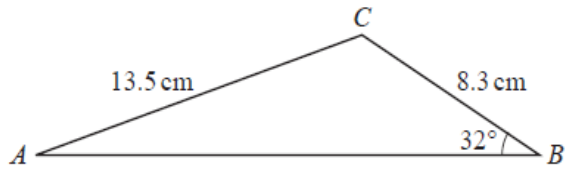


A Level Mathematics A
H240/03 Pure Mathematics and Mechanics

Question Set 3

1



The diagram shows triangle ABC , with $AC = 13.5$ cm, $BC = 8.3$ cm and angle $ABC = 32^\circ$.

Find angle CAB .

[2]

2

A circle with centre C has equation $x^2 + y^2 - 6x + 4y + 4 = 0$.

(a) Find

(i) the coordinates of C ,

[2]

(ii) the radius of the circle.

[1]

(b) Determine the set of values of k for which the line $y = kx - 3$ does not intersect or touch the circle.

[5]

3

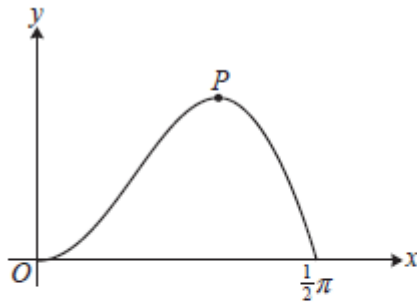
(a) In this question you must show detailed reasoning.

Solve the inequality $|x - 2| \leq |2x - 6|$.

[4]

(b) Give full details of a sequence of two transformations needed to transform the graph of $y = |x - 2|$ to the graph of $y = |2x - 6|$.

[3]



The diagram shows the part of the curve $y = 3x \sin 2x$ for which $0 \leq x \leq \frac{1}{2}\pi$.

The maximum point on the curve is denoted by P .

(a) Show that the x -coordinate of P satisfies the equation $\tan 2x + 2x = 0$. [3]

(b) Use the Newton-Raphson method, with a suitable initial value, to find the x -coordinate of P , giving your answer correct to 4 decimal places. Show the result of each iteration. [4]

(c) The trapezium rule, with four strips of equal width, is used to find an approximation to

$$\int_0^{\frac{1}{2}\pi} 3x \sin 2x \, dx.$$

Show that the result can be expressed as $k\pi^2(\sqrt{2} + 1)$, where k is a rational number to be determined. [4]

(d) (i) Evaluate $\int_0^{\frac{1}{2}\pi} 3x \sin 2x \, dx$. [1]

(ii) Hence determine whether using the trapezium rule with four strips of equal width gives an under- or over-estimate for the area of the region enclosed by the curve $y = 3x \sin 2x$ and the x -axis for $0 \leq x \leq \frac{1}{2}\pi$. [1]

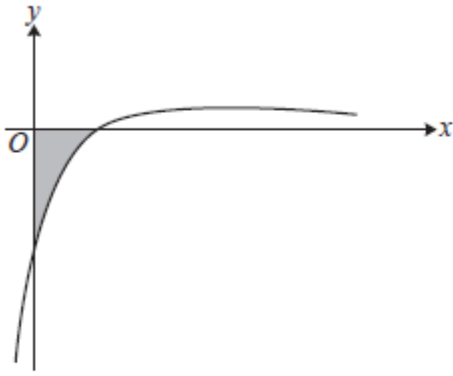
(iii) Explain briefly why it is not easy to tell from the diagram alone whether the trapezium rule with four strips of equal width gives an under- or over-estimate for the area of the region in this case. [1]

5 In this question you must show detailed reasoning.

(a) Prove that $(\cot \theta + \operatorname{cosec} \theta)^2 = \frac{1 + \cos \theta}{1 - \cos \theta}$. [4]

(b) Hence solve, for $0 < \theta < 2\pi$, $3(\cot \theta + \operatorname{cosec} \theta)^2 = 2 \sec \theta$. [5]

6



The diagram shows part of the curve $y = \frac{2x-1}{(2x+3)(x+1)^2}$.

Find the exact area of the shaded region, giving your answer in the form $p+q\ln r$, where p and q are positive integers and r is a positive rational number. [10]

Total Marks for Question Set 3: 50 Marks

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