AdmitPortfolio · sample marked script

Marked by: Trainee Examiner

Pearson Edexcel IAL Pure Mathematics 1 (WMA11/01), October 2022

One real student's handwritten script, 28 pages. Name and candidate details removed.

Marked against Pearson's official mark scheme with the same instructions given to all eight examiners.

Whole paper: 45/75

By question

Question 1	3 / 6 (page 2)
Question 2	6 / 7 (page 4)
Question 3	4 / 5 (page 6)
Question 4	2 / 6 (page 8)
Question 5	4 / 9 (page 10)
Question 6	1 / 6 (page 14)
Question 7	5 / 8 (page 16)
Question 8	7 / 14 (page 20)
Question 9	13 / 14 (page 24)

How to read it: every part has its mark, the examiner's reason, and for lost marks the concept to fix.

This is sample marking for practice and mocks, not official Pearson marking.

In normal use, the student's teacher approves every mark before it is released.

Compare all eight examiners at admitportfolio.com/examiners

AdmitPortfolio · Trainee Examiner · SAMPLE

Please check the examination details below before entering your candidate information

Candidate details removed

Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper reference **WMA11/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Pure Mathematics P1

You must have:
Mathematical Formulae and Statistical Tables (Yellow), 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 9 questions in this question paper. The total mark for this paper is 75.
- 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

P72137A

©2022 Pearson Education Ltd.

B:1/1/1/1/

P 7 2 1 3 7 A 0 1 2 8

Pearson

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Cover page. Marking starts on page 2.

1. The curve C has equation

$$y = \frac{x^3}{4} - x^2 + \frac{17}{x} \qquad x > 0$$

(a) Find $\frac{dy}{dx}$, giving your answer in simplest form.

(3)

The point $R\left(2, \frac{13}{2}\right)$ lies on C.

(b) Find the equation of the tangent to C at the point R. Write your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found.

(3)

a) $\frac{3x^2}{4} - 2x - \frac{17}{x^2}$

b) $m = \frac{2^3}{4} - 2^2 + \frac{17}{2} = \frac{13}{2}$

$y - y_1 = m(x - x_1)$

$y - \frac{13}{2} = \frac{13}{2}(x - 2)$

$y - \frac{13}{2} = \frac{13}{2}x - 13$

$y = \frac{13}{2}x - \frac{13}{2}$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 1 3/6

1(a) 3/3

The differentiation method and both accuracy marks are earned; all three terms are correct and simplified.

1(b) 0/3

No mark: the gradient is found by substituting x=2 into the derivative, but the student substitutes into the original function instead.

Fix: Tangent gradient must come from dy/dx

Trainee Examiner SAMPLE · AdmitPortfolio

Question 1 continued

(Total for Question 1 is 6 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 1 (continued) 3/6

1(a) 3/3

The differentiation method and both accuracy marks are earned; all three terms are correct and simplified.

1(b) 0/3

No mark: the gradient is found by substituting x=2 into the derivative, but the student substitutes into the original function instead.

Fix: Tangent gradient must come from dy/dx

Trainee Examiner · SAMPLE · AdmitPortfolio

2. Given that

$$(x-5)(2x+1)(x+3) \equiv ax^3 + bx^2 - 32x - 15$$

where a and b are constants,

(a) find the value of a and the value of b.

(2)

(b) Hence find

$$\int \frac{(x-5)(2x+1)(x+3)}{5\sqrt{x}}\,dx$$

writing each term in simplest form.

(5)

a) $(2x^2+x-10x-5)(x+3)$

$(2x^2-9x-5)(x+3)$

$2x^3-9x^2-5x+6x^2-27x-15$

$2x^3-3x^2-32x-15$

hence $a=2$

$b=-3$

b) $\frac{2x^3-3x^2-32x-15}{5\sqrt{x}}$

$\frac{2}{5}x^{2.5} - \frac{3}{5}x^{1.5} - 32x^{0.5} - \frac{3}{\sqrt{x}}$

$\frac{2x^{2.5+1}}{5(2.5+1)} - \frac{3x^{1.5+1}}{5(1.5+1)} - \frac{32x^{0.5+1}}{0.5+1} - 3\sqrt{x} + C$

$\frac{4}{35}x^{3.5} - \frac{6}{25}x^{2.5} - \frac{64}{3}x^{1.5} - 3\sqrt{x} + C$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 2 **6/7**

2(a) 2/2

Both coefficients are correct.

2(b) 4/5

The expansion, integration method and two integrated terms earn four marks. The x^1.5 term has the wrong coefficient; its integral should be -64/15 x^1.5.

Fix: Apply the integration power rule to the coefficient as well as the power

Trainee Examiner SAMPLE · AdmitPortfolio

Question 2 continued

(Total for Question 2 is 7 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 2 (continued) 6/7

2(a) 2/2

Both coefficients are correct.

2(b) 4/5

The expansion, integration method and two integrated terms earn four marks. The x^1.5 term has the wrong coefficient; its integral should be -64/15 x^1.5.

Fix: Apply the integration power rule to the coefficient as well as the power

Trainee Examiner · SAMPLE · AdmitPortfolio

3. The share price of a company is monitored.

Exactly 3 years after monitoring began, the share price was £1.05

Exactly 5 years after monitoring began, the share price was £1.65

The share price, £V, of the company is modelled by the equation

$$V = pt + q$$

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

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

(3)

Exactly T years after monitoring began, the share price was £2.50

(b) Find the value of T, according to the model, giving your answer to one decimal place.

(2)

a) $1.05 = p + q$

$1.05 = 3p + q$

$1.65 = 5p + q$

$1.05 - 3p = 1.65 - 5p$

$2p = 0.6$

$p = 0.3$

$q = 1.05 - 3(0.3) = \frac{3}{20}$

b) $2.5 = 0.3t + 0.15$

$\frac{2.5 - 0.15}{0.3} = t = \frac{47}{6}$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 3 4/5

3(a) 3/3

The simultaneous equations are formed and both constants are correct.

3(b) 1/2

The rearrangement using p and q earns the method mark. The answer is not given to the requested one decimal place (7.8).

Fix: Follow the requested rounding or answer format

Trainee Examiner SAMPLE · AdmitPortfolio

Question 3 continued

(Total for Question 3 is 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 3 (continued) 4/5

3(a) 3/3

The simultaneous equations are formed and both constants are correct.

3(b) 1/2

The rearrangement using p and q earns the method mark. The answer is not given to the requested one decimal place (7.8).

Fix: Follow the requested rounding or answer format

SAMPLE · AdmitPortfolio · Trainee Examiner

4. **In this question you must show detailed reasoning.**
Solutions relying on calculator technology are not acceptable.

$$f(x) = x^2(2x + 1) - 15x$$

(a) Solve

$$f(x) = 0$$

(4)

(b) Hence solve

$$y^{\frac{4}{3}}\left(2y^{\frac{2}{3}} + 1\right) - 15y^{\frac{2}{3}} = 0 \qquad y > 0$$

giving your answer in simplified surd form.

(2)

a) $x^2(2x+1) - 15x = 0$

$x(2x+1) = 15x$

$2x^2 + 2x - 15 = 0$

$\sqrt{b^2 - 4ac} = 2\sqrt{31}$

$\frac{-2 + 2\sqrt{31}}{2(2)} = 2.28, -3.28$

b) $y^{\frac{4}{3}}(2y^{\frac{2}{3}} + 1) = 15y^{\frac{2}{3}}$

$y^{\frac{2}{3}}(2y^{\frac{2}{3}} + 1) = 15$

$2y^{\frac{4}{3}} + y^{\frac{2}{3}} - 15$

$y^{\frac{2}{3}} = x$

$y^{\frac{2}{3}} = 2.28$

$y = \sqrt[\frac{2}{3}]{2.28}$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 4 2/6

4(a) 2/4

The student cancels the linear factor and attempts to solve the resulting quadratic, earning the method marks. The quadratic is incorrectly expanded, so neither the required roots nor the final accuracy marks are earned.
Fix: Expand the expression correctly after taking out the linear factor

4(b) 0/2

The preceding part does not provide a valid positive solution to follow through, and the student uses an approximate incorrect root rather than the required exact solution.
Fix: Use the valid positive root and handle the fractional power exactly

Trainee Examiner SAMPLE · AdmitPortfolio

Question 4 continued

(Total for Question 4 is 6 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 4 (continued) 2/6

4(a) 2/4

The student cancels the linear factor and attempts to solve the resulting quadratic, earning the method marks. The quadratic is incorrectly expanded, so neither the required roots nor the final accuracy marks are earned.

Fix: Expand the expression correctly after taking out the linear factor

4(b) 0/2

The preceding part does not provide a valid positive solution to follow through, and the student uses an approximate incorrect root rather than the required exact solution.

Fix: Use the valid positive root and handle the fractional power exactly

Trainee Examiner · SAMPLE · AdmitPortfolio

5. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

The curve C has equation $y = f(x), x > 0$

Given that

- $f'(x) = \frac{12}{\sqrt{x}} + \frac{x}{3} - 4$
- the point $P(9, 8)$ lies on C

(a) find, in simplest form, $f(x)$

(5)

The line l is the normal to C at P

(b) Find the coordinates of the point at which l crosses the y-axis.

(4)

a) $12x^{-0.5} + \frac{x}{3} - 4$

$\frac{12\sqrt{x}}{0.5} + \frac{x^2}{3(2)} - 4x + C$

$24\sqrt{x} + \frac{x^2}{6} - 4x + C = 8$

$24\sqrt{9} + \frac{9^2}{6} - 4(6) + C = 6$

$C = -\frac{107}{2}$

$24\sqrt{x} + \frac{x^2}{6} - 4x - \frac{107}{2}$

b) $12x^{-0.5} + \frac{x}{3} - 4 = m$

$12(9)^{-0.5} + \frac{9}{3} - 4 = m = 3$

$y - y_1 = m(x - x_1)$ → $y = 3x - 27 + 8$

$y - 8 = 3(x - 9)$ → $y = 3x - 19$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 5 4/9

5(a) 3/5

Integration and the correct antiderivative with a constant earn three marks. The substitution uses -4(6) instead of -4(9), so the constant and final function are wrong.
Fix: Substitute the given x-coordinate consistently when finding the constant

5(b) 1/4

Substitution into the derivative gives the tangent gradient 3, earning the first mark. The normal gradient should be its negative reciprocal, and the line written is the tangent rather than the normal.
Fix: A normal's gradient is the negative reciprocal of the tangent gradient

Trainee Examiner · SAMPLE · AdmitPortfolio

Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 5 (continued) 4/9

5(a) 3/5

Integration and the correct antiderivative with a constant earn three marks. The substitution uses -4(6) instead of -4(9), so the constant and final function are wrong.

Fix: Substitute the given x-coordinate consistently when finding the constant

5(b) 1/4

Substitution into the derivative gives the tangent gradient 3, earning the first mark. The normal gradient should be its negative reciprocal, and the line written is the tangent rather than the normal.

Fix: A normal's gradient is the negative reciprocal of the tangent gradient

Trainee Examiner · SAMPLE · AdmitPortfolio

Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 5 (continued) 4/9

5(a) 3/5

Integration and the correct antiderivative with a constant earn three marks. The substitution uses -4(6) instead of -4(9), so the constant and final function are wrong.

Fix: Substitute the given x-coordinate consistently when finding the constant

5(b) 1/4

Substitution into the derivative gives the tangent gradient 3, earning the first mark. The normal gradient should be its negative reciprocal, and the line written is the tangent rather than the normal.

Fix: A normal's gradient is the negative reciprocal of the tangent gradient

SAMPLE · AdmitPortfolio · Trainee Examiner

Question 5 continued

(Total for Question 5 is 9 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 5 (continued) 4/9

5(a) 3/5

Integration and the correct antiderivative with a constant earn three marks. The substitution uses -4(6) instead of -4(9), so the constant and final function are wrong.

Fix: Substitute the given x-coordinate consistently when finding the constant

5(b) 1/4

Substitution into the derivative gives the tangent gradient 3, earning the first mark. The normal gradient should be its negative reciprocal, and the line written is the tangent rather than the normal.

Fix: A normal's gradient is the negative reciprocal of the tangent gradient

Trainee Examiner · SAMPLE · AdmitPortfolio

6. (a) Given that k is a positive constant such that $0 < k < 4$ sketch, on **separate axes**, the graphs of

(i) $y = (2x - k)(x + 4)^2$

(ii) $y = \dfrac{k}{x^2}$

showing the coordinates of any points where the graphs cross or meet the coordinate axes, leaving coordinates in terms of k, where appropriate.

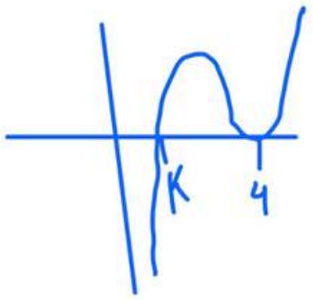
(5)

(b) State, with a reason, the number of roots of the equation

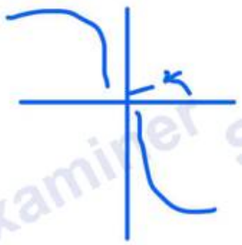
$$(2x - k)(x + 4)^2 = \frac{k}{x^2}$$

(1)

i)



ii)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

P 7 2 1 3 7 A 0 1 4 2 8

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 6 1/6

6(a)(i) 1/3

The sketch has a positive cubic shape with a local maximum and minimum, earning one mark. The required intercept positions and y-intercept are not correctly shown.
Fix: Use the roots and y-intercept to position the cubic sketch

6(a)(i) 0/2

The graph of $y=k/x^2$ has branches in quadrants I and II and does not cross either axis; the sketch shown is not the required shape.
Fix: Recognise the quadrant placement of $y=k/x^2$

6(b) 0/1

The mark requires both graphs in part (a) to have the correct shape and position; they do not.
Fix: Use the correct graph shapes before counting intersections

Question 6 continued

b)

No real roots as graphs do not intersect

(Total for Question 6 is 6 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 6 (continued) 1/6

6(a)(i) 1/3

The sketch has a positive cubic shape with a local maximum and minimum, earning one mark. The required intercept positions and y-intercept are not correctly shown.

Fix: Use the roots and y-intercept to position the cubic sketch

6(a)(i) 0/2

The graph of $y=k/x^2$ has branches in quadrants I and II and does not cross either axis; the sketch shown is not the required shape.

Fix: Recognise the quadrant placement of $y=k/x^2$

6(b) 0/1

The mark requires both graphs in part (a) to have the correct shape and position; they do not.

Fix: Use the correct graph shapes before counting intersections

Trainee Examiner · SAMPLE · AdmitPortfolio

7.

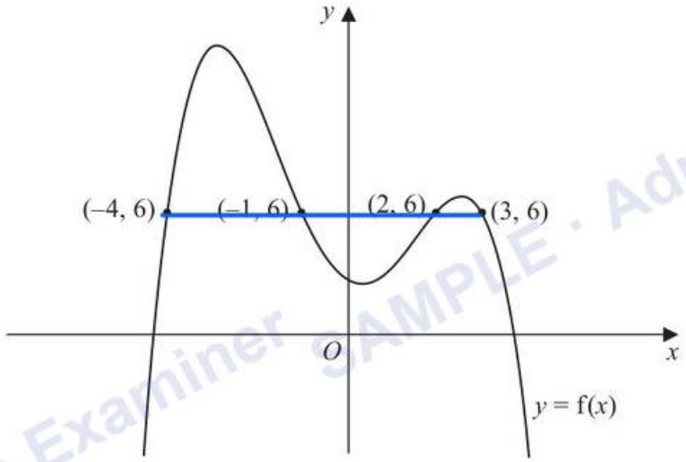


Figure 1

Figure 1 shows the curve with equation $y = f(x)$.

The points $P(-4, 6)$, $Q(-1, 6)$, $R(2, 6)$ and $S(3, 6)$ lie on the curve.

(a) Using Figure 1, find the range of values of x for which

$$f(x) < 6$$

(3)

(b) State the largest solution of the equation

$$f(2x) = 6$$

(1)

(c) (i) Sketch the curve with equation $y = f(-x)$.

On your sketch, state the coordinates of the points to which P, Q, R and S are transformed.

(ii) Hence find the set of values of x for which

$$f(-x) \geqslant 6 \text{ and } x < 0$$

(4)

a) below −4, between −1 and 2, above 3

b) 1·5 = k

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 7 5/8

7(a) 1/3

The inside interval between -1 and 2 is identified, earning the method mark. The answer does not state the required ranges as inequalities or interval notation.

Fix: Express solution ranges using x-inequalities or interval notation

7(b) 1/1

The largest solution is correctly given as 1.5.

7(c)(i) 3/3

The reflected sketch and all four transformed coordinates are correct.

7(c)(i) 0/1

The required set includes the endpoints, since the condition is f(-x)≥6; the written answer does not give inclusive inequalities.

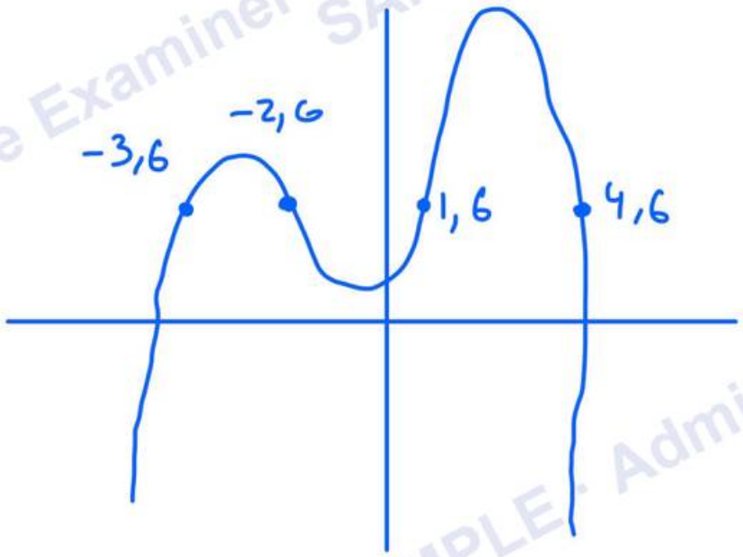
Fix: Include boundary values for a non-strict inequality

Trainee Examiner · SAMPLE · AdmitPortfolio

Question 7 continued

ii) between −3 and −2

()
1)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 7 (continued) 5/8

7(a) 1/3

The inside interval between -1 and 2 is identified, earning the method mark. The answer does not state the required ranges as inequalities or interval notation.

Fix: Express solution ranges using x-inequalities or interval notation

7(b) 1/1

The largest solution is correctly given as 1.5.

7(c)(i) 3/3

The reflected sketch and all four transformed coordinates are correct.

7(c)(i) 0/1

The required set includes the endpoints, since the condition is f(-x)≥6; the written answer does not give inclusive inequalities.

Fix: Include boundary values for a non-strict inequality

Trainee Examiner · SAMPLE · AdmitPortfolio

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

P 7 2 1 3 7 A 0 1 8 2 8

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 7 (continued) 5/8

7(a) 1/3

The inside interval between -1 and 2 is identified, earning the method mark. The answer does not state the required ranges as inequalities or interval notation.

Fix: Express solution ranges using x-inequalities or interval notation

7(b) 1/1

The largest solution is correctly given as 1.5.

7(c)(i) 3/3

The reflected sketch and all four transformed coordinates are correct.

7(c)(i) 0/1

The required set includes the endpoints, since the condition is f(-x)≥6; the written answer does not give inclusive inequalities.

Fix: Include boundary values for a non-strict inequality

SAMPLE · AdmitPortfolio · Trainee Examiner

Question 7 continued

(Total for Question 7 is 8 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 7 (continued) 5/8

7(a) 1/3

The inside interval between -1 and 2 is identified, earning the method mark. The answer does not state the required ranges as inequalities or interval notation.

Fix: Express solution ranges using x-inequalities or interval notation

7(b) 1/1

The largest solution is correctly given as 1.5.

7(c)(i) 3/3

The reflected sketch and all four transformed coordinates are correct.

7(c)(i) 0/1

The required set includes the endpoints, since the condition is f(-x)≥6; the written answer does not give inclusive inequalities.

Fix: Include boundary values for a non-strict inequality

Trainee Examiner · SAMPLE · AdmitPortfolio

8.

Diagram **NOT** to scale

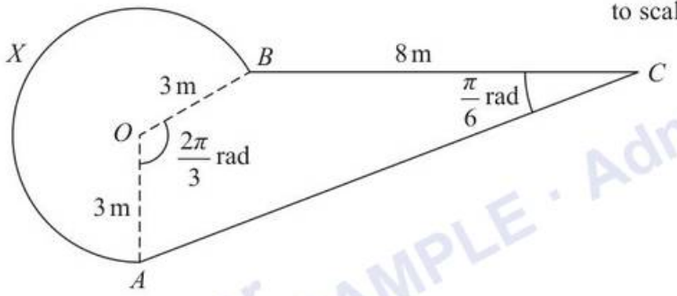


Figure 2

Figure 2 shows the plan view of a design for a pond.

The design consists of a sector $AOBX$ of a circle centre O joined to a quadrilateral $AOBC$.

- $BC = 8\,\text{m}$
- $OA = OB = 3\,\text{m}$
- angle AOB is $\frac{2\pi}{3}$ radians
- angle BCA is $\frac{\pi}{6}$ radians

(a) Calculate (i) the exact area of the sector $AOBX$,

(ii) the exact perimeter of the sector $AOBX$.

(5)

(b) Calculate the exact area of the triangle AOB.

(2)

(c) Show that the length AB is $3\sqrt{3}$ m.

(2)

(d) Find the total surface area of the pond. Give your answer in m^2 correct to 2 significant figures.

(5)

a) i) $2\pi - \frac{2\pi}{3} = \frac{4}{3}\pi$

$a = \frac{r^2\theta}{2} = \frac{3^2 \times \frac{4}{3}\pi}{2} = 6\pi\,\text{m}^2$

ii) $s = r\theta = 3 \times \frac{4}{3}\pi = 4\pi\,\text{m}$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 8 — 7/14

8(a)(i) 2/2

The sector angle and exact area are correct.

8(a)(i) 1/2

The correct arc length method and value earn the method mark. The perimeter also includes the two radii, giving $4\pi+6$.

Fix: Perimeter of a sector includes both radii

8(b) 2/2

The area method uses two sides and their included angle, and the exact area is correct.

8(c) 2/2

The cosine rule is correctly applied and gives the required length.

8(d) 0/5

The total omits the area of triangle ABC, so it does not use the required method for the pond's full surface area.

Fix: Add the areas of every component of the pond

Question 8 continued

b+c) $\frac{2\pi}{3} + 2x = \pi$

$x = \pi - \frac{2\pi}{3} \quad \times\frac{1}{2} = \frac{\pi}{6}$

$c^2 = 3^2 + 3^2 - 2(3)(3)\cos\frac{2\pi}{3}$

$c = 3\sqrt{3}$

$\frac{1}{2}ab\sin C$

$\frac{1}{2} 3\sqrt{3} \times 3 \sin\frac{\pi}{6} = \frac{9\sqrt{3}}{4} m^2$

d) $6\pi + \frac{9\sqrt{3}}{4} = 22.75 m^2$
$= 23 m^2$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 8 (continued) 7/14

8(a)(i) 2/2

The sector angle and exact area are correct.

8(a)(i) 1/2

The correct arc length method and value earn the method mark. The perimeter also includes the two radii, giving 4π+6.

Fix: Perimeter of a sector includes both radii

8(b) 2/2

The area method uses two sides and their included angle, and the exact area is correct.

8(c) 2/2

The cosine rule is correctly applied and gives the required length.

8(d) 0/5

The total omits the area of triangle ABC, so it does not use the required method for the pond's full surface area.

Fix: Add the areas of every component of the pond

Trainee Examiner SAMPLE · AdmitPortfolio

Question 8 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 8 (continued) 7/14

8(a)(i) 2/2

The sector angle and exact area are correct.

8(a)(i) 1/2

The correct arc length method and value earn the method mark. The perimeter also includes the two radii, giving $4\pi+6$.

Fix: Perimeter of a sector includes both radii

8(b) 2/2

The area method uses two sides and their included angle, and the exact area is correct.

8(c) 2/2

The cosine rule is correctly applied and gives the required length.

8(d) 0/5

The total omits the area of triangle ABC, so it does not use the required method for the pond's full surface area.

Fix: Add the areas of every component of the pond

Trainee Examiner · SAMPLE · AdmitPortfolio

Question 8 continued

(Total for Question 8 is 14 marks)

P 7 2 1 3 7 A 0 2 3 2 8

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 8 (continued) 7/14

8(a)(i) 2/2

The sector angle and exact area are correct.

8(a)(i) 1/2

The correct arc length method and value earn the method mark. The perimeter also includes the two radii, giving $4\pi+6$.

Fix: Perimeter of a sector includes both radii

8(b) 2/2

The area method uses two sides and their included angle, and the exact area is correct.

8(c) 2/2

The cosine rule is correctly applied and gives the required length.

8(d) 0/5

The total omits the area of triangle ABC, so it does not use the required method for the pond's full surface area.

Fix: Add the areas of every component of the pond

AdmitPortfolio · SAMPLE · Trainee Examiner

9.

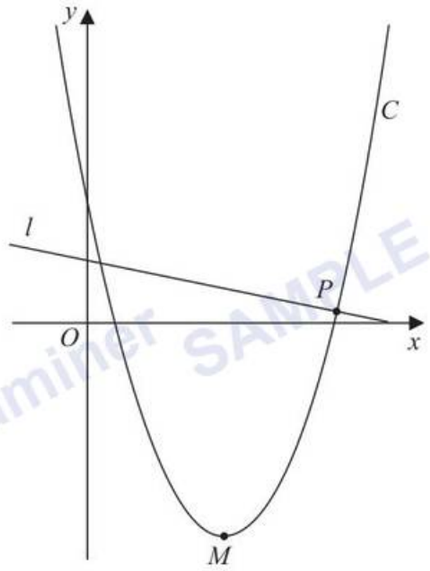


Figure 3

Figure 3 shows a sketch of the curve C with equation

$$y = \frac{1}{2}x^2 - 10x + 22$$

(a) Write $\frac{1}{2}x^2 - 10x + 22$ in the form

$$a(x + b)^2 + c$$

where a, b and c are constants to be found.

(3)

The point M is the minimum turning point of C, as shown in Figure 3.

(b) Deduce the coordinates of M

(2)

The line l is the normal to C at the point P, as shown in Figure 3.

Given that l has equation $y = k - \frac{1}{8}x$, where k is a constant,

(c) (i) find the coordinates of P

(ii) find the value of k

(6)

Question 9 continues on the next page

P 7 2 1 3 7 A 0 2 4 2 8

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 9 — 13/14

9(a) 3/3

The completed-square form and its constants are correct.

9(b) 2/2

Both values follow through from the student's completed-square constants, as allowed by the scheme.

9(c)(i) 4/4

The tangent gradient condition, coordinates of P and resulting y-coordinate are all correct.

9(c)(i) 2/2

The point is substituted correctly into the normal equation and k is found correctly.

9(d) 2/3

The inequalities placing the region above the curve and below the line are correct. The required x-bounds, $10 \leq x \leq 18$, are missing.

Fix: Include the vertical boundaries that bound the region

Question 9 continued

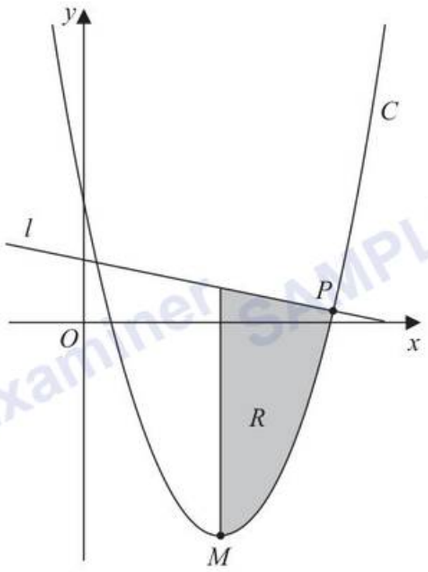


Figure 4

Figure 4 is a copy of Figure 3. The finite region R, shown shaded in Figure 4, is bounded by l, C and the line through M parallel to the y-axis.

(d) Identify the inequalities that define R.

(3)

a) $\frac{1}{2}(x-10)^2-28$ $\frac{1}{2}x^2-10x+22$

$\frac{1}{2}(x2-20x+100)-28$

$\frac{1}{2}x^2-10x+50-28$

$\frac{1}{2}x^2-10x+22$

b) $-10, -28$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 9 (continued) 13/14

9(a) 3/3

The completed-square form and its constants are correct.

9(b) 2/2

Both values follow through from the student's completed-square constants, as allowed by the scheme.

9(c)(i) 4/4

The tangent gradient condition, coordinates of P and resulting y-coordinate are all correct.

9(c)(i) 2/2

The point is substituted correctly into the normal equation and k is found correctly.

9(d) 2/3

The inequalities placing the region above the curve and below the line are correct. The required x-bounds, $10 \le x \le 18$, are missing.

Fix: Include the vertical boundaries that bound the region

Trainee Examiner SAMPLE · AdmitPortfolio

Question 9 continued

c)

i) $\frac{dy}{dx} = x - 10$

$x - 10 = 8$

$x = 18$

$y = \frac{1}{2}(18)^2 - 10(18) + 22 = 4$

P is 18, 4

ii) $4 = k - \frac{1}{8}(18)$

$k = \frac{25}{4}$

d) $y \geq \frac{1}{2}x^2 - 10x + 22$

$y \leq k - \frac{1}{8}x$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

P 7 2 1 3 7 A 0 2 6 2 8

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 9 (continued) 13/14

9(a) 3/3

The completed-square form and its constants are correct.

9(b) 2/2

Both values follow through from the student's completed-square constants, as allowed by the scheme.

9(c)(i) 4/4

The tangent gradient condition, coordinates of P and resulting y-coordinate are all correct.

9(c)(i) 2/2

The point is substituted correctly into the normal equation and k is found correctly.

9(d) 2/3

The inequalities placing the region above the curve and below the line are correct. The required x-bounds, $10 \leq x \leq 18$, are missing.

Fix: Include the vertical boundaries that bound the region

Trainee Examiner · SAMPLE · AdmitPortfolio

Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 9 (continued) 13/14

9(a) 3/3

The completed-square form and its constants are correct.

9(b) 2/2

Both values follow through from the student's completed-square constants, as allowed by the scheme.

9(c)(i) 4/4

The tangent gradient condition, coordinates of P and resulting y-coordinate are all correct.

9(c)(i) 2/2

The point is substituted correctly into the normal equation and k is found correctly.

9(d) 2/3

The inequalities placing the region above the curve and below the line are correct. The required x-bounds, $10 \leq x \leq 18$, are missing.

Fix: Include the vertical boundaries that bound the region

SAMPLE · AdmitPortfolio · Trainee Examiner

Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 9 is 14 marks)

TOTAL FOR PAPER IS 75 MARKS

P 7 2 1 3 7 A 0 2 8 2 8

Marked by: Trainee Examiner

Sample script · whole paper 45/75

Question 9 (continued) 13/14

9(a) 3/3

The completed-square form and its constants are correct.

9(b) 2/2

Both values follow through from the student's completed-square constants, as allowed by the scheme.

9(c)(i) 4/4

The tangent gradient condition, coordinates of P and resulting y-coordinate are all correct.

9(c)(i) 2/2

The point is substituted correctly into the normal equation and k is found correctly.

9(d) 2/3

The inequalities placing the region above the curve and below the line are correct. The required x-bounds, $10 \leq x \leq 18$, are missing.

Fix: Include the vertical boundaries that bound the region

Trainee Examiner · SAMPLE · AdmitPortfolio