

Pure Mathematics 1

www.CasperYC.club/wma11

Past Paper Collection

Last updated: January 21, 2025

Paper Name	Page	Paper Name	Page	Paper Name	Page
P1 2019 01	1	P1 2019 06	29	P1 2019 10	57
P1 2020 01	85			P1 2020 10	113
P1 2021 01	145	P1 2021 06	177	P1 2021 10	209
P1 2022 01	241	P1 2022 06	273	P1 2022 10	305
P1 2023 01	333	P1 2023 06	365	P1 2023 10	397
P1 2024 01	429	P1 2024 06	457	P1 2024 10	489



Please check the examination details below before entering your candidate information	
Candidate surname	Other names
Pearson Edexcel International Advanced Level	Centre Number Candidate Number
Tuesday 8 January 2019	
Morning (Time: 1 hour 30 minutes)	Paper Reference WMA11/01
Mathematics Advanced Subsidiary Pure Mathematics P1	
You must have: Mathematical Formulae and Statistical Tables (Lilac), calculator	Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. 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 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.



1. Find

$$\int \left(\frac{2}{3}x^3 - \frac{1}{2x^3} + 5 \right) dx$$

(4)

Q1

1

[illegible]

(Total 3 marks)

Q2

(a) Find the gradient of l_1 (2)

(b) Find the equation of l_2 in the form $y = mx + c$, where m and c are constants. (3)

Q3

(Total 5 marks)

4.

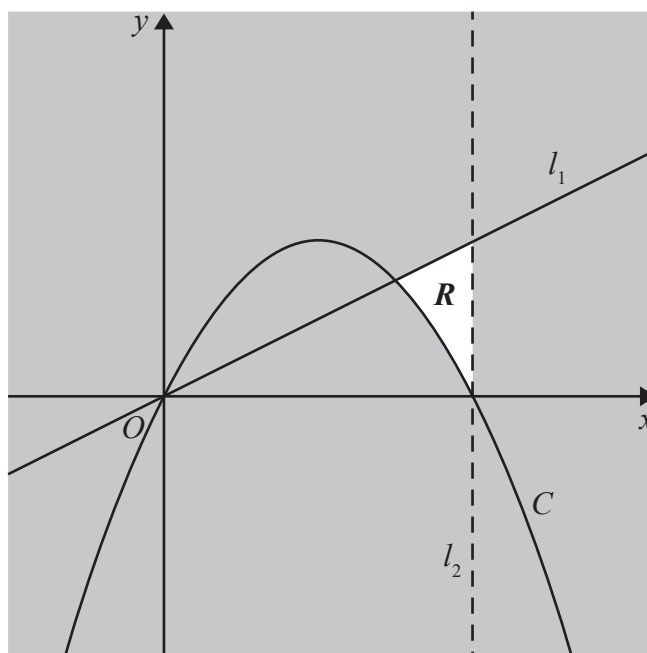
**Figure 1**

Figure 1 shows a line l_1 with equation $2y = x$ and a curve C with equation $y = 2x - \frac{1}{8}x^2$

The region R , shown unshaded in Figure 1, is bounded by the line l_1 , the curve C and a line l_2

Given that l_2 is parallel to the y -axis and passes through the intercept of C with the positive x -axis, identify the inequalities that define R .

(3)

Q4

(Total 3 marks)

5.

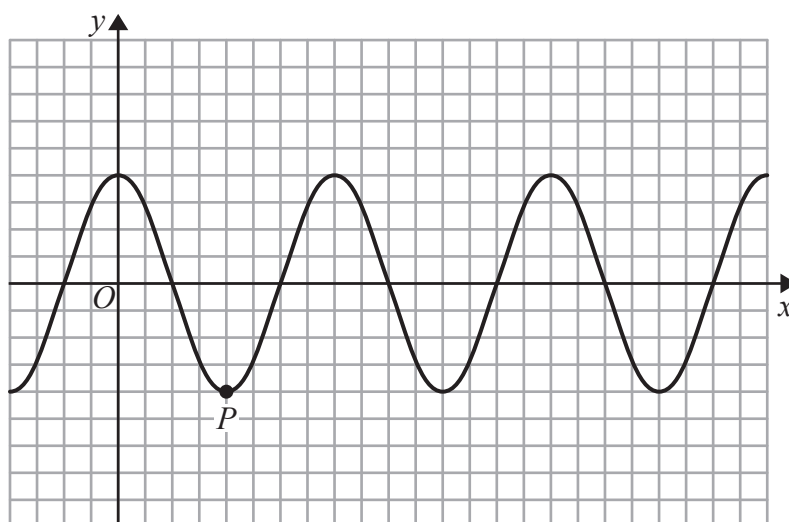


Figure 2

Figure 2 shows a plot of part of the curve with equation $y = \cos 2x$ with x being measured in radians.

The point P , shown on Figure 2, is a minimum point on the curve.

(a) State the coordinates of P .

(2)

A copy of Figure 2, called Diagram 1, is shown at the top of the next page.

(b) Sketch, on Diagram 1, the curve with equation $y = \sin x$

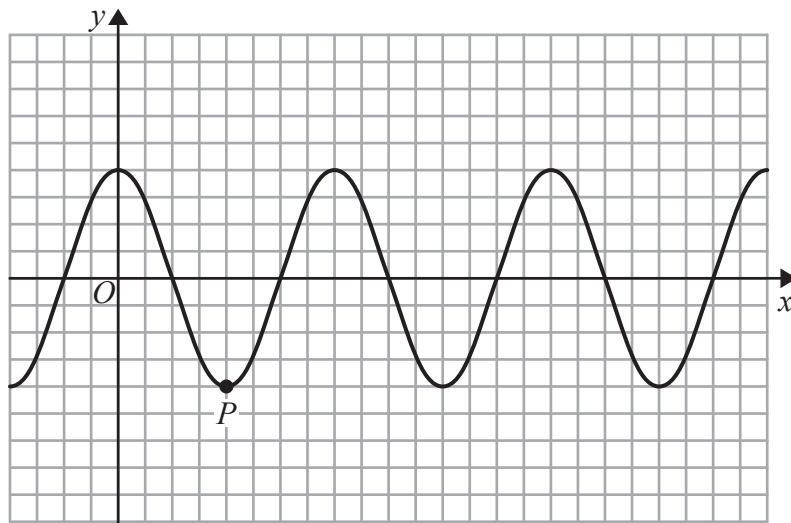
(2)

(c) Hence, or otherwise, deduce the number of solutions of the equation

(i) $\cos 2x = \sin x$ that lie in the region $0 \leq x \leq 20\pi$

(ii) $\cos 2x = \sin x$ that lie in the region $0 \leq x \leq 21\pi$

(2)

Question 5 continued**Diagram 1**

Q5

(Total 6 marks)

Given

(a) solve the equation $f'(x) = 0$

(4)

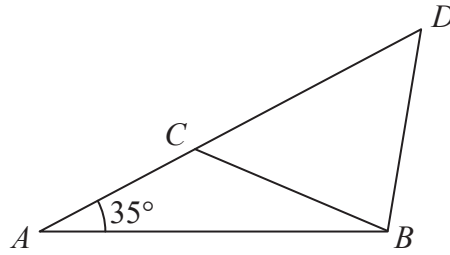
(b) solve the equation $f''(x) = 5$

(3)

Q6

0

Not to scale



- (a) find, to one decimal place, the size of angle ACB , (3)
- (b) find, to the nearest metre, the total length of wood required to make this structure. (3)

Q7

(Total 6 marks)

8.

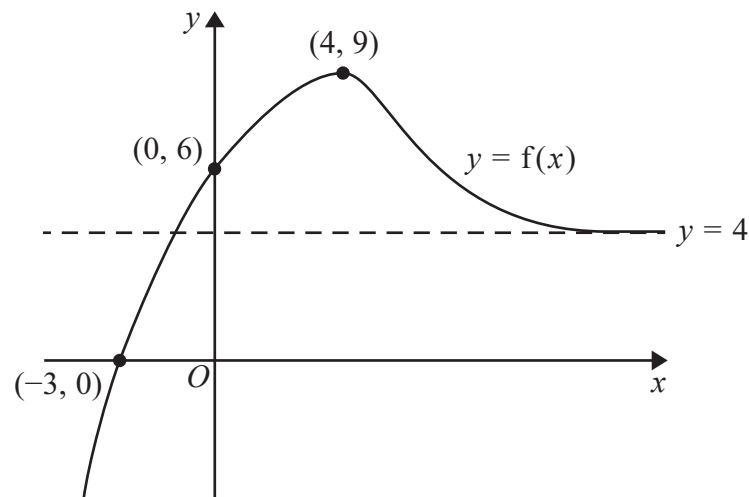


Figure 4

The curve C with equation $y = f(x)$ is shown in Figure 4.

The curve C

- has a single turning point, a maximum at $(4, 9)$
- crosses the coordinate axes at only two places, $(-3, 0)$ and $(0, 6)$
- has a single asymptote with equation $y = 4$

as shown in Figure 4.

(a) State the equation of the asymptote to the curve with equation $y = f(-x)$. (1)

(b) State the coordinates of the turning point on the curve with equation $y = f\left(\frac{1}{4}x\right)$. (1)

Given that the line with equation $y = k$, where k is a constant, intersects C at exactly one point,

(c) state the possible values for k . (2)

The curve C is transformed to a new curve that passes through the origin.

(d) (i) Given that the new curve has equation $y = f(x) - a$, state the value of the constant a .

(ii) Write down an equation for another single transformation of C that also passes through the origin. (2)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q8

$$\frac{3}{x} + 5 = -2x + c$$

Find the range of possible values of c .

(7)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q9

(Total 7 marks)

Q10

(i) $y = x(3 - x)$

showing clearly the coordinates of the points where the curves cross the coordinate axes.

(4)

$$y = x(3 - x) \text{ and } y = x(x - 2)(5 - x)$$

(3)

(c) find, using algebra and showing your working, the exact coordinates of P .

(5)

[illegible]

Question 11 continued

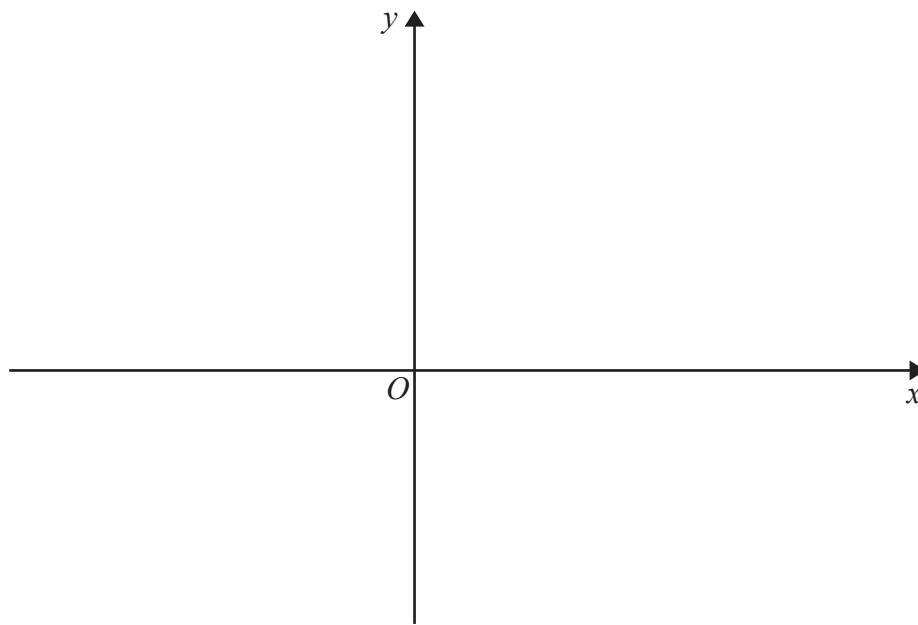


Diagram 1

Q11

www.CasperYC.club/ial

Given that

$$\frac{dy}{dx} = 3x\sqrt{x} - 10x^{-\frac{1}{2}}$$

- (4)

- (5)

Q12

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information	
Candidate surname	Other names
Pearson Edexcel International Advanced Level	Centre Number Candidate Number
Wednesday 22 May 2019	
Morning (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 (Lilac), 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

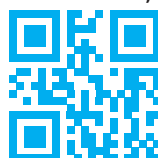
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly 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 10 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.



1. The curve C has equation $y = \frac{1}{8}x^3 - \frac{24}{\sqrt{x}} + 1$

(3)

(3)

(Total 6 marks)

Q1

(a) Simplify $\frac{1}{4 - 2\sqrt{2}}$

(2)

$$4x = 2\sqrt{2}x + 20\sqrt{2}$$

(3)

Q2

www.CasperYC.club/ial

3.

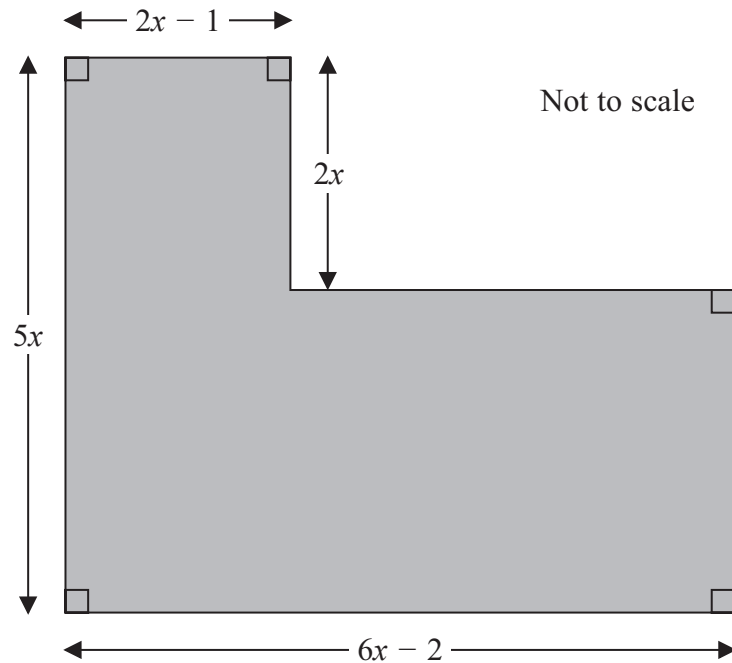
**Figure 1**

Figure 1 shows the plan of a garden. The marked angles are right angles.

The six edges are straight lines.

The lengths shown in the diagram are given in metres.

Given that the perimeter of the garden is greater than 29 m,

(a) show that $x > 1.5$ m

(3)

Given also that the area of the garden is less than 72 m^2 ,

(b) form and solve a quadratic inequality in x .

(5)

(c) Hence state the range of possible values of x .

(1)

Leave
blank

Question 3 continued

Q3

(5)

Q4

$$2x^3 + 3x^2 - 35x = 0$$
$$2(y-5)^6 + 3(y-5)^4 - 35(y-5)^2 = 0$$

Q5

(Total 7 marks)

- (3)

Leave
blank

Question 6 continued

Q6

(Total 7 marks)

Not to scale



(c) Hence find the perimeter of shape $ABCD$, giving your answer to one decimal place. **(4)**

Leave
blank

Question 7 continued

Leave
blank

Question 7 continued

Q7

www.CasperYC.club/ial

- (5)

Leave
blank

Question 8 continued

Q8

9.

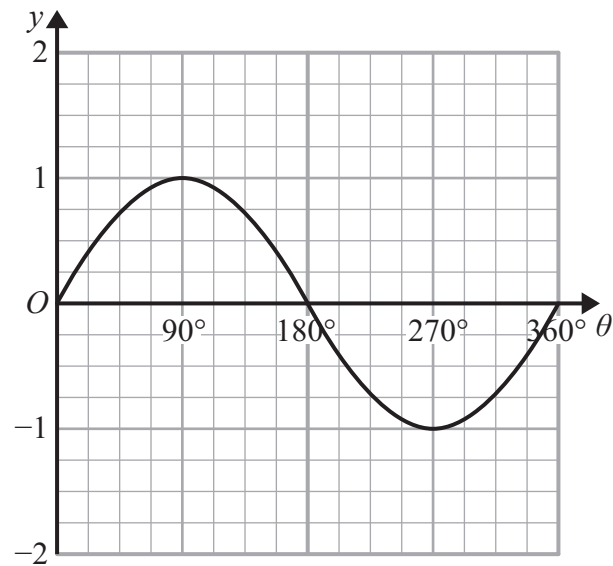
**Figure 3**

Figure 3 shows a plot of the curve with equation $y = \sin \theta$, $0 \leq \theta \leq 360^\circ$

(a) State the coordinates of the minimum point on the curve with equation

$$y = 4 \sin \theta, \quad 0 \leq \theta \leq 360^\circ$$

(2)

A copy of Figure 3, called Diagram 1, is shown on the next page.

(b) On Diagram 1, sketch and label the curves

(i) $y = 1 + \sin \theta$, $0 \leq \theta \leq 360^\circ$

(ii) $y = \tan \theta$, $0 \leq \theta \leq 360^\circ$

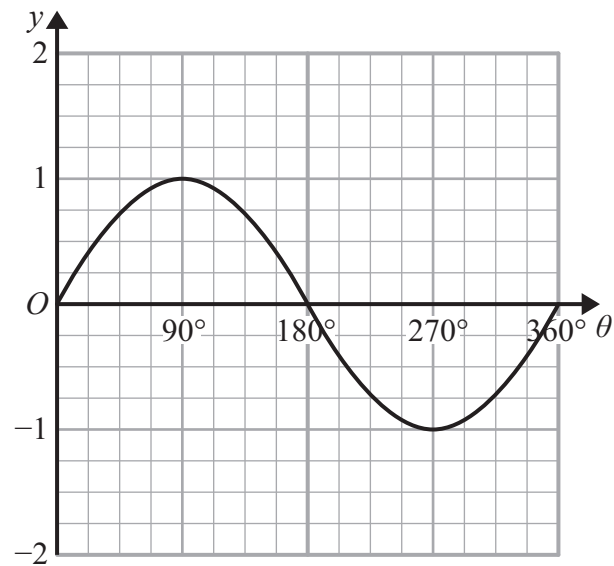
(2)

(c) Hence find the number of solutions of the equation

(i) $\tan \theta = 1 + \sin \theta$ that lie in the region $0 \leq \theta \leq 2160^\circ$

(ii) $\tan \theta = 1 + \sin \theta$ that lie in the region $0 \leq \theta \leq 1980^\circ$

(3)

Question 9 continued**Diagram 1****(Total 7 marks)****Q9**

$$f(x) = (x - 4)(2x + 1)^2$$

The curve touches the x -axis at the point P and crosses the x -axis at the point Q .

(a) State the coordinates of the point P . (1)

(b) Find $f'(x)$.

(4)

(c) Hence show that the equation of the tangent to the curve at the point where $x = \frac{5}{2}$ can be expressed in the form $y = k$, where k is a constant to be found. **(3)**

The curve with equation $y = f(x + a)$, where a is a constant, passes through the origin O .

(d) State the possible values of a . (2)

Leave
blank

Question 10 continued

Q10

END

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information			
Candidate surname	Other names		
Pearson Edexcel International Advanced Level	Centre Number	Candidate Number	
Wednesday 9 October 2019			
Morning (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 (Lilac), 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 11 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.



Q1

(Total 5 marks)

- (1)

Q2

0

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

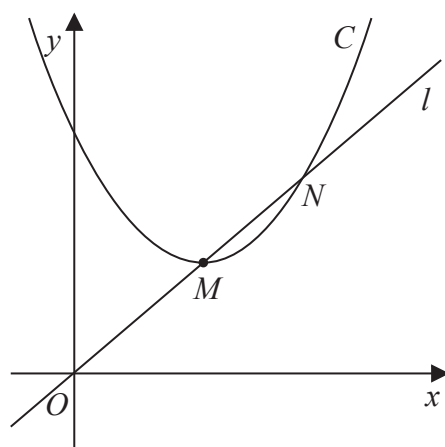


Figure 2

Figure 2 shows a sketch of the curve C with equation $y = x^2 - 5x + 13$

The point M is the minimum point of C .

The straight line l passes through the origin O and intersects C at the points M and N as shown.

Find, showing your working,

- (a) the coordinates of M , (3)

- (b) the coordinates of N . (5)

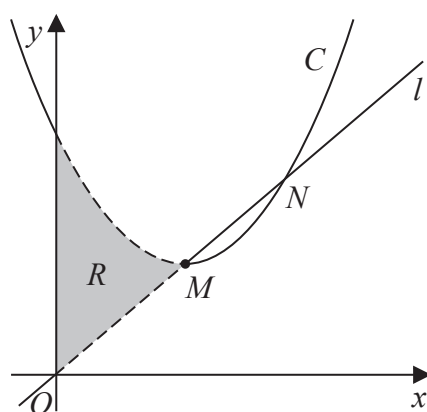


Figure 3

Figure 3 shows the curve C and the line l . The finite region R , shown shaded in Figure 3, is bounded by C , l and the y -axis.

- (c) Use inequalities to define the region R . (2)

Leave
blank

Question 3 continued

Q3

www.CasperYC.club/ial

- (2)

Q4

$$y = \frac{x^3}{6} + 4\sqrt{x} - 15 \quad x \geq 0$$

(3)

(4)

Leave
blank

Question 5 continued

Q5

(Total 7 marks)

- (b) Find the possible values for k . (5)

Q6

0

A Cartesian coordinate system with a horizontal x-axis and a vertical y-axis. The origin is labeled O . A parabola opens upwards with its vertex on the y-axis. A point $P(2, 13)$ is marked on the right branch of the parabola.

(1)

Q7

www.CasperYC.club/ial

$$x - 6x^{\frac{1}{2}} + 4 = 0$$

(5)

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank**Question 8 continued**

Q8

(Total 5 marks)

A graph of a function $y = f(x)$ is shown on a Cartesian coordinate system. The curve starts at the origin O , passes through a point (α, k) , and has a local minimum at point M . The x-axis is labeled x and the y-axis is labeled y . Dashed lines indicate the coordinates α and k for the point (α, k) .

Figure 5 shows a sketch of part of the curve C with equation $y = \sin\left(\frac{x}{12}\right)$, where x is measured in radians. The point M shown in Figure 5 is a minimum point on C .

- (c) (i) the negative solution of the equation $\sin\left(\frac{x}{12}\right) = k$ that is closest to zero,
(ii) the smallest positive solution of the equation $\cos\left(\frac{x}{12}\right) = k$.
- (2)**

Leave
blank**Question 9 continued**

Q9

(Total 4 marks)

10.

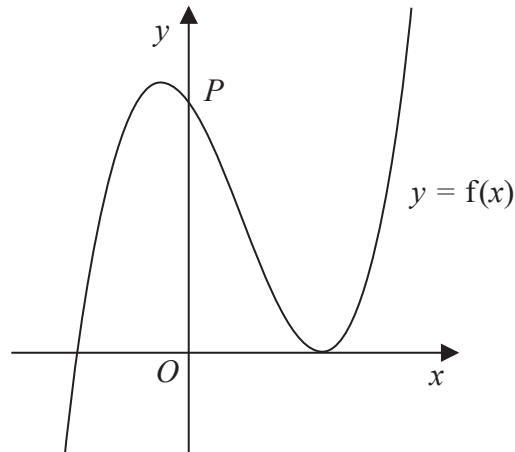


Figure 6

Figure 6 shows a sketch of part of the curve with equation $y = f(x)$, where

$$f(x) = (2x + 5)(x - 3)^2$$

- (a) Deduce the values of x for which $f(x) \leq 0$

(2)

The curve crosses the y -axis at the point P , as shown.

- (b) Expand $f(x)$ to the form

$$ax^3 + bx^2 + cx + d$$

where a , b , c and d are integers to be found.

(3)

- (c) Hence, or otherwise, find

- (i) the coordinates of P ,
(ii) the gradient of the curve at P .

(2)

The curve with equation $y = f(x)$ is translated two units in the positive x direction to a curve with equation $y = g(x)$.

- (d) (i) Find $g(x)$, giving your answer in a simplified factorised form.

- (ii) Hence state the y intercept of the curve with equation $y = g(x)$.

(3)

Leave
blank

Question 10 continued

Leave
blank

Question 10 continued

Q10

www.CasperYC.club/ial

The point $P\left(4, \frac{32}{3}\right)$ lies on the curve.

- $f''(x) = \frac{4}{\sqrt{x}} - 3$
- $f'(x) = 5$ at P

(a) the equation of the tangent to the curve at P , writing your answer in the form $y = mx + c$, where m and c are constants to be found,

(2)

(8)

Leave
blank

Question 11 continued

Q11

END

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information	
Candidate surname	Other names
Pearson Edexcel International Advanced Level	Centre Number Candidate Number
Wednesday 8 January 2020	
Morning (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 (Lilac), 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

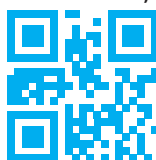
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly 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 11 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.



$$\int \left(\frac{8x^3}{3} - \frac{1}{2\sqrt{x}} - 5 \right) dx$$

Q1

$$(c) \quad \frac{81}{9^{2-3x}} \tag{2}$$

Q2

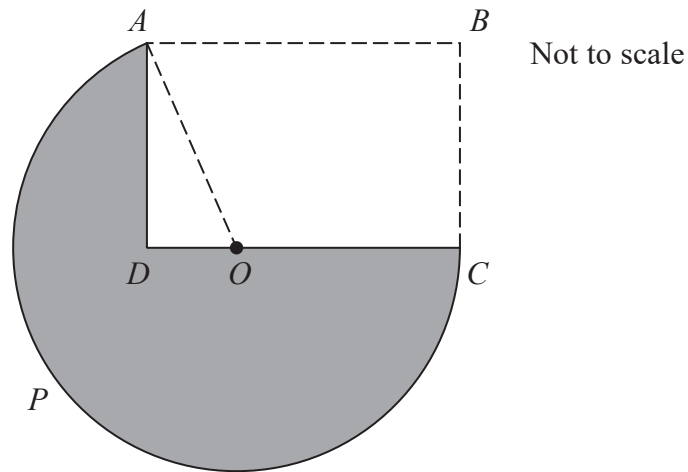
(Total 5 marks)

(1)

Q3

(Total 6 marks)

4.



Leave
blank

Question 4 continued

[illegible]

Leave
blank

Question 4 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q4

(3)

(4)

(Total 7 marks)

Q5

- (2)

Leave
blank

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q6

(Total 8 marks)

Q7

(Total 5 marks)

- Find the set of values of k for which l does not cross or touch C .

(6)

Q8

0

Q9

10. The curve C_1 has equation $y = f(x)$, where

$$f(x) = (4x - 3)(x - 5)^2$$

- (a) Sketch C_1 showing the coordinates of any point where the curve touches or crosses the coordinate axes.

(3)

- (b) Hence or otherwise

(i) find the values of x for which $f\left(\frac{1}{4}x\right) = 0$

- (ii) find the value of the constant p such that the curve with equation $y = f(x) + p$ passes through the origin.

(2)

A second curve C_2 has equation $y = g(x)$, where $g(x) = f(x + 1)$

- (c) (i) Find, in simplest form, $g(x)$. You may leave your answer in a factorised form.

- (ii) Hence, or otherwise, find the y intercept of curve C_2

(3)

Q10

$$f''(x) = \frac{6}{\sqrt{x^3}} + x \quad x > 0$$

(3)

(8)

[illegible]

Q11

END

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information	
Candidate surname	Other names
Pearson Edexcel International Advanced Level	Centre Number Candidate Number
Monday 19 October 2020	
Morning (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 (Lilac), 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.



This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 3 marks)

Q1

$$f(x) = 3 + 12x - 2x^2$$

(a) Express $f(x)$ in the form

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

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

(3)

The curve with equation $y = f(x) - 7$ crosses the x -axis at the points P and Q and crosses the y -axis at the point R .

(b) Find the area of the triangle PQR , giving your answer in the form $m\sqrt{n}$ where m and n are integers to be found.

(4)

Leave
blank

Question 2 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 7 marks)

Q2

3.

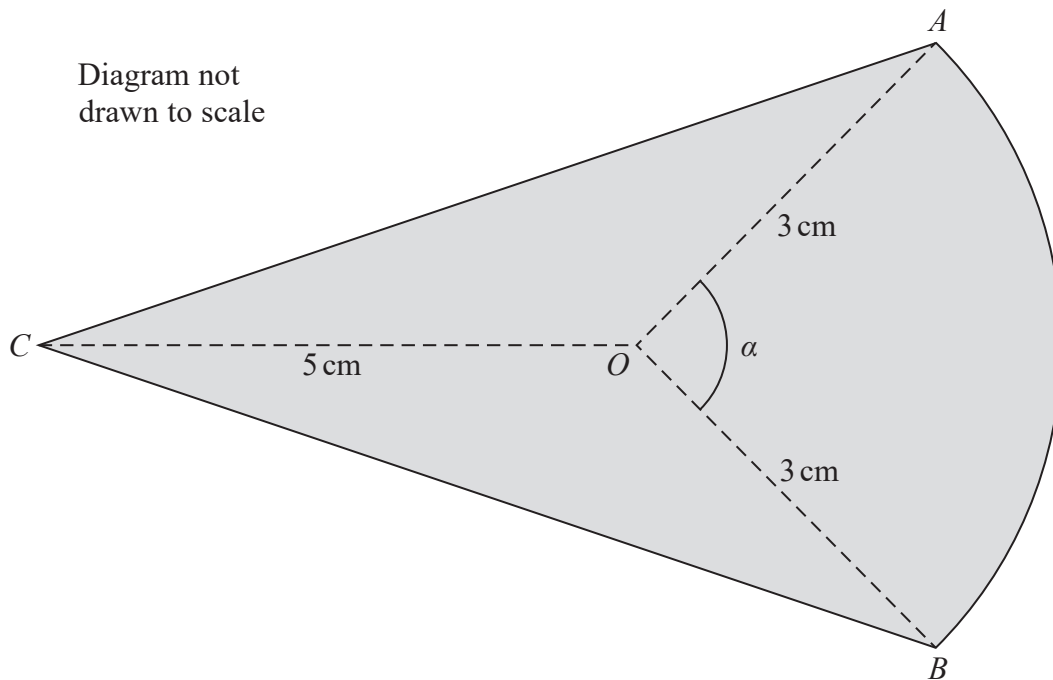
Diagram not
drawn to scale

Figure 1

Figure 1 shows the design for a badge.

The design consists of two congruent triangles, AOC and BOC , joined to a sector AOB of a circle centre O .

- Angle $AOB = \alpha$
- $AO = OB = 3 \text{ cm}$
- $OC = 5 \text{ cm}$

Given that the area of sector AOB is 7.2 cm^2

(a) show that $\alpha = 1.6$ radians.

(2)

(b) Hence find

- the area of the badge, giving your answer in cm^2 to 2 significant figures,
- the perimeter of the badge, giving your answer in cm to one decimal place.

(8)

Leave
blank

Question 3 continued

Q3

(Total 10 marks)

(7)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 7 marks)

Q4

5. (i)

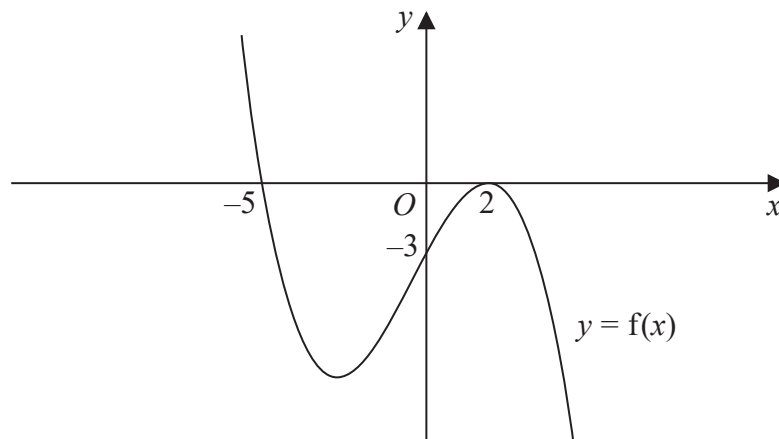
**Figure 2**

Figure 2 shows a sketch of the curve with equation $y = f(x)$.

The curve passes through the points $(-5, 0)$ and $(0, -3)$ and touches the x -axis at the point $(2, 0)$.

On separate diagrams sketch the curve with equation

(a) $y = f(x + 2)$

(b) $y = f(-x)$

On each diagram, show clearly the coordinates of all the points where the curve cuts or touches the coordinate axes.

(6)

(ii)

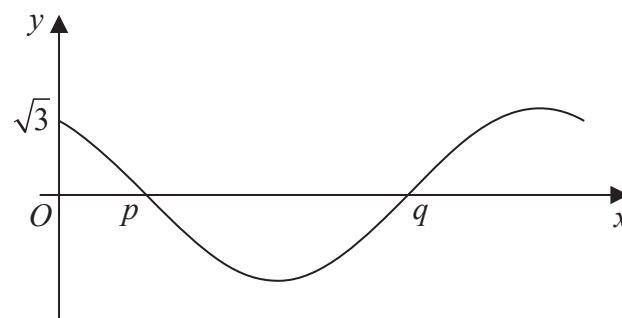
**Figure 3**

Figure 3 shows a sketch of the curve with equation

$$y = k \cos\left(x + \frac{\pi}{6}\right) \quad 0 \leq x \leq 2\pi$$

where k is a constant.

The curve meets the y -axis at the point $(0, \sqrt{3})$ and passes through the points $(p, 0)$ and $(q, 0)$.

Find

(a) the value of k ,

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

(3)

Question 5 continued

Question 5 continued

Q5

(Total 9 marks)

- (c) Find the two possible pairs of coordinates of point C . (5)

Q6

(Total 11 marks)

7. The curve C has equation

$$y = \frac{1}{2 - x}$$

- (a) Sketch the graph of C . On your sketch you should show the coordinates of any points of intersection with the coordinate axes and state clearly the equations of any asymptotes.

(3)

The line l has equation $y = 4x + k$, where k is a constant.

Given that l meets C at two distinct points,

- (b) show that

$$k^2 + 16k + 48 > 0$$

(4)

- (c) Hence find the range of possible values for k .

(4)

Leave
blank

Question 7 continued

Q7

(Total 11 marks)

$$y = (x - 2)(x - 4)^2$$
$$\frac{dy}{dx} = 3x^2 - 20x + 32$$

(b) Find the equation of l_1 , giving your answer in the form $y = mx + c$, where m and c are constants to be found.

(c) find the value of α

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 8 continued

Q8

(Total 11 marks)

Given that

$$f'(x) = 27x^2 - \frac{21x^3 - 5x}{2\sqrt{x}} \quad x > 0$$

find $f(x)$, fully simplifying each term.

(6)

Q9

(Total 6 marks)

TOTAL FOR PAPER IS 75 MARKS

END

Please check the examination details below before entering your candidate information			
Candidate surname		Other names	
Pearson Edexcel International Advanced Level		Centre Number 	Candidate Number
Monday 11 January 2021			
Morning (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 (Lilac), 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.



$$y = 2x^3 - 5x^2 - \frac{3}{2x} + 7 \quad x > 0$$

The point P lies on the curve and has x coordinate $\frac{1}{2}$

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q1

Leave
blank

Question 2 continued

Q2

(Total 6 marks)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 5 marks)

Q3

(c) Use inequalities to define region R . (2)

Leave
blank

Question 4 continued

[illegible]

Q4

Not to scale

Figure 3 shows the plan view of a viewing platform at a tourist site.

Given that

- find

- (a) the size of angle AOD , in radians, to 3 decimal places, (3)
- (b) the length of arc ABC , in metres, to one decimal place, (2)
- (c) the total area of the viewing platform, in m^2 , to one decimal place. (4)

Leave
blank

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave blank

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 9 marks)

Q5

6. (a) Sketch the curve with equation

$$y = -\frac{k}{x} \quad k > 0 \quad x \neq 0 \quad (2)$$

- (b) On a separate diagram, sketch the curve with equation

$$y = -\frac{k}{x} + k \quad k > 0 \quad x \neq 0$$

stating the coordinates of the point of intersection with the x -axis and, in terms of k , the equation of the horizontal asymptote.

(3)

- (c) Find the range of possible values of k for which the curve with equation

$$y = -\frac{k}{x} + k \quad k > 0 \quad x \neq 0$$

does not touch or intersect the line with equation $y = 3x + 4$

(5)

Leave
blank

Question 6 continued

Q6

(Total 10 marks)

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

$$f''(x) = 6 \tag{5}$$

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 7 continued

Leave
blank

Question 7 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q7

8.

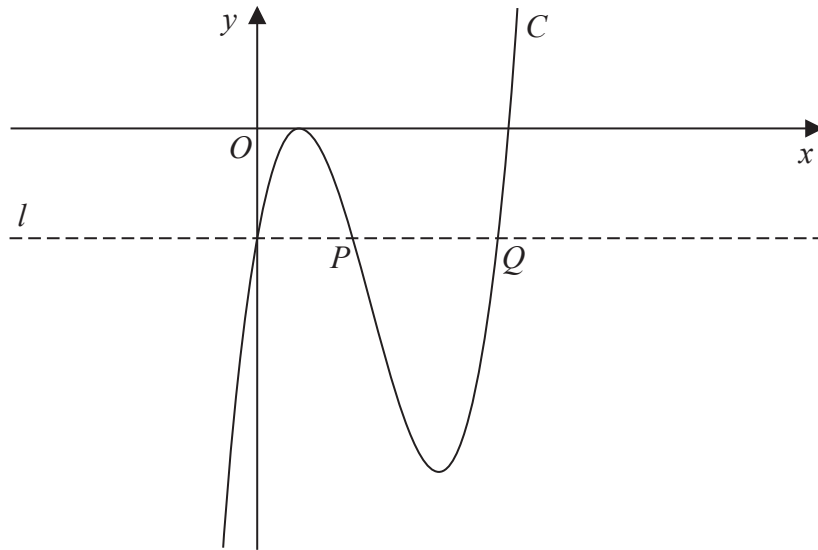
**Figure 4**

Figure 4 shows a sketch of part of the curve C with equation $y = f(x)$, where

$$f(x) = (3x - 2)^2 (x - 4)$$

- (a) Deduce the values of x for which $f(x) > 0$ (1)

- (b) Expand $f(x)$ to the form

$$ax^3 + bx^2 + cx + d$$

where a , b , c and d are integers to be found.

(3)

The line l , also shown in Figure 4, passes through the y intercept of C and is parallel to the x -axis.

The line l cuts C again at points P and Q , also shown in Figure 4.

- (c) Using algebra and showing your working, find the length of line PQ . Write your answer in the form $k\sqrt{3}$, where k is a constant to be found.

(Solutions relying entirely on calculator technology are not acceptable.)

(5)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q8

Leave
blank

Question 9 continued

[illegible]

Q9

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Pearson Edexcel		Centre Number	Candidate Number
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.
- Good luck with your examination



$$y = \frac{x^2}{3} + \frac{4}{\sqrt{x}} + \frac{8}{3x} - 5 \quad x > 0$$

(4)

(4)

Q1

(Total 8 marks)

Leave
blank

Question 2 continued

Leave
blank

Question 2 continued

Leave
blank

Question 2 continued

(Total 10 marks)

Q2

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

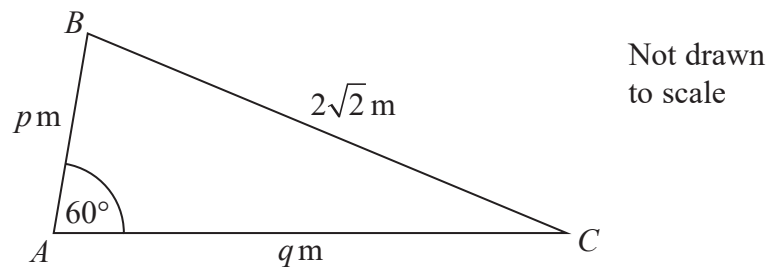


Figure 1

Figure 1 shows the plan view of a flower bed.
The flowerbed is in the shape of a triangle ABC with

- $AB = p$ metres
- $AC = q$ metres
- $BC = 2\sqrt{2}$ metres
- angle $BAC = 60^\circ$

- (a) Show that

$$p^2 + q^2 - pq = 8 \quad (2)$$

Given that side AC is 2 metres longer than side AB , use algebra to find

- (b) (i) the exact value of p ,
(ii) the exact value of q . (5)

Using the answers to part (b),

- (c) calculate the exact area of the flower bed. (2)

Leave
blank

Question 3 continued

Leave
blank

Question 3 continued

Q3

(Total 9 marks)

Leave
blank

Question 4 continued

(Total 6 marks)

Q4

5.

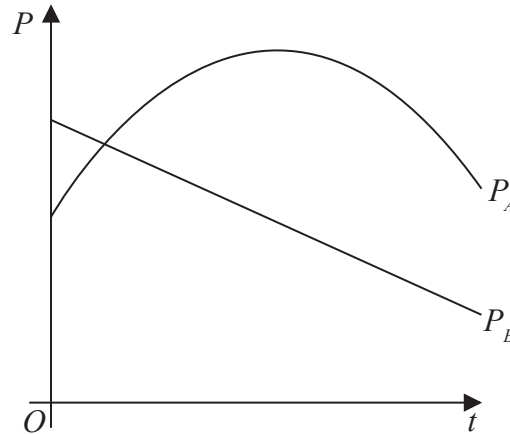


Figure 2

The share value of two companies, company *A* and company *B*, has been monitored over a 15-year period.

The share value P_A of **company A**, in millions of pounds, is modelled by the equation

$$P_A = 53 - 0.4(t - 8)^2 \quad t \geq 0$$

where t is the number of years after monitoring began.

The share value P_B of **company B**, in millions of pounds, is modelled by the equation

$$P_B = -1.6t + 44.2 \quad t \geq 0$$

where t is the number of years after monitoring began.

Figure 2 shows a graph of both models.

Use the equations of one or both models to answer parts (a) to (d).

- (a) Find the difference between the share value of **company A** and the share value of **company B** at the point monitoring began.

(2)

- (b) State the maximum share value of **company A** during the 15-year period.

(1)

- (c) Find, using algebra and showing your working, the times during this 15-year period when the share value of **company A** was greater than the share value of **company B**.

(4)

- (d) Explain why the model for **company A** should not be used to predict its share value when $t = 20$

(1)

Leave
blank

Question 5 continued

Leave
blank

Question 5 continued

Leave
blank

Question 5 continued

Q5

(Total 8 marks)

Given that

- $f'(x) = \frac{32}{3x^2} + 3 - 2(\sqrt[3]{x})$

(3)

(5)

Leave
blank

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 8 marks)

Q6

7.

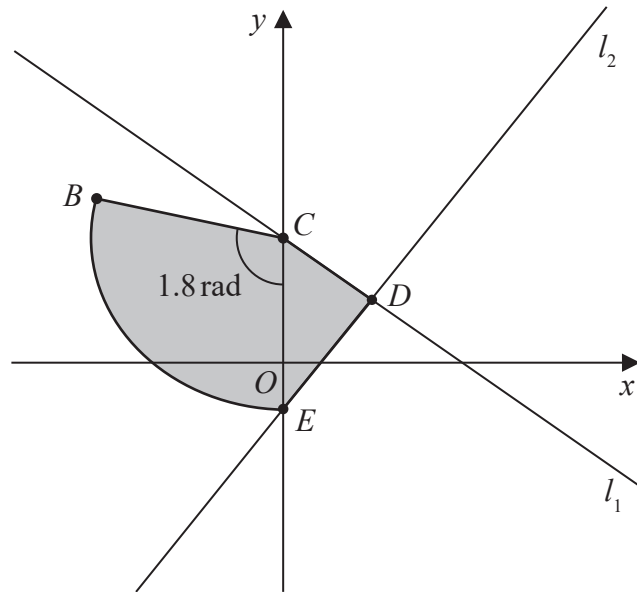


Figure 3

The line l_1 has equation $4y + 3x = 48$

The line l_1 cuts the y -axis at the point C , as shown in Figure 3.

(a) State the y coordinate of C .

(1)

The point $D(8, 6)$ lies on l_1

The line l_2 passes through D and is perpendicular to l_1

The line l_2 cuts the y -axis at the point E as shown in Figure 3.

(b) Show that the y coordinate of E is $-\frac{14}{3}$

(3)

A sector BCE of a circle with centre C is also shown in Figure 3.

Given that angle BCE is 1.8 radians,

(c) find the length of arc BE .

(3)

The region $CBED$, shown shaded in Figure 3, consists of the sector BCE joined to the triangle CDE .

(d) Calculate the exact area of the region $CBED$.

(3)

Q7

(Total 10 marks)

$$y = 3x^2 + 6x + 9$$
$$a(x + b)^2 + c$$

(3)

(1)

$$y = Ax^3 + Bx^2 + Cx + D$$

- passes through P
- intersects the x -axis at $-4, -2$ and 3

(5)

Leave
blank

Question 8 continued

Leave
blank

Question 8 continued

Q8

(Total 9 marks)

9.

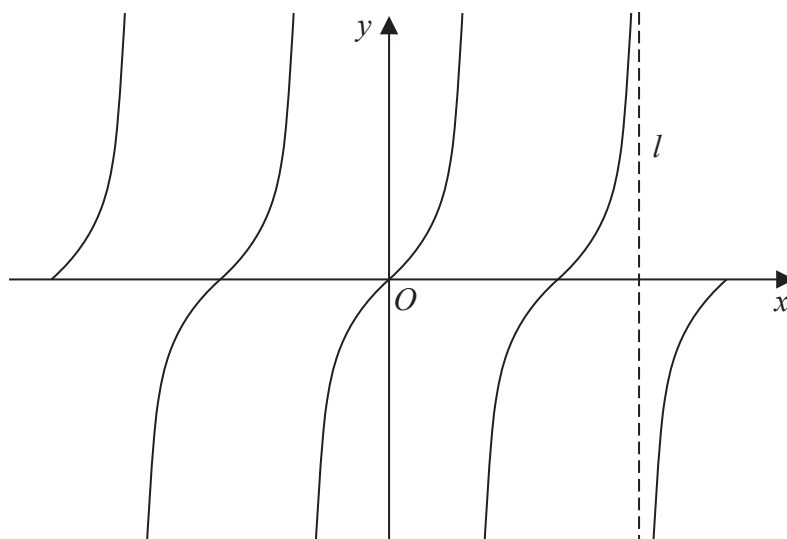


Figure 4

Figure 4 shows a sketch of the curve with equation

$$y = \tan x \quad -2\pi \leq x \leq 2\pi$$

The line l , shown in Figure 4, is an asymptote to $y = \tan x$

(a) State an equation for l .

(1)

A copy of Figure 4, labelled Diagram 1, is shown on the next page.

(b) (i) On Diagram 1, sketch the curve with equation

$$y = \frac{1}{x} + 1 \quad -2\pi \leq x \leq 2\pi$$

stating the equation of the horizontal asymptote of this curve.

(ii) Hence, **giving a reason**, state the number of solutions of the equation

$$\tan x = \frac{1}{x} + 1$$

in the region $-2\pi \leq x \leq 2\pi$

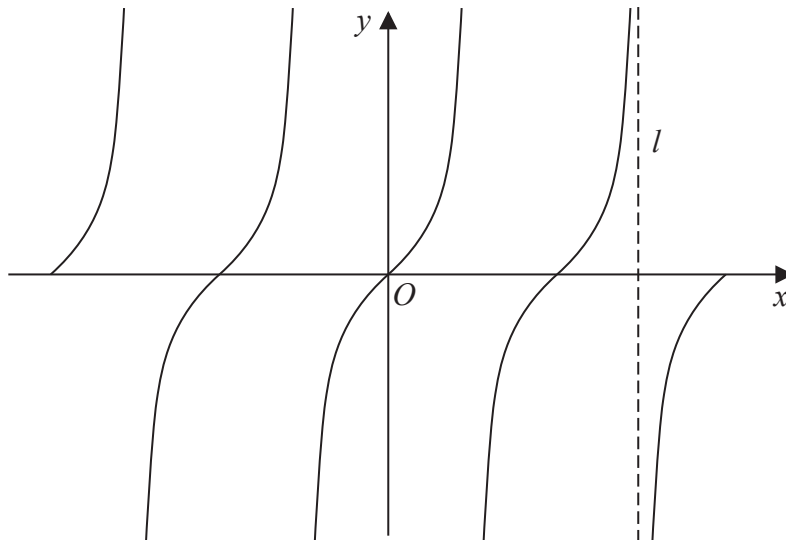
(4)

(c) State the number of solutions of the equation $\tan x = \frac{1}{x} + 1$ in the region

(i) $0 \leq x \leq 40\pi$

(ii) $-10\pi \leq x \leq \frac{5}{2}\pi$

(2)

Question 9 continued**Diagram 1**

[illegible]

(Total 7 marks)

TOTAL FOR PAPER IS 75 MARKS

END

Q9

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

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 10 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.



Q1

Solutions relying on calculator technology are not acceptable.

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

Find the x coordinates of P and Q .

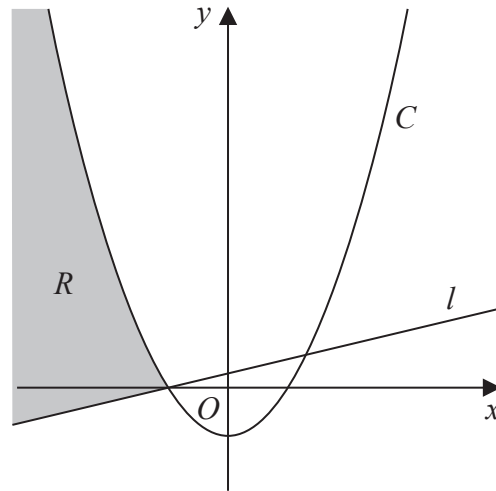
(5)

Q2

(Total 5 marks)

$$\frac{3}{x} > 4$$

(ii)



(3)

Q3

(Total 6 marks)

Figure 2 shows a sketch of the curve with equation $y = f(x)$, where

The point Q and the point $R(k, 0)$ lie on the curve and are shown in Figure 2.

(i) the coordinates of Q ,

(3)

$$\cos 2x^0 = p \quad \text{in the region } 0 \leq x \leq k$$

(2)

[illegible]

Q4

(Total 5 marks)

- (3)

Leave
blank

Question 5 continued

[illegible]

Q5

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

Solutions relying on calculator technology are not acceptable.

A curve C has equation $y = f(x)$ where

$$f(x) = 2(x + 1)(x - 3)^2$$

(a) Sketch a graph of C .

Show on your graph the coordinates of the points where C cuts or meets the coordinate axes.

(3)

(b) Write $f(x)$ in the form $ax^3 + bx^2 + cx + d$, where a , b , c and d are constants to be found.

(3)

(c) Hence, find the equation of the tangent to C at the point where $x = \frac{1}{3}$

(4)

Leave
blank

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q6

7.

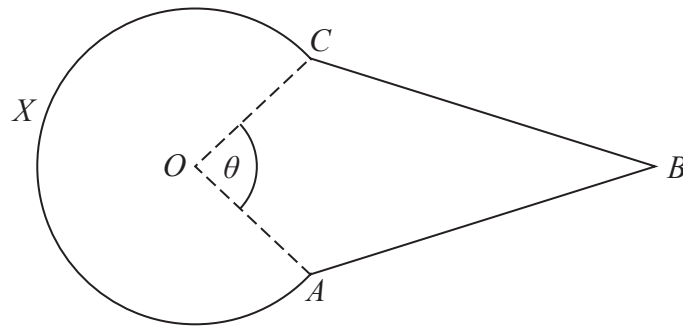


Figure 3

Figure 3 shows the design for a sign at a bird sanctuary.

The design consists of a kite $OABC$ joined to a sector $OCXA$ of a circle centre O .

In the design

- $OA = OC = 0.6\text{ m}$
- $AB = CB = 1.4\text{ m}$
- Angle $OAB = \text{Angle } OCB = 2 \text{ radians}$
- Angle $AOC = \theta \text{ radians}$, as shown in Figure 3

Making your method clear,

- (a) show that $\theta = 1.64$ radians to 3 significant figures, (4)
- (b) find the perimeter of the sign, in metres to 2 significant figures, (2)
- (c) find the area of the sign, in m^2 to 2 significant figures. (4)

[illegible]

Q7

Leave
blank**Question 8 continued**

Q8

(Total 10 marks)

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

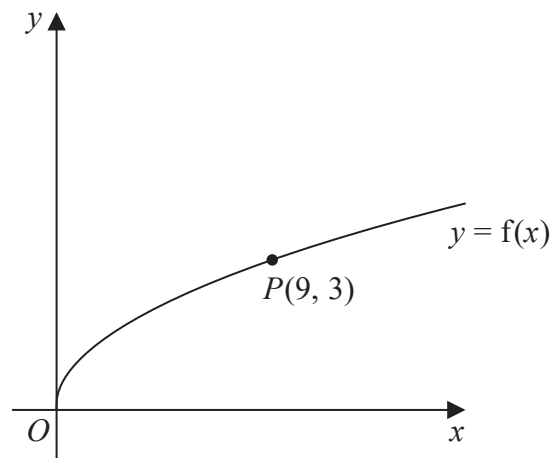


Figure 5

Figure 5 shows a sketch of the curve with equation $y = f(x)$ where

$$f(x) = \sqrt{x} \quad x > 0$$

The point $P(9, 3)$ lies on the curve and is shown in Figure 5.

On the next page there is a copy of Figure 5 called Diagram 1.

- (a) On Diagram 1, sketch and clearly label the graphs of

$$y = f(2x) \quad \text{and} \quad y = f(x) + 3$$

Show on each graph the coordinates of the point to which P is transformed.

(3)

The graph of $y = f(2x)$ meets the graph of $y = f(x) + 3$ at the point Q .

- (b) Show that the x coordinate of Q is the solution of

$$\sqrt{x} = 3(\sqrt{2} + 1)$$

(3)

- (c) Hence find, in simplest form, the coordinates of Q .

(3)

Question 9 continued

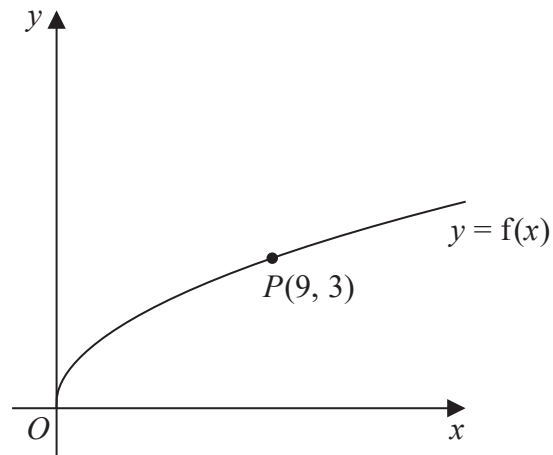


Diagram 1

Turn over for a copy of Diagram 1 if you need to redraw your graphs.

A Cartesian coordinate system with a horizontal x-axis and a vertical y-axis. The origin is labeled O . A curve, labeled $y = f(x)$, starts at the origin and increases as it moves to the right. A point on the curve is marked with a black dot and labeled $P(9, 3)$.

(Total 9 marks)

10

Given that

- (a) find the value of a .

(b) Hence find $f(x)$.

(4)

(Total 7 marks)

Q10

END

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

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

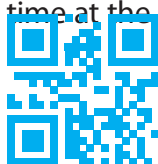
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly 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 10 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.



Leave
blank

Question 1 continued

(Total 4 marks)

Q1

$$f(x) = 11 - 4x - 2x^2$$

(a) Express $f(x)$ in the form

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

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

(3)

(b) Sketch the graph of the curve C with equation $y = f(x)$, showing clearly the coordinates of the point where the curve crosses the y -axis.

(2)

(c) Write down the equation of the line of symmetry of C .

(1)

Leave
blank**Question 2 continued**

Q2

(Total 6 marks)

Solutions relying on calculator technology are not acceptable.

$$f(x) = (x + \sqrt{2})^2 + (3x - 5\sqrt{8})^2$$
$$\sqrt{3}(4y - 3\sqrt{3}) = 5y + \sqrt{3}$$

Leave
blank

Question 3 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 3 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q3

(Total 7 marks)

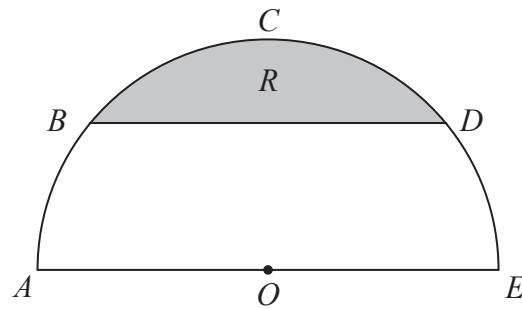
Solutions relying on calculator technology are not acceptable.

(b) Use inequalities to define the region R . (3)

Q4

(Total 7 marks)

5.



Not to scale

Figure 2

Figure 2 shows a plan view of a semicircular garden $ABCDEOA$

The semicircle has

- centre O
- diameter AOE
- radius 3 m

The straight line BD is parallel to AE and angle BOA is 0.7 radians.

- (a) Show that, to 4 significant figures, angle BOD is 1.742 radians.

(1)

The flowerbed R , shown shaded in Figure 2, is bounded by BD and the arc BCD .

- (b) Find the area of the flowerbed, giving your answer in square metres to one decimal place.

(3)

- (c) Find the perimeter of the flowerbed, giving your answer in metres to one decimal place.

(3)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q5

Given that

- $f'(x) = \frac{(x+3)^2}{x\sqrt{x}}$

(a) (i) find the value of the gradient at P

(4)

(7)

Leave
blank

Question 6 continued

[illegible]

Leave
blank

Question 6 continued

[illegible]

Q6

(Total 11 marks)

7.

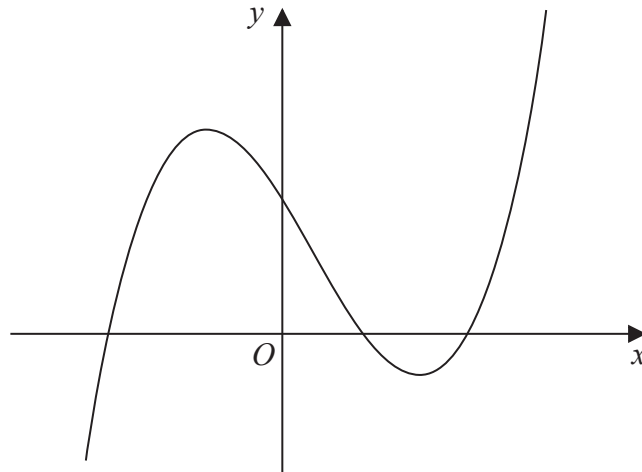
**Figure 3**

Figure 3 shows a sketch of part of the curve with equation $y = f(x)$, where

$$f(x) = (x + 4)(x - 2)(2x - 9)$$

Given that the curve with equation $y = f(x) - p$ passes through the point with coordinates $(0, 50)$

- (a) find the value of the constant p . (2)

Given that the curve with equation $y = f(x + q)$ passes through the origin,

- (b) write down the possible values of the constant q . (2)

- (c) Find $f'(x)$. (4)

- (d) Hence find the range of values of x for which the gradient of the curve with equation $y = f(x)$ is less than -18 (3)

Leave
blank

Question 7 continued

[illegible]

Leave
blank

Question 7 continued

[illegible]

Q7

(Total 11 marks)

$$2x - 5y + 7 = 0$$

(1)

- the point A has coordinates $(6, -2)$
- the line l_2 passes through A and is perpendicular to l_1

(3)

(3)

(2)

Leave
blank

Question 8 continued

[illegible]

Leave
blank

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q8

9.

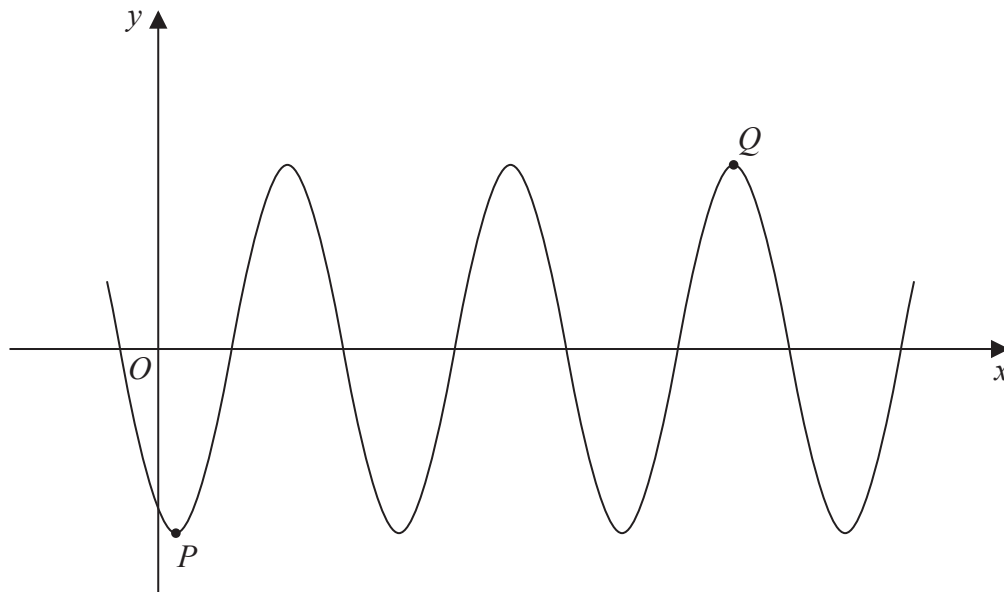


Figure 4

Figure 4 shows part of the curve with equation

$$y = A \cos(x - 30)^\circ$$

where A is a constant.

The point P is a minimum point on the curve and has coordinates $(30, -3)$ as shown in Figure 4.

- (a) Write down the value of A .

(1)

The point Q is shown in Figure 4 and is a maximum point.

- (b) Find the coordinates of Q .

(3)

Q9

10. The curve C has equation

$$y = \frac{1}{x^2} - 9$$

(a) Sketch the graph of C .

On your sketch

- show the coordinates of any points of intersection with the coordinate axes
- state clearly the equations of any asymptotes

(4)

The curve D has equation $y = kx^2$ where k is a constant.

Given that C meets D at 4 distinct points,

(b) find the range of possible values for k .

(5)

Leave
blank

Question 10 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 9 marks)

Q10

END

TOTAL FOR PAPER: 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

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 10 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.



Q1

(Total 4 marks)

- $AB = 21$ cm
- $BC = 13$ cm
- angle $BAC = 25^\circ$
- angle $ACB = x^\circ$

Given also that AB is the longest side of the triangle,

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q2

(Total 5 marks)

Solutions relying on calculator technology are not acceptable.

- (2)

$$\frac{4\sqrt{5} - 5}{7 - 3\sqrt{5}}$$

(3)

This image shows a full page of blank, lined paper. It features approximately 20 horizontal blue or grey lines spaced evenly apart, typical of notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings on the page.

Q3

(Total 5 marks)

4.

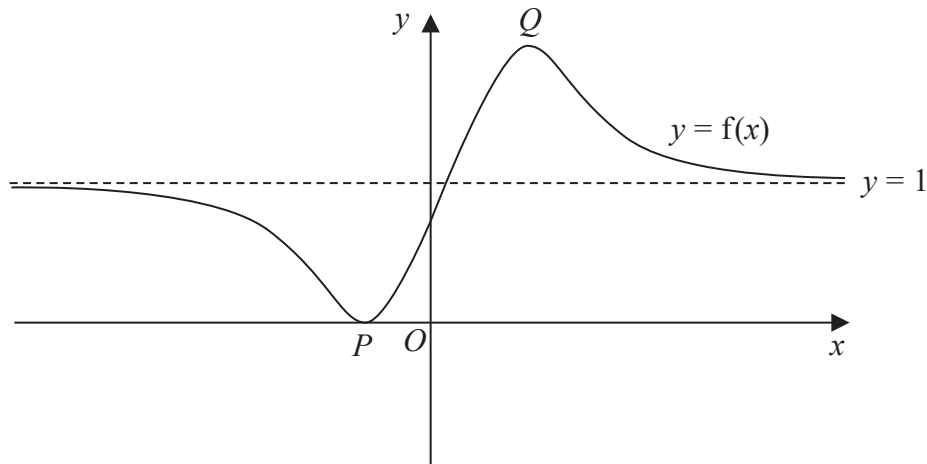
**Figure 1**

Figure 1 shows a sketch of a curve with equation $y = f(x)$

The curve has a minimum at $P(-1, 0)$ and a maximum at $Q\left(\frac{3}{2}, 2\right)$

The line with equation $y = 1$ is the only asymptote to the curve.

On separate diagrams sketch the curves with equation

(i) $y = f(x) - 2$

(3)

(ii) $y = f(-x)$

(3)

On each sketch you must clearly state

- the coordinates of the maximum and minimum points
- the equation of the asymptote

Leave
blank**Question 4 continued****Q4****(Total 6 marks)**

5. The curve C has equation $y = f(x)$

Given that

- $f(x)$ is a quadratic expression
- the maximum turning point on C has coordinates $(-2, 12)$
- C cuts the negative x -axis at -5

(a) find $f(x)$

(4)

The line l_1 has equation $y = \frac{4}{5}x$

Given that the line l_2 is perpendicular to l_1 and passes through $(-5, 0)$

(b) find an equation for l_2 , writing your answer in the form $y = mx + c$ where m and c are constants to be found.

(3)

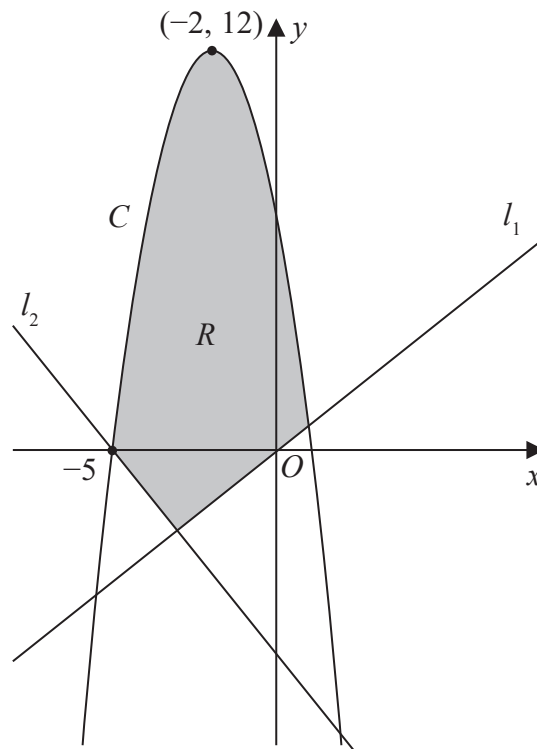


Figure 2

Figure 2 shows a sketch of the curve C and the lines l_1 and l_2

(c) Define the region R , shown shaded in Figure 2, using inequalities.

(2)

Leave
blank

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q5

Leave
blank

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q6

Given that

- $f''(x) = 0$ when $x = 4$

(4)

- $f(x) = 8\sqrt{3}$, when $x = 12$

(5)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Leave
blank

Question 7 continued

[illegible]

Q7

8.

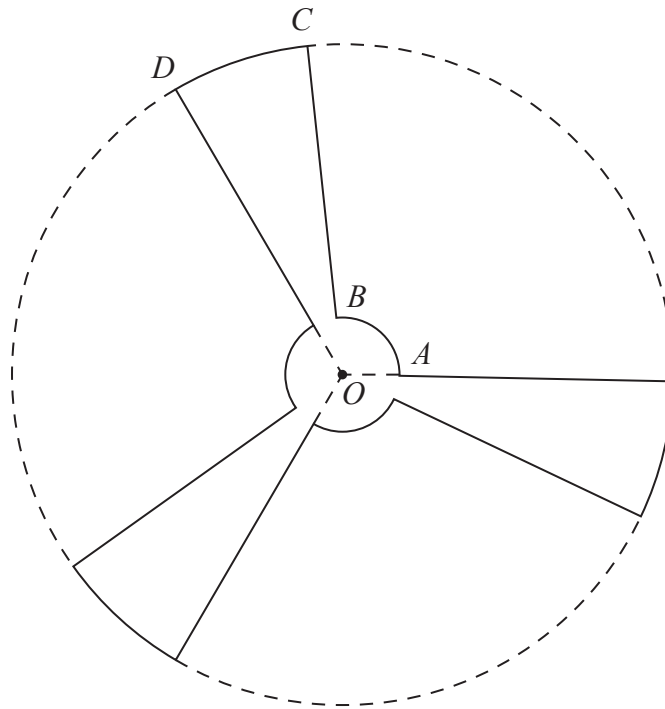
**Figure 3**

Figure 3 shows a sketch of the outline of the face of a ceiling fan viewed from below.

The fan consists of three identical sections congruent to $OABCD$ O, shown in Figure 3, where

- $OABO$ is a sector of a circle with centre O and radius 9 cm
- $OBCDO$ is a sector of a circle with centre O and radius 84 cm
- angle $AOD = \frac{2\pi}{3}$ radians

Given that the length of the arc AB is 15 cm,

- (a) show that the length of the arc CD is 35.9 cm to one decimal place.

(3)

The face of the fan is modelled to be a flat surface.

Find, according to the model,

- (b) the perimeter of the face of the fan, giving your answer to the nearest cm,

(2)

- (c) the surface area of the face of the fan.

Give your answer to 3 significant figures and make your units clear.

(5)

Leave
blank

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q8

(Total 10 marks)

9.

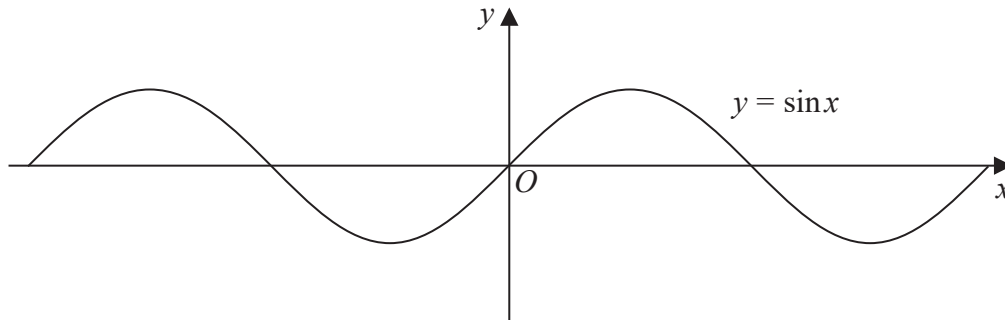
**Figure 4**

Figure 4 shows part of the graph of the curve with equation $y = \sin x$

Given that $\sin \alpha = p$, where $0 < \alpha < 90^\circ$

(a) state, in terms of p , the value of

(i) $2 \sin(180^\circ - \alpha)$

(ii) $\sin(\alpha - 180^\circ)$

(iii) $3 + \sin(180^\circ + \alpha)$

(3)

A copy of Figure 4, labelled Diagram 1, is shown on page 27.

On Diagram 1,

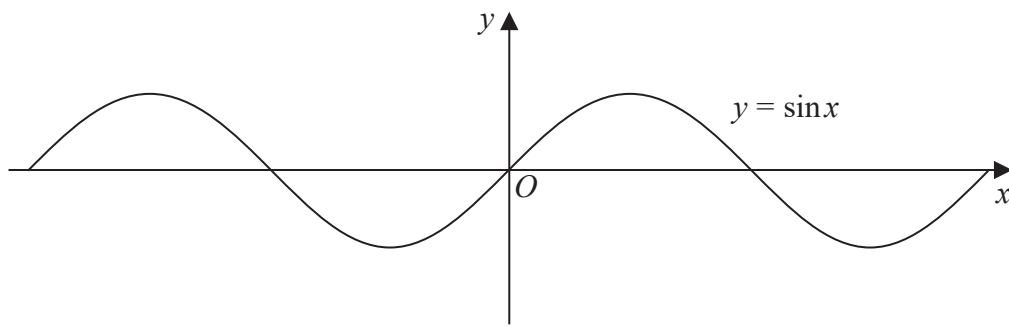
(b) sketch the graph of $y = \sin 2x$

(2)

(c) Hence find, in terms of α , the x coordinates of any points in the interval $0 < x < 180^\circ$ where

$$\sin 2x = p$$

(3)

Question 9 continued**Diagram 1****Q9****(Total 8 marks)**

10.

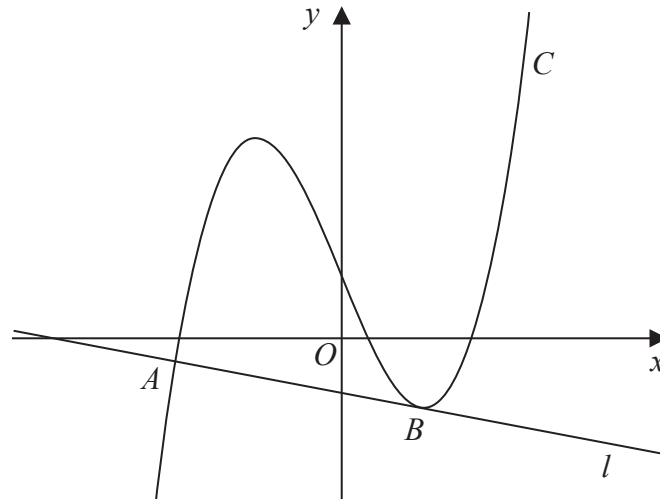


Figure 5

Figure 5 shows a sketch of the curve C with equation

$$y = \frac{2}{7}x^3 + \frac{1}{7}x^2 - \frac{5}{2}x + k$$

where k is a constant.

(a) Find $\frac{dy}{dx}$

(2)

The line l , shown in Figure 5, is the normal to C at the point A with x coordinate $-\frac{7}{2}$

Given that l is also a tangent to C at the point B ,

(b) show that the x coordinate of the point B is a solution of the equation

$$12x^2 + 4x - 33 = 0$$

(4)

(c) Hence find the x coordinate of B , justifying your answer.

(2)

Given that the y intercept of l is -1

(d) find the value of k .

(4)

Leave
blank

Question 10 continued

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire surface, typical of notebook or composition paper. The lines are uniform in thickness and color, providing a guide for handwriting. There are no margins, text, or other markings present on the page.

Leave
blank

Question 10 continued

This image shows a full page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, typical of notebook paper. There are no margins, text, or other markings on the page.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q10

11

103

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

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

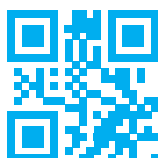
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly 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.



Question 1 continued

(Total for Question 1 is 6 marks)

Question 2 continued

(Total for Question 2 is 7 marks)

- 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, $\pounds V$, 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)

Question 3 continued

(Total for Question 3 is 5 marks)

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

$$f(x) = 0 \tag{4}$$

(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)

Question 4 continued

(Total for Question 4 is 6 marks)

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)

Question 5 continued

Question 5 continued

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total for Question 5 is 9 marks)

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) $y = \frac{k}{x^2}$

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)

Question 6 continued

(Total for Question 6 is 6 marks)

7.

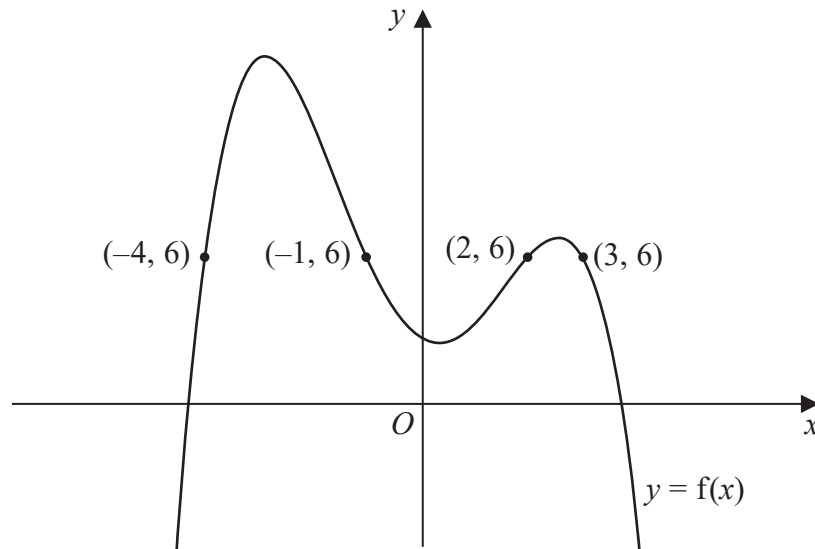
**Figure 1**

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

$$f(x) < 6 \quad (3)$$

(b) State the largest solution of the equation

$$f(2x) = 6 \quad (1)$$

(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

$$f(-x) \geq 6 \text{ and } x < 0 \quad (4)$$

Question 7 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 7 continued

Question 7 continued

(Total for Question 7 is 8 marks)

8.

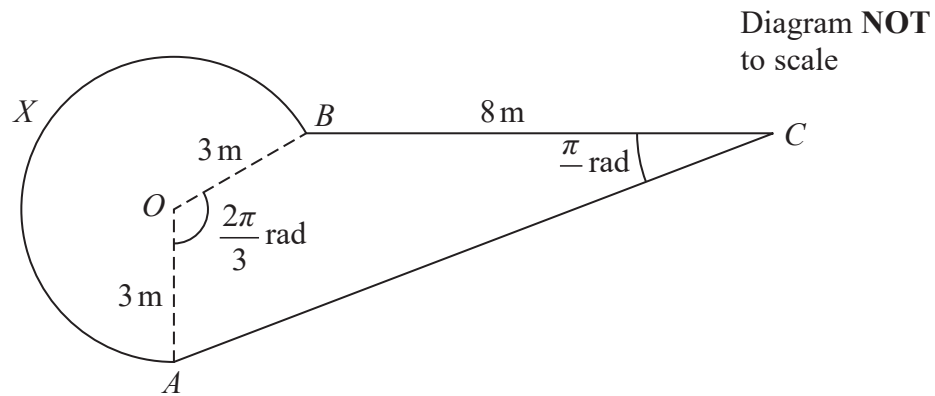
**Figure 2**

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 $AOBC$.

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

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 14 marks)

9.

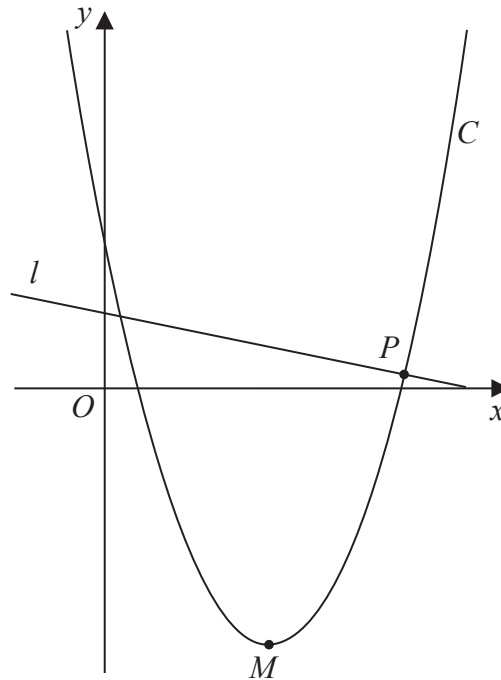
**Figure 3**

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

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 14 marks)

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

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

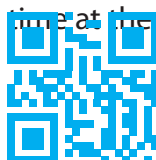
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly 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 11 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.



1. A curve C has equation

$$y = 2 + 10x^{\frac{1}{2}} - 2x^{\frac{3}{2}} \quad x > 0$$

- (a) Find $\frac{dy}{dx}$ giving your answer in simplest form. (3)
- (b) Hence find the exact value of the gradient of the tangent to C at the point where $x = 2$ giving your answer in simplest form.

(Solutions relying on calculator technology are not acceptable.)

[illegible]

Question 1 continued

(Total for Question 1 is 5 marks)

2. The points P , Q and R have coordinates $(-3, 7)$, $(9, 11)$ and $(12, 2)$ respectively.

(a) Prove that angle $PQR = 90^\circ$

(3)

Given that the point S is such that $PQRS$ forms a rectangle,

(b) find the coordinates of S .

(2)

Question 2 continued

(Total for Question 2 is 5 marks)

3. Find

$$\int \frac{4x^5 + 3}{2x^2} dx$$

giving your answer in simplest form.

(5)

Question 3 continued

(Total for Question 3 is 5 marks)

4. Given that the equation

$$kx^2 + 6kx + 5 = 0 \quad \text{where } k \text{ is a non zero constant}$$

has no real roots, find the range of possible values for k .

(4)

Question 4 continued

(Total for Question 4 is 4 marks)

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

Solutions relying on calculator technology are not acceptable.

(a) By substituting $p = 3^x$, show that the equation

$$3 \times 9^x + 3^{x+2} = 1 + 3^{x-1}$$

can be rewritten in the form

$$9p^2 + 26p - 3 = 0$$

(3)

(b) Hence solve

$$3 \times 9^x + 3^{x+2} = 1 + 3^{x-1}$$

(3)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

(Total for Question 5 is 6 marks)

6.

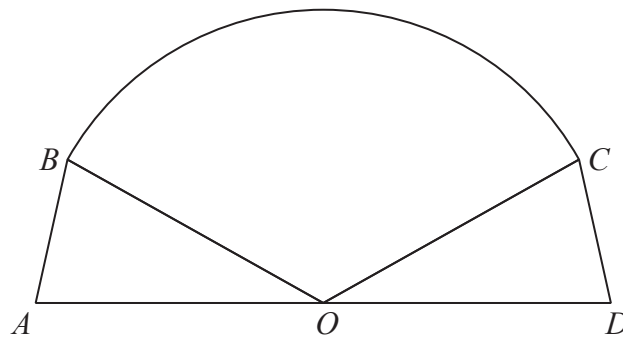


Diagram **NOT**
accurately drawn

Figure 1

Figure 1 shows the plan view for the design of a stage.

The design consists of a sector OBC of a circle, with centre O , joined to two congruent triangles OAB and ODC .

Given that

- angle $BOC = 2.4$ radians
- area of sector $BOC = 40 \text{ m}^2$
- AOD is a straight line of length 12.5 m

(a) find the radius of the sector, giving your answer, in m, to 2 decimal places,

(2)

(b) find the size of angle AOB , in radians, to 2 decimal places.

(1)

Hence find

(c) the total area of the stage, giving your answer, in m^2 , to one decimal place,

(3)

(d) the total perimeter of the stage, giving your answer, in m, to one decimal place.

(4)

[illegible]

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 6 continued

(Total for Question 6 is 10 marks)

7. (a) On Diagram 1, sketch a graph of the curve C with equation

$$y = \frac{6}{x} \quad x \neq 0 \quad (2)$$

The curve C is transformed onto the curve with equation $y = \frac{6}{x-2} \quad x \neq 2$

- (b) Fully describe this transformation. (2)

The curve with equation

$$y = \frac{6}{x-2} \quad x \neq 2$$

and the line with equation

$$y = kx + 7 \quad \text{where } k \text{ is a constant}$$

intersect at exactly two points, P and Q .

Given that the x coordinate of point P is -4

- (c) find the value of k , (2)

- (d) find, using algebra, the coordinates of point Q .

(Solutions relying entirely on calculator technology are not acceptable.) (4)

Question 7 continued

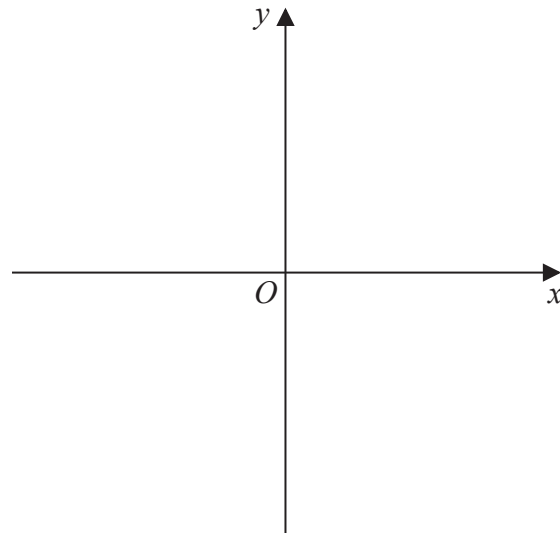


Diagram 1

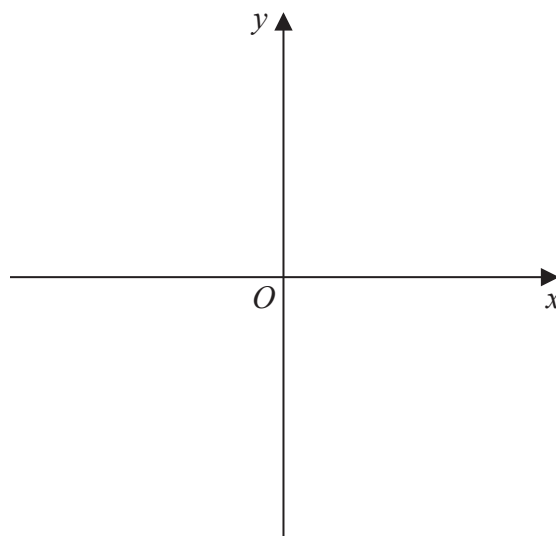
Turn over for a copy of Diagram 1 if you need to redraw your graph.

Question 7 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 7 continued

Only use this copy of Diagram 1 if you need to redraw your graph.



Copy of Diagram 1

(Total for Question 7 is 10 marks)

8.

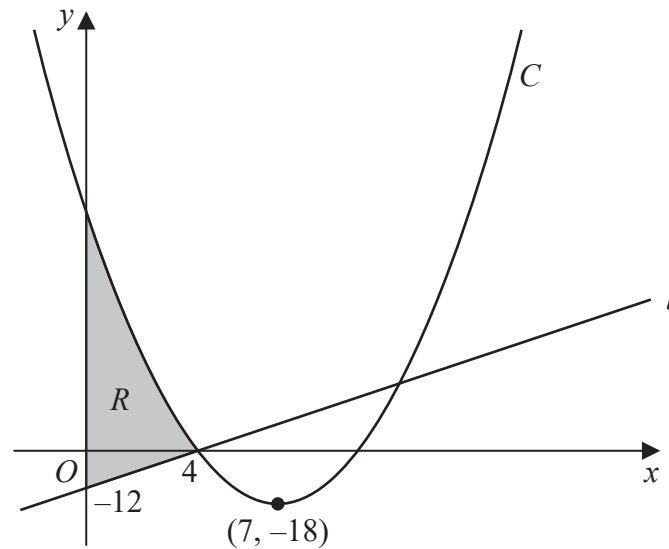
**Figure 2**

Figure 2 shows a sketch of the straight line l and the curve C .

Given that l cuts the y -axis at -12 and cuts the x -axis at 4 , as shown in Figure 2,

- (a) find an equation for l , writing your answer in the form $y = mx + c$, where m and c are constants to be found.

(2)

Given that C

- has equation $y = f(x)$ where $f(x)$ is a quadratic expression
- has a minimum point at $(7, -18)$
- cuts the x -axis at 4 and at k , where k is a constant

- (b) deduce the value of k ,

(1)

- (c) find $f(x)$.

(3)

The region R is shown shaded in Figure 2.

- (d) Use inequalities to define R .

(2)

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 8 continued

(Total for Question 8 is 8 marks)

9.

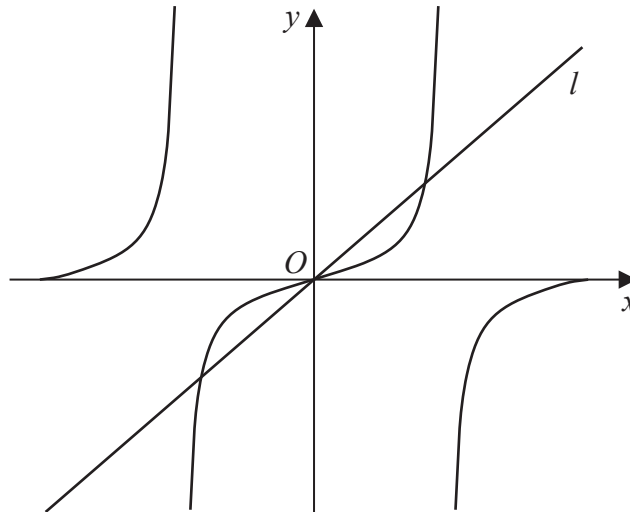


Figure 3

Figure 3 shows a sketch of

- the curve with equation $y = \tan x$
- the straight line l with equation $y = \pi x$

in the interval $-\pi < x < \pi$

(a) State the period of $\tan x$

(1)

(b) Write down the number of roots of the equation

(i) $\tan x = (\pi + 2)x$ in the interval $-\pi < x < \pi$

(1)

(ii) $\tan x = \pi x$ in the interval $-2\pi < x < 2\pi$

(1)

(iii) $\tan x = \pi x$ in the interval $-100\pi < x < 100\pi$

(1)

Question 9 continued

(Total for Question 9 is 4 marks)

10.

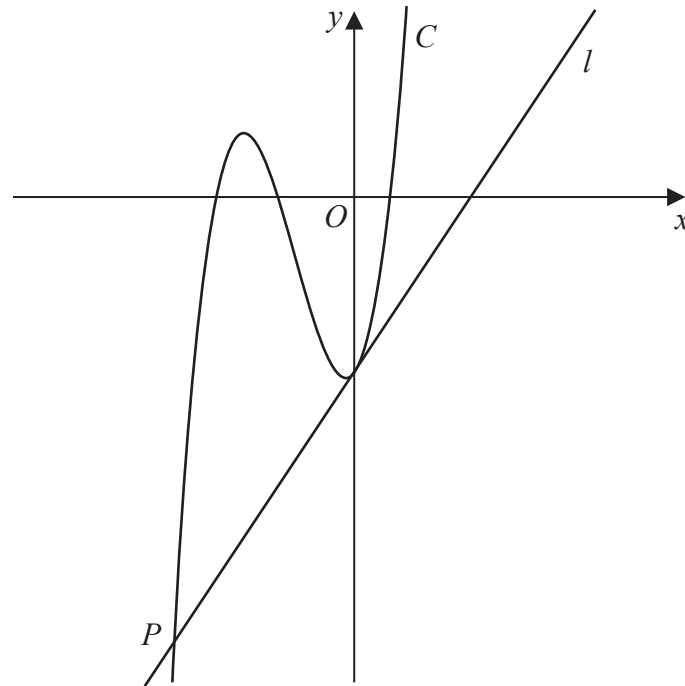
**Figure 4**

Figure 4 shows a sketch of part of the curve C with equation $y = f(x)$, where

$$f(x) = (3x + 20)(x + 6)(2x - 3)$$

(a) Use the given information to state the values of x for which

$$f(x) > 0$$

(2)

(b) Expand $(3x + 20)(x + 6)(2x - 3)$, writing your answer as a polynomial in simplest form.

(3)

The straight line l is the tangent to C at the point where C cuts the y -axis.

Given that l cuts C at the point P , as shown in Figure 4,

(c) find, using algebra, the x coordinate of P

(Solutions based on calculator technology are not acceptable.)

(5)

Question 10 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 10 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 10 continued

(Total for Question 10 is 10 marks)

11. A curve C has equation $y = f(x)$, $x > 0$

Given that

- $f''(x) = 4x + \frac{1}{\sqrt{x}}$

- the point P has x coordinate 4 and lies on C
- the tangent to C at P has equation $y = 3x + 4$

(a) find an equation of the normal to C at P

(2)

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

(6)

Question 11 continued

[illegible]

Question 11 continued

(Total for Question 11 is 8 marks)

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Tuesday 9 May 2023

Morning (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 allowed 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

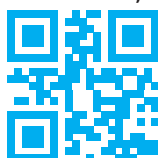
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly 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 10 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.



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

Solutions relying on calculator technology are not acceptable.

Solve the inequality

$$4x^2 - 3x + 7 \geq 4x + 9$$

(4)

Question 1 continued

(Total for Question 1 is 4 marks)

2.

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

Solutions relying entirely on calculator technology are not acceptable.

A rectangular sports pitch has length x metres and width y metres, where $x > y$

Given that the perimeter of the pitch is 350 m,

(a) write down an equation linking x and y

(1)

Given also that the area of the pitch is 7350 m^2

(b) write down a second equation linking x and y

(1)

(c) hence find the value of x and the value of y

(4)

Question 2 continued

(Total for Question 2 is 6 marks)

3. (a) Express $3x^2 + 12x + 13$ in the form

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

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

(3)

(b) Hence sketch the curve with equation $y = 3x^2 + 12x + 13$

On your sketch show clearly

- the coordinates of the y intercept
- the coordinates of the turning point of the curve

(3)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 3 continued

(Total for Question 3 is 6 marks)

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

(a) Write

$$y = \frac{5x^2 + \sqrt{x^3}}{\sqrt[3]{8x}}$$

in the form

$$y = Ax^p + Bx^q$$

where A, B, p and q are constants to be found.

(4)

(b) Hence find $\frac{dy}{dx}$ giving each coefficient in simplest form.

(3)

Question 4 continued

(Total for Question 4 is 7 marks)

5.

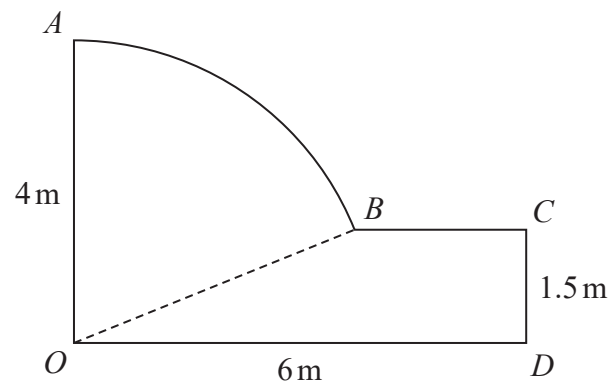


Figure 1

Figure 1 shows the plan for a garden.

In the plan

- OA and CD are perpendicular to OD
- AB is an arc of the circle with centre O and radius 4 metres
- BC is parallel to OD
- OD is 6 metres, OA is 4 metres and CD is 1.5 metres

(a) Show that angle AOB is 1.186 radians to 4 significant figures.

(2)

(b) Find the perimeter of the garden, giving your answer in metres to 3 significant figures.

(4)

(c) Find the area of the garden, giving your answer in square metres to 3 significant figures.

(4)

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

[illegible]

Question 5 continued

(Total for Question 5 is 10 marks)

6.

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

Solutions relying on calculator technology are not acceptable.

(a) Expand and simplify

$$\left(r - \frac{1}{r}\right)^2$$

(2)

(b) Express $\frac{1}{3+2\sqrt{2}}$ in the form $p+q\sqrt{2}$ where p and q are integers.

(2)

(c) Use the results of parts (a) and (b), or otherwise, to show that

$$\sqrt{3+2\sqrt{2}} - \frac{1}{\sqrt{3+2\sqrt{2}}} = 2$$

(3)

Question 6 continued

[illegible]

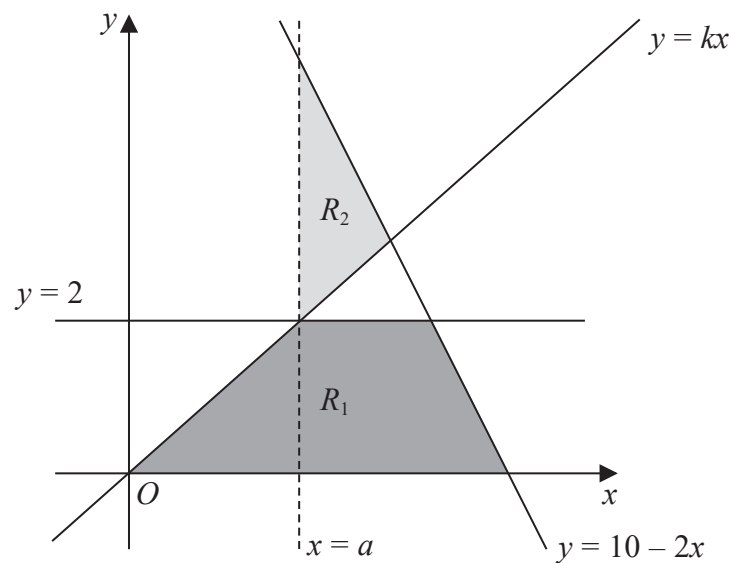
Question 6 continued

[illegible]

Question 6 continued

(Total for Question 6 is 7 marks)

7.

**Figure 2**

The region R_1 , shown shaded in Figure 2, is defined by the inequalities

$$0 \leq y \leq 2 \quad y \leq 10 - 2x \quad y \leq kx$$

where k is a constant.

The line $x = a$, where a is a constant, passes through the intersection of the lines $y = 2$ and $y = kx$

Given that the area of R_1 is $\frac{27}{4}$ square units,

(a) find

(i) the value of a

(ii) the value of k

(4)

(b) Define the region R_2 , also shown shaded in Figure 2, using inequalities.

(2)

Question 7 continued

(Total for Question 7 is 6 marks)

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

Solutions relying entirely on calculator technology are not acceptable.

(a) Find the equation of the tangent to the curve with equation

$$y = \frac{1}{4}x^3 - 8x^{-\frac{1}{2}}$$

at the point $P(4, 12)$

Give your answer in the form $ax + by + c = 0$ where a , b and c are integers.

(5)

The curve with equation $y = f(x)$ also passes through the point $P(4, 12)$

Given that

$$f'(x) = \frac{1}{4}x^3 - 8x^{-\frac{1}{2}}$$

(b) find $f(x)$ giving the coefficients in simplest form.

(5)

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 8 continued

(Total for Question 8 is 10 marks)

9. (i)

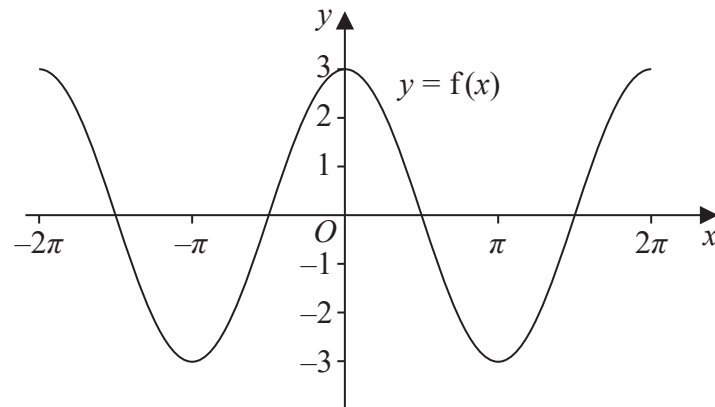


Figure 3

Figure 3 shows part of the graph of the trigonometric function with equation $y = f(x)$

(a) Write down an expression for $f(x)$

(2)

On a separate diagram,

(b) sketch, for $-2\pi < x < 2\pi$, the graph of the curve with equation $y = f\left(x + \frac{\pi}{4}\right)$

Show clearly the coordinates of all the points where the curve intersects the coordinate axes.

(3)

(ii)

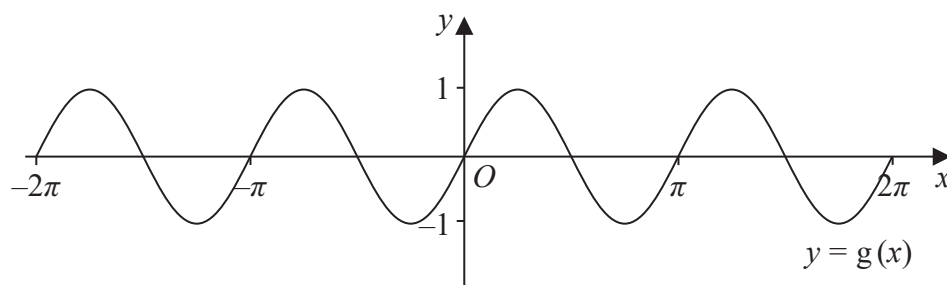


Figure 4

Figure 4 shows part of the graph of the trigonometric function with equation $y = g(x)$

(a) Write down an expression for $g(x)$

(2)

On a separate diagram,

(b) sketch, for $-2\pi < x < 2\pi$, the graph of the curve with equation $y = g(x) - 2$

Show clearly the coordinates of the y intercept.

(2)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 9 marks)

10.

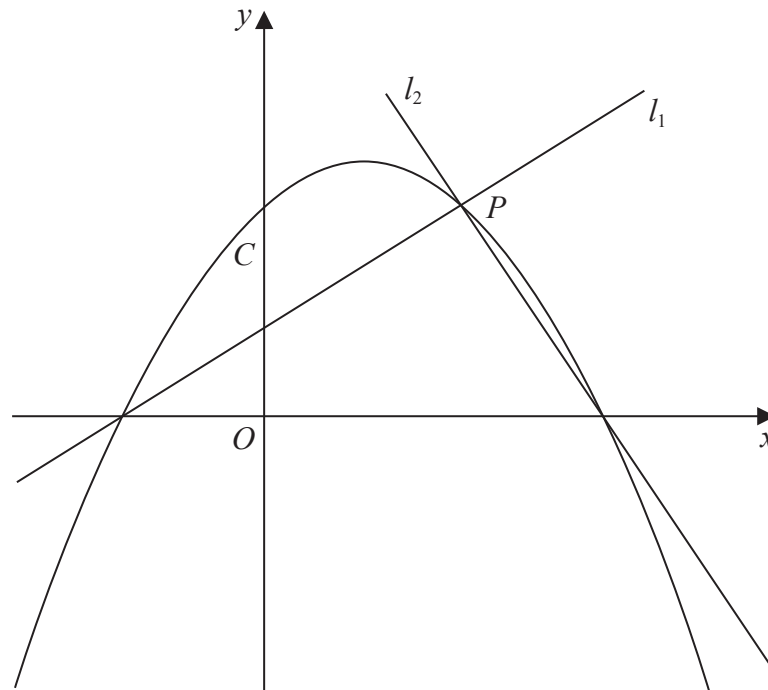


Figure 5

Figure 5 shows a sketch of the quadratic curve C with equation

$$y = -\frac{1}{4}(x+2)(x-b) \quad \text{where } b \text{ is a positive constant}$$

The line l_1 also shown in Figure 5,

- has gradient $\frac{1}{2}$
- intersects C on the negative x -axis and at the point P

(a) (i) Write down an equation for l_1 (1)

(ii) Find, in terms of b , the coordinates of P (3)

Given that the line l_2 is perpendicular to l_1 and intersects C on the positive x -axis,

(b) find, in terms of b , an equation for l_2 (2)

Given also that l_2 intersects C at the point P

(c) show that another equation for l_2 is

$$y = -2x + \frac{5b}{2} - 4 \quad (2)$$

(d) Hence, or otherwise, find the value of b (2)

Question 10 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 10 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 10 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 10 continued

(Total for Question 10 is 10 marks)

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Monday 9 October 2023

Afternoon (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 allowed 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 11 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.



1. Given that

$$y = 5x^3 + \frac{3}{x^2} - 7x \quad x > 0$$

find, in simplest form,

$$(a) \quad \frac{dy}{dx} \tag{3}$$

$$(b) \quad \frac{d^2 y}{dx^2} \tag{2}$$

Question 1 continued

(Total for Question 1 is 5 marks)

2. Given that

$$a = \frac{1}{64}x^2 \qquad b = \frac{16}{\sqrt{x}}$$

express each of the following in the form kx^n where k and n are simplified constants.

$$(a) \ a^{\frac{1}{2}} \tag{1}$$

$$(b) \quad \frac{16}{b^3} \tag{1}$$

$$(c) \left(\frac{ab}{2}\right)^{-\frac{4}{3}} \tag{2}$$

Question 2 continued

(Total for Question 2 is 4 marks)

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

Solutions relying on calculator technology are not acceptable.

- (a) Write $\frac{8 - \sqrt{15}}{2\sqrt{3} + \sqrt{5}}$ in the form $a\sqrt{3} + b\sqrt{5}$ where a and b are integers to be found. (3)
- (b) Hence, or otherwise, solve

$$(x + 5\sqrt{3})\sqrt{5} = 40 - 2x\sqrt{3}$$

giving your answer in simplest form.

(3)

Question 3 continued

(Total for Question 3 is 6 marks)

4.

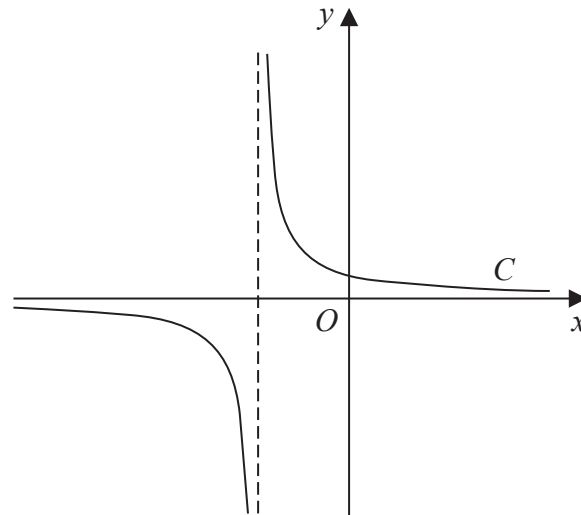
**Figure 1**

Figure 1 shows a sketch of part of the curve C with equation $y = \frac{1}{x+2}$

(a) State the equation of the asymptote of C that is parallel to the y -axis.

(1)

(b) Factorise fully $x^3 + 4x^2 + 4x$

(2)

A copy of Figure 1, labelled Diagram 1, is shown on the next page.

(c) On Diagram 1, add a sketch of the curve with equation

$$y = x^3 + 4x^2 + 4x$$

On your sketch, state clearly the coordinates of each point where this curve cuts or meets the coordinate axes.

(3)

(d) Hence state the number of real solutions of the equation

$$(x+2)(x^3 + 4x^2 + 4x) = 1$$

giving a reason for your answer.

(1)

Question 4 continued

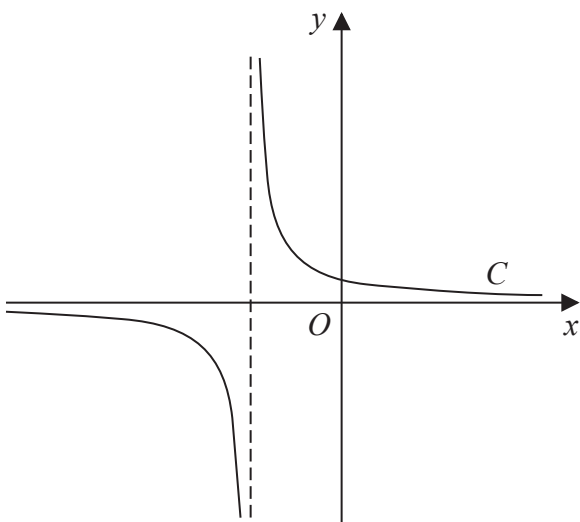
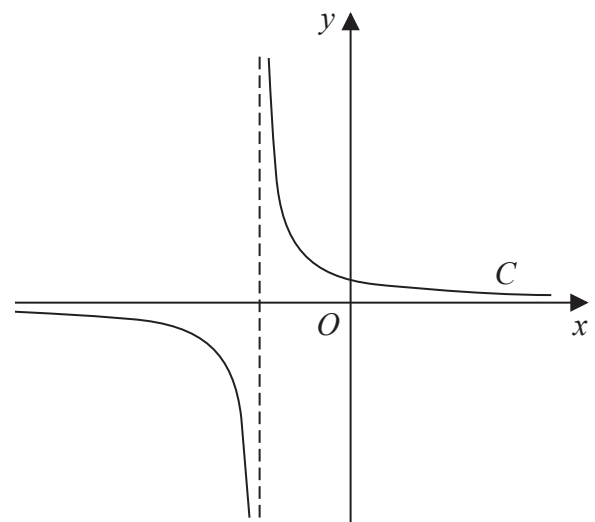


Diagram 1



copy of Diagram 1

Only use the copy of Diagram 1 if you need to redraw your answer to part (c).

(Total for Question 4 is 7 marks)

5.

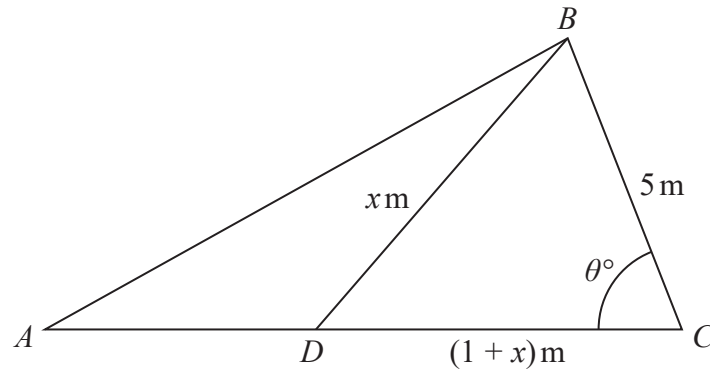


Diagram **NOT**
accurately drawn

Figure 2

Figure 2 shows the plan view of a frame for a flat roof.

The shape of the frame consists of triangle ABD joined to triangle BCD .

Given that

- $BD = x \text{ m}$
- $CD = (1 + x) \text{ m}$
- $BC = 5 \text{ m}$
- angle $BCD = \theta^\circ$

(a) show that $\cos \theta^\circ = \frac{13+x}{5+5x}$

(2)

Given also that

- $x = 2\sqrt{3}$
- $\text{angle } BAC = 30^\circ$
- ADC is a straight line

(b) find the area of triangle ABC , giving your answer, in m^2 , to one decimal place. (5)

[illegible]

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

(Total for Question 5 is 7 marks)

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

Solutions relying on calculator technology are not acceptable.

The equation

$$4(p - 2x) = \frac{12 + 15p}{x + p} \quad x \neq -p$$

where p is a constant, has two distinct real roots.

(a) Show that

$$3p^2 - 10p - 8 > 0 \quad (3)$$

(b) Hence, using algebra, find the range of possible values of p (3)

[illegible]

Question 6 continued

(Total for Question 6 is 6 marks)

7. The curve C has equation $y = f(x)$ where $x > 0$

Given that

$$\bullet \quad f'(x) = \frac{4x^2 + 10 - 7x^{\frac{1}{2}}}{4x^{\frac{1}{2}}}$$

- the point $P(4, -1)$ lies on C

(a) (i) find the value of the gradient of C at P

(ii) Hence find the equation of the normal to C at P , giving your answer in the form $ax + by + c = 0$ where a , b and c are integers to be found.

(4)

(b) Find $f(x)$.

(6)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 7 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 7 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 7 continued

(Total for Question 7 is 10 marks)

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

Solutions relying on calculator technology are not acceptable.

The curve C_1 has equation

$$xy = \frac{15}{2} - 5x \quad x \neq 0$$

The curve C_2 has equation

$$y = x^3 - \frac{7}{2}x - 5$$

(a) Show that C_1 and C_2 meet when

$$2x^4 - 7x^2 - 15 = 0 \quad (2)$$

Given that C_1 and C_2 meet at points P and Q

(b) find, using algebra, the exact distance PQ

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 8 continued

[illegible]

Question 8 continued

(Total for Question 8 is 7 marks)

9.

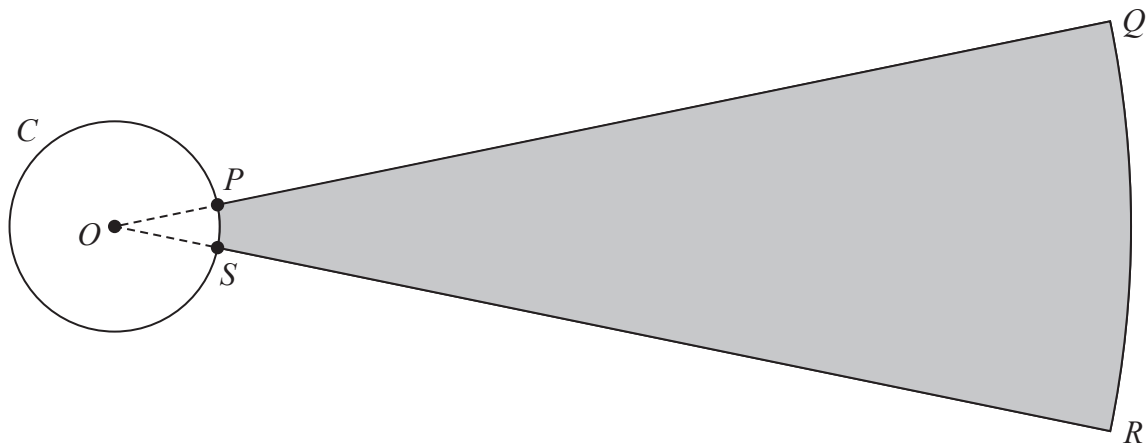
Diagram **NOT**
accurately drawn**Figure 3**

Figure 3 shows the plan view of the area being used for a ball-throwing competition.

Competitors must stand within the circle C and throw a ball as far as possible into the target area, $PQRS$, shown shaded in Figure 3.

Given that

- circle C has centre O
- P and S are points on C
- $OPQRSO$ is a sector of a circle with centre O
- the length of arc PS is 0.72 m
- the size of angle POS is 0.6 radians

(a) show that $OP = 1.2$ m

(1)

Given also that

- the target area, $PQRS$, is 90 m^2
- length $PQ = x$ metres

(b) show that

$$5x^2 + 12x - 1500 = 0$$

(3)

(c) Hence calculate the total perimeter of the target area, $PQRS$, giving your answer to the nearest metre.

(3)

Question 9 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 9 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 9 continued

(Total for Question 9 is 7 marks)

10.

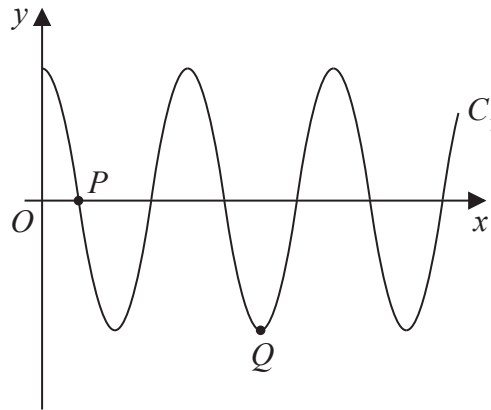


Figure 4

Figure 4 shows a sketch of part of the curve C_1 with equation

$$y = 3 \cos\left(\frac{x}{n}\right)^\circ \quad x \geq 0$$

where n is a constant.

The curve C_1 cuts the positive x -axis for the first time at point $P(270, 0)$, as shown in Figure 4.

(a) (i) State the value of n

(ii) State the period of C_1

(2)

The point Q , shown in Figure 4, is a minimum point of C_1

(b) State the coordinates of Q .

(2)

The curve C_2 has equation $y = 2 \sin x^\circ + k$, where k is a constant.

The point $R\left(a, \frac{12}{5}\right)$ and the point $S\left(-a, -\frac{3}{5}\right)$, both lie on C_2

Given that a is a constant less than 90

(c) find the value of k .

(2)

Question 10 continued

(Total for Question 10 is 6 marks)

11.

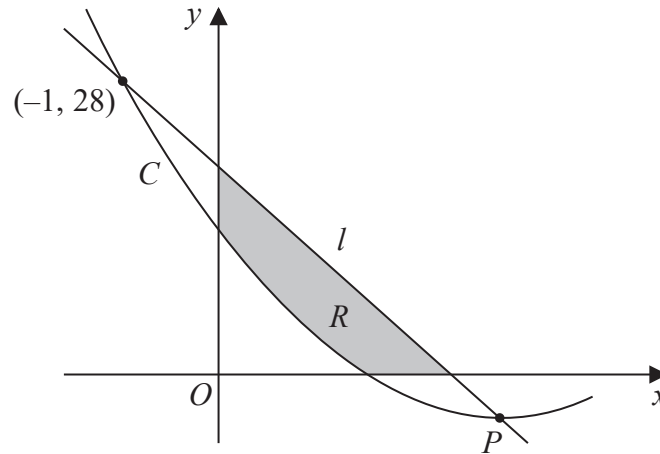
**Figure 5**

Figure 5 shows part of the curve C with equation $y = f(x)$ where

$$f(x) = 2x^2 - 12x + 14$$

- (a) Write $2x^2 - 12x + 14$ in the form

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

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

(3)

Given that C has a minimum at the point P

- (b) state the coordinates of P

(1)

The line l intersects C at $(-1, 28)$ and at P as shown in Figure 5.

- (c) Find the equation of l giving your answer in the form $y = mx + c$ where m and c are constants to be found.

(3)

The finite region R , shown shaded in Figure 5, is bounded by the x -axis, l , the y -axis, and C .

- (d) Use inequalities to define the region R .

(3)

Question 11 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 11 continued

(Total for Question 11 is 10 marks)

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Tuesday 9 January 2024

Morning (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.
- **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 10 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.



1. Find

$$\int (2x - 5)(3x + 2)(2x + 5)dx$$

writing your answer in simplest form.

(5)

Question 1 continued

(Total for Question 1 is 5 marks)

2. The triangle ABC is such that

- $AB = 15 \text{ cm}$
- $AC = 25 \text{ cm}$
- $\text{angle } BAC = \theta^\circ$
- $\text{area triangle } ABC = 100 \text{ cm}^2$

(a) Find the value of $\sin \theta^\circ$

(2)

Given that $\theta > 90$

(b) find the length of BC , in cm, to 3 significant figures.

(3)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 2 continued

(Total for Question 2 is 5 marks)

3. The curve C has equation

$$y = \frac{5x^3 - 8}{2x^2} \quad x > 0$$

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

(4)

The point $P(2, 4)$ lies on C .

(b) Find an equation for the tangent to C at P writing your answer in the form $ax + by + c = 0$, where a , b and c are integers.

(3)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 3 continued

(Total for Question 3 is 7 marks)

4.

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

Solutions relying on calculator technology are not acceptable.

(a) By substituting $p = 2^x$, show that the equation

$$2 \times 4^x - 2^{x+3} = 17 \times 2^{x-1} - 4$$

can be written in the form

$$4p^2 - 33p + 8 = 0$$

(3)

(b) Hence solve

$$2 \times 4^x - 2^{x+3} = 17 \times 2^{x-1} - 4$$

(3)

Question 4 continued

(Total for Question 4 is 6 marks)

5.

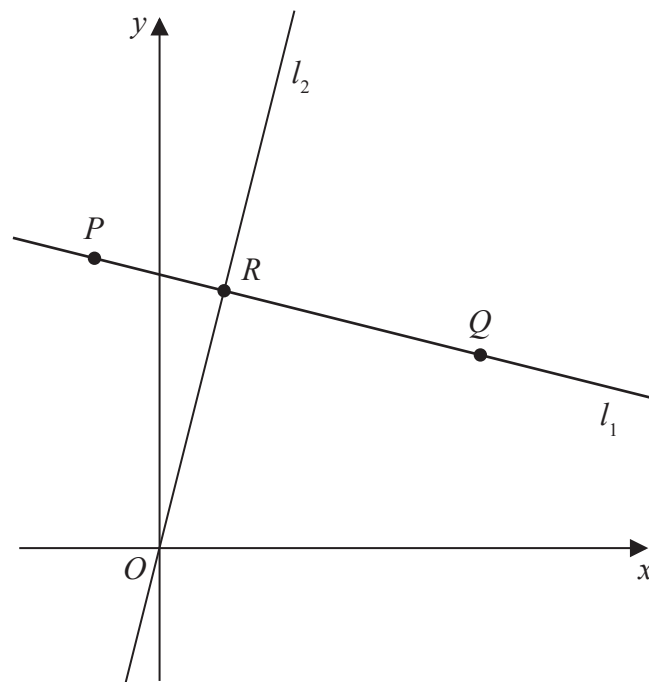


Figure 1

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

Solutions relying on calculator technology are not acceptable.

The straight line l_1 , shown in Figure 1, passes through the points $P(-2, 9)$ and $Q(10, 6)$.

- (a) Find the equation of l_1 , giving your answer in the form $y = mx + c$, where m and c are constants to be found. (3)

The straight line l_2 passes through the origin O and is perpendicular to l_1 .

The lines l_1 and l_2 meet at the point R as shown in Figure 1.

- (b) Find the coordinates of R (4)
- (c) Find the exact area of triangle OPQ . (3)

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

(Total for Question 5 is 10 marks)

6.

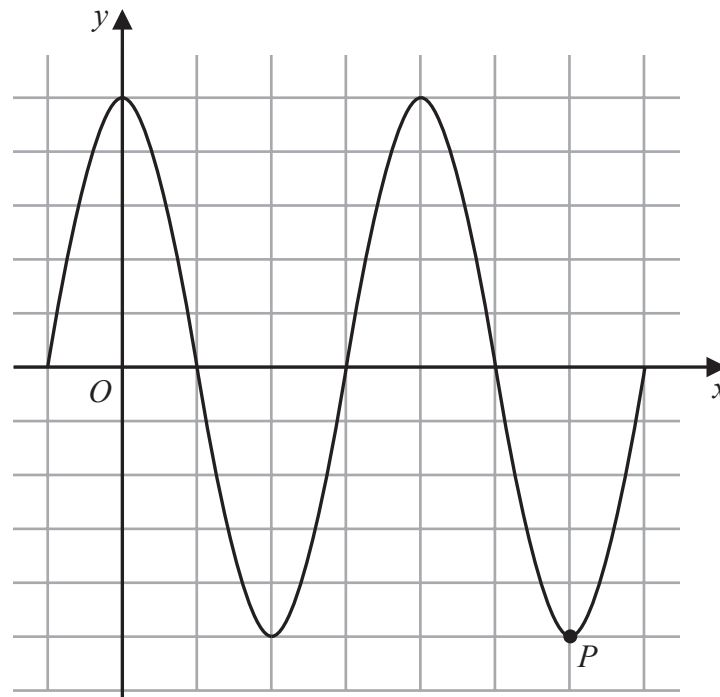


Figure 2

Figure 2 shows a plot of part of the curve C_1 with equation

$$y = 5 \cos x$$

with x being measured in degrees.

The point P , shown in Figure 2, is a minimum point on C_1

(a) State the coordinates of P

(2)

The point Q lies on a different curve C_2

Given that point Q

- is a maximum point on the curve
- is the maximum point with the **smallest** x coordinate, $x > 0$

(b) find the coordinates of Q when

(i) C_2 has equation $y = 5 \cos x - 2$

(ii) C_2 has equation $y = -5 \cos x$

(4)

Question 6 continued

(Total for Question 6 is 6 marks)

7. (a) Sketch the graph of the curve C with equation

$$y = \frac{4}{x - k}$$

where k is a positive constant.

Show on your sketch

- the coordinates of any points where C cuts the coordinate axes
- the equation of the vertical asymptote to C

(4)

Given that the straight line with equation $y = 9 - x$ does not cross or touch C

(b) find the range of values of k .

(5)

Question 7 continued

(Total for Question 7 is 9 marks)

8.

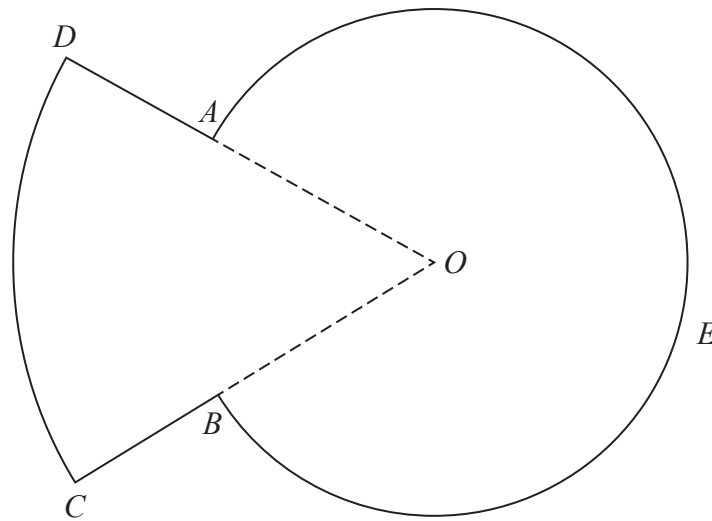
**Figure 3**

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)

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 8 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 8 continued

(Total for Question 8 is 9 marks)

9. The curve C_1 has equation $y = f(x)$.

Given that

- $f(x)$ is a quadratic expression
- C_1 has a maximum turning point at $(2, 20)$
- C_1 passes through the origin

(a) sketch a graph of C_1 showing the coordinates of any points where C_1 cuts the coordinate axes,

(2)

(b) find an expression for $f(x)$.

(3)

The curve C_2 has equation $y = x(x^2 - 4)$

Curve C_1 and C_2 meet at the origin, and at the points P and Q

Given that the x coordinate of the point P is negative,

(c) using algebra and showing all stages of your working, find the coordinates of P

(5)

Question 9 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 9 continued

[illegible]

Question 9 continued

(Total for Question 9 is 10 marks)

10. 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)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 10 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 10 continued

(Total for Question 10 is 8 marks)

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Thursday 9 May 2024

Morning (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 allowed 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

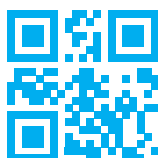
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly 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 11 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 ►

1. Find

$$\int \left(10x^4 - \frac{3}{2x^3} - 7 \right) dx$$

giving each term in simplest form.

(3)

Question 1 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total for Question 1 is 3 marks)

2. (i) Given that $m = 2^n$, express each of the following in simplest form in terms of m .

$$(a) \ 2^{n+3} \tag{1}$$

$$(b) \ 16^{3n} \tag{2}$$

(ii) **In this question you must show all stages of your working.**

Solutions relying on calculator technology are not acceptable.

Solve the equation

$$x\sqrt{3} - 3 = x + \sqrt{3}$$

giving your answer in the form $p + q\sqrt{3}$ where p and q are integers. (3)

Question 2 continued

(Total for Question 2 is 6 marks)

3.

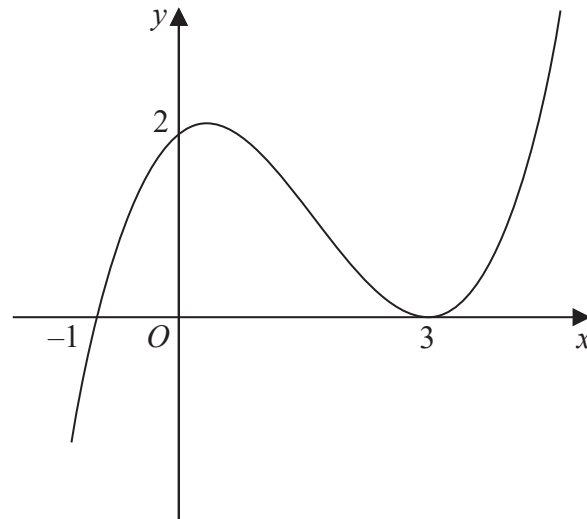
**Figure 1**

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

The curve passes through the points $(-1, 0)$ and $(0, 2)$ and touches the x -axis at the point $(3, 0)$.

On separate diagrams, sketch the curve with equation

(a) $y = f(x + 3)$ (3)

(b) $y = f(-3x)$ (3)

On each diagram, show clearly the coordinates of all the points where the curve cuts or touches the coordinate axes.

Question 3 continued

(Total for Question 3 is 6 marks)

4. The curve C_1 has equation

$$y = x^2 + kx - 9$$

and the curve C_2 has equation

$$y = -3x^2 - 5x + k$$

where k is a constant.

Given that C_1 and C_2 meet at a single point P

(a) show that

$$k^2 + 26k + 169 = 0 \quad (3)$$

(b) Hence find the coordinates of P (3)

Question 4 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total for Question 4 is 6 marks)

5.

Diagram **NOT**
accurately drawn

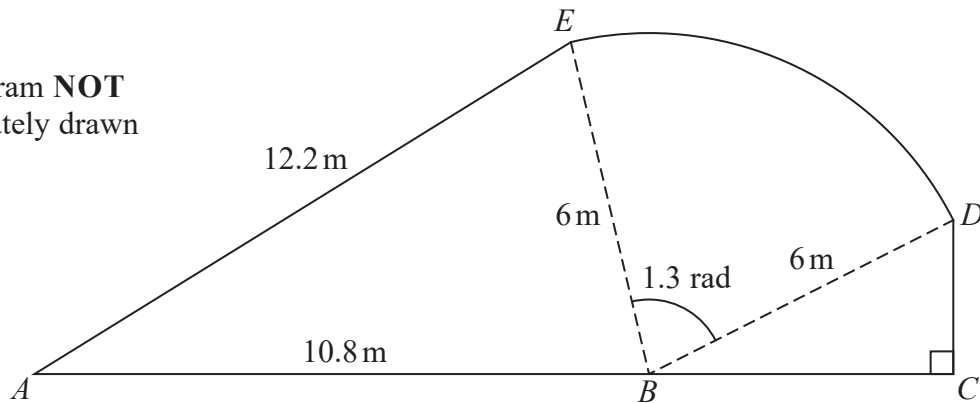


Figure 2

Figure 2 shows the plan view of a garden.

The shape of the garden $ABCDEA$ consists of a triangle ABE and a right-angled triangle BCD joined to a sector BDE of a circle with radius 6 m and centre B .

The points A , B and C lie on a straight line with $AB = 10.8$ m

Angle $BCD = \frac{\pi}{2}$ radians, angle $EBD = 1.3$ radians and $AE = 12.2$ m

- (a) Find the area of the sector BDE , giving your answer in m^2 (2)
- (b) Find the size of angle ABE , giving your answer in radians to 2 decimal places. (2)
- (c) Find the area of the garden, giving your answer in m^2 to 3 significant figures. (3)

Question 5 continued

Question 5 continued

[illegible]

Question 5 continued

(Total for Question 5 is 7 marks)

6.

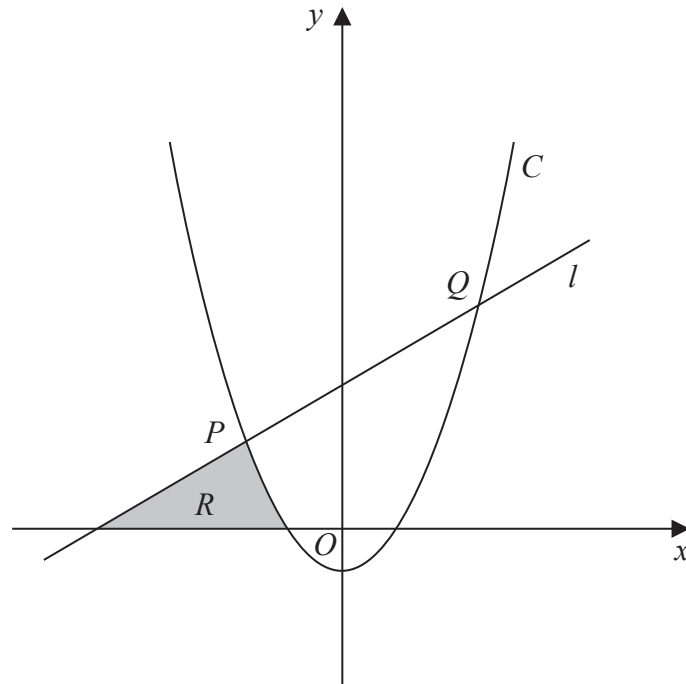


Figure 3

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

Solutions relying on calculator technology are not acceptable.

Figure 3 shows

- the line l with equation $y - 5x = 75$
- the curve C with equation $y = 2x^2 + x - 21$

The line l intersects the curve C at the points P and Q , as shown in Figure 3.

- (a) Find, using algebra, the coordinates of P and the coordinates of Q . (4)

The region R , shown shaded in Figure 3, is bounded by C , l and the x -axis.

- (b) Use inequalities to define the region R . (3)

Question 6 continued

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 6 continued

(Total for Question 6 is 7 marks)

7. The curve C has equation $y = f(x)$ where

$$f(x) = 2x^3 - kx^2 + 14x + 24$$

and k is a constant.

(a) Find, in simplest form,

(i) $f'(x)$

(ii) $f''(x)$

(3)

The curve with equation $y = f'(x)$ intersects the curve with equation $y = f''(x)$ at the points A and B .

Given that the x coordinate of A is 5

(b) find the value of k .

(2)

(c) Hence find the coordinates of B .

(3)

Question 7 continued

(Total for Question 7 is 8 marks)

8. The curve C_1 has equation

$$y = x(4 - x^2)$$

- (a) Sketch the graph of C_1 showing the coordinates of any points of intersection with the coordinate axes.

(3)

The curve C_2 has equation $y = \frac{A}{x}$ where A is a constant.

- (b) Show that the x coordinates of the points of intersection of C_1 and C_2 satisfy the equation

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

(1)

- (c) Hence find the range of possible values of A for which C_1 meets C_2 at 4 distinct points.

(3)

Question 8 continued

(Total for Question 8 is 7 marks)

9. Given that

- the point A has coordinates $(4, 2)$
- the point B has coordinates $(15, 7)$
- the line l_1 passes through A and B

(a) find an equation for l_1 , giving your answer in the form $px + qy + r = 0$ where p , q and r are integers to be found.

(3)

The line l_2 passes through A and is parallel to the x -axis.

The point C lies on l_2 so that the length of BC is $5\sqrt{5}$

(b) Find both possible pairs of coordinates of the point C .

(4)

(c) Hence find the minimum possible area of triangle ABC .

(2)

Question 9 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 9 continued

Question 9 continued

(Total for Question 9 is 9 marks)

10. The curve C has equation $y = f(x)$ where $x > 0$

Given that

- $f'(x) = 6x - \frac{(2x-1)(3x+2)}{2\sqrt{x}}$

- the point $P(4, 12)$ lies on C

(a) find the equation of the normal to C at P , giving your answer in the form $y = mx + c$ where m and c are integers to be found,

(4)

(b) find $f(x)$, giving each term in simplest form.

(6)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 10 marks)

11.

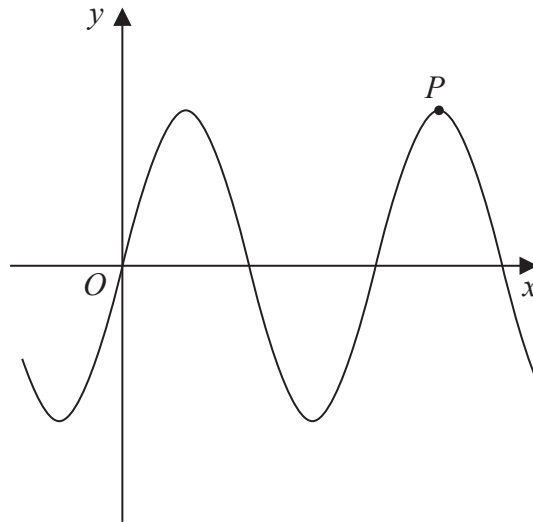


Figure 4

Figure 4 shows a sketch of part of the curve C_1 with equation

$$y = 12 \sin x$$

where x is measured in radians.

The point P shown in Figure 4 is a maximum point on C_1

(a) Find the coordinates of P .

(2)

The curve C_2 has equation

$$y = 12 \sin x + k$$

where k is a constant.

Given that the **maximum** value of y on C_2 is 3

(b) find the coordinates of the **minimum** point on C_2 which has the **smallest** positive x coordinate.

(2)

The curve C_3 has equation

$$y = 12 \sin(x + B)$$

where B is a positive constant.

Given that $\left(\frac{\pi}{4}, A\right)$, where A is a constant, is the **minimum** point on C_3 which has the **smallest** positive x coordinate,

(c) find

(i) the value of A ,

(ii) the smallest possible value of B .

(2)

Question 11 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 11 continued

(Total for Question 11 is 6 marks)

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	

Pearson Edexcel International Advanced Level

Wednesday 9 October 2024

Morning (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 ►

1. The line l_1 passes through the point $A(-5, 20)$ and the point $B(3, -4)$.

- (a) Find an equation for l_1 giving your answer in the form $y = mx + c$, where m and c are constants.

(3)

The line l_2 is perpendicular to l_1 and passes through the midpoint of AB

- (b) Find an equation for l_2 giving your answer in the form $px + qy + r = 0$, where p , q and r are integers.

(3)

Question 1 continued

(Total for Question 1 is 6 marks)

2.

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

Solutions relying on calculator technology are not acceptable.

(i) Simplify fully

$$\frac{3y^3(2x^4)^3}{4x^2y^4}$$

(3)

(ii) Find the exact value of a such that

$$\frac{16}{\sqrt{3} + 1} = a\sqrt{27} + 4$$

Write your answer in the form $p\sqrt{3} + q$ where p and q are fully simplified rational constants.

(4)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 2 continued

(Total for Question 2 is 7 marks)

3.

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

$$f(x) = \frac{(x+5)^2}{\sqrt{x}} \quad x > 0$$

(a) Find $\int f(x) \, dx$

(4)

(b) (i) Show that when $f'(x) = 0$

$$3x^2 + 10x - 25 = 0$$

(ii) Hence state the value of x for which

$$f'(x) = 0$$

(5)

Question 3 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 3 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 3 continued

(Total for Question 3 is 9 marks)

4.

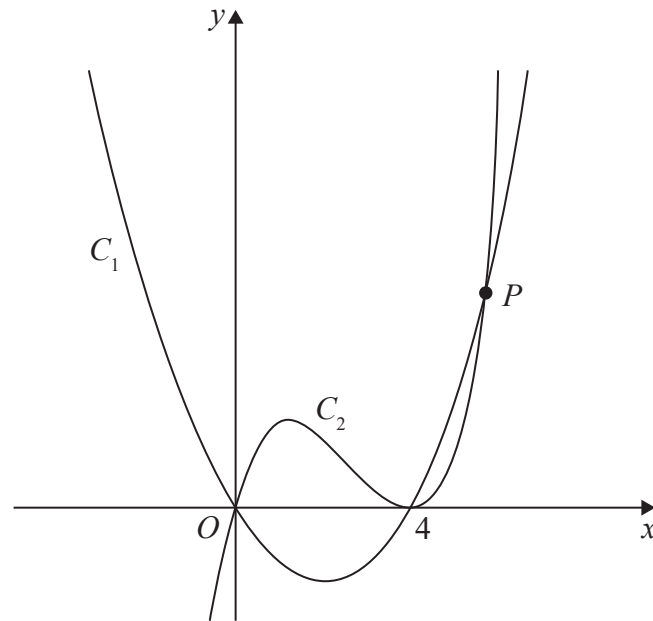
**Figure 1**

Figure 1 shows a sketch of part of the curves C_1 and C_2

Given that C_1

- has equation $y = f(x)$ where $f(x)$ is a quadratic function
- cuts the x -axis at the origin and at $x = 4$
- has a minimum turning point at $(2, -4.8)$

(a) find $f(x)$

(3)

Given that C_2

- has equation $y = g(x)$ where $g(x)$ is a cubic function
- cuts the x -axis at the origin and meets the x -axis at $x = 4$
- passes through the point $(6, 7.2)$

(b) find $g(x)$

(3)

The curves C_1 and C_2 meet in the first quadrant at the point P , shown in Figure 1.

(c) Use algebra to find the coordinates of P .

(4)

Question 4 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 4 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 4 continued

(Total for Question 4 is 10 marks)

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 5 continued

(Total for Question 5 is 9 marks)

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

Solutions relying on calculator technology are not acceptable.

(a) Sketch the curve C with equation

$$y = \frac{1}{2-x} \quad x \neq 2$$

State on your sketch

- the equation of the vertical asymptote
- the coordinates of the intersection of C with the y -axis

(3)

The straight line l has equation $y = kx - 4$, where k is a constant.

Given that l cuts C at least once,

(b) (i) show that

$$k^2 - 5k + 4 \geq 0$$

(ii) find the range of possible values for k .

(6)

Question 6 continued

[illegible]

Question 6 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 6 continued

(Total for Question 6 is 9 marks)

7.

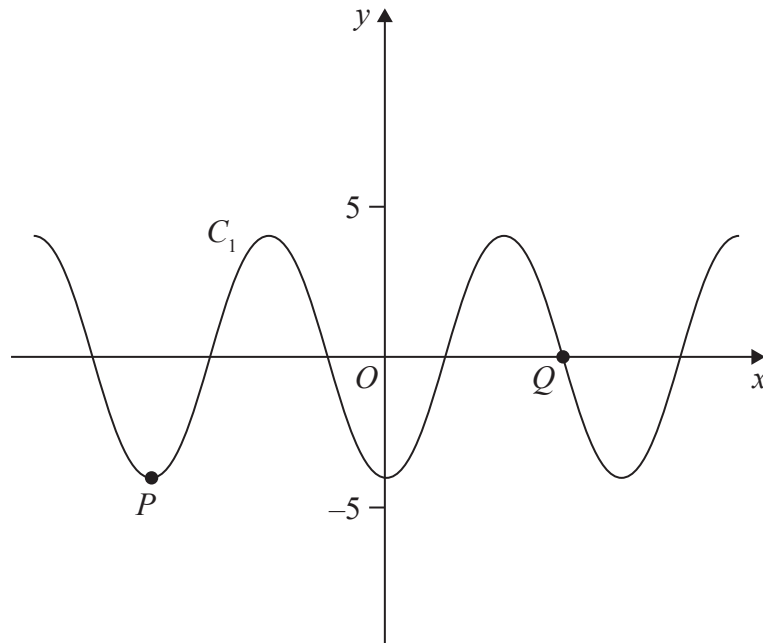
**Figure 3**

Figure 3 shows a plot of part of the curve C_1 with equation

$$y = -4 \cos x$$

where x is measured in radians.

Points P and Q lie on the curve and are shown in Figure 3.

(a) State

- (i) the coordinates of P
- (ii) the coordinates of Q

(3)

The curve C_2 has equation $y = -4 \cos x + k$ where x is measured in radians and k is a constant.

Given that C_2 has a maximum y value of 11

(b) (i) state the value of k

- (ii) state the coordinates of the minimum point on C_2 with the smallest positive x coordinate.

(3)

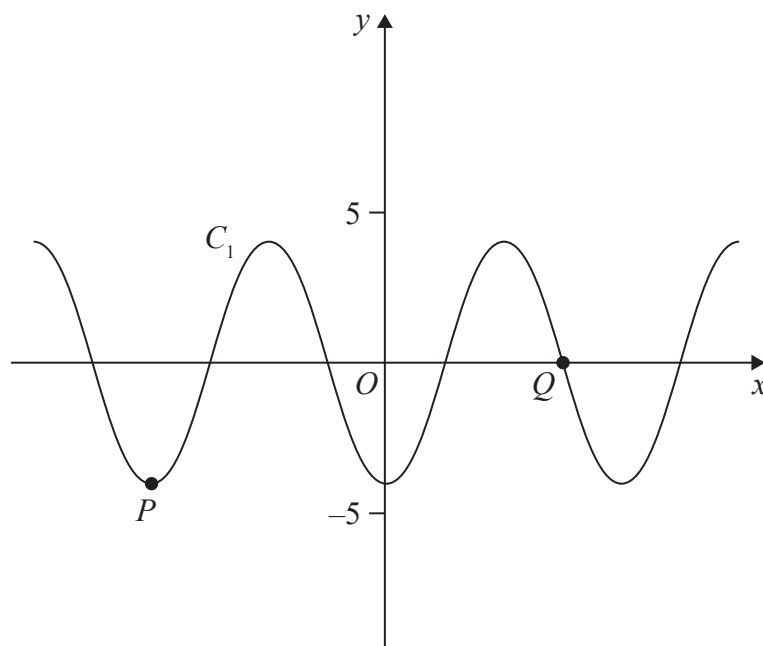
On the opposite page there is a copy of Figure 3 labelled Diagram 1.

(c) Using Diagram 1, state the number of solutions of the equation

$$-4 \cos x = 5 - \frac{10}{\pi} x$$

giving a reason for your answer.

(2)

Question 7 continued**Diagram 1****(Total for Question 7 is 8 marks)**

8. A curve C has equation $y = f(x)$.

The point P with x coordinate 3 lies on C

Given

- $f'(x) = 4x^2 + kx + 3$ where k is a constant
- the normal to C at P has equation $y = -\frac{1}{24}x + 5$

(a) show that $k = -5$

(3)

(b) Hence find $f(x)$.

(4)

Question 8 continued

(Total for Question 8 is 7 marks)

9.

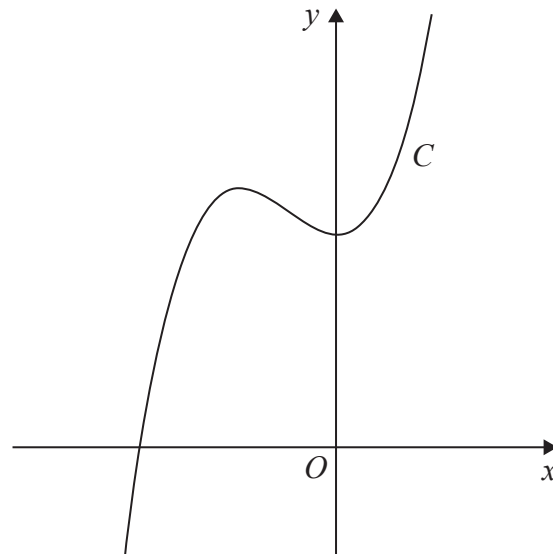
**Figure 4**

Figure 4 shows a sketch of the curve C with equation $y = f(x)$, where

$$f(x) = (x + 5)(3x^2 - 4x + 20)$$

(a) Deduce the range of values of x for which $f(x) \geq 0$ (1)

(b) Find $f'(x)$ giving your answer in simplest form. (3)

The point $R(-4, 84)$ lies on C .

Given that the tangent to C at the point P is parallel to the tangent to C at the point R

(c) find the x coordinate of P . (4)

(d) Find the point to which R is transformed when the curve with equation $y = f(x)$ is transformed to the curve with equation,

(i) $y = f(x - 3)$

(ii) $y = 4f(x)$ (2)

Question 9 continued

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 9 continued

(Total for Question 9 is 10 marks)

TOTAL FOR PAPER IS 75 MARKS