Question 1

[Maximum mark: 4] [x]

The following diagram shows a sector of a circle with radius \( r \) where \( \text{AOB} = x \) radians and the length of the arc \( \text{AB} = \frac{4}{x} \) cm.

Given that the area of the sector is 27 cm\(^2\), find the length of the arc \( \text{AB} \).

Working

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Question 2

[Maximum mark: 6]

Find all solutions to the equation $\tan 2x - 3 \tan x = 0$ where $0^\circ \leq x < 360^\circ$. 

Working

/6
Question 3

[Maximum mark: 8]

(a) Expand and simplify \((1 + \sqrt{3})^2\). \[1\]

(b) By writing 75° as 30° + 45°, find the value of \(\cos 75°\). \[3\]

The following diagram shows the triangle ABC where BC = \(\sqrt{6}\), CA = 2 and BCA = 75°.

(c) Find AB in the form \(a + \sqrt{b}\) where \(a, b \in \mathbb{Z}\). \[4\]
Question 4

[Maximum mark: 15]

In a triangle XYZ, XY = 9 cm, YZ = x cm, ZX = y cm and X\(\hat{Y}Z\) = 45°.

(a) Using the cosine rule, show that \(x^2 - 9\sqrt{2}x + 81 - y^2 = 0\). \([2]\)

Consider the possible triangles with ZX = 7 cm.

(b) Calculate the two corresponding values of YZ. \([3]\)

(c) Hence find the area of the smaller triangle. \([3]\)

Consider the case where y, the length of ZX, is not fixed at 7 cm.

(d) Determine the range of values of y for which it is possible to form two triangles. \([7]\)

**Working**
Working

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Question 5

[Maximum mark: 12]

Farmer Edward owns a triangular field with ratio of the sides 15 : 15 : 15\sqrt{2}. Edward attaches a rope to a wooden post at the right angle corner of his field, and attaches the other end to his cow Gertie.

(a) Given that the rope is 10 m long, calculate the percentage of Edward’s field that Gertie is able to graze. Give your answer correct to the nearest integer. [3]

(b) Edward replaces the rope with another one, this time of length \( b \), 10 m < \( b \) < 15 m, so that Gertie can graze exactly 90% of his field.

Show that \( b \) satisfies the equation

\[
b^2 \left[ \frac{\pi}{4} - \arccos \left( \frac{15\sqrt{2}}{2b} \right) \right] + \left( \frac{15\sqrt{2}}{2} \right) \sqrt{b^2 - \frac{225}{2}} = 101.25.\]

(c) Find the value of \( b \). Give your answer correct to two decimal places. [2]

Working