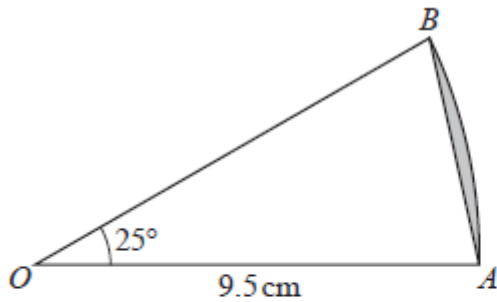


AS Level Mathematics A

H230/02 Pure Mathematics and Mechanics

Question Set 5

1



The diagram shows a sector AOB of a circle with centre O and radius 9.5 cm. The angle AOB is 25° .

(a) Calculate the length of the straight line AB . [2]

(b) Find the area of the segment shaded in the diagram. [3]

2 Two curves have equations $y = \ln x$ and $y = \frac{k}{x}$, where k is a positive constant.

(a) Sketch the curves on a **single** diagram. [3]

(b) Explain how your diagram shows that the equation $x \ln x - k = 0$ has exactly one real root. [2]

3 **In this question you must show detailed reasoning.**

Find the equation of the normal to the curve $y = 4\sqrt{x} - 3x + 1$ at the point on the curve where $x = 4$. Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. [7]

4 **In this question you must show detailed reasoning.**

The cubic polynomial $6x^3 + kx^2 + 57x - 20$ is denoted by $f(x)$. It is given that $(2x - 1)$ is a factor of $f(x)$.

(a) Use the factor theorem to show that $k = -37$. [2]

(b) Using this value of k , factorise $f(x)$ completely. [3]

(c) (i) Hence find the three values of t satisfying the equation $6e^{-3t} - 37e^{-2t} + 57e^{-t} - 20 = 0$. [2]

(ii) Express the sum of the three values found in part (c)(i) as a single logarithm. [2]

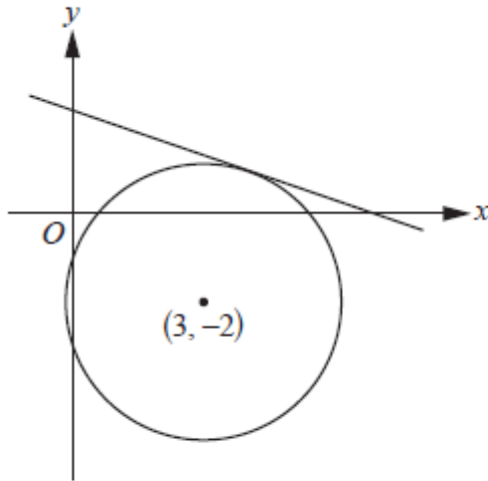
- 5 A curve has equation $y = a(x+b)^2 + c$, where a , b and c are constants. The curve has a stationary point at $(-3, 2)$.

(a) State the values of b and c . [2]

When the curve is translated by $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$ the transformed curve passes through the point $(3, -18)$.

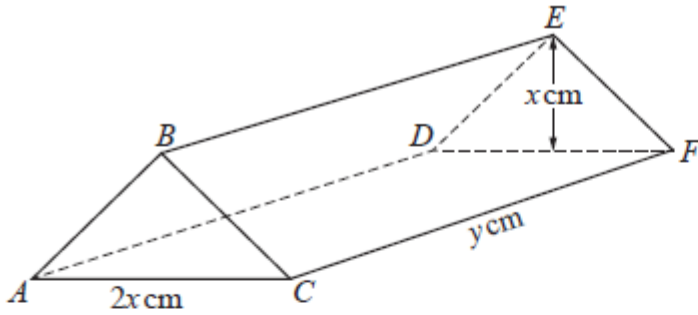
(b) Determine the value of a . [3]

- 6 In this question you must show detailed reasoning.



The diagram shows the line $3y + x = 7$ which is a tangent to a circle with centre $(3, -2)$.

Find an equation for the circle. [6]



The diagram shows a model for the roof of a toy building. The roof is in the form of a solid triangular prism $ABCDEF$. The base $ACFD$ of the roof is a horizontal rectangle, and the cross-section ABC of the roof is an isosceles triangle with $AB = BC$.

The lengths of AC and CF are $2x$ cm and y cm respectively, and the height of BE above the base of the roof is x cm.

The total surface area of the five faces of the roof is 600 cm² and the volume of the roof is V cm³.

- (a) Show that $V = kx(300 - x^2)$, where $k = \sqrt{a} + b$ and a and b are integers to be determined. [6]
- (b) Use differentiation to determine the value of x for which the volume of the roof is a maximum. [4]
- (c) Find the maximum volume of the roof. Give your answer in cm³, correct to the nearest integer. [1]
- (d) Explain why, for this roof, x must be less than a certain value, which you should state. [2]

Total Marks for Question Set 5: 50

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