GRADE 10

MATHEMATICS INVESTIGATION TERM 1

TOTAL : 50 **DURATION : 1h15min**

SCHOOL NAME	

SURNAME	
NAME	
TASK	INVESTIGATION
DATE	05 MARCH 2025

Question no.		Marker	School Moderator	Cluster Moderator	District Moderator
1	(6)				
2	(13)				
3	(10)				
4	(16)				
5	(5)				
TOTAL (50)					

This question paper consists of 12 pages including this one.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of 5 questions. Answer ALL the questions.
2. Show clearly ALL calculations, diagrams, graphs etc. which you have used in determining the answers.
3. Answers only will not necessarily be awarded full marks.
4. An approved scientific calculator (non-programmable and non- graphical) may be used, unless stated otherwise.
5. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
6. It is in your own interest to write legibly and to present the work neatly.
7. **The answers must be written on this question paper.**

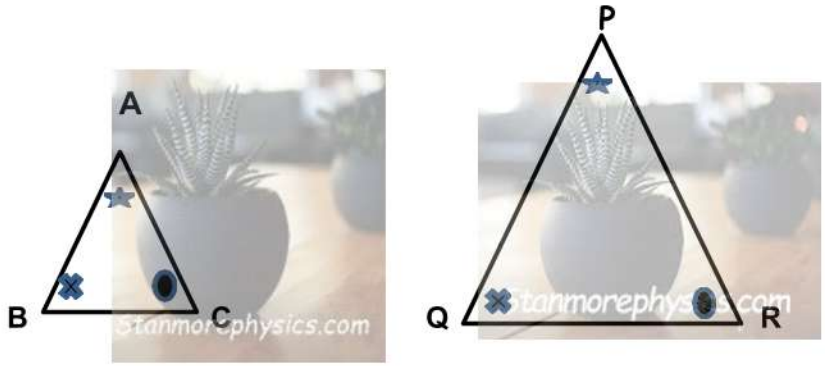
SIMILAR TRIANGLES

Triangles are similar if the:

- **Corresponding angles are equal**. (Then the corresponding sides are in the same ratio.)

OR

- **The corresponding sides are in the same ratio**. (Then the corresponding angles are equal)



From the 2 triangles we have:

$\hat{A} = \hat{P}$ *given*

$\hat{B} = \hat{Q}$ *given*

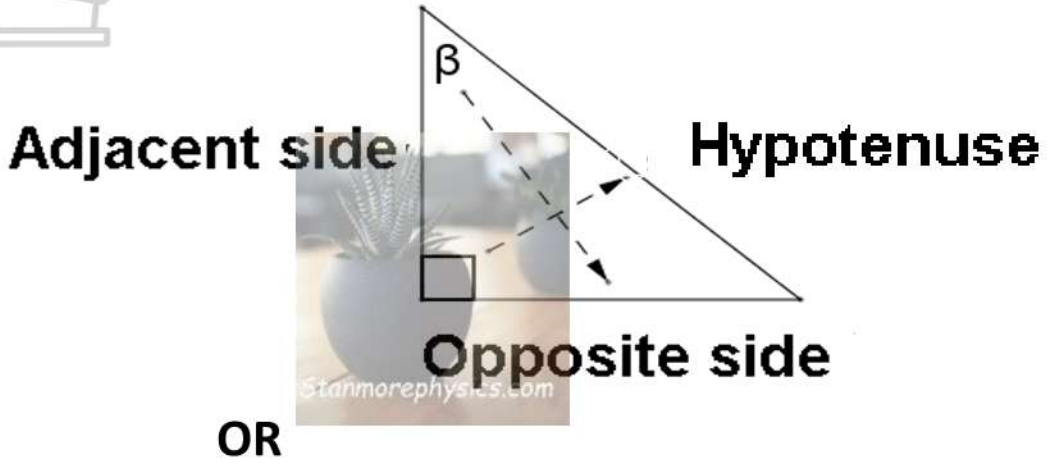
$\hat{C} = \hat{R}$ *given*

. $\Delta ABC \;|||\; \Delta PQR$ [AAA] (three corresponding angles of the two triangles are =)

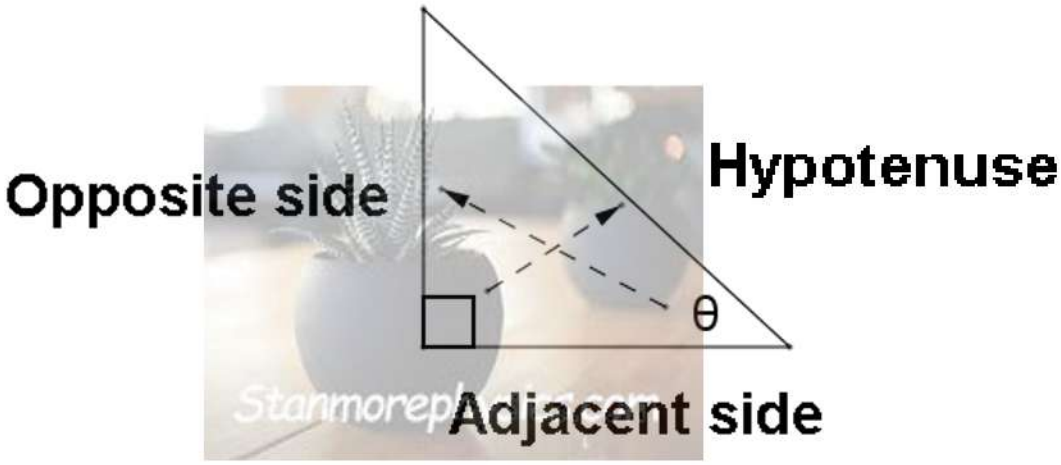
$$\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$$

COMPLETE THE FOLLOWING:

In a right-angled triangle, we can name the sides of the triangle according to **the position** of the angle and the right angle:

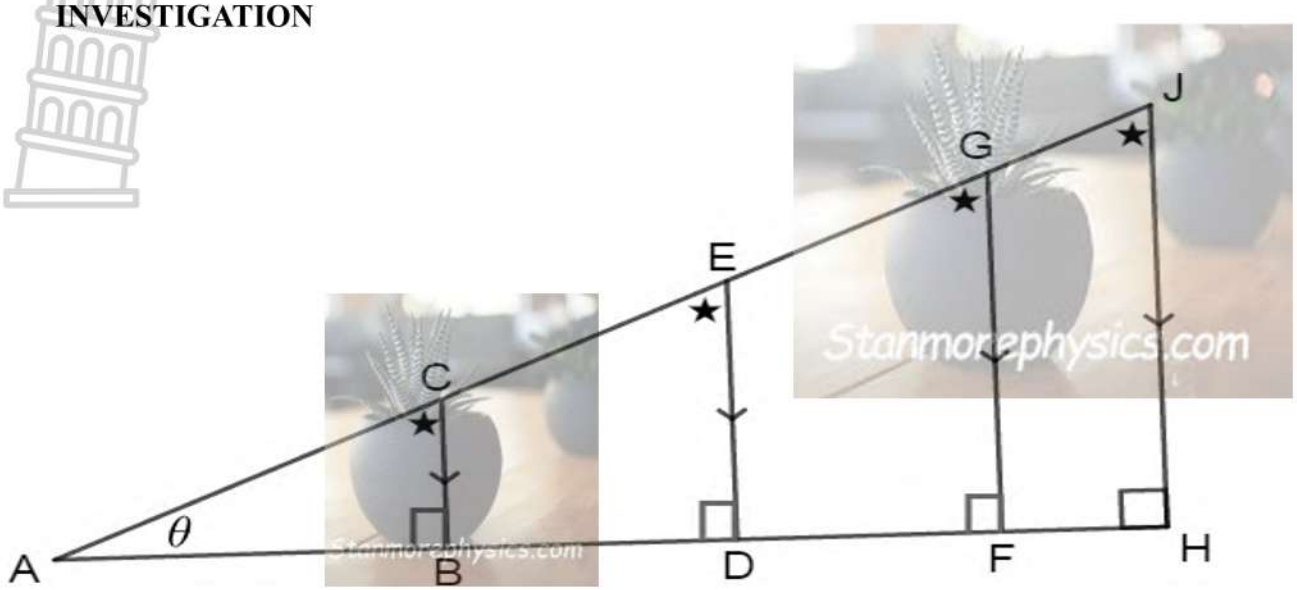


OR



Investigate the different RATIOS of all the sides in similar triangles. The four triangles below are given from smallest to biggest. The corresponding sides opposite the common angle, θ, is shown on the sketch as parallel lines. The angles which are equal is shown as ★.

USE THE FOLLOWING SKETCH TO ANSWER ALL THE QUESTIONS IN THIS INVESTIGATION



QUESTION 1

Given: the lengths of the lines:

AB = 4,9 cm, AD = 8,5 c, AF = 11,8 cm and AH = 13,9 cm AC = 5,4 cm

AE = 9,4 cm, AG = 13cm and AJ = 15,3 cm

CB = 2,3 cm, ED = 4 cm, GF = 5,5 cm and JH = 6,4 cm

1.1 Complete the similar triangles by writing the letters of the triangles in the correct order.

$\Delta A\ B\ C \ \|\|\| \ \Delta$_____ $\|\|\| \ \Delta$_____ $\|\|\| \ \Delta$_____ [3]

1.2 Why are the four triangles similar to each other?

_____ [1]

1.3 Why is it important to write the letters in the correct order when it comes to similarity? [2]

_____

_____

[6]

QUESTION 2

2.1 Complete the table by writing down THE CORRECT SIDES of the triangles: ΔADE, ΔAFG and ΔAHJ [3]

Name of the side	ΔABC	ΔADE	ΔAFG	ΔAHJ
Opposite side (O)	CB			
Adjacent side (A)	AB			
Hypotenuse (H)	AC			

2.2 Complete the table below [4]

Name of the side	ΔABC	ΔADE	ΔAFG	ΔAHJ
Opposite side (O)	cm	cm	cm	cm
Adjacent side (A)	cm	cm	cm	cm
Hypotenuse (H)	cm	cm	cm	cm

2.3 Complete the RATIOS by using the previous two tables and use your calculator to round it off to **one decimal place** [3]

Name of side	ΔABC	ΔADE	ΔAFG	ΔAHJ
$\frac{opposite\ side}{hypotenuse}$	$\frac{2,3}{5,4} = 0,4$ cm	___ = cm	___ = cm	___ = cm
$\frac{adjacent\ side}{hypotenuse}$	___ = cm	___ = cm	___ = cm	___ = cm
$\frac{opposite\ side}{adjacent\ side}$	___ = cm	___ = cm	___ = cm	___ = cm

2.4 Check the values of the ratios for **every triangle** like we calculated previously.

2.4.1 Did the value of the ratio of $\frac{opposite\ side}{hypotenuse}$ change or remain the same for all the different triangles? _____ [1]

2.4.2 Did the value of the ratio of $\frac{adjacent\ side}{hypotenuse}$ change or remain the same for all the different triangles? _____ [1]

2.4.3 Did the value of the ratio of $\frac{opposite\ side}{adjacent\ side}$ change or remain the same for all the different triangles? _____ [1] **[13]**

QUESTION 3 [10]

3.1 If the size of angle θ in the sketch on page 3, is: $\theta = 25°$

3.2 Use your calculator to determine the value of the following **to ONE decimal place:**

$sin25° =$	$cos25° =$	$tan25° =$

[3]

3.1 Compare your answers **in table 3.2 and table 2.3:**
(Choose only one option by marking the correct column on the right-hand side by X)

- $sin\ 25°$ had the same answer in 2.3 and 3.2 as: (choose only one option by marking the correct column on the right-hand side by an X)

[3]

$\frac{\textbf{opposite side}}{\textbf{hypotenuse}}$	$\frac{\textbf{adjacent side}}{\textbf{hypotenuse}}$	$\frac{\textbf{opposite side}}{\textbf{adjacent side}}$

- $cos\ 25°$ had the same answer in 2.3 and 3.2 as: (choose only one option)

$\frac{\textbf{opposite side}}{\textbf{hypotenuse}}$	$\frac{\textbf{adjacent side}}{\textbf{hypotenuse}}$	$\frac{\textbf{opposite side}}{\textbf{adjacent side}}$

CONCLUSION:

3.1 Do you think that the previous **RATIOS** wil always be the same for **THE SAME ANGLE SIZES** although the triangles may differ in size? Explain your answer. [3]

_____

_____

_____

_____

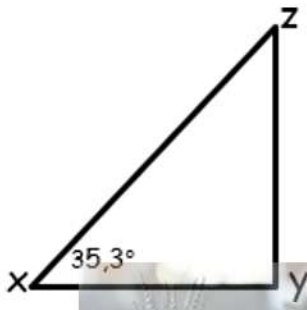
_____

_____

_____

QUESTION 4

In the following exercise the right angled ΔXYZ is given:



4.1 In the given triangle there are three sides.

Write down which one of the sides XY, YZ or XZ will be the: [3]

- **opposite side of 35,3°:** _____
- **adjacent side of of 35,3°:** _____
- **hypotenuse of the right-angled triangle:** _____

4.2 If YZ is the **WANTED SIDE** and XZ is the **GIVEN SIDE**, which **ratio** of

$\frac{o}{h} = sin35{,}3°$ *or* $\frac{a}{h} = cos\ 35{,}3°$ *or* $\frac{o}{a} = \tan 35{,}3°$ will you use to determine YZ? [3]

_____

_____

4.3 Use 4.2 to determine YZ, if **XZ = 32 cm** [5]

_____

_____

_____

_____

_____

_____

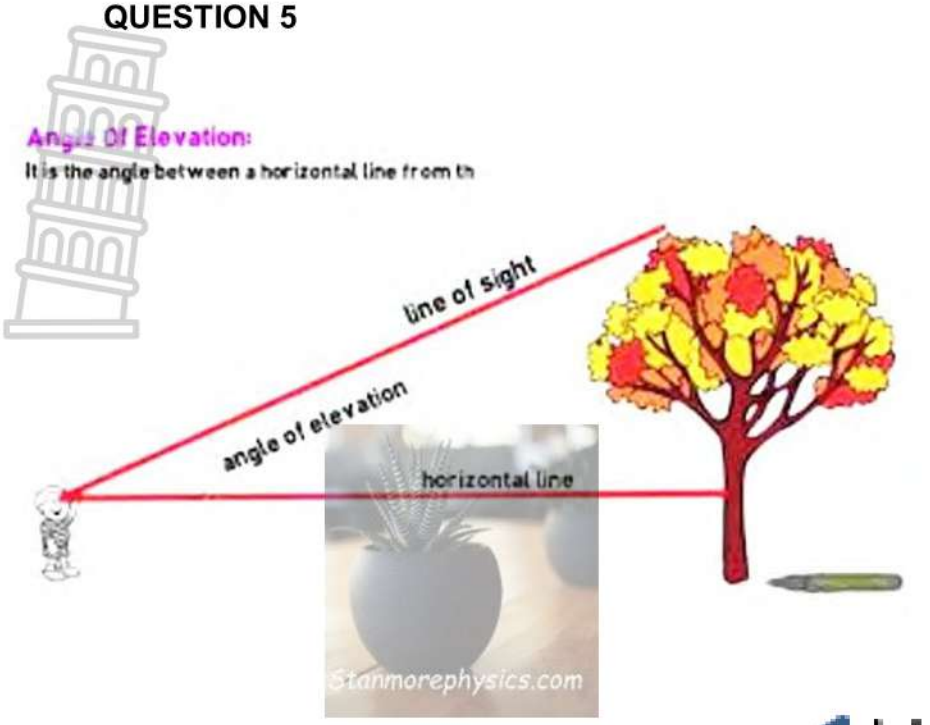
_____

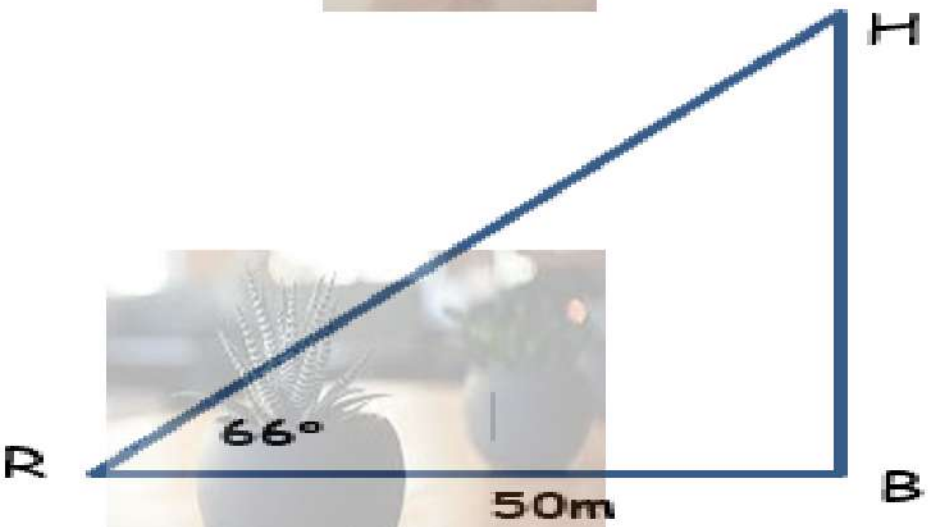
_____

4.4 Determine the length of XY in the same way you just did by choosing the correct ratio: [5]

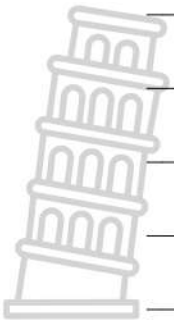
[16]

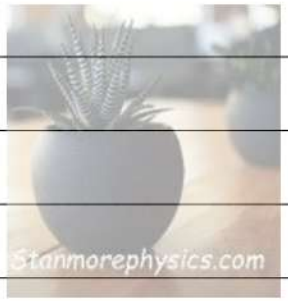
QUESTION 5





5.1 Ryan (R) is looking up at the cliff of a mountain. He is 50 m from B, the bottom of the mountain and the angle of elevation from where he stands is 66°. Determine the perpendicular height of the mountain. (Use question 4 as a guideline.
The diagram is not drawn according to scale) **[5]**





TOTAL: 50

ADDITIONAL SPACE

NATIONAL SENIOR CERTIFICATE

GRADE 10

MATHEMATICS INVESTIGATION MARKING GUIDELINE

No	Calculations	Mark Allocatin	Mark	Level
	Question 1 [7]			
1.1	Complete the similar triangles through writing the letters of the triangles in the correct order: ✓ ΔADE ✓ ΔAFG ✓ ΔAHJ	✓ ΔADE ✓ ΔAFG ✓ ΔAHJ	3	2
1.2	Why are the four triangles similar to each other? ✓✓ all the triangles are equiangular / corresponding angles are equal/ The triangles have the same shape	✓✓ any valid reason	2	1
1.3	Why is it important to write the letters in the correct order when it comes to similarity? ✓ to determine the corresponding sides ✓ and corresponding angles	✓ to determine the corresponding sides ✓ and corresponding angles	2 [6]	2
	Question 2 [13]			
2.1	**Name of the side** / **Opposite side (O)** / **Adjacent side (A)** / **Hypotenuse (H)** ΔABC: CB / AB / AC ΔADE: ED / AD / AE ✓ ΔAFG: GF / AF / AG ✓ ΔAHJ: JH / AH / AJ ✓	✓ Column ▲ ADE ✓ Column ▲ AFG ✓ Column ▲ AHJ	3	1
2.2	**Name of the side** / **(O)** / **(A)** / **(H)** ΔABC: $CB = 2,3cm$ / $AB = 4,9cm$ / $AC = 5,4cm$ ✓ ΔADE: $ED = 4cm$ / $AD = 8,5cm$ / $AE = 9,4cm$ ✓ ΔAFG: $GF = 5,5cm$ / $AF = 11,8cm$ / $AG = 13cm$ ✓ ΔAHJ: $JH = 6,4cm$ / $AH = 13,9cm$ / $AJ = 15,3cm$ ✓	✓ Column ▲ ABC ✓ Column ▲ ADE ✓ Column ▲ AFG ✓ Column ▲ AHJ	4	1

2.3	**Name of the side**	ΔABC	ΔADE	ΔAFG	ΔAHJ		✓ row $\frac{o}{h}$ ✓ row $\frac{a}{h}$ ✓ row $\frac{o}{a}$	3	2
	$\frac{o}{h}$	$\frac{2,3}{5,4} = 0,4$	$\frac{4}{9,4} = 0,4$	$\frac{5,5}{13} = 0,4$	$\frac{6,4}{15,3} = 0,4$				
	$\frac{a}{h}$	$\frac{4,9}{5,4} = 0,9$	$\frac{8,5}{9,4} = 0,9$	$\frac{11,8}{13} = 0,9$	$\frac{13,9}{15,3} = 0,9$				
	$\frac{o}{a}$	$\frac{2,3}{4,9} = 0,5$	$\frac{4}{8,5} = 0,5$	$\frac{5,5}{11,8} = 0,5$	$\frac{6,4}{13,9} = 0,5$				
2.4.1	✓ The same						✓ The same	1	1
2.4.2	✓ The same						✓ The same	1	1
2.4.3	✓ The same						✓ The same	1 **[13]**	1
	Question 3 [09]								
3.1	✓ $\sin 25° = 0,4$ ✓ $\cos 25° = 0,9$ ✓ $\tan 25° = 0,5$						✓ $\sin 25° = 0,4$ ✓ $\cos 25° = 0,9$ ✓ $\tan 25° = 0,5$	3	2
3.2	✓ $\sin 25° = \frac{t}{s}$ ✓ $\cos 25° = \frac{a}{s}$ ✓ $\tan 25° = \frac{t}{a}$						✓ $\sin 25° = \frac{o}{h}$ ✓ $\cos 25° = \frac{a}{h}$ ✓ $\tan 25° = \frac{o}{a}$	3	2
3.3	✓yes ✓it must be a right angled triangle ✓there must be another angle which is also equal						✓ yes ✓ right angled triangle ✓another angle equal	3 **[09]**	3

	Question 4 [16]			
4.1	✓ opposite side to 35,3°: ZY ✓ adjacent side to 35,3°: $\boldsymbol{XY}$ ✓ hypotenuse of the right-angled triangle: $\boldsymbol{XZ}$	✓ opposite side to 35,3°: $\boldsymbol{XY}$ ✓adjacent side to 35,3°: $\boldsymbol{YZ}$ ✓ hypotenuse of the right-angled triangle $\boldsymbol{XZ}$	3	3
4.2	If YZ is the WANTED side and XZ is the GIVEN side : $\frac{o}{h} = sin\ 35{,}3°$	✓sin 35,3° ✓o – numerator ✓ h- denominator	3	3
4.3	Calculate YZ: $\frac{YZ}{XZ} = sin\ 35{,}3°$ $\frac{YZ}{32} = sin\ 35{,}3°$ $YZ = 32 \sin 35.3°$ $= 18{,}49\ cm$	✓sin35,3° ✓ratio ✓replace values ✓simplify ✓answer	5	3
4.4	Calculate XY: $\frac{xy}{XZ} = cos35{,}3°$ $\frac{XY}{32} = cos35{,}3°$ $XY = 32\ cos\ 35{,}3°$ $= 26.12\ cm$	✓cos 35,3° ✓ratio ✓replace the values ✓simplify ✓answer	5 **[16]**	4
	Question 5 [5]			
5	$\tan 66° = \frac{o}{a} = \frac{BH}{BR}$ $\tan 66° = \frac{BH}{50}$ $BH = 50.\tan 66°$ $= 112{,}3m$	✓tan 66° ✓ratio ✓replace the values ✓simplify ✓answer	5 **[5]**	4
		TOTAL	**50**	