

# 2012 GRADE 9 ANNUAL NATIONAL ASSESSMENT ANALYSIS

## INTRODUCTION

This analysis was compiled by the AMESA Curriculum Committee in response to a request by the Department of Basic Education for an independent opinion on the standard of the Grade 9 ANA Mathematics paper that was administered in September 2012.

Our analysis is based on:

- A question by question analysis of content coverage, marks per question and cognitive level requirements (see Appendix 1).
- Summary data of the content area (learning outcome) coverage and the cognitive levels coverage (see Appendix 2).

## FINDINGS AND CONCLUSION

Our analysis shows that the Grade 9 ANA question paper presented a sound spread of content areas (learning outcomes) as in the NCS (and ANA), summarised as follows:

	<b>Numbers, operations and relationships</b>	<b>Patterns, functions and algebra</b>	<b>Space and shape</b>	<b>Measurement</b>	<b>Data handling</b>	<b>TOTAL</b>
Actual %	13,6%	36,4%	27,1%	12,9%	10%	100%
Required %	15%	35%	30%	10%	10%	100%
<b>Deviation (%)</b>	<b>-1,4%</b>	<b>+1,4%</b>	<b>-2,9%</b>	<b>+2,9%</b>	<b>0%</b>	<b>0%</b>

Our analysis shows that the Grade 9 ANA question paper presented a sound spread in the well-known different cognitive levels, summarised as follows:

	<b>Knowledge</b>	<b>Routine procedures</b>	<b>Complex procedures</b>	<b>Problem Solving</b>	<b>TOTAL</b>
Actual %	25%	47,1%	23,6%	4,3%	100%
Required %	25%	45%	20%	10%	100%
<b>Deviation (%)</b>	<b>0%</b>	<b>+2,1%</b>	<b>+3,6%</b>	<b>-5,7%</b>	<b>0%</b>

It is our opinion that the questions were formulated clearly and unambiguously. Second language learners would have been able to understand most terms/concepts in the paper as these are standard Grade 9 terms. We therefore conclude that language usage in the paper was appropriate.

After members have themselves worked through the paper, we are of the opinion that there was adequate time allowed for the question paper; learners had enough time to complete the question paper.

Based on our criteria (content coverage, cognitive level balance, language and time) and our analysis of these, we must conclude that the paper was set at an **appropriate, acceptable standard and must be regarded as fair.**

## SOME REMARKS

We reiterate that the standard of the paper is sound. The poor performance of learners countrywide can therefore not be explained by a too difficult paper or too high standards. Explanations must be sought elsewhere.

Children's learning is influenced by a myriad of factors. *Cognitive* explanations for pupils' learning problems may be sought in three areas. One explanation may lie at the level of an *epistemological* obstacle – an obstacle intrinsically related to the *nature of the content* itself, that is, the content may be inherently difficult. Thus although the paper, based on the curriculum, itself is fair, the content in the curriculum itself may not be appropriate for the grade level. That implies that the Department should revisit the curriculum itself.

A second explanation may be that there are *psycho-genetic* obstacles – obstacle due to the intrinsic characteristics of the children's development. Our children at this level may not be "ready", i.e. may not possess the necessary prerequisite cognitive structures for the given mathematical content. This implies that sound research should be conducted to find out if there is an appropriate alignment between cognition and content.

A third explanation may be found in *didactical* obstacles, i.e. the quality of the teaching that children receive. This implies that the Department should attend to appropriate teacher professional development. We remark that the new CAPS curriculum for the Senior Phase will be implemented in 2014 and training for this new curriculum is due to take place in 2013. We advise that the training should be intensive and training for mathematics teachers should focus mainly on the actual teaching of key concepts/content in this phase. The DBE should make this training compulsory for all teachers and should consult with stakeholders such as AMESA, SAMF, NGOs, Unions and Higher Education Institutions when planning this training.

We briefly communicate some inputs from teachers:

- Second language learners may have found the "word problems" in question 3 to be challenging.
- Many teachers complained that formulae were not provided for questions 1.7, 3.3, 8.2 and 8.3 and that this disadvantaged learners. However, we note that it is very clear in the CAPS document (p. 55, 57) that learners should know the formulae for perimeter, area and volume.
- The content that is usually done in term 4 (transformation geometry, data handling and probability) was included in the question paper. This may have disadvantaged learners if teachers were not able to complete these sections before the ANA was written. These questions (1.10, 7 and 9) comprised 22 marks (15,7%) of the paper.
- Most teachers were caught in a dilemma of revising for the ANA, having to complete content and doing prescribed tasks for term 3. This compromised the preparation for the ANA.
- There were very strict time frames for ANA revision. Resources for revision should have been given at the beginning of the year.
- Learners knew that the ANA marks would not contribute towards their progression, hence they did not take the ANA seriously. Teachers feel strongly that the ANA should count towards learners' final mark.

## APPENDIX 1: QUESTION BY QUESTION ANALYSIS

QUESTION	TOPIC/CONTENT	LO	COGNITIVE LEVEL	MARK	COMMENT
<b>QUEST 1</b>					
1.1	Number patterns	2	1	1	Simple sequence
1.2	Rational numbers	1	1	1	Knowing what a rational number is
1.3	Number patterns	2	1	1	Choosing two appropriate numbers
1.4	Exponents	1	2	1	Knowing and applying exponential rules
1.5	Graphs	2	1	1	Identifying correct graph; C & D easily eliminated
1.6	Solving equations	2	1	1	Equate both factors to 0
1.7	Volume	3	1	1	Cube not drawn
1.8	3D figures	3	2	1	Need to draw a rough 3D figure
1.9	Congruency	3	1	1	Application of congruency cases
1.10	Probability	5	2	1	Working out sample space
<b>QUEST 2</b>					
2.1	Scientific notation	1	1	1	Moving the decimal comma an appropriate number of places
2.2.1	Exponents	1	1	2	Applying exponential rules
2.2.2	Exponents, fractions	1	2	2	Multiplying fractions (using exponential rules)
2.3.1	Simplifying algebraic expressions	2	1	3	Multiply out
2.3.2	Simplifying algebraic expressions	2	2	3	Multiply out and collect like terms
2.4.1	Factorisation	2	1	2	Common factor
2.4.2	Factorisation	2	2	2	Common factor and difference of two squares
2.4.3	Factorisation	2	3	4	Grouping then common factor
2.5.1	Linear equation	2	1	2	Multiply out and solve
2.5.2	Quadratic equation	2	1	3	Factorise and solve
2.5.3	Fractional equation	2	2	3	Multiply by LCM and then solve
2.5.4	Exponential equation	2	2	3	Express RHS as a power of 2; then equate powers
<b>QUEST 3</b>					
3.1	Ratio	1	2	2	Expressing men as a fraction then calculating number of men
3.2	Distance ,speed & time	4	3	3	Interpreting a word problem and using $T = D/S$ ; converting to minutes
3.3	Compound interest	1	2	3	Formula ?
3.4.1	Amount paid in cash	1	2	1	Percentage calculation
3.4.2	Amount still to be paid	1	2	4	Difference between original amount and amount paid
3.4.3	Monthly instalment	1	2	2	Division

QUESTION	TOPIC/CONTENT	LO	COGNITIVE LEVEL	MARK	COMMENT
<b>QUEST 4</b>					
4.1	Terms of a sequence	2	1	2	Easy
4.2	Description	2	2	1	Using words
4.3	General term	2	3	2	Construct a formula in n
4.4	Calculating a specific term	2	3	3	Equating general term to 38 or using trial and error
<b>QUEST 5</b>					
5.1.1	Parallel/perpendicular lines	2	1	1	Knowing how to draw or having a mental picture of $x = 4$ and $x = -4$ and making deduction
5.1.2	Equation of horizontal line	2	1	1	Meaning of horizontal and associating with x or y
5.1.3	Gradient of a line	2	2	1	Write in terms of y; then get gradient
5.1.4	Graph of non-linear function	2	1	1	Deducing from drawn graph
5.2.1	Drawing graphs	2	2	8	Two straight line graphs which intersect
5.2.2	Intersection of two lines	2	3	2	Solving simultaneous equations
<b>QUEST 6</b>					
6.1.1	Angles on a straight line	3	1	3	Add and equate to 180; solve for x
6.1.2	Calculating specific angle	3	2	3	Alternate angles
6.1.3	Calculating specific angle	3	2	3	Corresponding angles
6.2	Identifying congruent triangles	3	1	2	Choosing two congruent triangles
6.3.1	Congruency(proof)	3	3	4	Proving two triangles congruent
6.3.2	Congruency(proof)	3	3	4	Proving two triangles congruent
6.3.3	Proving two angles equal	3	2	3	Application of congruency
6.3.4	Relationship between two lines	3	2	1	Making a deduction
6.4	Calculate length of side	3	3	4	Use similarity
<b>QUEST 7</b>					
7.1*	Translation	3	2	2*	Moving the figure
7.2*	Reflection	3	2	2*	Reflecting in the y-axis
7.3*	Reduction/perimeter	4	3	2*	Perimeter of reduced figure (not drawn)
7.4	Ratio/area	4	4	2	Ratio of original area to reduced area
<b>QUEST 8</b>					
8.1	Cylinder	4	1	6	Completing a table
8.2	Rectangular prism	4	2	5	Total surface area
8.3	Height of cylindrical can	4	4	4	Making h the subject of formula and substituting given values
<b>QUEST 9</b>					
9.1.1*	Data organisation	5	2	4	Completing frequency table
9.1.2*	Histogram	5	3	4	Drawing histogram
9.2.1*	Range and median	5	1	2	Only the boys
9.2.2*	Mode of data set	5	1	1	Only the girls
9.2.3*	Mean of data set	5	2	2	Only the girls

## APPENDIX 2: SUMMARY DATA

### CONTENT AREA (LEARNING OUTCOMES) COVERAGE

OUTCOMES/ QUESTION	Numbers, operations and relationships	Patterns functions and algebra	Space and shape	Measurement	Data handling	TOTAL
1	2	4	3		1	10
2	5	25				30
3	12			3		15
4		8				8
5		14				14
6			27			27
7			8			8
8				15		15
9					13	13
Total	19	51	34	18	14	140
Actual %	13,6%	36,4%	27,1%	12,9%	10%	100%
Required %	15%	35%	30%	10%	10%	100%
Deviation (%)	-1,4%	+1,4%	-2,9%	+2,9%	0%	0%

### COGNITIVE LEVEL SPREAD

COGNITIVE LEVEL/ QUESTION	Knowledge	Routine procedures	Complex procedures	Problem Solving	TOTAL
1	3	7			10
2	13	12	5		30
3		12	3		15
4	2	1	5		8
5	3	9	2		14
6	5	10	12		27
7		4	2	2	8
8	6	5		4	15
9	3	6	4		13
Total	35	66	33	6	140
Actual %	25%	47,1%	23,6%	4,3%	100%
Required %	25%	45%	20%	10%	100%
Deviation (%)	0%	+2,1%	+3,6%	-5,7%	0%

Submitted to the Department on 7 December 2012

Edited a few typing errors on 9 December 2012.



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

<b>MARKS</b>	
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## ANNUAL NATIONAL ASSESSMENT 2012 GRADE 9 MATHEMATICS TEST

**MARKS: 140**

**TIME: 2½ hours**

**PROVINCE** \_\_\_\_\_

**REGION** \_\_\_\_\_

**DISTRICT** \_\_\_\_\_

**SCHOOL NAME** \_\_\_\_\_

**NATIONAL EMIS NUMBER (9 digits)**

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**CLASS (e.g. 9A)** \_\_\_\_\_

**SURNAME** \_\_\_\_\_

**NAME** \_\_\_\_\_

**GENDER (✓)**

<b>BOY</b>	
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<b>GIRL</b>	
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**DATE OF BIRTH**

C	C	Y	Y	M	M	D	D
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**This test consists of 23 pages, excluding the cover page.**

**Instructions to learners.**

1. Read all the instructions carefully.
2. Question 1 consists of 10 multiple-choice questions. You must circle the letter of the correct answer.
3. Answer questions 2 to 9 in the spaces or boxes provided.
4. All working must be shown.
5. The test duration is  $2\frac{1}{2}$  hours.
6. The teacher will lead you through the practice exercise before you start the test.
7. Approved scientific calculators (non-programmable and non-graphical) may be used.

**Practice exercise**

Circle the letter of the correct answer.

Which of the numbers below is a mixed number?

0; 0,2;  $\frac{1}{8}$ ;  $2\frac{1}{4}$

A 0

B  $2\frac{1}{4}$

C 0,2

D  $\frac{1}{8}$

You have done it correctly if you circled B.

**The test starts on the next page.**

## QUESTION 1

1.1 The next number in the sequence 1; 9; 25; ... is

- A 33
- B 36
- C 49
- D 50

1.2 Which of the following numbers is a rational number?

- A  $\sqrt{3}$
- B  $\sqrt{16}$
- C  $\sqrt{-9}$
- D  $\sqrt{13}$

1.3 The two missing numbers in the sequence below

18; 36; \_\_\_ ; 72; \_\_\_ ; 108

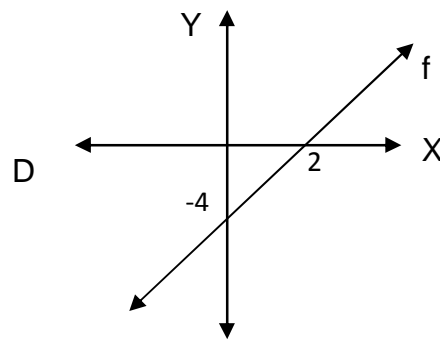
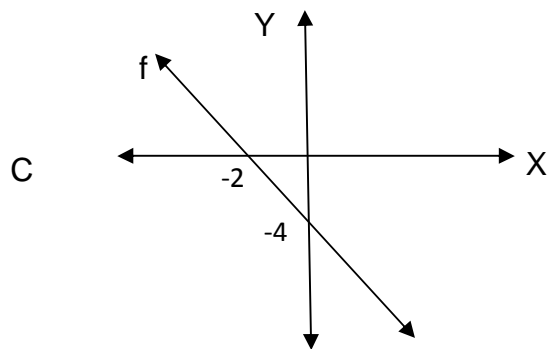
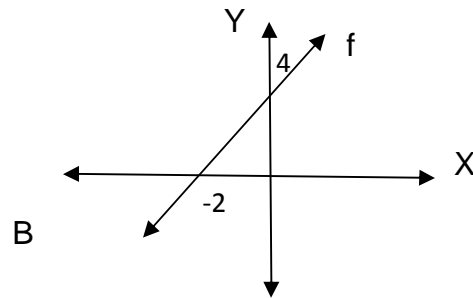
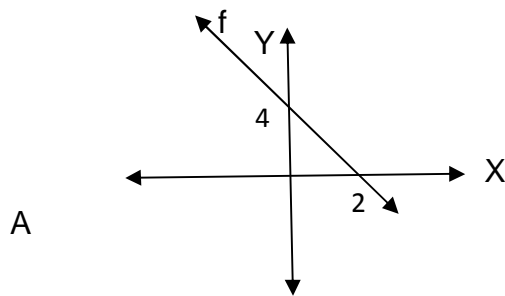
- A 38 and 74
- B 42 and 78
- C 54 and 90
- D 45 and 81

1.4  $5^0 \times 3^{-2} =$

- A -6
- B 45
- C  $\frac{1}{9}$
- D 9



1.5 The graph of the straight line defined by  $f(x) = 2x + 4$  is



1.6 If  $(x - 1)(x + 2) = 0$  then  $x =$

- A -1 or 0
- B 1 or -2
- C 1
- D -2

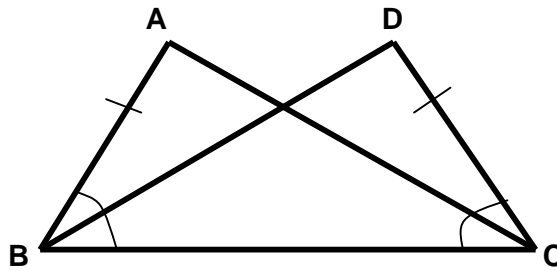
1.7 The volume of a cube with side length of 7 cm is

- A  $49 \text{ cm}^3$
- B  $28 \text{ cm}^3$
- C  $343 \text{ cm}^3$
- D  $14 \text{ cm}^3$

1.8 The 3-D figure which has 5 faces, 5 vertices and 8 edges is a

- A cylinder
- B triangular prism
- C square-based pyramid
- D triangular-based pyramid

1.9 Why is  $\triangle ABC \cong \triangle DCB$  ?



- A s, s, s
- B  $90^\circ$  hyp, s
- C s,  $\angle$ , s
- D  $\angle$ ,  $\angle$ , s

1.10 The probability of picking an odd number from numbers 1 to 13 is

- A  $\frac{6}{13}$
- B  $\frac{7}{13}$
- C  $\frac{1}{13}$
- D  $\frac{1}{2}$

[10]

## QUESTION 2

2.1 Write 0,00000356 kℓ in scientific notation.

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(1)

2.2 Simplify.

2.2.1  $(3x)^3 + 2x^3$

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(2)

2.2.2  $\frac{a^2b^2}{ac^2} \times \frac{4a^2bc}{20b^3}$

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(2)

2.3 Multiply and simplify if necessary.

2.3.1  $4ab(5a^2b^2 + 2ab - 3)$

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(3)

2.3.2  $(2x - 1)^2 - (x + 1)(x - 1)$

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(3)

2.4 Factorise fully.

2.4.1  $8p^3 + 4p^2$

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(2)

2.4.2  $9p^2 - 36q^2$

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(2)

2.4.3  $tx - ty - 2x + 2y$

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(4)

2.5 Solve for  $x$ .

2.5.1  $3(x + 6) = 12$

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(2)

2.5.2  $x^2 - 2x = 0$

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(3)

2.5.3  $\frac{x+1}{3} - \frac{x-1}{6} = 1$

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(3)

2.5.4  $2^{x+1} = 32$

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(3)  
**[30]**

### QUESTION 3

- 3.1 There are 240 children at a party. The ratio of the number of boys to the number of girls at the party is 3 : 1.  
How many boys are there at the party?

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(2)

- 3.2 Petrus takes a bus to school. The bus travels at an average speed of  $40 \text{ km/h}$ . The school is  $9 \text{ km}$  from his house.  
How many minutes does he take to get to school?

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(3)

- 3.3 Bongiwe invests R12 000 in a savings account at 6,5% per annum compound interest.  
Calculate how much there will be in the savings account after 5 years.

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(3)

3.4 Philani bought a scooter for R15 000. He paid 15% of the amount in cash and signed a hire-purchase agreement to pay the balance in 24 equal monthly instalments. The interest rate is 10% per annum.

3.4.1 How much did he pay in cash?

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(1)

3.4.2 Calculate the total amount that he must still pay.

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(4)

3.4.3 Calculate the monthly instalment.

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(2)  
**[15]**

**QUESTION 4**

4.1. Write down the next two terms in the given sequence.

3; 8; 13; \_\_\_\_\_; \_\_\_\_\_; (2)

4.2 Describe the pattern in question 4.1 in your own words.

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(1)

4.3 Write down the general term of the given sequence in the form

$T_n =$  \_\_\_\_\_ . (2)

4.4 Which term in the sequence is equal to 38?

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(3)  
**[8]**



## QUESTION 5

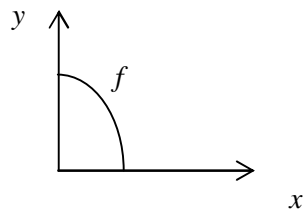
5.1 Underline the word, the number or the equation between brackets so that each of the following statements is correct.

5.1.1 The lines  $x = 4$  and  $x = -4$  lines are (parallel/perpendicular) to one another. (1)

5.1.2 The equation of the horizontal line through the point  $P(3; -2)$  is ( $x = 3 / y = -2$ ). (1)

5.1.3 The gradient of the line defined by  $y - 4x + 5 = 0$  is equal to  $(-4 / 4)$ . (1)

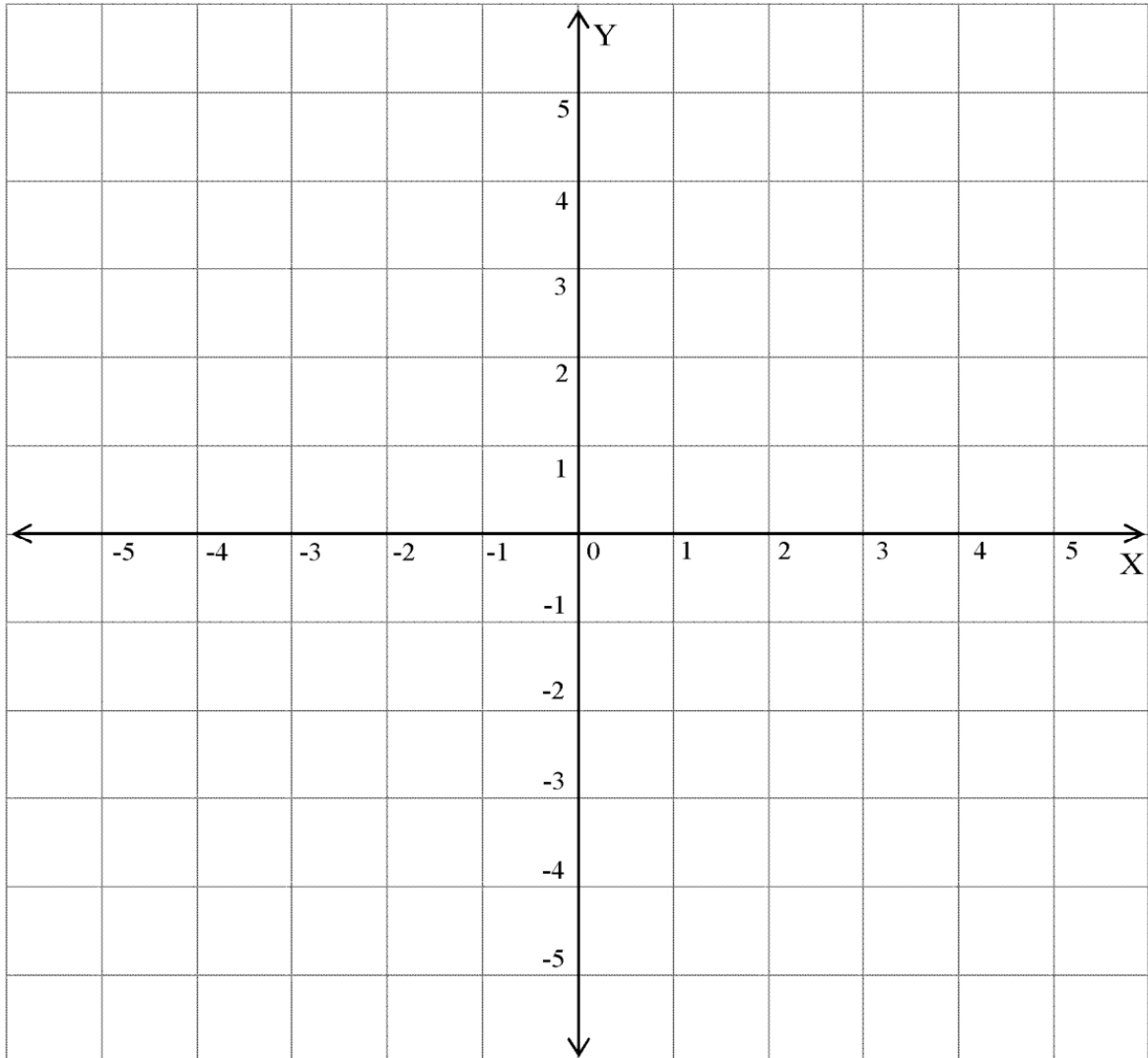
5.1.4 This graph of  $f$  below represents a (linear/non-linear) function.



(1)

5.2

5.2.1 On the same set of axes, draw and label the graphs defined by  $y = -2x + 1$  and  $y = x - 2$ . Use the given grid and clearly indicate the points where the lines cut the axes.



(8)

5.2.2 The lines intersect at T. Show by calculation that the co-ordinates of T are  $x = 1$  and  $y = -1$  or  $(1; -1)$ .

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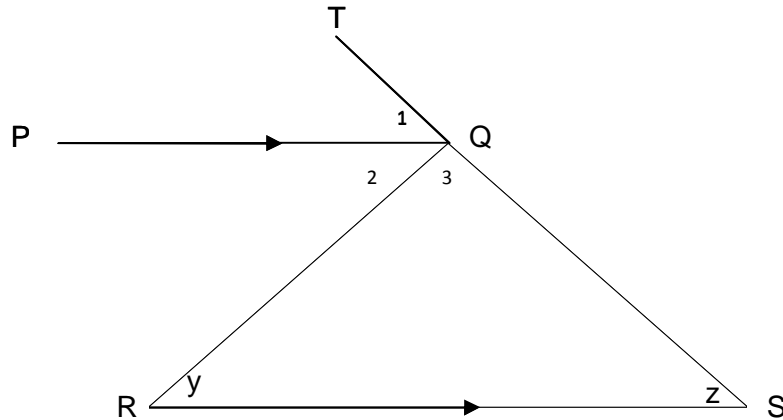
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(2)  
[14]

## QUESTION 6

Give reasons for each of your statements in question 6.1 and 6.2.

- 6.1 In the figure  $PQ \parallel RS$ ,  $\hat{Q}_1$ ,  $\hat{Q}_2$  and  $\hat{Q}_3$  are equal to  $2x$ ,  $3x$  and  $4x$  respectively.  $\hat{R} = y$  and  $\hat{S} = z$ .



- 6.1.1 Calculate the value of  $x$

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(3)

6.1.2 Calculate the value of  $y$ .

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(3)

6.1.3 Calculate the value of  $z$ .

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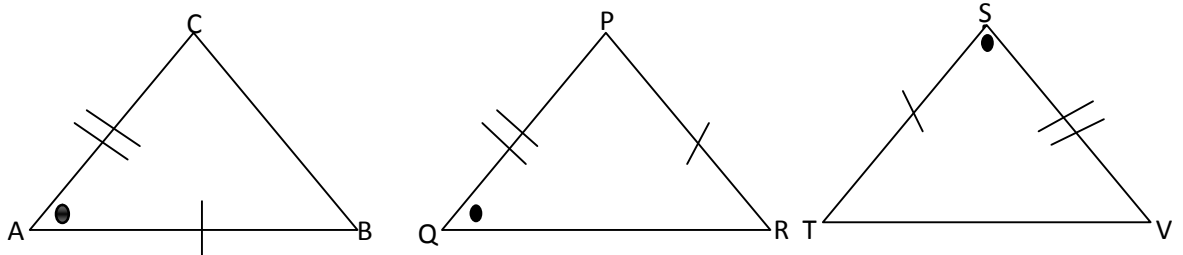
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(3)

6.2 State which triangle is congruent to  $\triangle ABC$ .

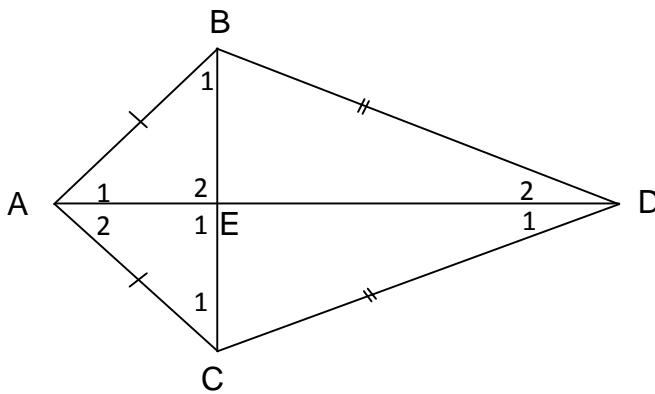


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(2)

6.3



In the above figure  $AB = AC$  and  $BD = CD$ .

6.3.1 Prove that  $\triangle ABD \cong \triangle ACD$ .

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(4)

6.3.2 Prove that  $\triangle ABE \cong \triangle ACE$

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(4)

6.3.3 Prove that  $\hat{E}_1 = \hat{E}_2 = 90^\circ$ .

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(3)

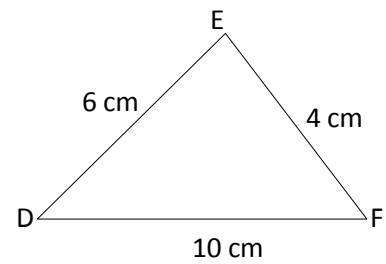
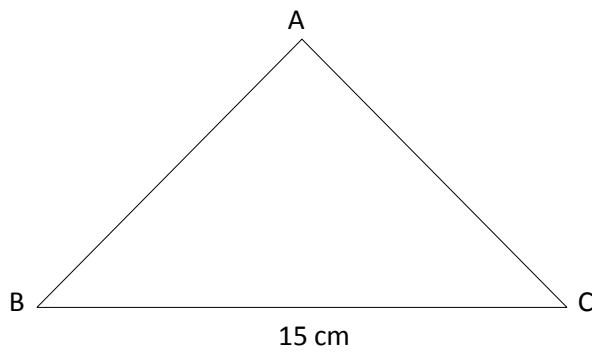
6.3.4 Hence, state the relationship between AE and BC.

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(1)

6.4 Calculate the length of AB if  $\triangle ABC \parallel \triangle EDF$  :



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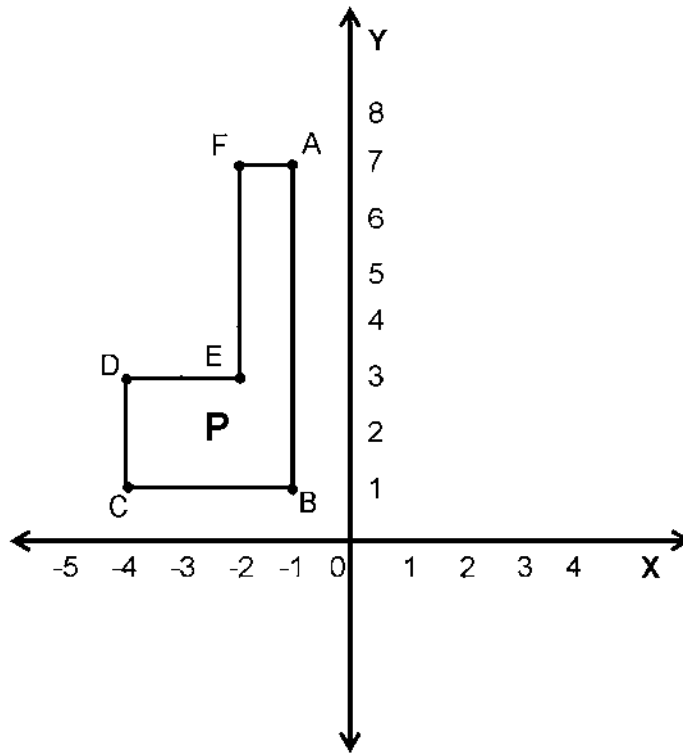
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(4)  
[27]

**QUESTION 7**

A, B, C, D, E and F are the vertices of figure P.



7.1 Write down the coordinates of the image of D and E if figure P is translated 3 units to the right and 2 units down.

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(2)

7.2 Write down the coordinates of the image of A and B if figure P is reflected in the Y-axis.

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(2)

7.3 The length of each side of figure P is halved. Calculate the perimeter of the new figure.

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(2)

7.4 Determine the ratio of the area of figure P to the area of the reduced figure in question 7.3.

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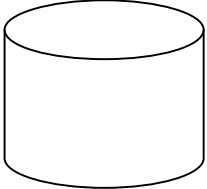
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(2)  
**[8]**



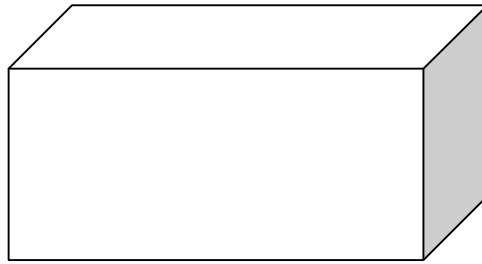
**QUESTION 8**

8.1 Complete the table by filling in the name of the 3-D figure, the number of faces, the number of vertices, the number of edges and the shape of the faces.

3-D figure	Name of figure	No. of faces	No. of vertices	No. of edges
				
Shape of the faces:				

(6)

- 8.2 Calculate the total surface area of the rectangular prism with length =  $7,2\text{ m}$  breadth =  $5\text{ m}$  and height =  $3,32\text{ m}$ .  
Give the answer correct to 2 decimal places.



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(5)

- 8.3 A bottling company produced a cylindrical can which has a capacity of  $1\ell$ .  
The radius of the cylinder is  $2,82\text{ cm}$ . Calculate the height of the can correct to 1 decimal place. ( $1\ell = 1\,000\text{ cm}^3$  and  $\pi = 3,14$ )

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(4)  
**[15]**

### QUESTION 9

9.1 The following marks were obtained by a Grade 9 class for a Mathematics test out of 50.

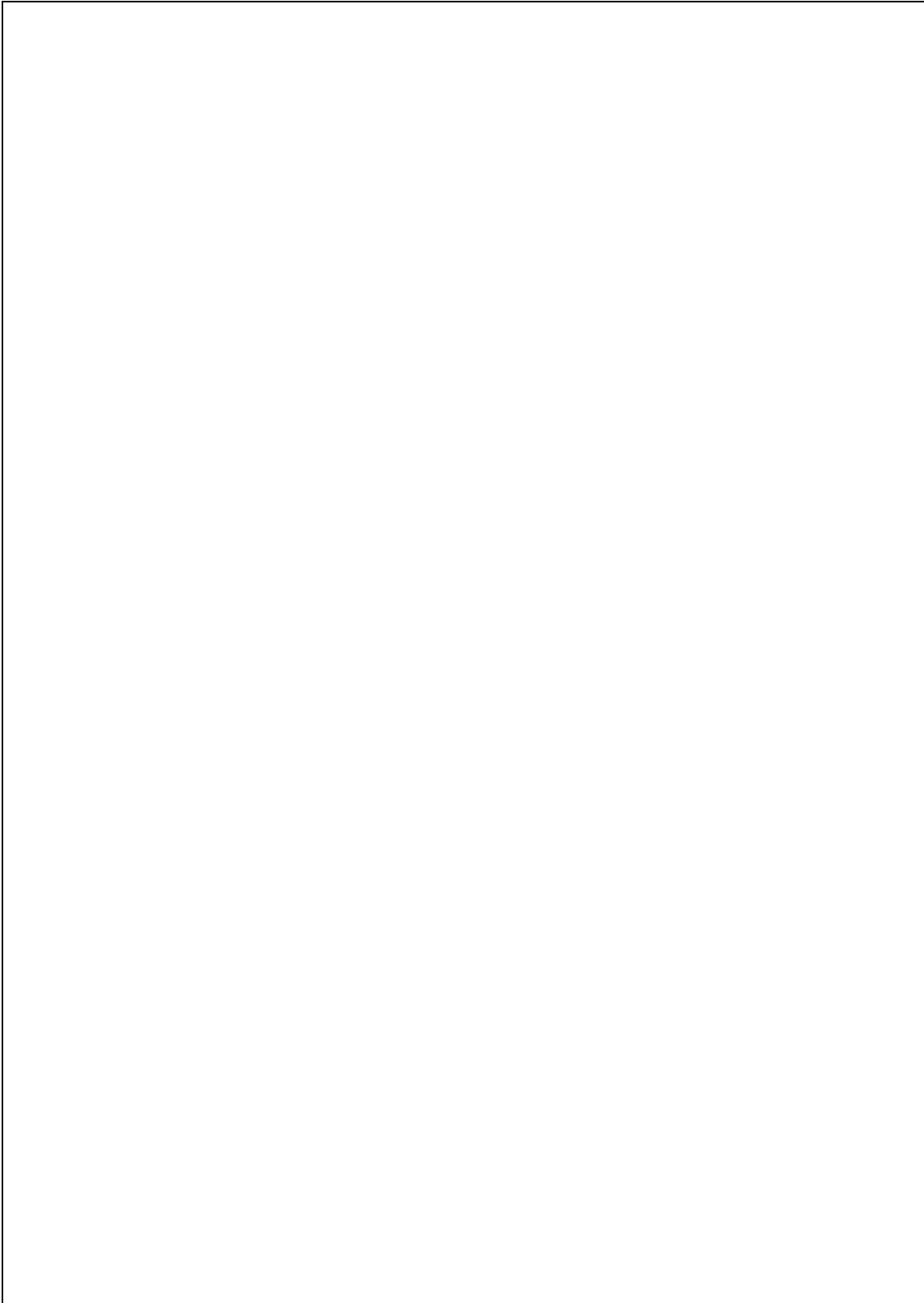
14	21	29	32	36	43
41	17	43	31	38	35
32	29	27	23	36	25
22	26	40	28	47	30
24	46	25	44	42	39

9.1.1 Complete the frequency table.

Class interval	Tally marks	Frequency
1 – 10		
11 – 20		
21 – 30		
31 – 40		
41 – 50		

(4)

9.1.2 Draw a histogram to illustrate the data.



(4)

9.2 Vuvu recorded the following data from her class about their shoe sizes.

Girls	5	7	7	5	5	7	5	5	8	6	
Boys	5	6	9	8	7	9	9	10	5	9	8

9.2.1 Write down the range and the median for the boys.

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(2)

9.2.2 Write down the mode (modal size) for the girls.

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(1)

9.2.3 Calculate the mean size for the girls.

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(2)  
**[13]**

**TOTAL: 140**