropriate divisions - Not clearly drawn	4
Data plotting **Bar drawing**	- 8 bars accurately plotted - Bars are neat with appropriate marker size	- 6-7 bars accurately plotted - Bars are neat with inappropriate marker size	- 3-5 bars accurately plotted - Bars have inappropriate marker size	- 1-2 bars accurately plotted - Bars are untidy with inappropriate marker size	4
TOTAL					**13**

3.

3.1 What is the most popular way of garbage disposal? (1)

- Response with highest modal frequency. ✓

3.2 Give a reason for your answer. (1)

- From the tally chart it has the modal frequency, showing that most respondents use the method; OR

- From the graph it has the tallest bar, showing that most respondents use the method; OR

- Most people interviewed use the method for garbage disposal. ✓

3.3 What is the least popular way of garbage disposal? (1)

- Response with lowest frequency.✓

3.4 Why is the disposal method mentioned above the least popular choice? (1)

- From the tally chart it has the lowest frequency, showing that less respondents use the method; OR

- From the graph it has the shortest bar, showing that less respondents use the method; OR

- Less number of people interviewed uses the method for garbage disposal. ✓

3.5 What method of waste management would you advise your classmates to use in your community to help keep the natural environment safe? Briefly explain why you think the method is useful. (3)

- Any relevant method applicable to waste management. ✓

- Relevant explanation which supports the method provided. ✓✓

TOTAL = 45

8.2. Grade 8 Project exemplar

DESIGN AND CREATE YOUR SCHOOL'S

OWN GARDEN

MARKS 40

TIME: 3 WEEKS

Projects are used to assess a range of skills and competencies. Through projects, learners are able to demonstrate their understanding of different Mathematics concepts and apply them in real-life situations. Caution should, however, be exercised not to give projects that are above learners' cognitive levels. The assessment criteria should be clearly indicated on the project specification and should focus on the Mathematics involved and not on duplicated pictures and facts copied from reference material. Good projects contain the collection and display of real data, followed by deductions that can be substantiated.

DESIGN AND CREATE YOUR SCHOOL'S

OWN GARDEN

OVERVIEW

Our mother earth is going through a tough situation and we, the entire human race, are very much responsible for this. Gardening is always an excellent and environment-friendly idea and if you can create a sustainable garden, it could be useful for all. Recent research carried out by the National Gardens Science Scheme showed that more than 79% of people said that being in a garden makes them feel healthier and that access to a garden is essential for quality of life. Creating a garden of any kind simply improves mental and physical wellbeing. (*The Telegraph, 19 March 2012)*.

The idea of this project is that the learners should design and create a garden that is sustainable at the school. By the end of this project, the learners should be able to submit a proposal to the SMT, motivating the need for a sustainable and environmentally friendly garden.

By using their mathematical skills (area, perimeter, geometric patterns, quadrilaterals in terms of their sides, angles and diagonals, working with scale, 2-D and 3-D geometry), learners will create a garden for the school. They must first plan the garden and then build a model of the garden, which will be on scale. After planning, they will have to collect information such as specific costs, plants, layout and responsibilities. After collecting the most appropriate information, the learners will have to decide on the most cost-effective way of creating the garden. They will have to make calculations and decide on the best way of representing this information to motivate their decisions.

STARTING THE PROJECT

The learners should start in class with their planning. This should be done so that the teacher can see whether the learners understand the project well. Learners can do their first planning on a sheet of paper. The garden should at least comprise a space of 30 m x 20 m. The learners should now be creative and plan all features of the garden. The garden must comply with the minimum requirements set below. They will also need to consider all expenses and create a budget in which to complete the actual garden.

MINIMUM

- Model: 300 mm x 200 mm garden with a scale of 1 cm : 1 m.
- Area and perimeter calculated.
- Geometric patterns used.
- Quadrilaterals in terms of their sides, angles and diagonals.
- Working with scale.
- 2-D and 3-D geometry
- There must be a pathway of any length and width.
- There must be a fence – anywhere you want it.

PRESENTATION

1. **The model:**

Build a model of this garden and use any form of material to represent your garden. The scale of this model must be 1 cm : 1 m. Show your dimensions on the model.

2. **The calculations, cost and budget:**

Make a poster to present your findings and calculations. This poster can be of any size and in any manner you prefer.

Collect all the information, organise and summarise it, in such a way that it is easy to see and understand your calculations for your garden and prices. The more evidence you can show of the collection of prices (quotations or advertisements), calculations and decisions you have made, the better.

Represent the calculations of cost in any way that would be easy to read and understand. Remember that you always work with a minimum budget.

CONCLUSION

Interpret your findings and write a conclusion on your findings.

Analyse your project and write a clear report with possible ideas and suggestions.

ASSESSMENT

	1	2	3	4
Model	Design is done on paper. 2-D	Construction of design roughly done. 3-D	Construction of design done without dimensions. 3-D	Construction of design done with all dimensions complete. 3-D
Area	Area of one kind of geometrical shape is given.	Area of three different geometrical shapes is given.	Area of four different geometrical shapes is given.	Area of at least five different geometrical shapes is given.
Perimeter	Perimeter of one geometrical shape is given.	Perimeter of three different geometrical shapes is given.	Perimeter of four different geometrical shapes is given.	Perimeter of at least five different geometrical shapes is given.

Fence	There is a fence.	Dimensions of fence are given.	Total length of fence was attempted, but with mistakes.	Total length of fence needed was correctly calculated.
Collection of data (1)	Estimated pricing of at least two items.	Evidence of the actual prices of at least four items is presented with the option to choose the best price.	Evidence of the actual prices of at least six items is presented with the option to choose the best price.	Evidence of the actual prices of at least eight items is presented with the option to choose the best price.
Collection of data (2)	Indication of at least four different types of plants to be used in the garden.	Indication of at least five items to be planted in the garden.	Indication of at least six items to be planted in the garden.	Indication of at least seven items to be planted in the garden.
Organising data	Data is incomplete and not clearly organised.	Data is complete **but not** clearly organised.	Data is complete and clearly organised.	Data is complete, clearly organised and illustrated by means of tables.
Poster	There is a poster, presented by only one member of the group.	The poster is neatly done and presented by less than half of the group.	The poster is informative with all relevant information and presented by most of the group.	The poster is informative with all relevant information and presented with confidence by all the learners of the group.
Presentation	The presentation of the project and its sustainability **are not** clearly communicated.	The presentation of the project and its sustainability are communicated **without** a clear plan of action or clear sustainability.	The presentation of the project and its sustainability are communicated **with** a **clear** plan of action.	The presentation of the project and its sustainability are communicated **with** a **clear** plan of action and a **detailed** budget.
Report	A report was written.	A fair attempt to write a report on the project was made.	The report is detailed and convincingly concluded with suggestions.	The report is detailed and convincingly concluded with suggestions and accepted by the SMT as the most viable option.

8.3. Grade 9 Project exemplar

TOTAL: 40 MARKS TIME : 1 WEEK

Follow the data cycle as outlined in the previous page to undertake this project.

Stage 1: Focus/problem

Background/focus of the project: A company that manufactures specialised protective clothing for people who work in high-tech environments needs to decide on the kind of hand- and footwear that must be purchased for each individual in the lab. To be able to do this, data are needed about the relationship between people's hand size and foot size. The management of the company has hired you to gather this data for them. After gathering the data, you will represent it graphically, analyse and interpret it and communicate your findings to the management of the company.

This project therefore aims to find a relationship between:

A) Span of hand and length of foot.

B) The combined width of the four fingers and width of foot.

For both A and B you will need to take measurements from the same 10 individuals in your community.

In this project you will work in groups of three learners. Each member of the group will collect data from 10 persons. The three of you will then combine your data so that you have 30 different people to represent graphically, analyse and interpret, and communicate your findings to management.

Method:

Identification of the population. It is best to collect data from people of the same age group. Data collected from individuals of different age groups will probably affect the interpretation and predictions of the data.

What is your population?

_____

How did you select the sample of 10 people from the population?

_____

Stage 2: Pose a question

i) In your own words, pose the question that this project is trying to answer.

_____

_____

ii) On a separate sheet, include diagrams of exactly what parts of the hand and foot you will be measuring.

iii) On the same sheet, explain how you will actually measure the hand span, the length of the foot, the width of 4 fingers and the width of the foot. Also, how are you going to handle the cases where lengths or widths are not whole centimetres?

Stage 3: Data collection

Each member of the project group will identify 10 people either from school or home. Use them to complete the following two tables.

NB: It is best to collect data from 10 people of the same age group.

Table A

Person	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Data set 1: Width of four fingers in cm										
Data set 2: Width of foot in cm										

Table B

Person	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Data set 1: Width of four fingers in cm										
Data set 2: Width of foot in cm										

Stage 4: Organise the data

During this stage you are expected to organise, summarise and represent the data you have collected using frequency tally tables, and a scatter plot for each of the tables above. [You may need to use a grouped frequency table. You may need to make a brief study of this kind of frequency table.]

i) Frequency tally tables for data in Table A (two frequency tally tables, one for each set of data)

ii) Frequency tally tables for data in Table B (two frequency tally tables, one for each set of data)

iii) For each data set in both Table A and Table B, summarise the data by calculating the mean, median and range. State the mode if there is one. [If you used a grouped frequency table in parts i) and ii) immediately above, then state what is called the modal group.]

In order to represent your data, draw a scatter plot showing the relationship between the data sets (pair of variables) in each table.

iv) Scatter plot A (from the two data sets in Table A)

Title: _____

v) Scatter plot B (from the two data sets in Table B)

Title: _____

Stage 5: Interpretation of your project research (you may use a separate sheet)

i) Summarise your findings

_____
_____
_____
_____

ii) Draw conclusions

_____
_____
_____
_____
_____

iii) Communicate findings to management

_____
_____
_____
_____

END

RUBRIC FOR GRADE 9 DATA CYCLE PROJECT (maximum: 10 x 4 = 40 marks)

Criteria	No effort (0)	Needs improvement (1)	Satisfactory (2)	Good (3)	Excellent (4)
1. Question identified	No attempt at all or below standard.	No math information / numbers identified.	No math information is used to solve the problem. Math information / numbers identified.	Labels may be missing. Some of the math information is used to solve the problem. Math information / numbers identified.	Appropriate labels identified. Most of the math information is used to solve the problem. Math information / numbers identified. Appropriate labels identified. Math information used to solve the problem.
2. Explanation of methods (population, sample)	No attempt at all or below standard.	Only the population is explained but no effort made to explain sampling.	No systematic approach in identifying populations. Both population and sample identified but no coherence and logic in presentation.	Both population and sample identified but some key aspects are left out.	Both population and sample identified. Considerable effort was made and there is logical presentation.
3. Data collection	No attempt at all or below standard.	Data insufficient and scanty. No order and coherence in presentation of data. Only one table completed.	There are errors that emanated from incorrect measurements. Data available, orderly and logically presented. Both tables completed. There are minimal errors from measurements.	Data available, orderly and logically presented. Both tables completed. Most of the measurements are reasonably accurate and there is logic to the work.	Data available, orderly and logically presented. Both tables completed. All the measurements are accurate.
4. Organisation of data	No attempt at all or below standard.	Data not well organised, and not clear to the assessor.	Data is available but there is no logic and coherence. Organisation show little understanding.	Data is organised in tables but there is missing information. Available information is correct to some extent.	Data excellently organised in tables. Correct labels are evident and clear.
5. Summary of data	No attempt at all or below standard.	Calculations of central tendencies performed but there	Calculations of central tendencies performed, but some computational errors.	Calculations of central tendencies performed but most of	Calculations of central tendencies excellently performed without errors.

		are many computation errors.		the calculations are correct.	
6. Correct answer (calculations, mean, median, range)	No attempt at all or below standard.	Incorrect answer.	Arrived at a correct answer but with some conceptual errors.	Arrived at correct answer but with some computation errors.	Arrived at a correct answer.
7. Representation of data	No attempt at all or below standard.	Data is represented on a graph but no labels on the axes. No title.	Work does not show an understanding of the task. There is an attempt to represent data in a graph. Only the axes are labelled. Points are incorrectly plotted, shows little that the graph is communicating. The message is not clear.	Most of the aspects of the graph are correct, e.g. axes are labelled, title is available, points showing pairs of variables.	Data is clearly represented. All the aspects of graphical representation are clear to the assessor. The message is clear.
8. Summary of findings	No attempt at all or below standard.	Findings have no link to the research. Cannot be clearly interpreted.	Attempts to outline findings but no logical coherence.	Findings are outlined but leaves out important details.	Findings are clearly communicated. They are clearly linked to the research question. They point to the research question.
9. Conclusions	No attempt at all or below standard.	No justification for the strategy, conclusion, and/or answer.	Attempts to justify the strategy, conclusion, and/or answer, but the justification is not relevant to the problem.	Justifies the strategy, conclusion, and/or answer, but leaves out details.	Justifies the strategy, conclusion, and/or answer to the problem.
10. Communication	No attempt at all or below standard.	Very little or no mathematical language, graphs, diagrams, and/or charts used and contains conceptual errors. Presents the problem in an unclear manner, steps are missing or out of sequence. Cannot determine a sequence of steps.	Uses mathematical language, graphs, diagrams, and/or charts appropriately, but contains conceptual errors. Solution is not clearly presented. Difficulty in following the sequence of steps.	Uses mathematical language, graphs, diagrams, and/or charts appropriately, but may contain transcription or computation errors. Solution is presented in a manner so the scorer can follow most of the steps in the solution and final answer.	Uses mathematical language, graphs, diagrams, and/or charts appropriately. Solution is presented in a clear, orderly and coherent manner so the reader can follow the flow of the solution and final answer.

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