

Please check the examination details below before entering your candidate information

Candidate surname		Other names
		TAW
Centre Number	Candidate Number	

Pearson Edexcel

Thursday 6 June 2024

Time: 2 hours

Paper reference

Mathematics

YEAR 12 UCAS EXAM

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 12 questions in this question paper. The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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Pearson

1 (a) Given that

$$2\log_4(x+3) + \log_4 x = \log_4(4x+2) + \frac{1}{2}$$

show that

$$x^3 + 6x^2 + x - 4 = 0$$

(4)

(b) Given also that -1 is a root of the equation

$$x^3 + 6x^2 + x - 4 = 0$$

(i) use algebra to find the other two roots of the equation.

(3)

(ii) Hence solve

$$2\log_4(x+3) + \log_4 x = \log_4(4x+2) + \frac{1}{2}$$

(1)

$$a) \log_4(x+3)^2 + \log_4 x - \log_4(4x+2) = \frac{1}{2}$$

$$\log_4 \frac{x(x+3)^2}{(4x+2)} = \frac{1}{2} \quad \text{B1 m1}$$

$$\therefore \frac{x(x+3)^2}{(4x+2)} = 4^{\frac{1}{2}} = 2$$

$$x(x+3)^2 = 2(4x+2) \quad \text{A1.}$$

$$x(x^2 + 6x + 9) = 8x + 4$$

$$x^3 + 6x^2 + 9x = 8x + 4$$

$$x^3 + 6x^2 + x - 4 = 0$$

A1.

QED

Question 1 continued

$$b) x^3 + 6x^2 + x - 4 = 0$$

$$(x+1)(x^2+5x-4) = 0 \quad m_1.$$

$$x^2+5x-4=0$$

$$\therefore x = \frac{-5 \pm \sqrt{5^2 - (4 \times 1 \times -4)}}{2}$$

$$x = \frac{-5 \pm \sqrt{41}}{2} \quad m_1 A_1.$$

$$c) x = \frac{-5 \pm \sqrt{41}}{2} \quad B_1$$

Question 1 continued

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Question 1 continued

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(Total for Question 1 is 8 marks)



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2.

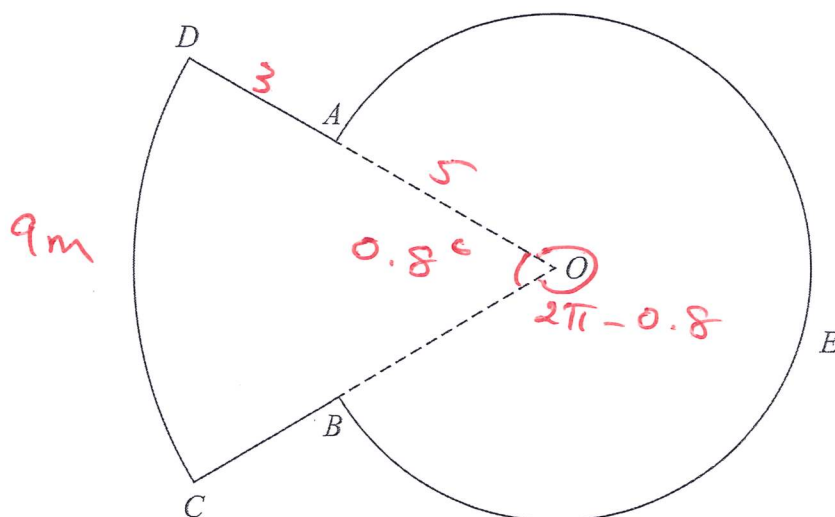


Figure 3

Figure 3 shows a sketch of the plan view of a platform.

The plan view of the platform consists of a sector DOC of a circle centre O joined to a sector $AOBEA$ of a different circle, also with centre O .

Given that

- angle $AOB = 0.8$ radians
- arc length $CD = 9$ m
- $DA:AO = 3:5$

(a) show that $AO = 7.03$ m to 3 significant figures.

(3)

(b) Find the perimeter of the platform, in m, to 3 significant figures.

(3)

(c) Find the total area of the platform, giving your answer in m^2 to the nearest whole number.

(3)

$$a) s = r\theta$$

$$9 = 0.8r$$

$$\therefore r = \frac{9}{0.8} = \frac{45}{4} = OD = 11.25$$

$$\therefore AO = \frac{5}{8} \times \frac{45}{4} = 7.03125 = 7.03 \text{ cm (3sf)}$$

Question 2 continued

$$\begin{aligned} \text{b) } P &= 7.03 (2\pi - 0.8) + 9 \quad \text{m} \\ &\quad + 2 (11.25 - 7.03125) \quad \text{m} \\ &= 38.55 + 9 + 8.4375 \\ &= \underline{\underline{56.0}} \text{ (m) (3sf)} \quad A_1 \end{aligned}$$

$$\begin{aligned} \text{c) } A &= \frac{1}{2} (11.25)^2 (0.8) + \frac{1}{2} (7.03)^2 (2\pi - 0.8) \\ &= 50.625 + 135.4 \\ &= \underline{\underline{186}} \text{ (m}^2\text{) (3sf)} \\ &\quad A_1 \end{aligned}$$

Question 2 continued

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Question 2 continued

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(Total for Question 2 is 9 marks)



3. (i) Find the value of

$$\sum_{r=1}^{\infty} 6 \times (0.25)^r$$

(3)

(ii) A sequence $u_1, u_2, u_3, \dots$ is defined by

$$u_1 = 3$$

$$u_{n+1} = \frac{u_n - 3}{u_n - 2} \quad n \in \mathbb{N}$$

(a) Show that this sequence is periodic.

(2)

(b) State the order of this sequence.

(1)

(c) Hence find

$$\sum_{n=1}^{70} u_n$$

$$i) \sum_{r=1}^{\infty} 6 \times (0.25)^r = 1.5 + 1.5(0.25) + 1.5(0.25)^2 + \dots \quad (2)$$

$$= \frac{a}{1-r}$$

$$= \frac{1.5}{1-0.25} \quad m_1 = 2$$

B1

$$ii) u_2 = \frac{u_1 - 3}{u_1 - 2} = \frac{3 - 3}{3 - 2} = 0$$

$$u_3 = \frac{u_2 - 3}{u_2 - 2} = \frac{0 - 3}{0 - 2} = \frac{3}{2}$$

Question 3 continued

$$u_4 = \frac{u_3 - 3}{u_3 - 2} = \frac{\frac{3}{2} - 3}{\frac{3}{2} - 2} = \frac{-\frac{3}{2}}{-\frac{1}{2}} = 3$$

Since $u_1 = u_4$ sequence is Periodic

b) Order 3

$$c) \sum_{n=1}^{70} u_n = 23 \left(3 + 0 + \frac{3}{2} \right) + 3$$

$$= 23 \left(\frac{9}{2} \right) + 3$$

$$= \underline{\underline{106.5}}$$

Question 3 continues

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Question 3 continued

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(Total for Question 3 is 8 marks)

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4 The circle C

- has centre $A(3, 5)$
- passes through the point $B(8, -7)$

(a) Find an equation for C .

(3)

The points M and N lie on C such that MN is a chord of C .

Given that MN

- lies above the x -axis
- is parallel to the x -axis
- has length $4\sqrt{22}$

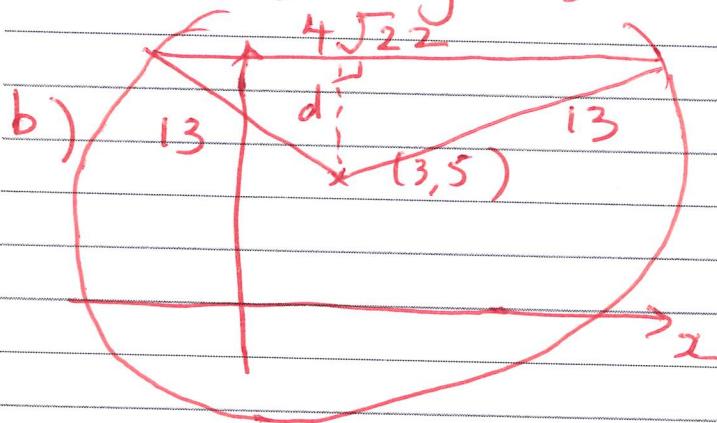
(b) find an equation for the line passing through points M and N .

(3)

$$\begin{aligned} a) \quad r^2 &= (8-3)^2 + (-7-5)^2 \\ &= 5^2 + (-12)^2 \\ &= 169 \text{ m.} \end{aligned}$$

$$r = \sqrt{169} = 13$$

$$\therefore (x-3)^2 + (y-5)^2 = 169 \text{ m.} \quad \underline{\underline{A1.}}$$



$$d^2 = 13^2 - (2\sqrt{22})^2$$

$$= 169 - 88$$

$$= 81 \quad \therefore d = \sqrt{81} = 9 \text{ m.}$$

Question 4 continued

$$\therefore MN: y = 5 + 9 \quad m_1$$

$$\therefore y = \underline{\underline{14}} \quad A_1$$

(Total for Question 4 is 6 marks)

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

$$\frac{8}{(2-5x)^2}$$

writing each term in simplest form.

(4)

- (b) Find the range of values of x for which this expansion is valid.

(1)

$$\begin{aligned} \text{a) } (2-5x)^{-2} &= 2^{-2} \left(1 - \frac{5}{2}x\right)^{-2} \\ &= \frac{1}{4} \left(1 - \frac{5}{2}x\right)^{-2} \end{aligned}$$

$$\therefore 8(2-5x)^{-2} = 2 \left(1 - \frac{5}{2}x\right)^{-2}$$

$$\begin{aligned} &= 2 \left[1 + (-2) \left(\frac{-5}{2}x\right) + \frac{(-2)(-3)}{2!} \left(\frac{-5}{2}x\right)^2 \right. \\ &\quad \left. + \frac{(-2)(-3)(-4)}{3!} \left(\frac{-5}{2}x\right)^3 + \dots \right] \end{aligned}$$

$$= 2 \left[1 + 5x + \frac{75}{4}x^2 + \frac{125}{2}x^3 + \dots \right]$$

$$= 2 + 10x + \frac{75}{2}x^2 + 125x^3 + \dots$$

$$\text{b) } \left| \frac{5}{2}x \right| < 1$$

$$\therefore |x| < \frac{2}{5} \quad \text{or} \quad -\frac{2}{5} < x < \frac{2}{5}$$

Bl

Question 5 continued

(Total for Question 5 is 5 marks)

Turn over ►

6. An area of sea floor is being monitored.

The area of the sea floor, $S \text{ km}^2$, covered by coral reefs is modelled by the equation

$$S = pq^t$$

where p and q are constants and t is the number of years after monitoring began.

Given that

$$\log_{10} S = 4.5 - 0.006t$$

- (a) find, according to the model, the area of sea floor covered by coral reefs when $t = 2$ (2)
- (b) find a complete equation for the model in the form

$$S = pq^t$$

giving the value of p and the value of q each to 3 significant figures. (3)

- (c) With reference to the model, interpret the value of the constant q (1)

$$a) \log_{10} S = 4.5 - 0.006(2)$$
$$= 4.488$$

$$\therefore S = 10^{4.488} = 30760.96815$$
$$= 30800 \text{ km}^2 \quad (3\text{sf})$$

An

$$b) \log_{10} S = 4.5 - 0.006t$$

$$\therefore S = 10^{4.5 - 0.006t}$$

$$S = 10^{4.5} \times 10^{-0.006t} = 10^{4.5} \times (10^{-0.006})^t$$

$$\therefore S = 31600 \times 0.986^t$$

An

c) The area of Sea floor covered by coral

Question 6 continued

reef is reducing by 1.4% each year
Bl.

(Total for Question 6 is 6 marks)

7. In this question you must show all stages of your working. The curve C has equation $y = f(x)$, $x > 0$

Given that

- the point $P(2, 8\sqrt{2})$ lies on C
- $f'(x) = 4\sqrt{x^3} + \frac{k}{x^2}$ where k is a constant
- $f''(x) = 0$ at P

(a) find the exact value of k ,

(4)

(b) find $f(x)$, giving your answer in simplest form.

(4)

$$2^{5/2} = \sqrt{2^5} \\ = \sqrt{32} \\ = 4\sqrt{2}$$

$$f'(x) = 4x^{3/2} + kx^{-2}$$

$$a) f''(x) = 6x^{1/2} - 2kx^{-3} \quad m1 \quad A1$$

$$\therefore f''(2) = 6(2^{1/2}) - 2k(2^{-3}) = 0 \quad m1$$

$$\therefore 6\sqrt{2} - \frac{2k}{8} = 0$$

$$\therefore \frac{k}{4} = 6\sqrt{2}$$

$$k = 24\sqrt{2} \quad A1$$

$$b) f(x) = \int (4x^{3/2} + 24\sqrt{2}x^{-2}) dx$$

$$= 4x^{5/2} + \frac{24\sqrt{2}x^{-1}}{-1} + C$$

$$f(x) = \frac{8}{5}x^{5/2} - \frac{24\sqrt{2}}{x} + C \quad m1 \quad A1$$

Question 7 continued

$$\therefore 8\sqrt{2} = \frac{8}{5} (2^{5/2}) - \frac{24\sqrt{2}}{2} + C$$

$$8\sqrt{2} = \frac{8}{5} (4\sqrt{2}) - 12\sqrt{2} + C$$

$$8\sqrt{2} = \frac{32\sqrt{2}}{5} - 12\sqrt{2} + C$$

$$8\sqrt{2} = -\frac{28}{5}\sqrt{2} + C$$

$$C = \frac{68}{5}\sqrt{2} \quad \text{m1}$$

$$\therefore f(x) = \frac{8}{5}x^{5/2} - \frac{24\sqrt{2}}{x} + \frac{68}{5}\sqrt{2} \quad \text{A1}$$

(Total for Question 7 is 8 marks)

8.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

The temperature, $T^{\circ}\text{C}$, of the air in a room t minutes after a heat source is switched off, is modelled by the equation

$$T = 10 + Ae^{-Bt}$$

where A and B are constants.

Given that the temperature of the air in the room at the instant the heat source was switched off was 18°C ,

- (a) find the value of A

(1)

Given also that, exactly 45 minutes after the heat source was switched off, the temperature of the air in the room was 16°C ,

- (b) find the value of B to 3 significant figures.

(3)

Using the values for A and B ,

- (c) find, according to the model, the rate of change of the temperature of the air in the room exactly two minutes after the heat source was switched off.

Give your answer in $^{\circ}\text{C min}^{-1}$ to 3 significant figures.

(2)

- (d) Explain why, according to the model, the temperature of the air in the room cannot fall to 5°C

(1)

$$a) 18 = 10 + Ae^{-B(0)}$$

$$\therefore 18 = 10 + A$$

$$A = 8 \quad B1$$

$$b) 16 = 10 + 8e^{-45B}$$

$$\therefore e^{-45B} = \frac{6}{8} = \frac{3}{4} \text{ m1}$$

$$\therefore -45B = \ln\left(\frac{3}{4}\right), \quad \therefore B = \frac{\ln\left(\frac{3}{4}\right)}{-45} \text{ m1}$$

Question 8 continued

$$\therefore B = 0.00639 \text{ (3sf)} \quad \text{A1.}$$

$$c) T = 10 + 8e^{-0.00639t}$$

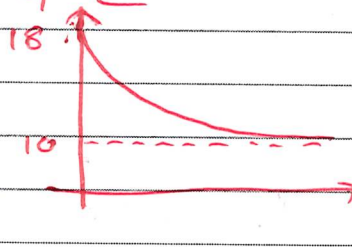
$$\therefore \frac{dT}{dt} = -0.05112e^{-0.00639t} \quad \text{M1}$$

$$\therefore \left. \frac{dT}{dt} \right|_{t=2} = -0.05112e^{-0.00639(2)}$$

$$= -0.0505^\circ\text{C/min} \quad \text{A1.}$$

$$d) \text{ As } t \rightarrow \infty, e^{-0.00639t} \rightarrow 0$$

hence as $t \rightarrow \infty$, $T \rightarrow 10^\circ\text{C}$



Temperature of air in the room can not be

below 10°C hence cannot be 5°C . B1

(Total for Question 8 is 7 marks)

9 Wheat is grown on a farm.

- In year 1, the farm produced 300 tonnes of wheat.
- In year 12, the farm is predicted to produce 4 000 tonnes of wheat.

Model *A* assumes that the amount of wheat produced on the farm will increase by the same amount each year.

- (a) Using model *A*, find the amount of wheat produced on the farm in year 4.
Give your answer to the nearest 10 tonnes.

(3)

Model *B* assumes that the amount of wheat produced on the farm will increase by the same percentage each year.

- (b) Using model *B*, find the amount of wheat produced on the farm in year 2.
Give your answer to the nearest 10 tonnes.

(3)

- (c) Calculate, according to the two models, the difference between the total amounts of wheat predicted to be produced on the farm from year 1 to year 12 inclusive.
Give your answer to the nearest 10 tonnes.

(3)

$$a) \text{ Year 1} = a = 300$$

$$\text{Year 12} = a + 11d = 4000$$

$$\therefore 11d = 3700 \quad \therefore d = \frac{3700}{11} \text{ m1}$$

$$\text{Year 4} = a + 3d = 300 + 3 \left(\frac{3700}{11} \right) = 1310 \text{ tonnes (nearest 10)} \text{ A1}$$

$$b) \text{ Year 1} = a = 300$$

$$\text{Year 12} = ar^{11} = 4000 \text{ m1}$$

$$\therefore r^{11} = \frac{4000}{300} = \frac{40}{3}$$

$$\therefore r = \sqrt[11]{\frac{40}{3}} = 1.2655 \dots \text{ m1}$$

Question 9 continued

$$\text{Year 2} = ar = 300 \times 1.2655 \dots$$

$$= 380 \text{ tonnes (nearest 10)}$$

c) Model A:

$$S_{12} = \frac{n}{2} [a + L] = \frac{12}{2} (300 + 4000)$$

$$= 25800 \text{ m}_1$$

Model B:

$$S_{12} = \frac{300 (1.2655^{12} - 1)}{1.2655 - 1} = 17935 \text{ m}_1$$

At,

$$\therefore 25800 - 17935 = 7870 \text{ tonnes (nearest 10)}$$

Question 9 continued

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Question 9 continued

(Total for Question 9 is 9 marks)

10.

In this question you must show detailed reasoning.

Solutions relying entirely on calculator technology are not acceptable.

- (i) Solve, for
- $0 \leq x < 360^\circ$
- , the equation

$$\sin x \tan x = 5$$

giving your answers to one decimal place.

(6)

- (ii)

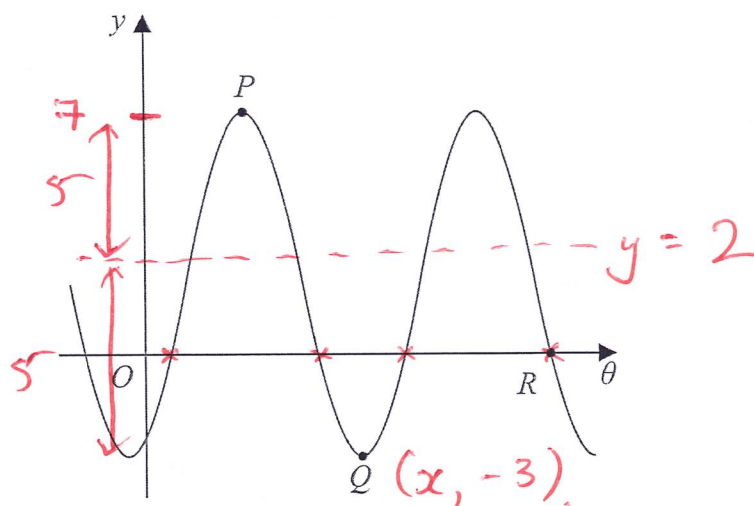


Figure 1

Figure 1 shows a sketch of part of the curve with equation

$$y = A \sin \left(2\theta - \frac{3\pi}{8} \right) + 2$$

where A is a constant and θ is measured in radians.The points P , Q and R lie on the curve and are shown in Figure 1.Given that the y coordinate of P is 7

- (a) state the value of A , (1)
- (b) find the exact coordinates of Q , (3)
- (c) find the value of θ at R , giving your answer to 3 significant figures. (4)

Question 10 continued

$$i) \sin x \left(\frac{\sin x}{\cos x} \right) = 5 \quad \text{BI}$$

$$\therefore \sin^2 x = 5 \cos x$$

$$1 - \cos^2 x = 5 \cos x$$

$$\therefore \cos^2 x + 5 \cos x - 1 = 0 \quad \text{M1 A1}$$

$$\therefore \cos x = \frac{-5 \pm \sqrt{5^2 - (4 \times 1 \times -1)}}{2} = \frac{-5 \pm \sqrt{29}}{2}$$

$$\therefore x = \cos^{-1} \left(\frac{-5 + \sqrt{29}}{2} \right) \quad \text{M1} \quad \left(\text{reject } \frac{-5 - \sqrt{29}}{2} \right)$$

$$= 78.9^\circ, \underline{\underline{281.1^\circ}} \quad (1 \text{ dp}) \quad \text{A1}$$

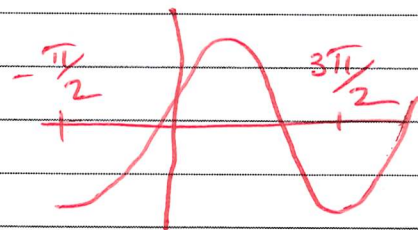
$$ii) a) A = 5$$

$$b) 5 \sin \left(2\theta - \frac{3\pi}{8} \right) + 2 = -3$$

$$\sin \left(2\theta - \frac{3\pi}{8} \right) = -1$$

$$\therefore 2\theta - \frac{3\pi}{8} = \sin^{-1}(-1)$$

$$= \left(-\frac{\pi}{2} \right), \frac{3\pi}{2} \quad \text{M1}$$



$$\therefore 2\theta = \frac{3\pi}{2} + \frac{3\pi}{8} = \frac{15\pi}{8}$$

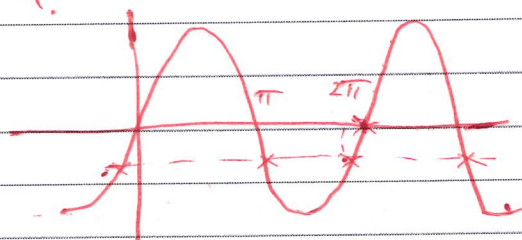
$$\theta = \frac{15\pi}{16} \quad \text{A1} \quad \therefore Q \left(\frac{15\pi}{16}, -3 \right) \quad \text{BI}$$

Question 10 continued

$$c) 5 \sin\left(2\theta - \frac{3\pi}{8}\right) + 2 = 0$$

$$\sin\left(2\theta - \frac{3\pi}{8}\right) = -\frac{2}{5} \text{ m.l.}$$

$$2\theta - \frac{3\pi}{8} = \sin^{-1}\left(-\frac{2}{5}\right) \text{ m.l.}$$



$$= (-0.4115, 3.5531, 5.8717, 9.8363)$$

$$\therefore 2\theta = 11.01437$$

$$\theta = 5.5071876 \text{ A}$$

$$= 5.51$$

$$\therefore R(5.51, 0) \text{ A.}$$

Question 10 continued

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(Total for Question 10 is 14 marks)



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11.

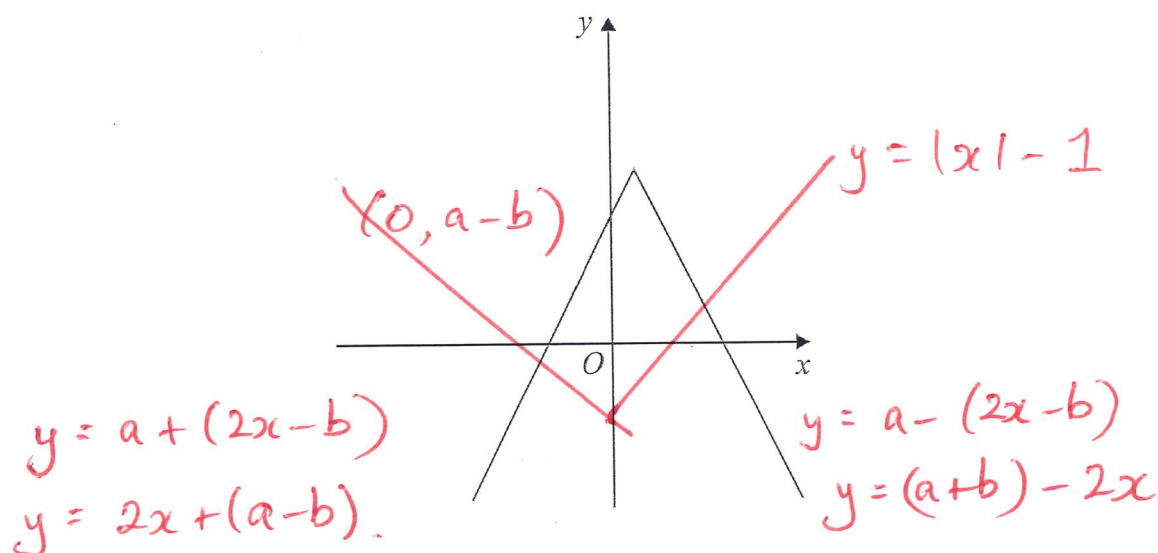


Figure 2

In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

The graph shown in Figure 2 has equation

$$y = a - |2x - b|$$

$$2x - b = 0$$

$$x = \frac{b}{2}$$

where a and b are positive constants, $a > b$

- (a) Find, giving your answer in terms of a and b ,
- the coordinates of the maximum point of the graph,
 - the coordinates of the point of intersection of the graph with the y -axis,
 - the coordinates of the points of intersection of the graph with the x -axis.

(5)

On page 24 there is a copy of Figure 2 called Diagram 1.

- (b) On Diagram 1, sketch the graph with equation

$$y = |x| - 1$$

(2)

Given that the graphs $y = |x| - 1$ and $y = a - |2x - b|$ intersect at $x = -3$ and $x = 5$

- (c) find the value of a and the value of b

(4)

Question 11 continued

a) i) Vertex is $\left(\frac{b}{2}, a\right)$ B1 B1

ii) y-intercept is $(0, a-b)$ B1

iii) x-intercepts:

$$2x + (a-b) = 0$$

$$\therefore 2x = -(a-b) \\ = b-a$$

$$\therefore x = \frac{(b-a)}{2}$$

$$\therefore \left(\frac{(b-a)}{2}, 0\right) \quad \text{and} \quad \left(\frac{(a+b)}{2}, 0\right)$$

B1 B1

b) See overleaf

$$c) \left[\begin{array}{l} x = -3 \\ \therefore | -3 | - 1 = a - | 2(-3) - b | \\ \therefore 2 = a - | -6 - b | \\ \therefore 2 = a - (6+b) \\ 2 = a - 6 - b \\ 8 = a - b \end{array} \right]$$

See
overleaf

Question 11 continued

$$-x - 1 = 2x + (a - b)$$

$$x = -3$$

$$\therefore -(-3) - 1 = 2(-3) + (a - b)$$

$$\therefore 2 = -6 + (a - b)$$

$$\therefore (a - b) = 8 \quad (1) \quad m_1$$

$$x - 1 = (a + b) - 2x$$

$$x = 5$$

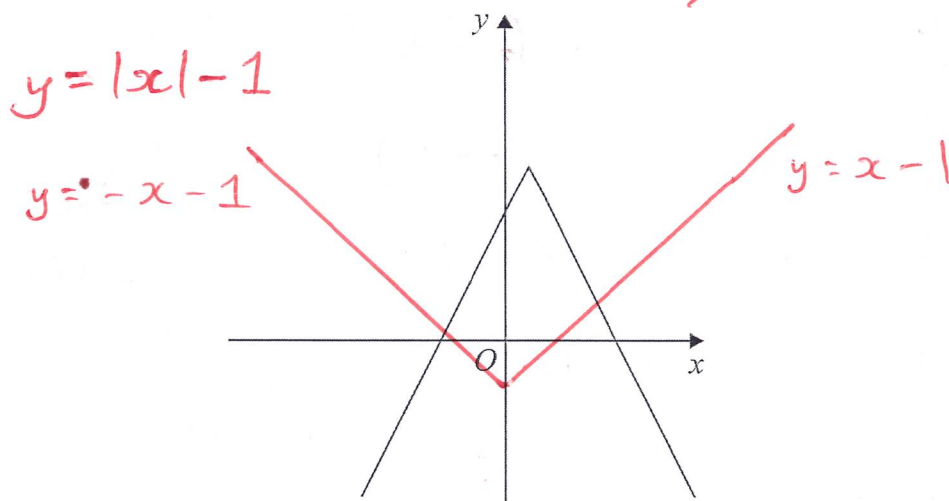
$$5 - 1 = (a + b) - 2(5)$$

$$4 = (a + b) - 10$$

$$\therefore (a + b) = 14 \quad (2) \quad m_1$$

$$(1) + (2) \text{ gives } 2a = 22 \quad m_1$$

$$\therefore a = 11, b = 3 \quad \underline{\underline{A_1}}$$



Question 11 continued

(Total for Question 11 is 11 marks)

Turn over ►

12.

In this question you must show detailed reasoning.

Solutions relying entirely on calculator technology are not acceptable.

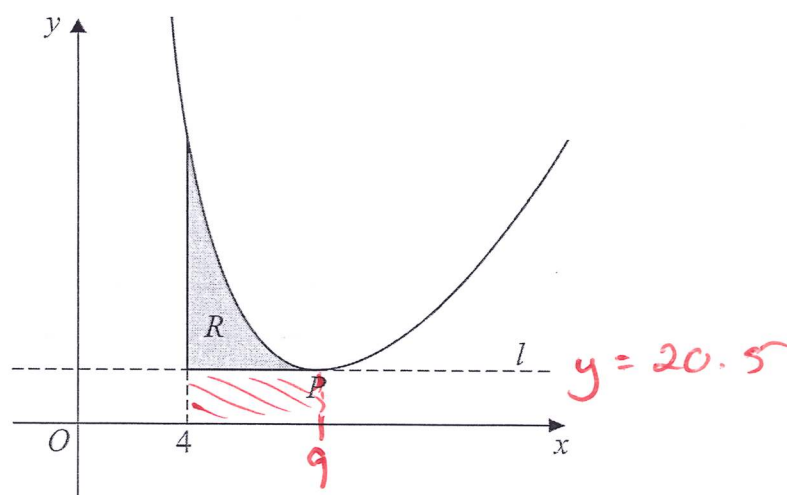


Figure 2

Figure 2 shows a sketch of the curve with equation

$$y = \frac{1}{2}x^2 + \frac{1458}{\sqrt{x^3}} - 74 \quad x > 0$$

The point P is the only stationary point on the curve.(a) Use calculus to show that the x coordinate of P is 9

(4)

The line l passes through the point P and is parallel to the x -axis.The region R , shown shaded in Figure 2, is bounded by the curve, the line l and the line with equation $x = 4$ (b) Use algebraic integration to find the exact area of R .

(5)

$$a) y = \frac{1}{2}x^2 + 1458x^{-3/2} - 74$$

$$\frac{dy}{dx} = x - 2187x^{-5/2} = 0$$

$$\therefore x - \frac{2187}{x^{5/2}} = 0$$

$$x^{7/2} - 2187 = 0 \quad \therefore x^{7/2} = 2187$$

Question 12 continued

$$\therefore x = (2187)^{\frac{2}{17}} = 3^2 = 9$$

$$\text{or } \frac{dy}{dx} \bigg|_{x=9} = \frac{9 - 2187}{9^{5/2}}$$

$$= 9 - \frac{2187}{(\sqrt{9})^5} = 9 - \frac{2187}{3^5}$$

$$= 9 - \frac{2187}{243}$$

$$= 9 - 9 = 0$$

$\therefore$ x -coordinate of P is 9

$$b) R = \int_4^9 \left(\frac{1}{2}x^2 + 1458x^{-3/2} - 74 \right) dx - (5 \times 20.5)$$

$$= \left[\frac{1}{6}x^3 + \frac{1458x^{-1/2}}{-\frac{1}{2}} - 74x \right]_4^9 - 102.5$$

$$= \left[\frac{1}{6}x^3 - \frac{2916}{\sqrt{x}} - 74x \right]_4^9 - 102.5$$

$$= \left(\frac{1}{6}(9^3) - \frac{2916}{\sqrt{9}} - 74(9) \right) - \left(\frac{1}{6}(4^3) - \frac{2916}{\sqrt{4}} - 74(4) \right) - 102.5$$

Question 12 continued

$$= \left(\frac{243}{2} - 972 - 666 \right) - \left(\frac{32}{3} - 1458 - 296 \right)$$

$$- 102.5$$

$$= -\frac{3033}{2} - \left(-\frac{5230}{3} \right) - \frac{205}{2}$$

$$= 373 \frac{1}{3} \quad \text{or} \quad 124 \frac{1}{3}$$

(Total for Question 12 is 9 marks)

TOTAL FOR PAPER IS 100 MARKS

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