MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
30	45 minutes	3

Name: ..... Class: .....

Date: .....

MARK ____ / 30

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 An angle of elevation is measured ... (1)

A) from the horizontal UP to the line of sight ✓ **B)** from the line of sight up to the vertical

C) from the vertical down to the line of sight **D)** between the two objects

Answer: A — Angles of elevation and of depression are always measured from the HORIZONTAL.

- **B** — the angle is measured FROM the horizontal, not TO the vertical
- **C** — that angle is the COMPLEMENT of the angle of elevation
- **D** — an angle of elevation needs an observer and a horizontal, not two objects

1.2 A tower is 45 m tall. From a point 60 m away on level ground, the angle of elevation of its top is ... (1)

A) 36,87° ✓ **B)** 53,13°

C) 0,64° **D)** 48,59°

Answer: A — $\tan\theta = \frac{45}{60} = 0{,}75$, so $\theta = \tan^{-1}(0{,}75) = 36{,}87°$.

- **B** — inverted the ratio — that is the angle at the TOP of the tower
- **C** — the calculator was in RADIAN mode
- **D** — used $\sin^{-1}(45 \div 60)$, but 60 m is the horizontal distance, not the line of sight

1.3 From the top of a cliff 80 m high the angle of depression of a boat is $25°$. The boat is ... from the foot of the cliff. (1)

A) 37,30 m
B) 189,30 m
C) 72,50 m
D) 171,56 m ✓

> **Answer: D** — The angle of depression equals the angle of elevation from the boat, so $\tan 25° = 80 \div d$ and $d = 80 \div \tan 25°$.
>
> - **A** — MULTIPLIED by $\tan 25°$ instead of dividing
> - **B** — used $80 \div \sin 25°$, which gives the line of sight, not the ground distance
> - **C** — used $80 \cos 25°$, which is neither

1.4 In $\triangle ABC$, $\hat{B} = 90°$, $AC = 26$ and $BC = 10$. Then AB = ... (1)

A) 36
B) 16
C) 27,86
D) 24 ✓

> **Answer: D** — By Pythagoras $AB^2 = 26^2 - 10^2 = 576$, so $AB = 24$.
>
> - **A** — added the two given sides
> - **B** — subtracted the two sides instead of their squares
> - **C** — ADDED the squares instead of subtracting them

1.5 A ramp rises $1{,}5$ m over a horizontal distance of 8 m. Its angle of inclination is ... (1)

A) 79,38°
B) 10,81°
C) 10,62° ✓
D) 0,19°

> **Answer: C** — $\tan\theta = 1{,}5 \div 8 = 0{,}1875$, so $\theta = 10{,}62°$.
>
> - **A** — inverted the ratio — that is the angle at the top of the ramp
> - **B** — used $\sin^{-1}(1{,}5 \div 8)$, but 8 m is the horizontal run, not the slope length
> - **D** — wrote the ratio $0{,}19$ down as though it were the angle

1.6 In $\triangle PQR$, $\hat{Q} = 90°$, $\hat{P} = 32°$ and $PR = 15$ cm. Then QR = ... (1)

A) 12,72 cm
B) 7,95 cm ✓
C) 28,31 cm
D) 9,37 cm

> **Answer: B** — PR is the hypotenuse and QR lies opposite $\hat{P}$, so $QR = 15 \sin 32° = 7{,}95$ cm.
>
> - **A** — that is $15 \cos 32°$, which gives PQ, the adjacent side
> - **C** — DIVIDED 15 by $\sin 32°$ instead of multiplying
> - **D** — used $15 \tan 32°$, but tan never involves the hypotenuse

1.7 Two buildings stand 30 m apart. From the top of the shorter one the angle of elevation of the top of the taller one is $40°$. The taller building is higher by ... (1)

A) 25,17 m ✓
B) 19,28 m
C) 39,16 m
D) 35,75 m

> **Answer: A** — The 30 m gap is the adjacent side, so the difference in height is $30 \tan 40° = 25{,}17$ m.
>
> - **B** — used $30 \sin 40°$, but 30 m is the adjacent side, not the hypotenuse
> - **C** — used $30 \div \cos 40°$, which gives the line of sight
> - **D** — DIVIDED 30 by $\tan 40°$ instead of multiplying

1.8 Which ratio finds an ANGLE when the opposite side and the hypotenuse are known? (1)

A) sin
B) **$\sin^{-1}$ ✓**
C) $\cos^{-1}$
D) $\tan^{-1}$

> **Answer: B** — Opposite over hypotenuse is a SINE, so the inverse sine returns the angle.
> - **A** — sin turns an angle into a ratio; the inverse is needed to go the other way
> - **C** — cosine uses the ADJACENT side with the hypotenuse
> - **D** — tangent uses the opposite with the ADJACENT side, never the hypotenuse

1.9 A kite string 50 m long makes an angle of $58°$ with the ground. The kite is ... above the ground. (1)

A) $58{,}96$ m
B) **$42{,}40$ m ✓**
C) $26{,}50$ m
D) $80{,}02$ m

> **Answer: B** — The string is the hypotenuse, so the height is $50 \sin 58° = 42{,}40$ m.
> - **A** — DIVIDED 50 by $\sin 58°$ instead of multiplying
> - **C** — that is $50 \cos 58°$, the horizontal distance to the kite
> - **D** — used $50 \tan 58°$, but tan never involves the hypotenuse

1.10 In $\triangle ABC$, $\hat{B} = 90°$. Then $\hat{A} = 90° - \hat{C}$ because ... (1)

A) the two acute angles are always equal
B) $\hat{B}$ is the largest angle
C) **the three angles of a triangle add up to $180°$ ✓**
D) the sides are always in the ratio $3 : 4 : 5$

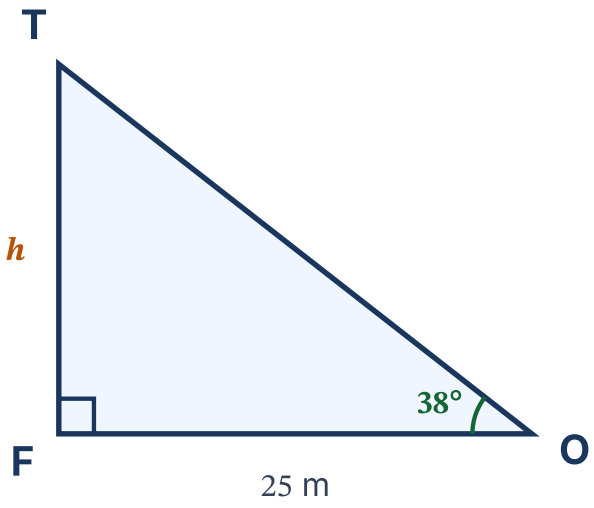
> **Answer: C** — With $\hat{B} = 90°$ the other two angles must add to $90°$, so each is the complement of the other.
> - **A** — they add to $90°$ but are equal only in the $45°$-$45°$-$90°$ case
> - **B** — $\hat{B}$ being the largest is true, but it says nothing about the other two
> - **D** — $3 : 4 : 5$ is ONE particular right-angled triangle, not every one

ANSWER GRID — MARKING GUIDELINE

1.1	(A)	B	C	D
1.2	(A)	B	C	D
1.3	A	B	C	(D)
1.4	A	B	C	(D)
1.5	A	B	(C)	D
1.6	A	(B)	C	D
1.7	(A)	B	C	D
1.8	A	(B)	C	D
1.9	A	(B)	C	D
1.10	A	B	(C)	D

QUESTION 2 **[10 MARKS]**

In the diagram below, a vertical tower stands on level ground. From a point 25 m from the foot of the tower, the angle of elevation to the top of the tower is $38°$. The height of the tower is h.



not drawn to scale

2.1 Write down which trigonometric ratio relates the 25 m, the $38°$ and the height h, and give a reason for your choice. **(2)**

> **tan**, because the 25 m is ADJACENT to the $38°$ angle and h is OPPOSITE it *(1)*
> $\tan\theta$ = opposite ÷ adjacent, and the hypotenuse is neither given nor asked for *(1)*

2.2 Calculate the height of the tower, correct to TWO decimal places. **(4)**

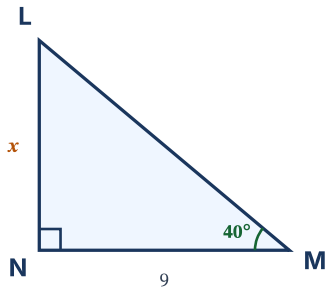
> $\tan 38° = \frac{h}{25}$ *(2)*
> $h = 25\tan 38°$ *(1)* $=$ **19,53 m** *(1)*

2.3 The observer now moves to a point where the angle of elevation is $50°$. Determine, with a calculation, whether the observer is closer to or further from the tower. **(4)**

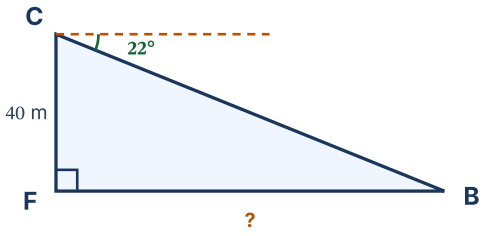
> The height stays $19{,}53$ m *(1)*
> New distance $= \frac{19{,}53}{\tan 50°}$ *(2)* $\approx 16{,}39$ m, so the observer is **CLOSER** *(1)*

QUESTION 3 [10 MARKS]

Answer the questions below. Round off to TWO decimal places where necessary.



(a)



(b) the dashed line is horizontal

3.1 In a right-angled triangle the side opposite a $40°$ angle is x and the adjacent side is 9. Calculate x. **(3)**

$\tan 40° = \frac{x}{9}$ *(1)*

$x = 9 \tan 40°$ *(1)* $= \mathbf{7{,}55}$ *(1)*

3.2 The angle of DEPRESSION from the top of a 40 m cliff to a boat is $22°$. Calculate how far the boat is from the foot of the cliff. **(4)**

The angle of depression equals the angle of elevation from the boat *(1)*

$\tan 22° = \frac{40}{d}$ *(1)*

$d = \frac{40}{\tan 22°}$ *(1)* $= \mathbf{99{,}00\ m}$ *(1)*

3.3 Explain the difference between an angle of elevation and an angle of depression, and why they are equal in the question above. **(3)**

Elevation is measured UP from the horizontal, depression DOWN from it *(2)*
The two horizontals are parallel, so the angles are alternate and therefore equal *(1)*

TOTAL: 30 marks

This question paper consists of 3 questions.

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