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4.

$$f(x) = 2x^3 + 3x^2 - 29x - 60.$$

(a) Find the remainder when $f(x)$ is divided by $(x + 2)$. (2)

(b) Use the factor theorem to show that $(x + 3)$ is a factor of $f(x)$. (2)

(c) Factorise $f(x)$ completely. (4)



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5. (a) In the space provided, sketch the graph of $y = 3^x$, $x \in \mathbb{R}$, showing the coordinates of the point at which the graph meets the y -axis.

(2)

(b) Complete the table, giving the values of 3^x to 3 decimal places.

x	0	0.2	0.4	0.6	0.8	1
3^x		1.246	1.552			3

(2)

(c) Use the trapezium rule, with all the values from your table, to find an approximation

for the value of $\int_0^1 3^x dx$.

(4)



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Question 5 continued

Q5

(Total 8 marks)



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6. (a) Given that $\sin \theta = 5 \cos \theta$, find the value of $\tan \theta$. (1)

(b) Hence, or otherwise, find the values of θ in the interval $0 \leq \theta < 360^\circ$ for which

$$\sin \theta = 5 \cos \theta,$$

giving your answers to 1 decimal place. (3)



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Question 6 continued

(This section contains 28 horizontal lines for writing the answer to Question 6.)

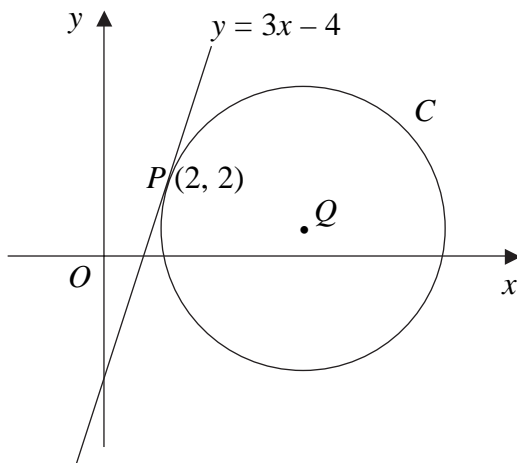
(Total 4 marks)

Q6



7.

Figure 1



The line $y = 3x - 4$ is a tangent to the circle C , touching C at the point $P(2, 2)$, as shown in Figure 1.

The point Q is the centre of C .

- (a) Find an equation of the straight line through P and Q . (3)

Given that Q lies on the line $y = 1$,

- (b) show that the x -coordinate of Q is 5, (1)

- (c) find an equation for C . (4)



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Question 7 continued

Lined writing area with 30 horizontal lines for the answer to Question 7.

(Total 8 marks)

Q7



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

8.

Figure 2

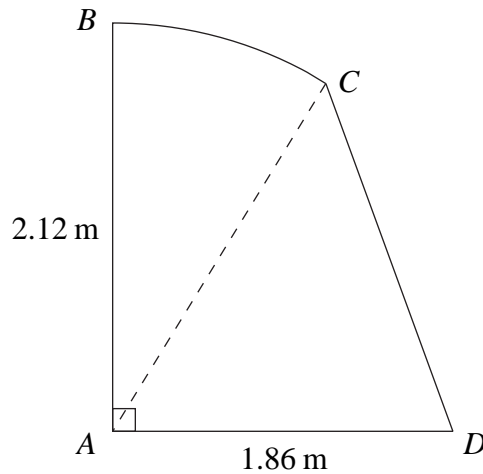


Figure 2 shows the cross section $ABCD$ of a small shed.
 The straight line AB is vertical and has length 2.12 m.
 The straight line AD is horizontal and has length 1.86 m.
 The curve BC is an arc of a circle with centre A , and CD is a straight line.
 Given that the size of $\angle BAC$ is 0.65 radians, find

- (a) the length of the arc BC , in m, to 2 decimal places, (2)
- (b) the area of the sector BAC , in m^2 , to 2 decimal places, (2)
- (c) the size of $\angle CAD$, in radians, to 2 decimal places, (2)
- (d) the area of the cross section $ABCD$ of the shed, in m^2 , to 2 decimal places. (3)

9. A geometric series has first term a and common ratio r .
The second term of the series is 4 and the sum to infinity of the series is 25.

(a) Show that $25r^2 - 25r + 4 = 0$.

(4)

(b) Find the two possible values of r .

(2)

(c) Find the corresponding two possible values of a .

(2)

(d) Show that the sum, S_n , of the first n terms of the series is given by

$$S_n = 25(1 - r^n).$$

(1)

Given that r takes the larger of its two possible values,

(e) find the smallest value of n for which S_n exceeds 24.

(2)



10.

Figure 3

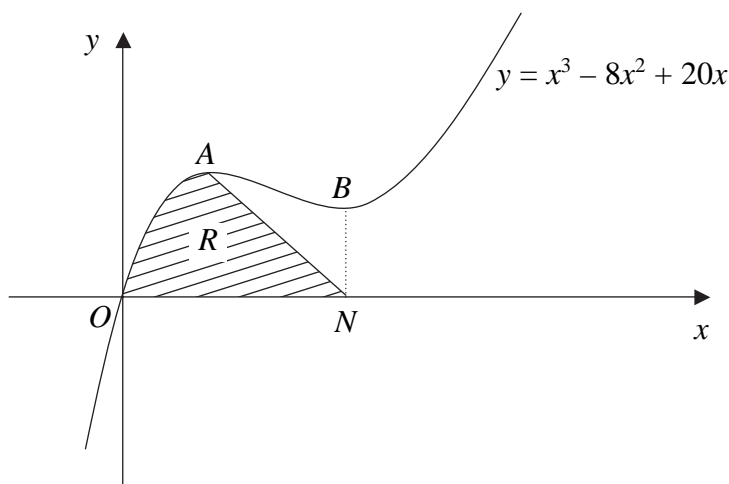


Figure 3 shows a sketch of part of the curve with equation $y = x^3 - 8x^2 + 20x$. The curve has stationary points A and B .

(a) Use calculus to find the x -coordinates of A and B . (4)

(b) Find the value of $\frac{d^2y}{dx^2}$ at A , and hence verify that A is a maximum. (2)

The line through B parallel to the y -axis meets the x -axis at the point N . The region R , shown shaded in Figure 3, is bounded by the curve, the x -axis and the line from A to N .

(c) Find $\int (x^3 - 8x^2 + 20x) dx$. (3)

(d) Hence calculate the exact area of R . (5)



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Question 10 continued

Lined area for writing the answer to Question 10.

Q10

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(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

END

