

Year 10 Mathematics: Unit Assessment

Time Allowed: 45 minutes
Total Marks: 25 Marks
Calculator: Board Approved
Scientific

Topic: Trigonometry & Right-Angled Triangles

MASTER ANSWER SHEET

Instructions to Students

- Answer all questions in the spaces provided. Show all necessary working out.
- Give answers to two decimal places unless specified otherwise.
- Diagrams are not to scale unless specified.

SECTION A: SHORT ANSWER & APPLIED TRIGONOMETRY

Question 1

[3 Marks]

A right-angled triangle has a hypotenuse of length 12 cm and one interior angle of 34° . Find the length of the side opposite to the given angle.

OFFICIAL MARKING GUIDELINE & SOLUTION

Step 1: Identify the correct trigonometric ratio.

$$\sin(\theta) = \text{opposite} / \text{hypotenuse}$$

$$\sin(34^\circ) = x / 12$$

Step 2: Rearrange to solve for x .

$$x = 12 \times \sin(34^\circ)$$

Step 3: Compute the final value accurately.

$$x = 12 \times 0.559192... = 6.7103...$$

Correct Answer: 6.71 cm (to 2 d.p.)

Question 2

[4 Marks]

From a point on the ground 45 meters away from the base of a vertical tower, the angle of elevation to the top of the tower is measured to be 28° . Calculate the height of the tower.

OFFICIAL MARKING GUIDELINE & SOLUTION

Step 1: Identify the correct trigonometric ratio (Opposite and Adjacent sides).

$$\tan(\theta) = \text{opposite} / \text{adjacent}$$

$$\tan(28^\circ) = h / 45$$

Step 2: Rearrange to solve for the height h .

$$h = 45 \times \tan(28^\circ)$$

Step 3: Perform calculations precisely.

$$h = 45 \times 0.531709... = 23.9269...$$

Correct Answer: 23.93 meters (to 2 d.p.)

Question 3

[5 Marks]

An 8-meter extension ladder leans against a vertical masonry wall. For safety reasons, the angle the ladder makes with the ground must be exactly 75° .

a) How far up the wall will the ladder reach?

[2 Marks]

b) Calculate the distance from the foot of the ladder to the base of the wall.

[3 Marks]

OFFICIAL MARKING GUIDELINE & SOLUTION

Part a):

$$\sin(75^\circ) = \text{height} / 8 \Rightarrow \text{height} = 8 \times \sin(75^\circ) = 8 \times 0.9659... = 7.73 \text{ m}$$

Part b):

$$\text{Method 1 (Trigonometry): } \cos(75^\circ) = \text{distance} / 8 \Rightarrow \text{distance} = 8 \times \cos(75^\circ) = 8 \times 0.2588... = 2.07 \text{ m}$$

$$\text{Method 2 (Pythagoras): } \text{distance}^2 = 8^2 - 7.727^2 = 64 - 59.71 = 4.29 \Rightarrow \sqrt{4.29} = 2.07 \text{ m}$$

Correct Answers: a) 7.73 m, b) 2.07 m

SECTION B: MULTI-STEP APPLICATIONS & BEARINGS

Question 4

[6 Marks]

A rescue helicopter leaves a base checkpoint and flies 60 km on a true bearing of 045° to Point A. It then changes direction and flies due East for 40 km to reach Point B.

a) Sketch a fully labeled vector diagram showing the helicopter's path, noting internal angles. [2 Marks]

b) Determine how far North Point B is relative to the starting base checkpoint. [4 Marks]

OFFICIAL MARKING GUIDELINE & SOLUTION

Part a): Diagram should show a right-angled component split for the first leg. True bearing 045° leaves an angle of 45° to the North line. Second leg goes horizontally East.

Part b):

Only the first leg contributes to the displacement Northward because the second leg is due East.

$$\text{North Displacement} = 60 \times \cos(45^\circ)$$

$$\text{North Displacement} = 60 \times 0.7071 = 42.43 \text{ km}$$

The second leg (40 km East) has a North component of 0 km.

$$\text{Total North distance} = 42.43 + 0 = 42.43 \text{ km}$$

Correct Answer: b) 42.43 km North

Question 5

[7 Marks]

From the top of a 120m coastal cliff, an observer spots two ships anchored directly out at sea in a straight line. The angles of depression to the two ships are measured to be 22° and 35° respectively. Calculate the exact distance between the two ships.

OFFICIAL MARKING GUIDELINE & SOLUTION

Using alternate interior angles, angles of elevation from the ships to the cliff top are 22° (Further Ship, X) and 35° (Closer Ship, Y).

Step 1: Distance to Closer Ship (d_1):

$$\tan(35^\circ) = 120 / d_1 \Rightarrow d_1 = 120 / \tan(35^\circ) = 120 / 0.7002 = 171.38 \text{ m}$$

Step 2: Distance to Further Ship (d_2):

$$\tan(22^\circ) = 120 / d_2 \Rightarrow d_2 = 120 / \tan(22^\circ) = 120 / 0.4040 = 297.01 \text{ m}$$

Step 3: Distance between ships (Δd):

$$\Delta d = d_2 - d_1 = 297.01 - 171.38 = 125.63 \text{ m}$$

Correct Answer: 125.63 meters