

Q1

(4)

2



Q2

(Total 5 marks)



Turn over

3. Find an equation, with integer coefficients, for the perpendicular bisector of the line joining the points (5, 9) and (11, -3).

(5)

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Q3

(Total 5 marks)



4. The finite region enclosed by the curve with equation $y = 9 - x^2$ and the x -axis is rotated through 360° about the x -axis. Find, to 3 significant figures, the volume of the solid generated.

(6)

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Q4

(Total 6 marks)

5

Turn over



N 3 0 4 5 4 A 0 5 2 8

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5. A particle P moves in a straight line. At time t seconds, the velocity, v m/s, of P is given by $v = t^2 - 2t + 9$. Find

- (a) the acceleration of P , in m/s^2 , when $t = 3$,

- (b) the distance P travels in the interval $0 \leq t \leq 6$. (4)



Q5

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6. A curve has equation $y = 3 - \frac{2}{x+1}, x \neq -1$.

(a) Find an equation of the asymptote to the curve which is parallel to

(i) the x -axis,

(ii) the y -axis.

(2)

(b) Find the coordinates of the point where the curve crosses

(i) the x -axis,

(ii) the y -axis.

(2)

(c) Sketch the curve, showing clearly the asymptotes and the coordinates of the points where the curve crosses the coordinate axes.

(3)

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Q6

103

Turn over



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7. $f(x) = x^2 + kx - 5, k \in \mathbb{R}.$

The roots of the equation $f(x) = 0$ are α and β .

(a) Find, in terms of k where appropriate, the value of

$$\begin{aligned} \text{(i)} \quad & \alpha^2 + \beta^2, & \text{(ii)} \quad & \alpha^2 \beta^2. \end{aligned} \tag{4}$$

Given that $5(\alpha^2 + \beta^2) = 7\alpha^2\beta^2$,

(b) find the possible values of k . (2)

Using the positive value of k found in part (b), and without solving the equation $f(x) = 0$,

(c) form a quadratic equation, with integer coefficients, which has roots $\frac{1}{\alpha^2}$ and $\frac{1}{\beta^2}$.

(5)



Q7

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8. Solve, to 3 significant figures, for $0 \leq \theta \leq \pi$,

(a) $(4 \sin \theta - 1)(2 \sin \theta + 5) = 0$,

(3)

(b) $\tan(2\theta - \frac{1}{3}\pi) = 2.4$,

(4)

(c) $9 \sin^2 \theta - 9 \cos \theta = 11$.

(5)

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Q8

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9. The third and fifth terms of an arithmetic series are given by $\log pq^4$ and $\log pq^8$ respectively, $q \neq 1$.

The common difference of the series is $b \log q$, where b is a constant. Find

- (a) the value of b ,
- (3)**

- (b) the first term of the series. (2)

The sum of the first n terms of the series can be written in the form $s \log pq^r$.

- (c) Express r and s in terms of n . (4)

Given that the sum of the first 16 terms of the series is 10 times the sum of the first 4 terms of the series,

- (d) show that $\log p = 5 \log q$. (4)

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Question 9 continued

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Q9

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10. (a) Expand $(1 + \frac{1}{2}x)^{\frac{1}{5}}$ in ascending powers of x up to and including the term in x^2 , simplifying each term. (3)

(b) Expand $(1 - \frac{1}{2}x)^{-\frac{1}{5}}$ in ascending powers of x up to and including the term in x^2 , simplifying each term. (3)

(c) State the range of values of x for which both expansions are valid. (1)

(d) Expand $\left(\frac{2+x}{2-x}\right)^{\frac{1}{5}}$ in ascending powers of x up to and including the term in x^2 , simplifying each term. (3)

(e) Hence obtain an estimate, to 4 significant figures, of

$$\int_0^{0.5} \left(\frac{2+x}{2-x}\right)^{\frac{1}{5}} dx.$$
(4)





Question 10 continued

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Q10

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11.

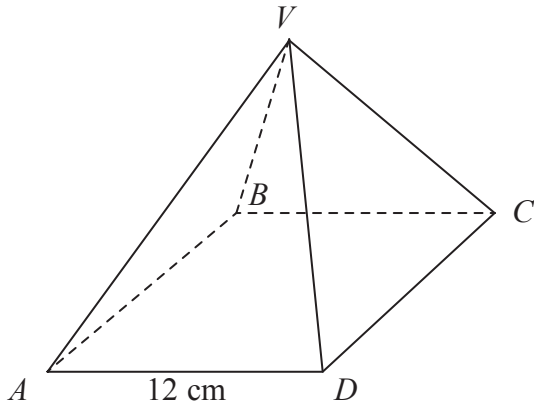


Figure 1

Figure 1 shows a right pyramid with vertex V and square base $ABCD$, of side 12 cm. The size of angle AVC is 90° .

- (a) Show that the height of the pyramid is $6\sqrt{2}$ cm. (4)
- (b) Find, in cm, the length of VA . (3)
- (c) Find, in cm, the exact length of the perpendicular from D to VA . Give your answer in the form $p\sqrt{q}$, where p and q are integers and q is prime. (3)

Find, in degrees to 1 decimal place, the size of

- (d) the angle between the plane VAB and the base $ABCD$, (3)
- (e) the angle between the plane VAB and the plane VAD . (4)





Question 11 continued

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Lined area for writing the answer to Question 11.



Q11

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