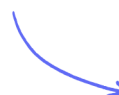


Practice Paper 1 (Pure 1)

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Total Marks

/75

- 1 The line segment AB is the diameter of a circle.

A has coordinates $(-7, -9)$ and B has coordinates $(9, 3)$.

Find the coordinates of the centre of the circle and the length of the diameter.

(3 marks)

- 2 Find the equation of the curve passing through the point $(-2, 3)$ and given by

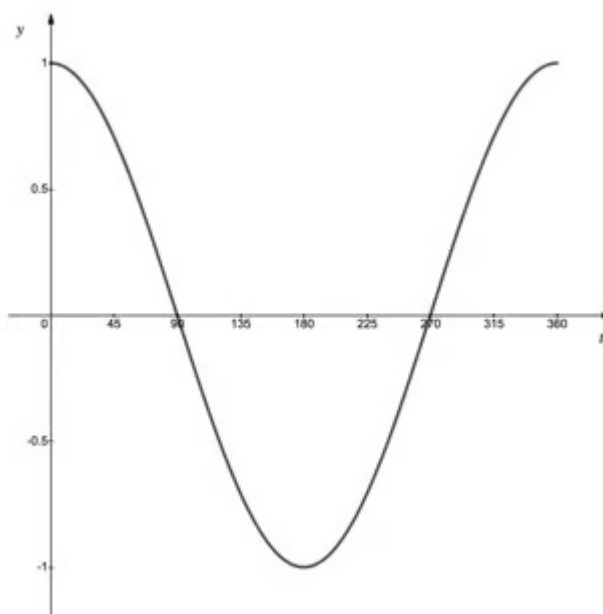
$$y = \int \left(3 - 2x + \frac{4}{x^2} \right) dx$$

(4 marks)

- 3 In a computer animation, the radius of a circle increases at a constant rate of 1 millimetre per second. Find the rate, per second, at which the area of the circle is increasing at the time when the radius is 8 millimetres. Give your answer as a multiple of π .

(4 marks)

4 (a) The diagram shows the graph of $y = f(t)$, where $f(t) = \cos t$, $0^\circ \leq t \leq 360^\circ$.



- (i) Write down the maximum value of y when $y = -2f(3t)$.
- (ii) Write down the value of t for which this maximum occurs.

(2 marks)

(b) Find, in terms of $f(t)$, the combination of transformations that would map the graph of $y = f(t)$ onto the graph of $y = 2 - 4\sin t, 0^\circ \leq t \leq 180^\circ$.

(2 marks)

5 In the expansion of $(a + bx)^4$, the coefficient of the x^3 term is 216.

In the expansion of $(a + bx)^6$, the coefficient of the x^4 term is 4860.

Find the possible values of a and b .

(5 marks)

6 (a) The curve C has equation $y = 3x^2 - 6 + \frac{4}{x}$. The point $P(1, 1)$ lies on C .

Find an expression for $\frac{dy}{dx}$.

(2 marks)

(b) Show that an equation of the normal to C at point P is $x + 2y = 3$.

(3 marks)

7 (a) Show that $(x+1)(x-2)(x-3) \equiv x^3 - 4x^2 + x + 6$.

(2 marks)

(b) Hence, or otherwise, solve the equation $\tan^3 x - 4 \tan^2 x + \tan x + 6 = 0$ for $0^\circ \leq x \leq 360^\circ$, giving your answers to 1 decimal place where appropriate.

(5 marks)

8 (a) The k th term of a geometric progression is given by $u_k = 2401 \left(\frac{2}{7}\right)^k$.

Calculate, giving your answers as exact values

The sum to infinity of the progression starting with the seventh term.

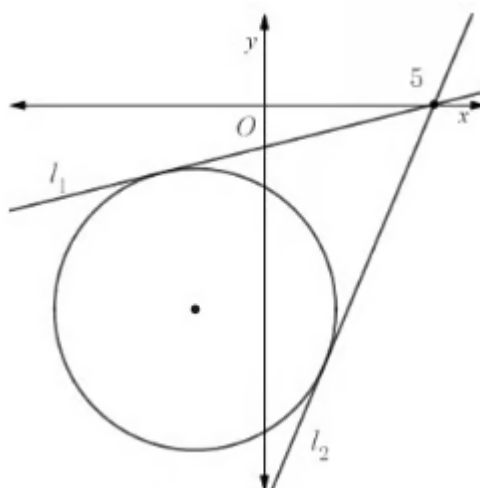
(3 marks)

(b) The sum to infinity of the progression whose k th term is given by $v_k = u_{k+4}$, where u_k is defined as above.

(2 marks)

9 A circle has equation $x^2 + y^2 + 4x + 12y = -23$.

The lines l_1 and l_2 are both tangents to the circle, and they intersect at the point $(5, 0)$.



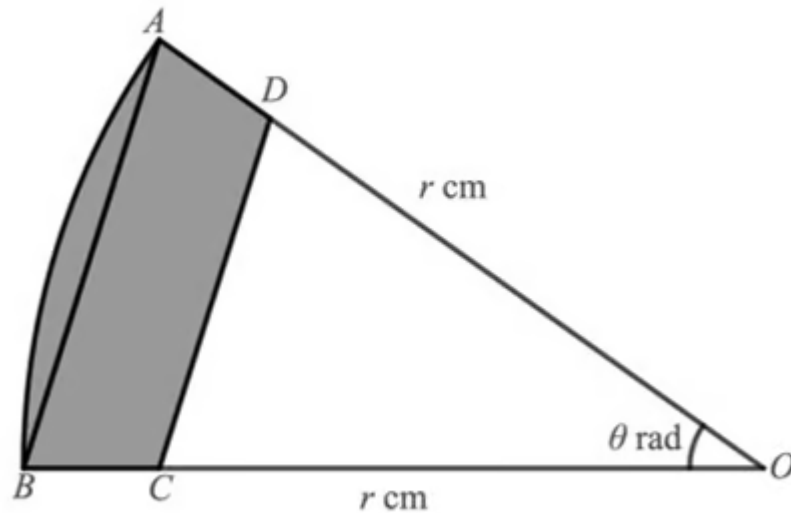
Find the equations of l_1 and l_2 , giving your answers in the form $y = mx + c$.

(8 marks)

10 (a) The circle sector OAB is shown in the diagram below.

The angle at the centre is θ radians, and the radii OA and OB are each equal to r cm

Additionally, CD is parallel to AB , so that $AD = BC$ and $OD = OC$.



In the case when $AD = BC = 1$ cm, show that the area of the shaded shape $ABCD$ is given by $\frac{1}{2}\theta r^2 - \frac{1}{2}(r-1)^2 \sin \theta$.

(4 marks)

(b) Show that for small values of θ , the area of $ABCD$ is approximately $\frac{1}{2}\theta(2r-1)$.

(3 marks)

11 (a) The functions $f(x)$ and $g(x)$ are defined as follows

$$f(x) = (x - 1)^2 - 4 \quad x \in \mathbb{R}, x \geq 1$$

$$g(x) = 1 + \sqrt{(x+4)} \quad x \in \mathbb{R}, x \geq -4$$

Find

(i) $fg(x)$

(ii) $gf(x)$

(3 marks)

(b) Write down $f^{-1}(x)$ and state its domain and range.

(2 marks)

(c) The graphs of $f(x)$ and $f^{-1}(x)$ are drawn on the same axes.

Describe the transformation that would map one graph onto the other.

(2 marks)

(d) Find the coordinates of the point where the graphs of $y = f(x)$ and $y = f^{-1}(x)$ meet.

(2 marks)

12 (a) A curve has the equation $y = x^3 - 12x + 7$.

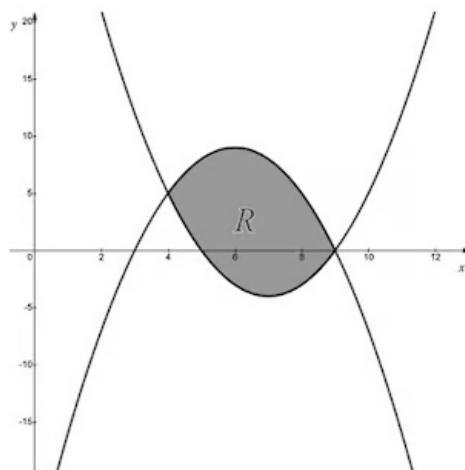
Find expressions for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

(3 marks)

(b) Determine the coordinates of the local minimum of the curve.

(3 marks)

13 The diagram below shows the graphs of $y = 12x - x^2 - 27$ and $y = x^2 - 14x + 45$.



Find the area of the shaded region, R .

(8 marks)