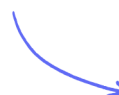


Practice Paper 1 (Pure 1)

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Total Marks

/75

1 (a) Find the first three terms in the expansion of $(2 - 3x)^7$.

(3 marks)

(b) Given that x is small such that x^3 and higher powers of x can be ignored show that

$$(1 - 2x)(2 - 3x)^7 \approx 128 - 1600x + 8736x^2$$

(3 marks)

2 (a) The equation $2k - 3kx - x^2 = 0$ has two distinct real roots.

k is a negative constant.

Find the possible values of k .

(2 marks)

(b) In the case $k = -1$ sketch the graph of $y = 2k - 3kx - x^2$, labelling all points where the graph crosses the coordinate axes.

(3 marks)

- 3 (a)** Show that the equation $2 \sin^2 x + 3 \cos x = 0$ can be written in the form $a \cos^2 x + b \cos x + c = 0$, where a , b and c are integers to be found.

(2 marks)

- (b)** Hence, or otherwise, solve the equation $2 \sin^2 x + 3 \cos x = 0$ for $-180^\circ \leq x \leq 180^\circ$

(3 marks)

- 4** The sum of the first three terms in a geometric series is 8.75.
The sum of the first six terms in the same series is 13.23.

Find the common ratio, r , of the series.

(4 marks)

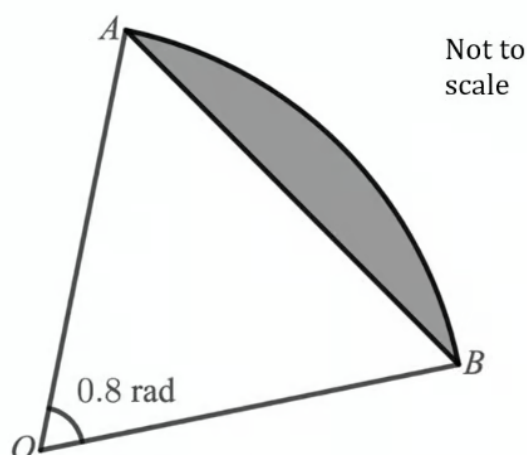
- 5 (a)** On the same set of axes, sketch the graphs of $y = \sin \frac{1}{2} \theta$ and $y = \sin(\theta + 30^\circ)$ in the interval $-270^\circ \leq \theta \leq 270^\circ$. Label the coordinates of points of intersection with the coordinate axes and of maximum and minimum points where appropriate.

(4 marks)

- (b)** Find the solution to the equation $\sin \frac{1}{2} \theta = \sin(\theta + 30^\circ)$ within the interval $-90^\circ \leq \theta \leq 0^\circ$. Hence, determine the coordinates of the corresponding point of intersection between the two graphs in part (a).

(2 marks)

6 (a) The diagram below shows the sector of a circle OAB .



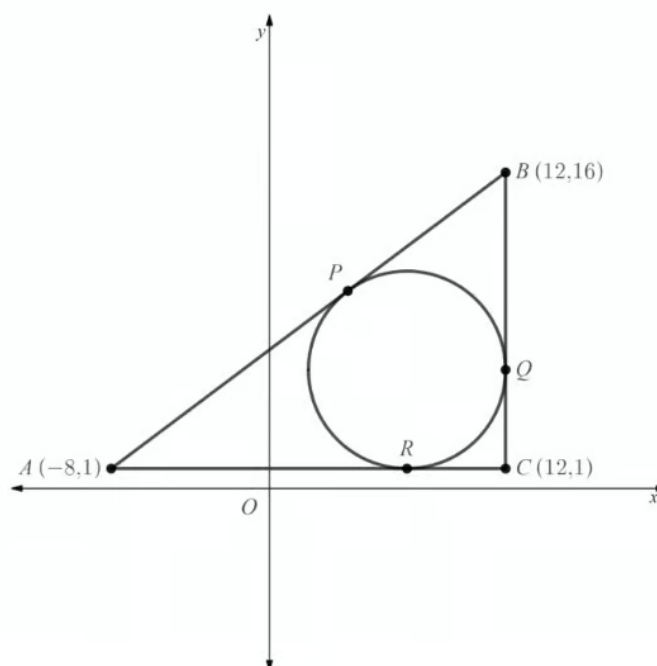
Given that the area of triangle $OAB = 5.64 \text{ cm}^2$, find the area of the shaded segment.
Give your answer correct to 3 significant figures.

(5 marks)

(b) Find the perimeter of the sector OAB , giving your answer correct to 3 significant figures.

(3 marks)

- 7 (a)** Triangle ABC has vertices $A(-8, 1)$, $B(12, 16)$ and $C(12, 1)$. A circle with equation $(x - 7)^2 + (y - 6)^2 = 25$ touches Triangle ABC at the three points P , Q and R , as shown in the diagram below:



Write down the coordinates of points R and Q .

(2 marks)

- (b)** Find the coordinates of point P .

(5 marks)

- 8 (a)** Write the quadratic function $y = 4x^2 + 8x - 5$ in the form $y = a(x + b)^2 + c$ where a , b and c are integers to be found.

(2 marks)

- (b)** Write down the minimum point on the graph of $y = 4x^2 + 8x - 5$.

(1 mark)

- (c)** Sketch the graph of $y = 4x^2 + 8x - 5$, clearly labelling the minimum point and any point where the graph intersects the coordinate axes.

(3 marks)

- 9 (a)** The point $P(-12, -9)$ lies on the curve with equation $y = x^2 + 15x + 27$.

The graph is translated so that the point P is mapped to the point $(-12, 3)$.

Write down the equation of the transformed function.

(2 marks)

- (b)** The graph is translated so that the point P is mapped to the point $(-10, -9)$.

Write down the equation of the transformed function in the form

$y = (x + a)^2 + 15(x + a) + 27$, where a is a constant to be found.

(2 marks)

- 10** A function, $f(x)$, has second derivative given by

$$f''(x) = 6(x - 2).$$

Given that $f(3) = 20$, and $f'(2) = 8$, find $f(x)$.

(5 marks)

- 11** A curve has the equation $y = x(x + 6)^2 + 4(3x + 11)$.

The point $P(x, y)$ is the stationary point of the curve.

Find the coordinates of P and determine its nature.

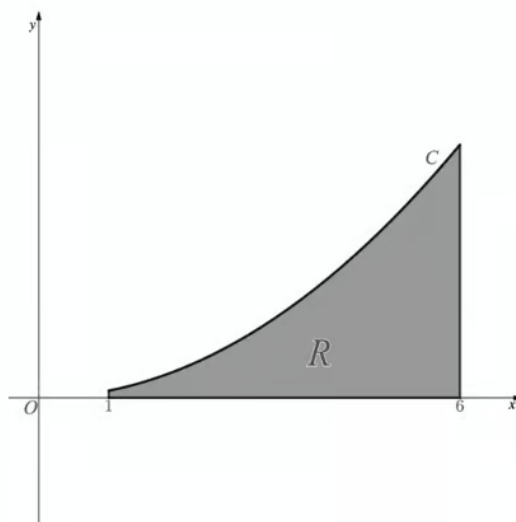
(5 marks)

12 Use calculus to find the value of

$$\int_4^9 \frac{x^2 + 1}{\sqrt{x}} \, dx$$

(5 marks)

13 The diagram below shows part of the curve C defined by the equation $y = \frac{1}{a}x^2$, where a is a positive constant. The shaded region R is bounded by the curve, the x -axis, and the lines $x = 1$ and $x = 6$.



Given that the volume of the solid formed when the region R is rotated 360° about the x -axis is $\frac{311\pi}{20}$ cubic units, find the value of a .

(4 marks)

- 14** The curve C has equation $y = 3x^2 - 6x + \sqrt{2x}$. The point $P(2, 2)$ lies on C .

Find an equation of the tangent to C at P .

(5 marks)