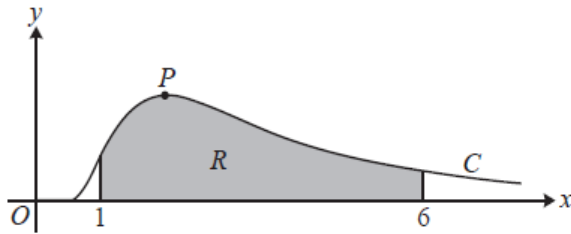


A Level Mathematics A
H240/03 Pure Mathematics and Mechanics

Question Set 5

1. Triangle ABC has $AB = 8.5$ cm, $BC = 6.2$ cm and angle $B = 35^\circ$.
Calculate the area of the triangle. [2]
2. A sequence of transformations maps the curve $y = e^x$ to the curve $y = e^{2x+3}$.
Give details of these transformations. [3]
3. The functions f and g are defined for all real values of x by
 $f(x) = 2x^2 + 6x$ and $g(x) = 3x + 2$.
- (a) Find the range of f . [3]
- (b) Give a reason why f has no inverse. [1]
- (c) Given that $fg(-2) = g^{-1}(a)$, where a is a constant, determine the value of a . [4]
- (d) Determine the set of values of x for which $f(x) > g(x)$. Give your answer in set notation. [3]
4. A curve has equation $y = 2 \ln(k - 3x) + x^2 - 3x$, where k is a positive constant.
- (a) Given that the curve has a point of inflection where $x = 1$, show that $k = 6$. [5]
- It is also given that the curve intersects the x -axis at exactly one point.
- (b) Show by calculation that the x -coordinate of this point lies between 0.5 and 1.5. [2]
- (c) Use the Newton-Raphson method, with initial value $x_0 = 1$, to find the x -coordinate of the point where the curve intersects the x -axis, giving your answer correct to 5 decimal places. Show the result of each iteration to 6 decimal places. [3]
- (d) By choosing suitable bounds, verify that your answer to part (c) is correct to 5 decimal places. [1]

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The diagram shows the curve C with parametric equations

$$x = \frac{3}{t}, \quad y = t^3 e^{-2t}, \quad \text{where } t > 0.$$

The maximum point on C is denoted by P .

- (a) Determine the exact coordinates of P . [4]

The shaded region R is enclosed by the curve, the x -axis and the lines $x = 1$ and $x = 6$.

- (b) Show that the area of R is given by

$$\int_a^b 3te^{-2t} dt,$$

where a and b are constants to be determined.

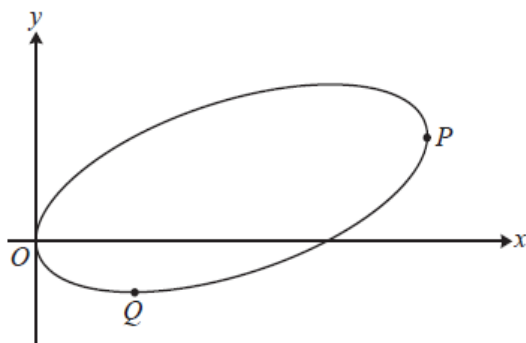
[3]

- (c) Hence determine the exact area of R .

[5]

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In this question you must show detailed reasoning.



The diagram shows the curve with equation $4xy = 2(x^2 + 4y^2) - 9x$.

- (a) Show that $\frac{dy}{dx} = \frac{4x - 4y - 9}{4x - 16y}$. [3]

At the point P on the curve the tangent to the curve is parallel to the y -axis and at the point Q on the curve the tangent to the curve is parallel to the x -axis.

- (b) Show that the distance PQ is $k\sqrt{5}$, where k is a rational number to be determined. [8]

Total Marks for Question Set 5: 50 Marks

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