

GRADE 10

FEBRUARY 2024

TIME: 60 MIN

MATHEMATICS
INVESTIGATION

TOTAL : 50

NAME :

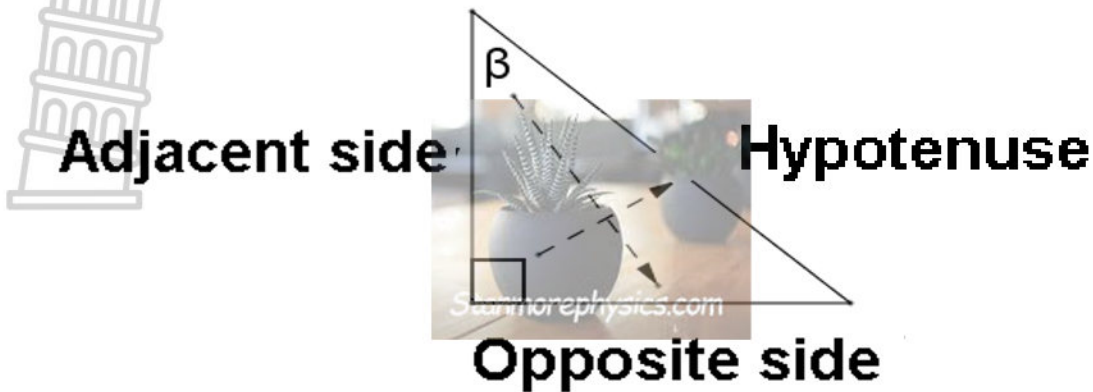
INSTRUCTIONS:

- You may use a calculator, round your answers off to **one decimal place** where needed.
- Write neatly and legible
- Read through all the hints and answer all the questions

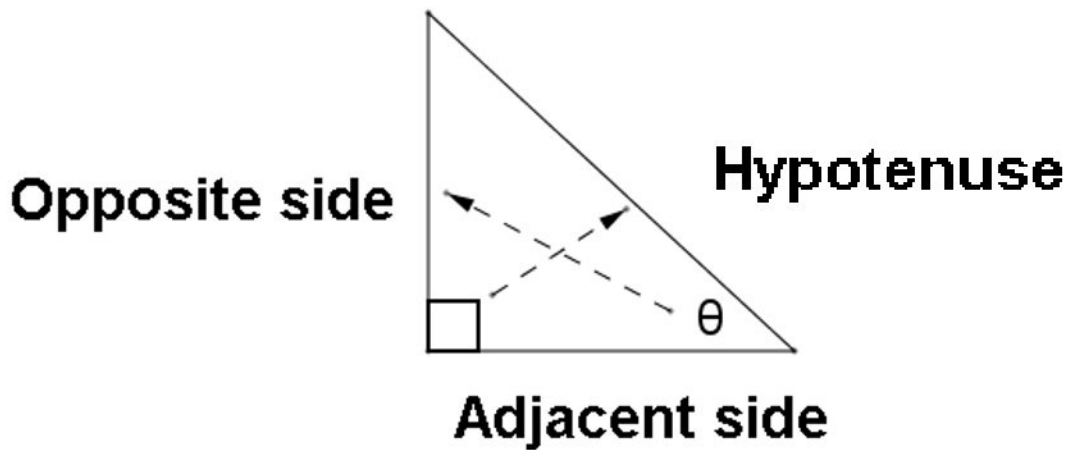
Question	Question Total	Learners total per uestion
1	6	
2	13	
3	10	
4	16	
5	5	
Total	50	

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:

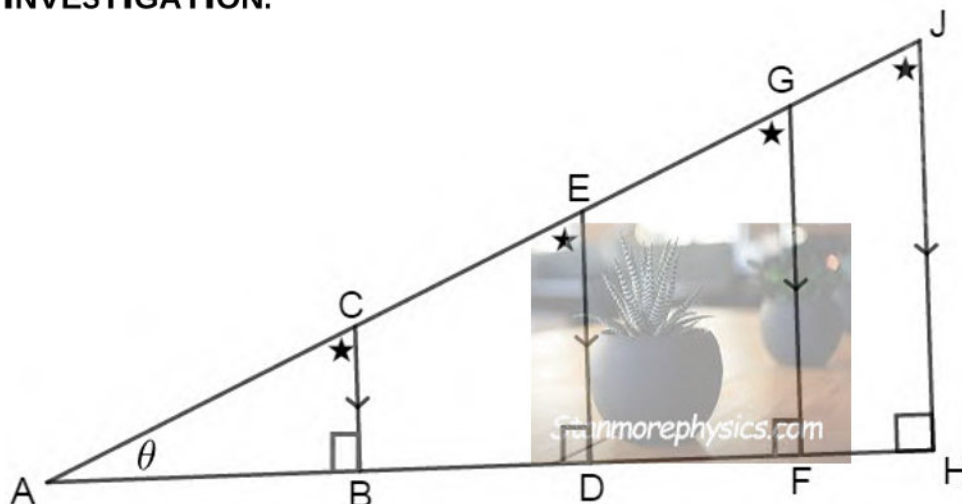


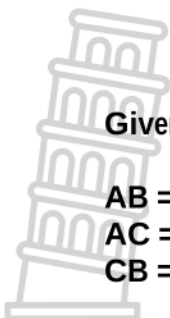
Or



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 \star .

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





Question 1 [6]

Given : the lengths of the lines:

$AB = 4,9 \text{ cm}$, $AD = 8,5 \text{ cm}$, $AF = 11,8 \text{ cm}$ and $AH = 13,9 \text{ cm}$

$AC = 5,4 \text{ cm}$, $AE = 9,4 \text{ cm}$, $AG = 13 \text{ cm}$ and $AJ = 15,3 \text{ cm}$

$CB = 2,3 \text{ cm}$, $ED = 4 \text{ cm}$, $GF = 5,5 \text{ cm}$ and $JH = 6,4 \text{ cm}$

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

$\triangle ABC \parallel \triangle$ _____ $\parallel \triangle$ _____ $\parallel \triangle$ _____ [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]

Question 2 [13]

2.1 Complete the table by writing down THE CORRECT SIDES of the triangles: $\triangle ADE$, $\triangle AFG$ and $\triangle AHJ$ [3]

Name of the side	$\triangle ABC$	$\triangle ADE$	$\triangle AFG$	$\triangle AHJ$
Opposite side (O)	CB			
Adjacent side (A)	AB			
Hypotenuse (H)	AC			

2.2 Complete the table below: [4]

Name of the side	$\triangle ABC$	$\triangle ADE$	$\triangle AFG$	$\triangle AHJ$
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
$\frac{\textit{opposite side}}{\textit{hypotenuse}}$	— = cm	— = cm	— = cm	— = cm
$\frac{\textit{adjacent side}}{\textit{hypotenuse}}$	— = cm	— = cm	— = cm	— = cm
$\frac{\textit{opposite side}}{\textit{adjacent side}}$	— = 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 $\frac{\textit{opposite side}}{\textit{hypotenuse}}$ change or stayed the same for all the different triangles? _____ [1]

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

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

Question 3 [10]

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

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

$\sin 25^\circ =$	$\cos 25^\circ =$	$\tan 25^\circ =$
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[3]

3.3 Compare your answers in **table 3.2 and table 2.3**:
(choose only one option by marking the correct column on the righthand side by X)

- $\sin 25^\circ$ had the same answer in 2.3 and 3.2 as: (choose only one option by marking the correct column on the righthand side by an X) [3]

$\frac{\textit{opposite side}}{\textit{hypotenuse}}$	$\frac{\textit{adjacent side}}{\textit{hypotenuse}}$	$\frac{\textit{opposite side}}{\textit{adjacent side}}$
--	--	---

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

$\frac{\textit{opposite side}}{\textit{hypotenuse}}$	$\frac{\textit{adjacent side}}{\textit{hypotenuse}}$	$\frac{\textit{opposite side}}{\textit{adjacent side}}$
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- $\tan 25^\circ$ had the same answer in 2.3 and 3.2 as: (choose only one option)

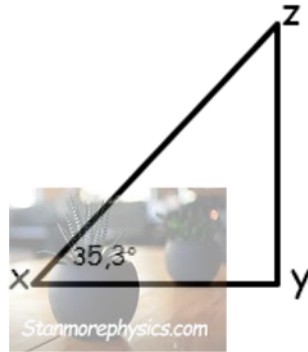
$\frac{\textit{opposite side}}{\textit{hypotenuse}}$	$\frac{\textit{adjacent side}}{\textit{hypotenuse}}$	$\frac{\textit{opposite side}}{\textit{adjacent side}}$
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CONCLUSION:

3.4 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 [16]

In the following exercise the right angled ΔXYZ is given:



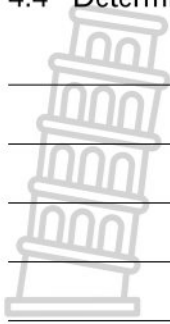
4.1 In the given triangle there are three sides.
Write down which one of the sides XY, YZ or XZ will be the: [3]

- opposite side of $35,3^\circ$: _____
- adjacent side of $35,3^\circ$: _____
- hypotenuse of the rightangled triangle: _____

4.2 If YZ is the **WANTED SIDE** and XZ is the **GIVEN SIDE**, which **ratio** of $\frac{o}{h} = \sin 35,3^\circ$ or $\frac{a}{h} = \cos 35,3^\circ$ or $\frac{o}{a} = \tan 35,3^\circ$ will you use to determine YZ? [3]

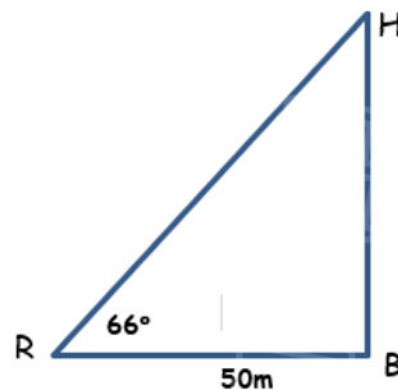
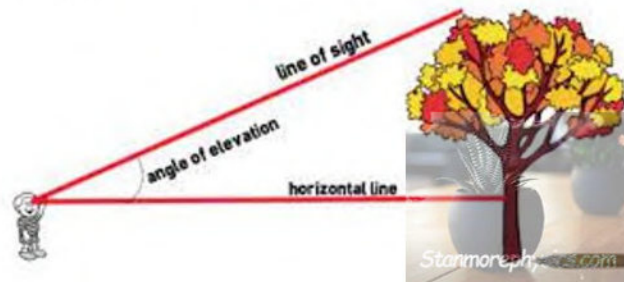
4.3 Use 4.2 to determine YZ, if **XZ = 32 cm** [5]

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



Question 5 [5]

Angle Of Elevation:
It is the angle between a horizontal line from the



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)



TOTAL 50

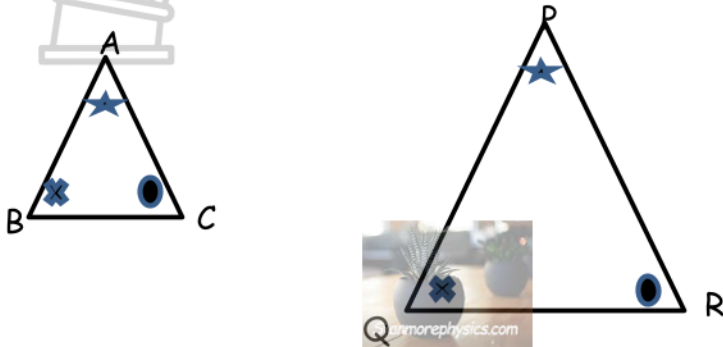
SIMILAR TRIANGLES

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 :

In $\triangle ABC$ and $\triangle PQR$

$A = P$ given

$B = Q$ given

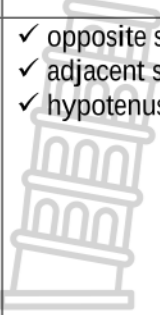
$C = R$ given

$\therefore \triangle ABC \parallel \triangle PQR$ [AAA] (three corresponding angles of the two triangles are =)

\therefore $AB = PQ$ and
 $AC = PR$ and
 $BC = QR$

No	Calculations	Mark Allocatin	Mar k	Level																									
Question 1 [6]																													
1.1	Complete the similar triangles through writing the letters of the triangles in the correct order: ✓ $\triangle ADE$ ✓ $\triangle AFG$ ✓ $\triangle AHJ$	✓ $\triangle ADE$ ✓ $\triangle AFG$ ✓ $\triangle AHJ$	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	1	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	2																									
			[6]																										
Question 2 [13]																													
2.1	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Name of the side</th> <th style="width: 15%;">$\triangle ABC$</th> <th style="width: 15%;">$\triangle ADE$</th> <th style="width: 15%;">$\triangle AFG$</th> <th style="width: 15%;">$\triangle AHJ$</th> </tr> </thead> <tbody> <tr> <td>Opposite side (O)</td> <td>CB</td> <td>ED</td> <td>GF</td> <td>JH</td> </tr> <tr> <td>Adjacent side (A)</td> <td>AB</td> <td>AD</td> <td>AF</td> <td>AH</td> </tr> <tr> <td>Hypotenuse (H)</td> <td>AC</td> <td>AE</td> <td>AG</td> <td>AJ</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> </tbody> </table>	Name of the side	$\triangle ABC$	$\triangle ADE$	$\triangle AFG$	$\triangle AHJ$	Opposite side (O)	CB	ED	GF	JH	Adjacent side (A)	AB	AD	AF	AH	Hypotenuse (H)	AC	AE	AG	AJ			✓	✓	✓	✓ Column $\triangle ADE$ ✓ Column $\triangle AFG$ ✓ Column $\triangle AHJ$	3	1
Name of the side	$\triangle ABC$	$\triangle ADE$	$\triangle AFG$	$\triangle AHJ$																									
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2.2	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Name of the side</th> <th style="width: 15%;">$\triangle ABC$</th> <th style="width: 15%;">$\triangle ADE$</th> <th style="width: 15%;">$\triangle AFG$</th> <th style="width: 15%;">$\triangle AHJ$</th> </tr> </thead> <tbody> <tr> <td>(O)</td> <td>CB = 2,3cm</td> <td>ED = 4cm</td> <td>GF = 5,5cm</td> <td>JH = 6,4cm</td> </tr> <tr> <td>(A)</td> <td>AB = 4,9cm</td> <td>AD = 8,5cm</td> <td>AF = 11,8cm</td> <td>AH = 13,9cm</td> </tr> <tr> <td>(H)</td> <td>AC = 5,4cm</td> <td>AE = 9,4cm</td> <td>AG = 13cm</td> <td>AJ = 15,3cm</td> </tr> <tr> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> </tbody> </table>	Name of the side	$\triangle ABC$	$\triangle ADE$	$\triangle AFG$	$\triangle AHJ$	(O)	CB = 2,3cm	ED = 4cm	GF = 5,5cm	JH = 6,4cm	(A)	AB = 4,9cm	AD = 8,5cm	AF = 11,8cm	AH = 13,9cm	(H)	AC = 5,4cm	AE = 9,4cm	AG = 13cm	AJ = 15,3cm		✓	✓	✓	✓	✓ Column $\triangle ABC$ ✓ Column $\triangle ADE$ ✓ Column $\triangle AFG$ ✓ Column $\triangle AHJ$	4	1
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(H)	AC = 5,4cm	AE = 9,4cm	AG = 13cm	AJ = 15,3cm																									
	✓	✓	✓	✓																									

2.3	Name of the side	ΔABC	ΔADE	ΔAFG	ΔAHJ	\checkmark row $\frac{o}{h}$ \checkmark row $\frac{a}{h}$ \checkmark 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	\checkmark The same					\checkmark The same	1	1
2.4.2	\checkmark The same					\checkmark The same	1	1
2.4.3	\checkmark The same					\checkmark The same	1	1
Question 3 [10]								
3.1	$\checkmark \theta = 25^\circ$					$\checkmark \theta = 25^\circ$	1	2
3.2	$\checkmark \sin 25^\circ = 0,4$ $\checkmark \cos 25^\circ = 0,9$ $\checkmark \tan 25^\circ = 0,5$					$\checkmark \sin 25^\circ = 0,4$ $\checkmark \cos 25^\circ = 0,9$ $\checkmark \tan 25^\circ = 0,5$	3	2
3.3	$\checkmark \sin 25^\circ = \frac{t}{s}$ $\checkmark \cos 25^\circ = \frac{a}{s}$ $\checkmark \tan 25^\circ = \frac{t}{a}$					$\checkmark \sin 25^\circ = \frac{o}{h}$ $\checkmark \cos 25^\circ = \frac{a}{h}$ $\checkmark \tan 25^\circ = \frac{o}{a}$	3	2
3.4	\checkmark yes \checkmark it must be a right angled triangle \checkmark there must be another which is also equal					\checkmark yes \checkmark right angled triangle \checkmark another angle equal	3	3
							[10]	

Question 4 [16]				
4.1	 <ul style="list-style-type: none"> ✓ opposite side to 35,3°: <i>ZY</i> ✓ adjacent side to 35,3°: <i>XY</i> ✓ hypotenuse of the right-angled triangle: <i>XZ</i> 	<ul style="list-style-type: none"> ✓ opposite side to 35,3°: <i>XY</i> ✓ adjacent side to 35,3°: <i>YZ</i> ✓ hypotenuse of the right-angled triangle <i>XZ</i> 	3	3
4.2	<p>If <i>YZ</i> is the WANTED side and <i>XZ</i> is the GIVEN side :</p> $\frac{o}{h} = \sin 35,3^\circ$	<ul style="list-style-type: none"> ✓ $\sin 35,3^\circ$ ✓ o – numerator ✓ h- denominator 	3	3
4.3	<p>Calculate <i>YZ</i>: $\frac{YZ}{XZ} = \sin 35,3^\circ$</p> $\frac{YZ}{32} = \sin 35,3^\circ$ $YZ = 32 \sin 35,3^\circ$ $= 18,49 \text{ cm}$	<ul style="list-style-type: none"> ✓ $\sin 35,3^\circ$ ✓ ratio ✓ replace values ✓ simplify ✓ answer 	5	3
4.4	<p>Bereken <i>XY</i>: $\frac{XY}{XZ} = \cos 35,3^\circ$</p> $\frac{XY}{32} = \cos 35,3^\circ$ $XY = 32 \cos 35,3^\circ$ $= 26,12 \text{ cm}$	<ul style="list-style-type: none"> ✓ $\cos 35,3^\circ$ ✓ ratio ✓ replace the values ✓ simplify ✓ answer 	5	4
Vraag 5 [5]				
5	$\tan 66^\circ = \frac{o}{a} = \frac{BH}{BR}$ $\tan 66^\circ = \frac{BH}{50}$ $BH = 50 \cdot \tan 66^\circ$ $= 112,3m$	<ul style="list-style-type: none"> ✓ $\tan 66^\circ$ ✓ ratio ✓ replace the values ✓ simplify ✓ answer 	5	4
TOTAL			50	

Level 1	Level 2	Level 3	Level 4
11	15	14	10
22%	30%	28%	20%

Angle Of Elevation:

It is the angle between a horizontal line from the

