Leave blank

1. $\mathrm{f}(x) = 2x^3 + x^2 - 5x + c$, where c is a constant.

Given that $\mathrm{f}(1) = 0$,

(a) find the value of c, **(2)**

(b) factorise $\mathrm{f}(x)$ completely, **(4)**

(c) find the remainder when $\mathrm{f}(x)$ is divided by $(2x - 3)$. **(2)**

Leave blank

2. (a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(1 + px)^9,$$

where p is a constant.

(2)

These first 3 terms are 1, $36x$ and qx^2, where q is a constant.

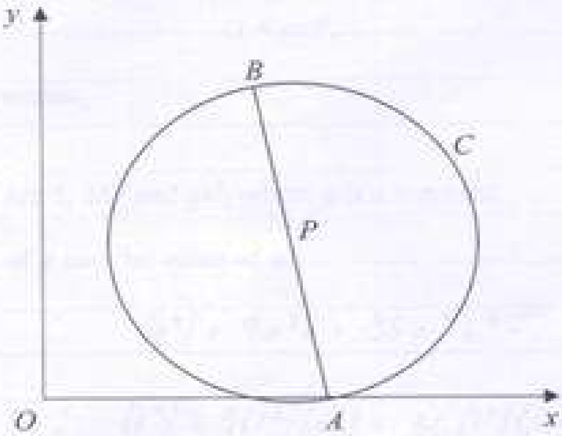
(b) Find the value of p and the value of q.

(4)

N 2 3 5 5 2 A 0 4 2 0

Leave blank

3. **Figure 1**



In Figure 1, $A(4, 0)$ and $B(3, 5)$ are the end points of a diameter of the circle C.

Find

(a) the exact length of AB, **(2)**

(b) the coordinates of the midpoint P of AB, **(2)**

(c) an equation for the circle C. **(3)**

N 2 3 5 5 2 A 0 6 2 0

Leave blank

4. The first term of a geometric series is 120. The sum to infinity of the series is 480.

(a) Show that the common ratio, r, is $\frac{3}{4}$.

(3)

(b) Find, to 2 decimal places, the difference between the 5th and 6th term.

(2)

(c) Calculate the sum of the first 7 terms.

(2)

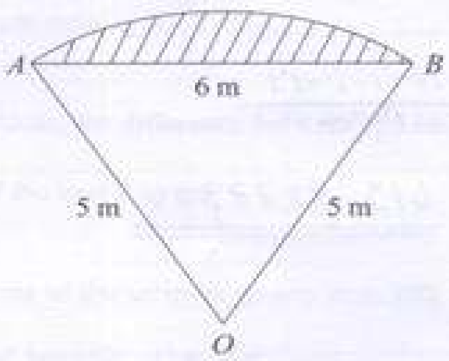
The sum of the first n terms of the series is greater than 300.

(d) Calculate the smallest possible value of n.

(4)

Leave blank

5. **Figure 2**



In Figure 2 OAB is a sector of a circle radius 5 m. The chord AB is 6 m long.

(a) Show that $\cos A\hat{O}B = \frac{7}{25}$.
(2)

(b) Hence find the angle $A\hat{O}B$ in radians, giving your answer to 3 decimal places.
(1)

(c) Calculate the area of the sector OAB.
(2)

(d) Hence calculate the shaded area.
(3)

Leave blank

6. The speed, v m s^{-1}, of a train at time t seconds is given by

$$v = \sqrt{(1.2^t - 1)}, \quad 0 \leqslant t \leqslant 30.$$

The following table shows the speed of the train at 5 second intervals.

t	0	5	10	15	20	25	30
v	0	1.22	2.28		6.11		

(a) Complete the table, giving the values of v to 2 decimal places.

(3)

The distance, s metres, travelled by the train in 30 seconds is given by

$$s = \int_0^{30} \sqrt{(1.2^t - 1)}\,dt .$$

(b) Use the trapezium rule, with all the values from your table, to estimate the value of s.

(3)

Leave blank

7. The curve C has equation

$$y = 2x^3 - 5x^2 - 4x + 2.$$

(a) Find $\frac{dy}{dx}$. **(2)**

(b) Using the result from part (a), find the coordinates of the turning points of C. **(4)**

(c) Find $\frac{d^2y}{dx^2}$. **(2)**

(d) Hence, or otherwise, determine the nature of the turning points of C. **(2)**

Leave blank

8. (a) Find all the values of θ, to 1 decimal place, in the interval $0° \leqslant \theta < 360°$ for which

$$5\sin(\theta + 30°) = 3.$$

(4)

(b) Find all the values of θ, to 1 decimal place, in the interval $0° \leqslant \theta < 360°$ for which

$$\tan^2\theta = 4.$$

(5)

N 2 3 5 5 2 A 0 1 6 2 0

Leave blank

9. **Figure 3**

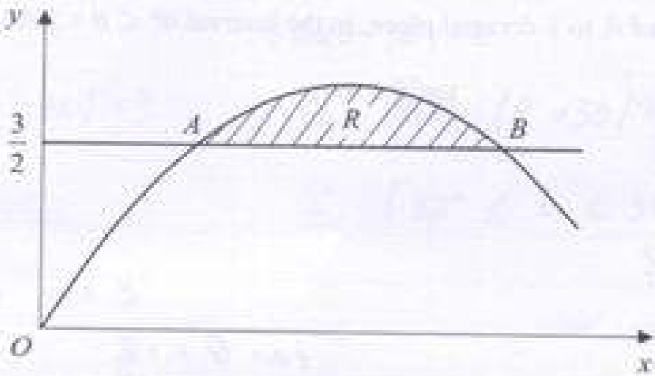


Figure 3 shows the shaded region R which is bounded by the curve $y = -2x^2 + 4x$ and the line $y = \frac{3}{2}$. The points A and B are the points of intersection of the line and the curve.

Find

(a) the x-coordinates of the points A and B,

(4)

(b) the exact area of R.

(6)

N 2 3 5 5 2 A 0 1 8 2 0