Pearson Edexcel International A Level Mathematics
Pure Mathematics 1
Past Paper Collection (from 2020)

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Last updated: July 1, 2024

Comments and suggestions to DrYuFromShanghai@QQ.com

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.
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- 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.

Leave blank

Answer ALL questions. Write your answers in the spaces provided.

1. Find

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

simplifying your answer.

(4)

Leave blank

Question 1 continued

Q1

(Total 4 marks)

Leave
blank

2. Given

$$\frac{3^x}{3^{4y}} = 27\sqrt{3}$$

find y as a simplified function of x.

(3)

$$\frac{3^x}{3^{4y}} = 27\sqrt{3}$$

Leave
blank

Question 2 continued

Q2

(Total 3 marks)

3. The line l_1 has equation $3x + 5y - 7 = 0$

(a) Find the gradient of l_1

(2)

The line l_2 is perpendicular to l_1 and passes through the point $(6, -2)$.

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

(3)

Leave
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Question 3 continued

Q3

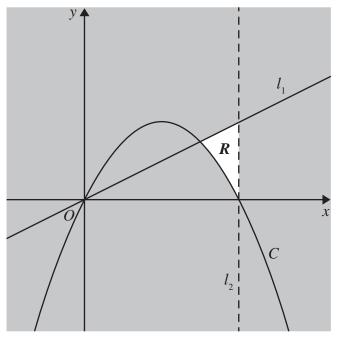**(Total 5 marks)**

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)

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Question 4 continued
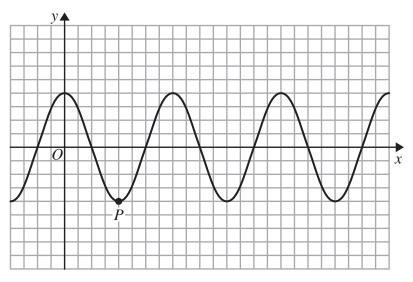
Q4

(Total 3 marks)

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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 $0 \leqslant x \leqslant 20\pi$

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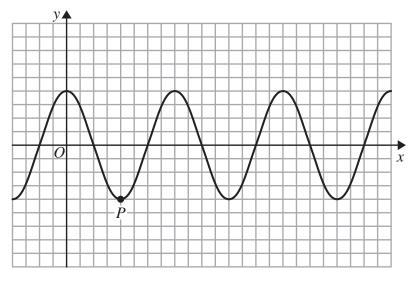
(2)

Question 5 continued

Diagram 1

(Total 6 marks)

Leave
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6. (*Solutions based entirely on graphical or numerical methods are not acceptable.*)

Given

$$f(x) = 2x^{\frac{5}{2}} - 40x + 8 \qquad x > 0$$

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

(4)

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

(3)

Leave
blank

Question 6 continued

Q6

(Total 7 marks)

Leave
blank

7.

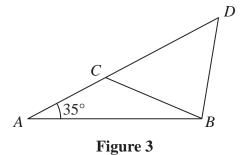

Not to scale

Figure 3

Figure 3 shows the design for a structure used to support a roof.

The structure consists of four wooden beams, *AB*, *BD*, *BC* and *AD*.

Given *AB* = 6.5 m, *BC* = *BD* = 4.7 m and angle *BAC* = 35°

(a) find, to one decimal place, the size of angle *ACB*,

(3)

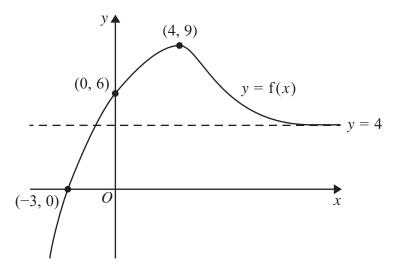(b) find, to the nearest metre, the total length of wood required to make this structure.

(3)

Leave
blank

Question 7 continued

Q7

(Total 6 marks)

8.

Figure 4

The curve C with equation $y = \mathrm{f}(x)$ 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 $y = \mathrm{f}(-x)$.

(1)

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

(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 $y = \mathrm{f}(x) - a$, 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)

Leave
blank

Question 8 continued

Q8

(Total 6 marks)

9. The equation

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

where c is a constant, has no real roots.

Find the range of possible values of c.

(7)

Leave blank

Question 9 continued

Q9

(Total 7 marks)

10. A sector AOB, of a circle centre O, has radius r cm and angle θ radians.

Given that the area of the sector is $6\,\text{cm}^2$ and that the perimeter of the sector is $10\,\text{cm}$,

(a) show that

$$3\theta^2 - 13\theta + 12 = 0$$

(4)

(b) Hence find possible values of r and θ.

(3)

Leave blank

Question 10 continued

Q10

(Total 7 marks)

Leave blank

11. (a) On Diagram 1 sketch the graphs of

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

   (ii) $y = x(x - 2)(5 - x)$

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

(4)

(b) Show that the x coordinates of the points of intersection of

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

   are given by the solutions to the equation $x(x^2 - 8x + 13) = 0$

(3)

The point P lies on both curves. Given that P lies in the first quadrant,

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

(5)

Question 11 continued

y

O

x

Diagram 1

Leave blank

Question 11 continued

Leave blank

Question 11 continued

Q11

(Total 12 marks)

Leave blank

12. The curve with equation $y = \mathrm{f}(x)$, $x > 0$, passes through the point $P(4, -2)$.

Given that

$$\frac{\mathrm{d}y}{\mathrm{d}x} = 3x\sqrt{x} - 10x^{-\frac{1}{2}}$$

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

(4)

(b) Find $\mathrm{f}(x)$.

(5)

Leave blank

Question 12 continued

Leave blank

Question 12 continued

Q12

(Total 9 marks)

TOTAL FOR PAPER IS 75 MARKS

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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**

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Mathematical Formulae and Statistical Tables (Lilac), calculator

Total Marks

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Information

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Leave
blank

Answer all questions. Write your answers in the spaces provided.

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

   (a) Find $\dfrac{dy}{dx}$, giving the answer in its simplest form.

   (3)

   The point $P(4, -3)$ lies on C.

   (b) Find the equation of the tangent to C at the point P. Write your answer in the form $y = mx + c$, where m and c are constants to be found.

   (3)

Leave
blank

Question 1 continued

(Total 6 marks)

Q1

2. **Answer this question showing each stage of your working.**

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

giving your answer in the form $a + b\sqrt{2}$ where a and b are rational numbers.

(2)

(b) Hence, or otherwise, solve the equation

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

giving your answer in the form $p + q\sqrt{2}$ where p and q are rational numbers.

(3)

Leave
blank

Question 2 continued

Q2

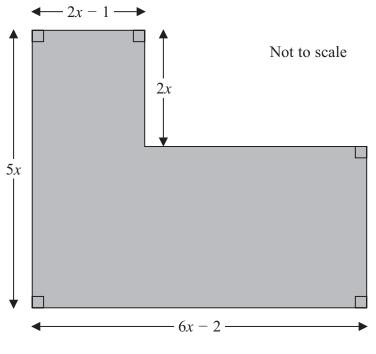**(Total 5 marks)**

Leave blank

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 m²,

(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

Question 3 continued

Leave
blank

Question 3 continued

Q3

(Total 9 marks)

4. Find

$$\int \frac{4x^2 + 1}{2\sqrt{x}}\,dx$$

giving the answer in its simplest form.

(5)

Leave blank

Question 4 continued

Q4

(Total 5 marks)

Leave blank

5. (a) Find, using algebra, all real solutions of

$$2x^3 + 3x^2 - 35x = 0$$

(3)

(b) Hence find all real solutions of

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

(4)

Leave blank

Question 5 continued

Q5

(Total 7 marks)

Leave blank

6. The line with equation $y = 4x + c$, where c is a constant, meets the curve with equation $y = x(x - 3)$ at only one point.

(a) Find the value of c.

(4)

(b) Hence find the coordinates of the point of intersection.

(3)

Leave blank

Question 6 continued

Q6

(Total 7 marks)

7.

Not to scale
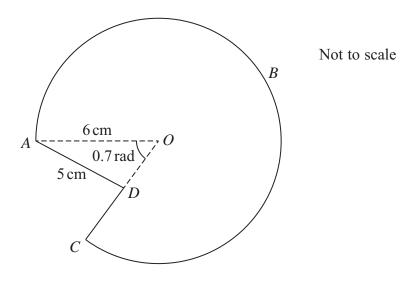
Figure 2

The shape *ABCDA* consists of a sector *ABCOA* of a circle, centre *O*, joined to a triangle *AOD*, as shown in Figure 2.

The point *D* lies on *OC*.

The radius of the circle is 6 cm, length *AD* is 5 cm and angle *AOD* is 0.7 radians.

(a) Find the area of the sector *ABCOA*, giving your answer to one decimal place.

(3)

Given angle *ADO* is obtuse,

(b) find the size of angle *ADO*, giving your answer to 3 decimal places.

(3)

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

(4)

Leave
blank

Question 7 continued

Leave blank

Question 7 continued

Leave blank

Question 7 continued

(Total 10 marks)

Q7

8. The curve C with equation $y = f(x)$, $x > 0$, passes through the point $P(4, 1)$.

Given that $f'(x) = 4\sqrt{x} - 2 - \dfrac{8}{3x^2}$

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

(4)

(b) Find $f(x)$.

(5)

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Leave blank

Question 8 continued

Leave blank

Question 8 continued

Leave
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Question 8 continued

(Total 9 marks)

Q8

Leave
blank

9.
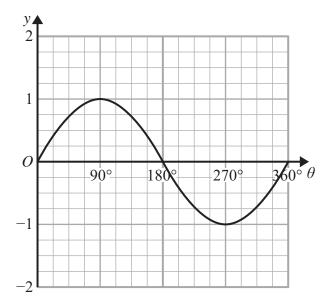
Figure 3

Figure 3 shows a plot of the curve with equation $y = \sin\theta, \quad 0 \leqslant \theta \leqslant 360°$

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

$$y = 4\sin\theta, \quad 0 \leqslant \theta \leqslant 360°$$

(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) $y = 1 + \sin\theta, \quad 0 \leqslant \theta \leqslant 360°$

   (ii) $y = \tan\theta, \quad 0 \leqslant \theta \leqslant 360°$

(2)

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

   (i) $\tan\theta = 1 + \sin\theta$ that lie in the region $0 \leqslant \theta \leqslant 2160°$

   (ii) $\tan\theta = 1 + \sin\theta$ that lie in the region $0 \leqslant \theta \leqslant 1980°$

(3)

Question 9 continued

Diagram 1

(Total 7 marks)

Leave blank

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

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

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 $x = \dfrac{5}{2}$ 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

Leave blank

Question 10 continued

Q10

(Total 10 marks)

TOTAL FOR PAPER IS 75 MARKS
END

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Other names

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Advanced Level

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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:
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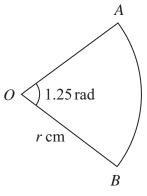- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Leave
blank

1.

Figure 1

Figure 1 shows a sector AOB of a circle with centre O and radius r cm.

The angle AOB is 1.25 radians.

Given that the area of the sector AOB is 15 cm²

(a) find the exact value of r,

(2)

(b) find the exact length of the perimeter of the sector. Write your answer in simplest form.

(3)

Leave
blank

Question 1 continued

Q1

(Total 5 marks)

Leave blank

2. A tree was planted in the ground.

Exactly 2 years after it was planted, the height of the tree was 1.85 m.

Exactly 7 years after it was planted, the height of the tree was 3.45 m.

Given that the height, H metres, of the tree, t years after it was planted in the ground, can be modelled by the equation

$$H = at + b$$

where a and b are constants,

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

(4)

(b) State, according to the model, the height of the tree when it was planted.

(1)

Leave
blank

Question 2 continued

Q2

(Total 5 marks)

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

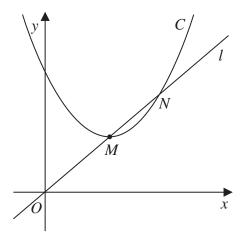**Solutions relying on calculator technology are not acceptable.**

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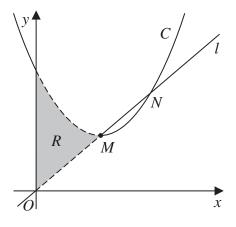
Figure 3 shows the curve C and the line l. The finite region R, shown shaded in Figure 3, is bounded by C, l and the y-axis.

(c) Use inequalities to define the region R.

(2)

Question 3 continued

Question 3 continued

Leave blank

Question 3 continued

Q3

(Total 10 marks)

Leave
blank

4. A parallelogram *ABCD* has area 40 cm²

Given that *AB* has length 10 cm, *BC* has length 6 cm and angle *DAB* is obtuse, find

(a) the size of angle *DAB*, in degrees, to 2 decimal places,

(3)

(b) the length of diagonal *BD*, in cm, to one decimal place.

(2)

Leave blank

Question 4 continued

(Total 5 marks)

5. A curve has equation

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

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

(3)

The point $P\left(4, \dfrac{11}{3}\right)$ lies on the curve.

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

(4)

Leave blank

Question 5 continued

Q5

(Total 7 marks)

Leave
blank

6. The curve C has equation $y = \dfrac{4}{x} + k$, where k is a positive constant.

(a) Sketch a graph of C, stating the equation of the horizontal asymptote and the coordinates of the point of intersection with the x-axis.

(3)

The line with equation $y = 10 - 2x$ is a tangent to C.
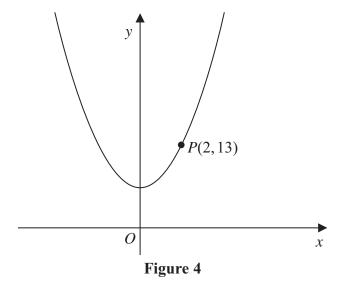
(b) Find the possible values for k.

(5)

Leave
blank

Question 6 continued

Q6

(Total 8 marks)

7.

Figure 4

Figure 4 shows part of the curve with equation $y = 2x^2 + 5$

The point $P(2,13)$ lies on the curve.

(a) Find the gradient of the tangent to the curve at P.

(2)

The point Q with x coordinate $2 + h$ also lies on the curve.

(b) Find, in terms of h, the gradient of the line PQ. Give your answer in simplest form.

(3)

(c) Explain briefly the relationship between the answer to (b) and the answer to (a).

(1)

Leave blank

Question 7 continued

Q7

(Total 6 marks)

8. Solve, using algebra, the equation

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

Fully simplify your answers, writing them in the form $a + b\sqrt{c}$, where a, b and c are integers to be found.
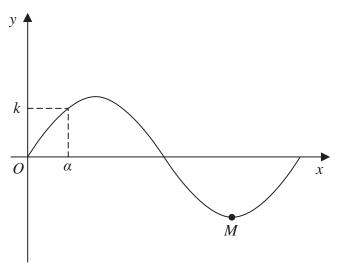
(5)

Leave blank

Question 8 continued

Q8

(Total 5 marks)

9.

Figure 5

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

(a) State the period of C.

(1)

(b) State the coordinates of M.

(1)

The smallest positive solution of the equation $\sin\left(\dfrac{x}{12}\right) = k$, where k is a constant, is α.

Find, in terms of α,

(c) (i) the negative solution of the equation $\sin\left(\dfrac{x}{12}\right) = k$ that is closest to zero,

(ii) the smallest positive solution of the equation $\cos\left(\dfrac{x}{12}\right) = k$.

(2)

Leave
blank

Question 9 continued

Q9

(Total 4 marks)

10.

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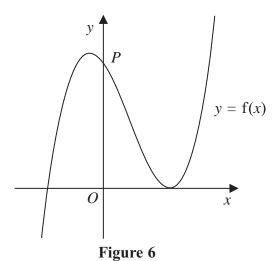
Figure 6 shows a sketch of part of the curve with equation $y = f(x)$, where

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

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

(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

Leave blank

Question 10 continued

Q10

(Total 10 marks)

Leave
blank

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

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

Given that

- $f''(x) = \dfrac{4}{\sqrt{x}} - 3$

- $f'(x) = 5$ at P

find

(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)

(b) $f(x)$.

(8)

Leave blank

Question 11 continued

Leave blank

Question 11 continued

Q11

(Total 10 marks)

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differentiation and integration, or have retrievable mathematical
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Instructions

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  – *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.
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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.
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  – *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, in simplest form,

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

(4)

Leave blank

Question 1 continued

Q1

(Total 4 marks)

Leave
blank

2. Given $y = 3^x$, express each of the following in terms of y. Write each expression in its simplest form.

(a) 3^{3x}

(1)

(b) $\dfrac{1}{3^{x-2}}$

(2)

(c) $\dfrac{81}{9^{2-3x}}$

(2)

Leave
blank

Question 2 continued

Q2

(Total 5 marks)

3.
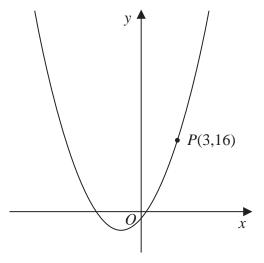
Figure 1

Figure 1 shows part of the curve with equation $y = x^2 + 3x - 2$

The point $P(3,16)$ lies on the curve.

(a) Find the gradient of the tangent to the curve at P.

(2)

The point Q with x coordinate $3 + h$ also lies on the curve.

(b) Find, in terms of h, the gradient of the line PQ. Write your answer in simplest form.

(3)

(c) Explain briefly the relationship between the answer to (b) and the answer to (a).

(1)

Leave blank

Question 3 continued

Q3

(Total 6 marks)

4.

Figure 2
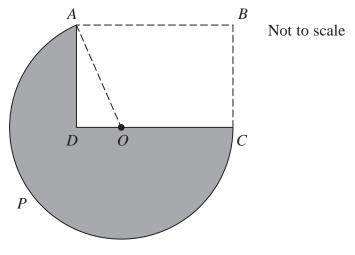
Figure 2 shows the plan view of a house *ABCD* and a lawn *APCDA*.

ABCD is a rectangle with *AB* = 16 m.

APCOA is a sector of a circle centre *O* with radius 12 m.

The point *O* lies on the line *DC*, as shown in Figure 2.

(a) Show that the size of angle *AOD* is 1.231 radians to 3 decimal places.

(2)

The lawn *APCDA* is shown shaded in Figure 2.

(b) Find the area of the lawn, in m², to one decimal place.

(4)

(c) Find the perimeter of the lawn, in metres, to one decimal place.

(3)

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Q4

(Total 9 marks)

Leave
blank

5. (a) Find, using algebra, all solutions of

$$20x^3 - 50x^2 - 30x = 0$$

(3)

(b) Hence find all real solutions of

$$20(y + 3)^{\frac{3}{2}} - 50(y + 3) - 30(y + 3)^{\frac{1}{2}} = 0$$

(4)

Leave
blank

Question 5 continued

Q5

(Total 7 marks)

Leave blank

6. The line l_1 has equation $3x - 4y + 20 = 0$

The line l_2 cuts the x-axis at $R(8,0)$ and is parallel to l_1

(a) Find the equation of l_2, writing your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found.

(3)

The line l_1 cuts the x-axis at P and the y-axis at Q.

Given that $PQRS$ is a parallelogram, find

(b) the area of $PQRS$,

(3)

(c) the coordinates of S.

(2)

Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Q6

(Total 8 marks)

Leave
blank

7.

Figure 3
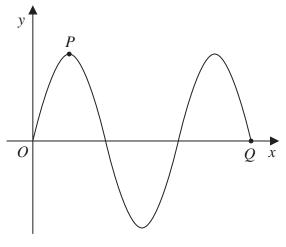
Figure 3 shows part of the curve C_1 with equation $y = 3\sin x$, where x is measured in degrees.

The point P and the point Q lie on C_1 and are shown in Figure 3.

(a) State

    (i) the coordinates of P,

    (ii) the coordinates of Q.

(3)

A different curve C_2 has equation $y = 3\sin x + k$, where k is a constant.

The curve C_2 has a maximum y value of 10

The point R is the minimum point on C_2 with the smallest positive x coordinate.

(b) State the coordinates of R.

(2)

Leave blank

Question 7 continued

Q7

(Total 5 marks)

Leave blank

8. The straight line l has equation $y = k(2x - 1)$, where k is a constant.

The curve C has equation $y = x^2 + 2x + 11$

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

(6)

Leave
blank

Question 8 continued

Q8

(Total 6 marks)

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

Solutions relying on calculator technology are not acceptable.

A curve has equation

$$y = \frac{4x^2 + 9}{2\sqrt{x}} \qquad x > 0$$

Find the x coordinate of the point on the curve at which $\dfrac{dy}{dx} = 0$

(6)

Leave blank

Question 9 continued

Q9

(Total 6 marks)

Leave
blank

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 $f\left(\dfrac{1}{4}x\right) = 0$

   (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)

Leave blank

Question 10 continued

Q10

(Total 8 marks)

Leave blank

11. A curve has equation $y = f(x)$, where

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

The point $P(4, -50)$ lies on the curve.

Given that $f'(x) = -4$ at P,

(a) find the equation of the normal at P, writing your answer in the form $y = mx + c$, where m and c are constants,

(3)

(b) find $f(x)$.

(8)

Question 11 continued

Leave
blank

Question 11 continued

Q11

(Total 11 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 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 _____

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1. Given that

$$(3pq^2)^4 \times 2p \sqrt{q^8} \equiv ap^b q^c$$

find the values of the constants a, b and c.

(3)

Leave blank

Question 1 continued

Q1

(Total 3 marks)

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

(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)

Question 2 continued

Question 2 continued

Leave blank

Question 2 continued

Q2

(Total 7 marks)

Leave
blank

3.

Diagram not
drawn to scale

Figure 1
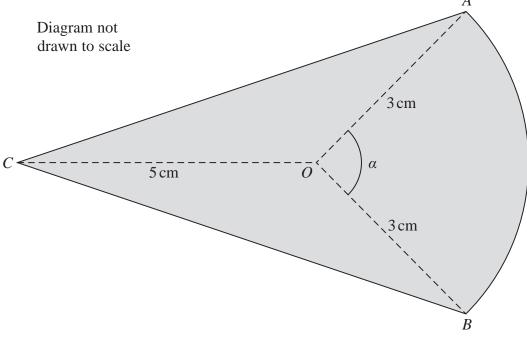
Figure 1 shows the design for a badge.

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

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

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

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

(2)

(b) Hence find

(i) the area of the badge, giving your answer in cm^2 to 2 significant figures,

(ii) the perimeter of the badge, giving your answer in cm to one decimal place.

(8)

Question 3 continued

Question 3 continued

Leave
blank

Question 3 continued

Q3

(Total 10 marks)

Leave
blank

4. Use algebra to solve the simultaneous equations

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

You must show all stages of your working.

(7)
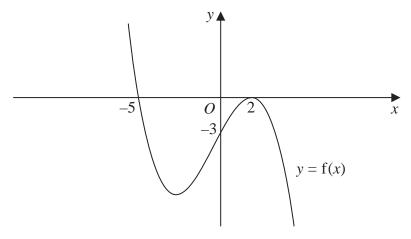
Leave blank

Question 4 continued

Q4

(Total 7 marks)

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
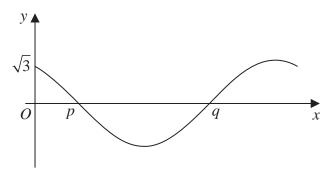
Figure 3 shows a sketch of the curve with equation

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

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)

Leave
blank

Question 5 continued

Question 5 continued

Leave
blank

Question 5 continued

Q5

(Total 9 marks)

Leave
blank

6. The point *A* has coordinates (–4, 11) and the point *B* has coordinates (8, 2).

(a) Find the gradient of the line *AB*, giving your answer as a fully simplified fraction.

(2)

The point *M* is the midpoint of *AB*. The line *l* passes through *M* and is perpendicular to *AB*.

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

(4)

The point *C* lies on *l* such that the area of triangle *ABC* is 37.5 square units.

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

(5)

Question 6 continued

Leave blank

Question 6 continued

Leave
blank

Question 6 continued

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

Leave blank

Question 7 continued

Leave blank

Question 7 continued

(Total 11 marks)

Q7

8. The curve C has equation

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

(a) Show that

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

(4)

The line l_1 is the tangent to C at the point where $x = 6$

(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.

(4)

The line l_2 is the tangent to C at the point where $x = \alpha$

Given that l_1 and l_2 are parallel and distinct,

(c) find the value of α

(3)

Leave blank

Question 8 continued

Question 8 continued

Leave
blank

Question 8 continued

Q8

(Total 11 marks)

Leave
blank

9. A curve with equation $y = f(x)$ passes through the point (9, 10).

Given that

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

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

(6)

Question 9 continued

Leave blank

Question 9 continued

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

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- Try to answer every question.
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Leave blank

1. A curve has equation

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

(a) Find, in simplest form, $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

(3)

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

(b) Find an equation of the normal to the curve at P, writing your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found.

(5)

Leave blank

Question 1 continued

Q1

(Total 8 marks)

2. A tree was planted.

Exactly 3 years after it was planted, the height of the tree was 2 m.

Exactly 5 years after it was planted, the height of the tree was 2.4 m.

Given that the height, H metres, of the tree, t years after it was planted, can be modelled by the equation

$$H^3 = pt^2 + q$$

where p and q are constants,

(a) find, to 3 significant figures where necessary, the value of p and the value of q.

(4)

Exactly T years after the tree was planted, its height was 5 m.

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

(2)

Question 2 continued

Question 2 continued

Leave blank

Question 2 continued

Q2

(Total 6 marks)

3.

Figure 1
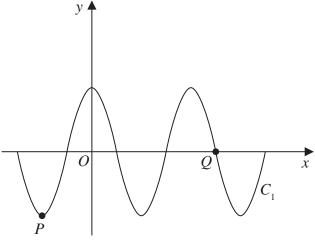
Figure 1 shows a sketch of part of the curve C_1 with equation $y = 4\cos x°$

The point P and the point Q lie on C_1 and are shown in Figure 1.

(a) State

    (i) the coordinates of P,

    (ii) the coordinates of Q.

$\hspace{12cm}$ **(3)**

The curve C_2 has equation $y = 4\cos x° + k$, where k is a constant.

Curve C_2 has a minimum y value of -1

The point R is the maximum point on C_2 with the smallest positive x coordinate.

(b) State the coordinates of R.

$\hspace{12cm}$ **(2)**

Leave
blank

Question 3 continued

Q3

(Total 5 marks)

Leave
blank

4.
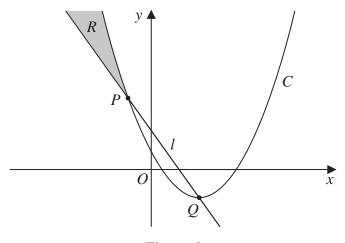
Figure 2

The points P and Q, as shown in Figure 2, have coordinates $(-2, 13)$ and $(4, -5)$ respectively.

The straight line l passes through P and Q.

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

(3)

The quadratic curve C passes through P and has a minimum point at Q.

(b) Find an equation for C.

(3)

The region R, shown shaded in Figure 2, lies in the second quadrant and is bounded by C and l only.

(c) Use inequalities to define region R.

(2)

Leave blank

Question 4 continued

Question 4 continued

Leave
blank

Question 4 continued

Q4

(Total 8 marks)

Leave blank

5.

Not to scale

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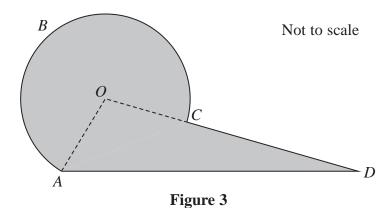
Figure 3 shows the plan view of a viewing platform at a tourist site.

The shape of the viewing platform consists of a sector *ABCOA* of a circle, centre *O*, joined to a triangle *AOD*.

Given that

- $OA = OC = 6\,$m
- $AD = 14\,$m
- angle *ADC* = 0.43 radians
- angle *AOD* is an obtuse angle
- *OCD* is a straight line

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 m², to one decimal place.

(4)

Question 5 continued

Question 5 continued

Leave
blank

Question 5 continued

Q5

(Total 9 marks)

6. (a) Sketch the curve with equation

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

(2)

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

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

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

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

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

(5)

Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Q6

(Total 10 marks)

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

   Solutions relying on calculator technology are not acceptable.

$$\mathrm{f}(x) = 2x - 3\sqrt{x} - 5 \qquad x > 0$$

(a) Solve the equation

$$\mathrm{f}(x) = 9$$

(4)

(b) Solve the equation

$$\mathrm{f}''(x) = 6$$

(5)

Leave blank

Question 7 continued

Question 7 continued

Question 7 continued

Q7

(Total 9 marks)

Leave
blank

8.

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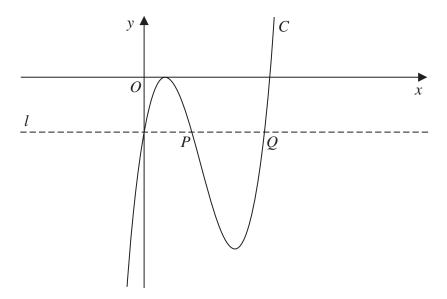
Figure 4 shows a sketch of part of the curve C with equation $y = f(x)$, where

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

(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)

Leave blank

Question 8 continued

Question 8 continued

Leave
blank

Question 8 continued

Q8

(Total 9 marks)

Leave
blank

9. **(i)** Find

$$\int \frac{(3x + 2)^2}{4\sqrt{x}} \, dx \qquad x > 0$$

giving your answer in simplest form.

(5)

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

Given

- $f'(x) = x^2 + ax + b$ where a and b are constants
- the y intercept of C is -8
- the point $P(3, -2)$ lies on C
- the gradient of C at P is 2

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

(6)

Leave blank

Question 9 continued

Leave
blank

Question 9 continued

Q9

(Total 11 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

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

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- 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.

1. The curve C has equation

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

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$, giving your answer in simplest form.

(4)

The point $P(4,3)$ lies on C.

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

(4)

Question 1 continued

Leave blank

Q1

(Total 8 marks)

Leave blank

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

Solutions relying on calculator technology are not acceptable.

$$f(x) = ax^3 + (6a + 8)x^2 - a^2x$$

where a is a positive constant.

Given $f(-1) = 32$

(a) (i) show that the only possible value for a is 3

(ii) Using $a = 3$ solve the equation

$$f(x) = 0$$

(5)

(b) Hence find all real solutions of

(i) $3y + 26y^{\frac{2}{3}} - 9y^{\frac{1}{3}} = 0$

(ii) $3\left(9^{3z}\right) + 26\left(9^{2z}\right) - 9\left(9^z\right) = 0$

(5)

Question 2 continued

Question 2 continued

Leave blank

Question 2 continued

Q2

(Total 10 marks)

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

Solutions relying on calculator technology are not acceptable.
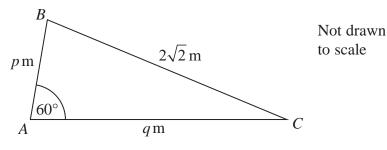

Figure 1

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 $BAC = 60°$

(a) Show that

$$p^2 + q^2 - pq = 8$$

(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)

Question 3 continued

Question 3 continued

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Question 3 continued

Q3

(Total 9 marks)
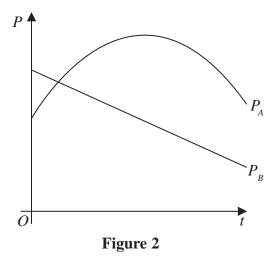
4. Find

$$\int \frac{(3\sqrt{x} + 2)(x - 5)}{4\sqrt{x}} \, dx$$

writing each term in simplest form.

(6)

Question 4 continued

Leave
blank

Q4

(Total 6 marks)

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

$$P_A = 53 - 0.4(t - 8)^2 \qquad t \geqslant 0$$

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

$$P_B = -1.6t + 44.2 \qquad t \geqslant 0$$

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)

Question 5 continued

Question 5 continued

Leave blank

Question 5 continued

Q5

(Total 8 marks)

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

Given that

- C passes through the point $P(8, 2)$

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

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

(3)

(b) Find, in simplest form, $f(x)$.

(5)

Question 6 continued

Question 6 continued

Leave blank

Question 6 continued

Q6

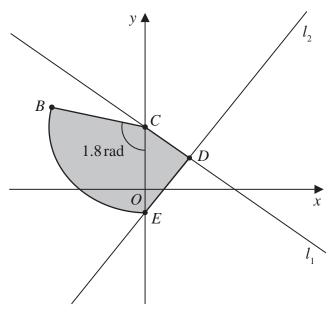**(Total 8 marks)**

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 $-\dfrac{14}{3}$

(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)

Question 7 continued

Question 7 continued

Leave
blank

Question 7 continued

Q7

(Total 10 marks)

Leave blank

8. The curve C_1 has equation

$$y = 3x^2 + 6x + 9$$

(a) Write $3x^2 + 6x + 9$ in the form

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

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

(3)

The point P is the minimum point of C_1

(b) Deduce the coordinates of P.

(1)

A different curve C_2 has equation

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

where A, B, C and D are constants.

Given that C_2

- passes through P

- intersects the x-axis at -4, -2 and 3

(c) find, making your method clear, the values of A, B, C and D.

(5)

Question 8 continued

Question 8 continued

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Question 8 continued
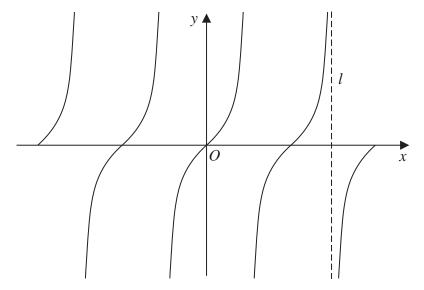
Q8

(Total 9 marks)

9.

Figure 4

Figure 4 shows a sketch of the curve with equation

$$y = \tan x \qquad -2\pi \leqslant x \leqslant 2\pi$$

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

$$y = \frac{1}{x} + 1 \qquad -2\pi \leqslant x \leqslant 2\pi$$

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 $-2\pi \leqslant x \leqslant 2\pi$

(4)

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

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

(ii) $-10\pi \leqslant x \leqslant \dfrac{5}{2}\pi$

(2)

Question 9 continued

Diagram 1

Leave
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Question 9 continued

(Total 7 marks)

TOTAL FOR PAPER IS 75 MARKS

END

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.

1. Find

$$\int 12x^3 + \frac{1}{6\sqrt{x}} - \frac{3}{2x^4} \, dx$$

giving each term in simplest form.

(5)

Leave
blank

Question 1 continued

Q1

(Total 5 marks)

Leave blank

2.

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

Solutions relying on calculator technology are not acceptable.

A curve has equation

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

The points P and Q lie on the curve.

The gradient of the curve at both point P and point Q is 2

Find the x coordinates of P and Q.

(5)

Leave blank

Question 2 continued

Q2

(Total 5 marks)

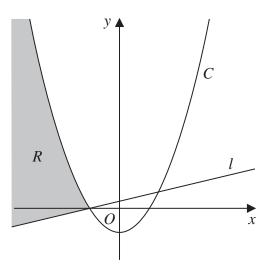**3.** (i) Solve

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

(3)

(ii)

Figure 1

Figure 1 shows a sketch of the curve C and the straight line l.

The infinite region R, shown shaded in Figure 1, lies in quadrants 2 and 3 and is bounded by C and l only.

Given that

- l has a gradient of 3
- C has equation $y = 2x^2 - 50$
- C and l intersect on the negative x-axis

use inequalities to define the region R.

(3)

Leave blank

Question 3 continued

Q3

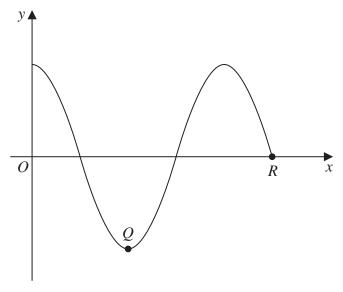(Total 6 marks)

4.

Figure 2

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

$$f(x) = \cos 2x^{\circ} \qquad 0 \leqslant x \leqslant k$$

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

(a) State

    (i) the coordinates of Q,

    (ii) the value of k.

(3)

(b) Given that there are exactly two solutions to the equation

$$\cos 2x^{\circ} = p \qquad \text{in the region } 0 \leqslant x \leqslant k$$

find the range of possible values for p.

(2)

Leave blank

Question 4 continued

Q4

(Total 5 marks)

Leave
blank

5. The line l_1 has equation $3y - 2x = 30$

The line l_2 passes through the point $A(24, 0)$ and is perpendicular to l_1

Lines l_1 and l_2 meet at the point P

(a) Find, using algebra and showing your working, the coordinates of P.

(5)

Given that l_1 meets the x-axis at the point B,

(b) find the area of triangle BPA.

(3)

Leave blank

Question 5 continued

Leave
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Question 5 continued

Leave
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Question 5 continued

Q5

(Total 8 marks)

Leave
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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 $x = \dfrac{1}{3}$

(4)

Question 6 continued

Question 6 continued

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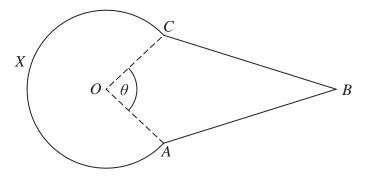**Question 6 continued**

Q6

(Total 10 marks)

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 = Angle OCB = 2 radians
- Angle $AOC = \theta$ 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)

Question 7 continued

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Question 7 continued

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Question 7 continued

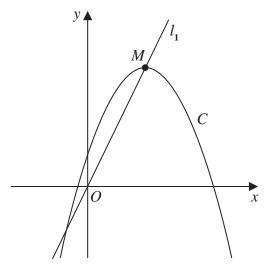**(Total 10 marks)**

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8.

Figure 4

Figure 4 shows a sketch of the curve C with equation

$$y = 4 + 12x - 3x^2$$

The point M is the maximum turning point on C.

(a) (i) Write $4 + 12x - 3x^2$ in the form

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

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

(ii) Hence, or otherwise, state the coordinates of M.

(5)

The line l_1 passes through O and M, as shown in Figure 4.

A line l_2 touches C and is parallel to l_1

(b) Find an equation for l_2

(5)

Question 8 continued

Question 8 continued

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Question 8 continued

Q8

(Total 10 marks)

Leave blank

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

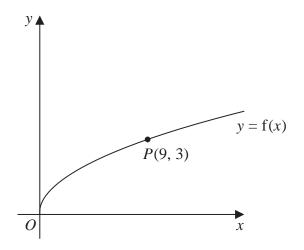**Solutions relying on calculator technology are not acceptable.**

Figure 5

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

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

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

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

(3)

(c) Hence find, in simplest form, the coordinates of Q.
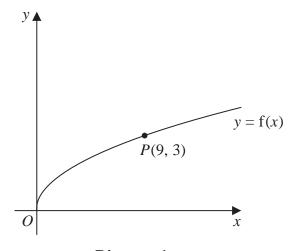
(3)

Question 9 continued

Diagram 1

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

Question 9 continued

Question 9 continued

Only use this copy if you need to redraw your graphs.

y

$y = f(x)$

$P(9, 3)$

O

x

Copy of Diagram 1

(Total 9 marks)

Leave
blank

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

Given that

- $f'(x) = ax - 12x^{\frac{1}{3}}$, where a is a constant

- $f''(x) = 0$ when $x = 27$

- the curve passes through the point $(1, -8)$

(a) find the value of a.

(3)

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

(4)

Question 10 continued

Leave
blank

Question 10 continued

Q10

(Total 7 marks)

TOTAL FOR PAPER IS 75 MARKS

END

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

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- 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

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- 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

1. Find

$$\int \left(\frac{8x^3}{5} - \frac{2}{3x^4} - 1 \right) dx$$

giving each term in simplest form.

(4)

Leave
blank

Question 1 continued

Q1

(Total 4 marks)

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

(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)

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

Solutions relying on calculator technology are not acceptable.

(i)

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

Express f(x) in the form $ax^2 + bx\sqrt{2} + c$ where a, b and c are integers to be found.

(3)

(ii) Solve the equation

$$\sqrt{3}\left(4y - 3\sqrt{3}\right) = 5y + \sqrt{3}$$

giving your answer in the form $p + q\sqrt{3}$ where p and q are simplified fractions to be found.

(4)

Leave blank

Question 3 continued

Question 3 continued

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Question 3 continued

Q3

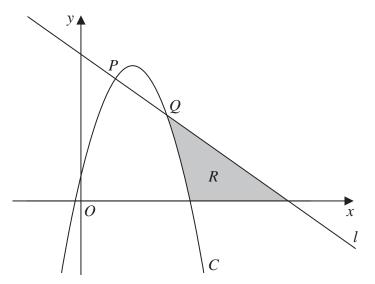**(Total 7 marks)**

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4.

Figure 1

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

Solutions relying on calculator technology are not acceptable.

Figure 1 shows a line l with equation $x + y = 6$ and a curve C with equation $y = 6x - 2x^2 + 1$

The line l intersects the curve C at the points P and Q as shown in Figure 1.

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

(4)

The region R, shown shaded in Figure 1, is bounded by C, l and the x-axis.

(b) Use inequalities to define the region R.

(3)

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Question 4 continued
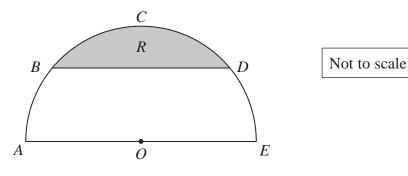
Q4

(Total 7 marks)

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5.

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)

Question 5 continued

Leave blank

Question 5 continued

Leave
blank

Question 5 continued

Q5

(Total 7 marks)

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

Given that

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

- the point $P(4, 20)$ lies on C

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

 (ii) Hence find the equation of the tangent 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 $f(x)$, simplifying your answer.

(7)

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Question 6 continued

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Question 6 continued

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Question 6 continued

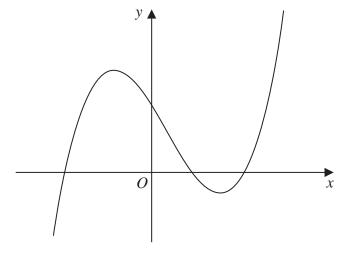**Q6**

(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

Leave blank

Question 7 continued

Leave
blank

Question 7 continued

Q7

(Total 11 marks)

8. The line l_1 has equation

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

(a) Find the gradient of l_1

(1)

Given that

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

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

(3)

The lines l_1 and l_2 intersect at the point M.

(c) Using algebra and showing all your working, find the coordinates of M.

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

(3)

Given that the diagonals of a square $ABCD$ meet at M,

(d) find the coordinates of the point C.

(2)

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Question 8 continued

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Question 8 continued

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Question 8 continued
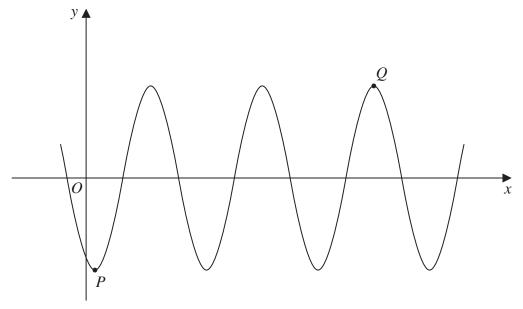
Q8

(Total 9 marks)

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blank

9.

Figure 4

Figure 4 shows part of the curve with equation

$$y = A\cos(x - 30)°$$

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)

Leave blank

Question 9 continued

Q9

(Total 4 marks)

Leave
blank

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

Leave
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Question 10 continued

Q10

(Total 9 marks)

TOTAL FOR PAPER: 75 MARKS

END

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

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Instructions

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- Inexact answers should be given to three significant figures unless otherwise stated.

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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

$$\int \left(10x^5 + 6x^3 - \frac{3}{x^2} \right) dx$$

giving your answer in simplest form.

(4)

Leave blank

Question 1 continued

Q1

(Total 4 marks)

Leave blank

2. In the triangle *ABC*,

- $AB = 21\,\text{cm}$
- $BC = 13\,\text{cm}$
- angle $BAC = 25°$
- angle $ACB = x°$

(a) Use the sine rule to find the value of $\sin x°$, giving your answer to 4 decimal places.

(2)

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

(b) find the value of *x*, giving your answer to 2 decimal places.

(3)

Leave
blank

Question 2 continued

Q2

(Total 5 marks)

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

Solutions relying on calculator technology are not acceptable.

(i) Show that $\dfrac{\sqrt{180} - \sqrt{80}}{\sqrt{5}}$ is an integer and find its value.

(2)

(ii) Simplify

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

giving your answer in the form $a + b\sqrt{5}$ where a and b are rational numbers.
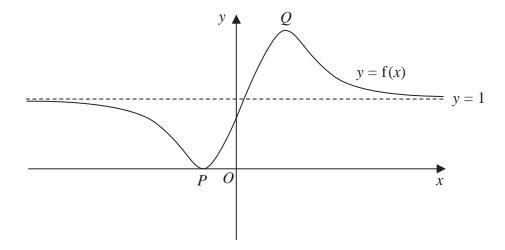
(3)

Question 3 continued

Leave blank

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 $Q\left(\dfrac{3}{2}, 2\right)$

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 $y = \dfrac{4}{5}x$

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.
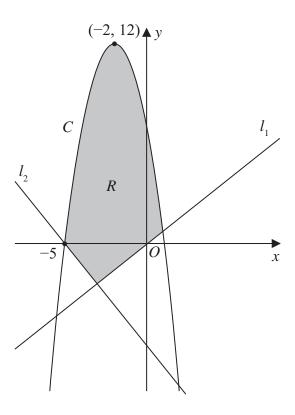
(3)

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

Leave
blank

Question 5 continued

Question 5 continued

Q5

(Total 9 marks)

Leave
blank

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

Solutions relying on calculator technology are not acceptable.

(a) Given that

$$2xy - 3x^2 = 50$$

and

$$y - x^3 + 6x = 0$$

show that

$$2x^4 - 15x^2 - 50 = 0$$

(2)

(b) Hence solve the simultaneous equations

$$2xy - 3x^2 = 50$$
$$y - x^3 + 6x = 0$$

Give your answers in fully simplified surd form.

(5)

Question 6 continued

Question 6 continued

Leave blank

Question 6 continued

Q6

(**Total 7 marks**)

Leave
blank

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

Given that

- $f'(x) = \dfrac{2}{\sqrt{x}} + \dfrac{A}{x^2} + 3$, where A is a constant

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

(a) find the value of A.

(4)

Given also that

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

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

(5)

Question 7 continued

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blank

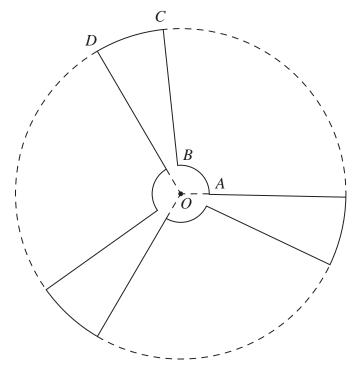**Question 7 continued**

Leave blank

Question 7 continued

Q7

(Total 9 marks)

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 *OABCDO*, 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 $AOD = \dfrac{2\pi}{3}$ 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)

Question 8 continued

Leave
blank

Question 8 continued

Leave
blank

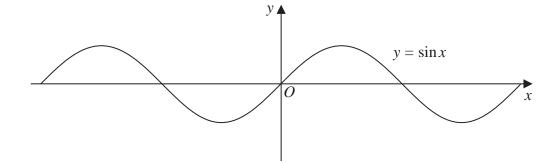**Question 8 continued**

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 $0 < \alpha < 90°$

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

    (i) $2 \sin(180° - \alpha)$

    (ii) $\sin(\alpha - 180°)$

    (iii) $3 + \sin(180° + \alpha)$

(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 $0 < x < 180°$ where

$$\sin 2x = p$$

(3)

Leave
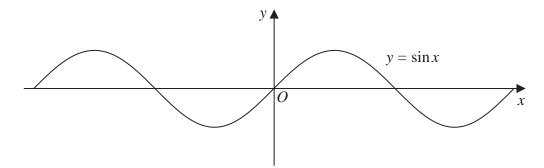blank

Question 9 continued

Diagram 1
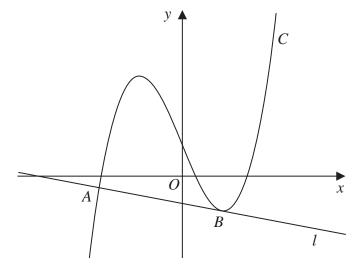
Q9

(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 $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

(2)

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

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)

Question 10 continued

Question 10 continued

Question 10 continued

Leave blank

Question 10 continued

Q10

(Total 12 marks)

TOTAL FOR PAPER IS 75 MARKS

END

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.

1. The curve C has equation

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

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

(3)

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

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

(3)

Question 1 continued

(Total for Question 1 is 6 marks)

2. Given that

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

where a and b are constants,

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

(2)

(b) Hence find

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

writing each term in simplest form.

(5)

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, £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

$$f(x) = 0$$

(4)

(b) Hence solve

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

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

- $f'(x) = \dfrac{12}{\sqrt{x}} + \dfrac{x}{3} - 4$

- 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

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

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

(5)

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

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

(1)

Question 6 continued

7.

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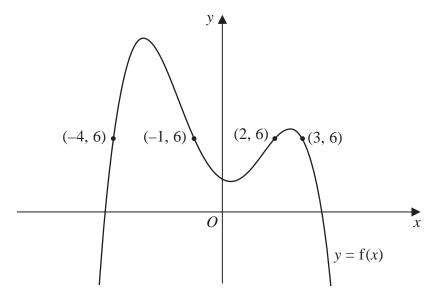
Figure 1 shows the curve with equation $y = f(x)$.

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

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

$$f(x) < 6$$

(3)

(b) State the largest solution of the equation

$$f(2x) = 6$$

(1)

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

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

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

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

(4)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 8 marks)
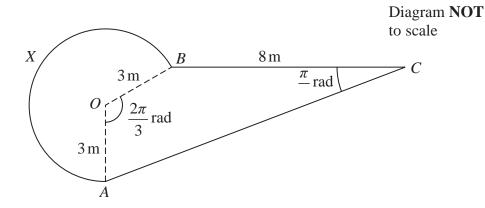
8.

Diagram **NOT**
to scale

Figure 2

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

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

- $BC = 8$ m

- $OA = OB = 3$ m

- angle *AOB* is $\dfrac{2\pi}{3}$ radians

- angle *BCA* is $\dfrac{\pi}{4}$ 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 m² correct to
2 significant figures.

(5)

Question 8 continued

Question 8 continued

Question 8 continued
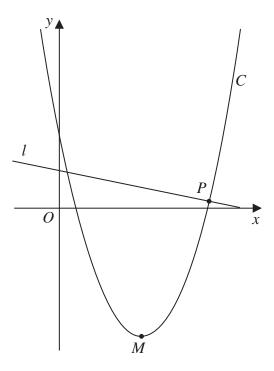
(Total for Question 8 is 14 marks)

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
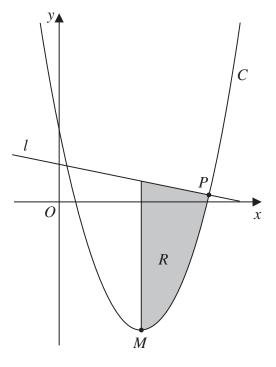
Question 9 continued

Figure 4

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

(d) Identify the inequalities that define R.

(3)

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

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

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ 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.)

(2)

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 $PQR = 90°$

(3)

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

(b) find the coordinates of S.

(2)

Question 2 continued

3. Find

$$\int \frac{4x^5 + 3}{2x^2}\,\mathrm{d}x$$

giving your answer in simplest form.

(5)

Question 3 continued

4. Given that the equation

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

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)

Question 5 continued

(Total for Question 5 is 6 marks)

6.
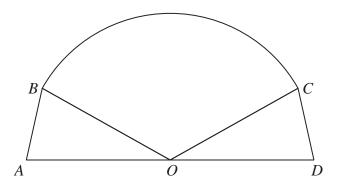

Figure 1

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 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)

Question 6 continued

Question 6 continued

Question 6 continued

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

$$y = \frac{6}{x} \qquad x \neq 0$$

(2)

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

(b) Fully describe this transformation.

(2)

The curve with equation

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

and the line with equation

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

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

Question 7 continued

Question 7 continued

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

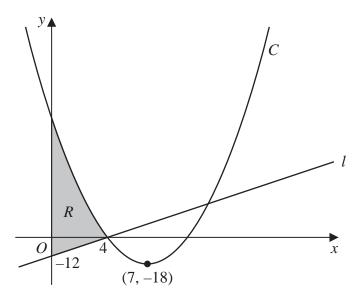**Copy of Diagram 1**

(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

Question 8 continued

Question 8 continued

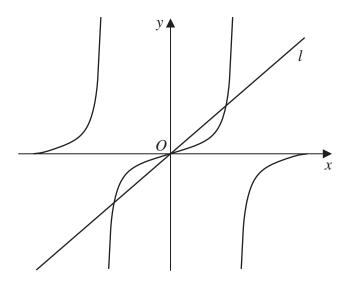**(Total for Question 8 is 8 marks)**

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

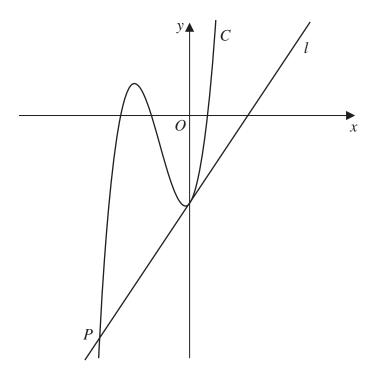**(Total for Question 9 is 4 marks)**

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

Question 10 continued

Question 10 continued

(Total for Question 10 is 10 marks)

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

Given that

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

- 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

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

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

(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 $350\,\text{m}$,

(a) write down an equation linking x and y

(1)

Given also that the area of the pitch is $7350\,\text{m}^2$

(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)

Question 3 continued

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 $\dfrac{dy}{dx}$ giving each coefficient in simplest form.

(3)

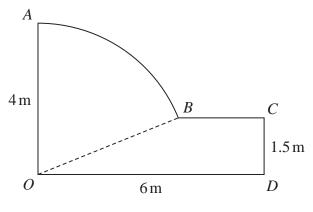**Question 4 continued**

(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

Question 5 continued

Question 5 continued

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 $\dfrac{1}{3 + 2\sqrt{2}}$ 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

Question 6 continued

Question 6 continued

(Total for Question 6 is 7 marks)

7.

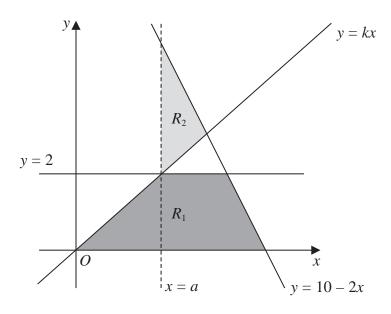**Figure 2**

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

$$0 \leqslant y \leqslant 2 \qquad y \leqslant 10 - 2x \qquad y \leqslant kx$$

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 $\dfrac{27}{4}$ 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

Question 8 continued

Question 8 continued

(Total for Question 8 is 10 marks)
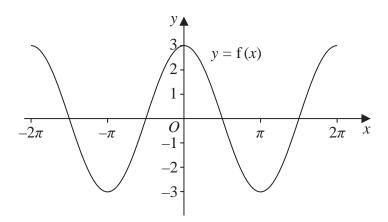
9. (i)

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 $y = f\left(x + \dfrac{\pi}{4}\right)$

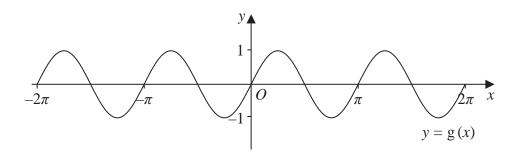Show clearly the coordinates of all the points where the curve intersects the coordinate axes.

(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

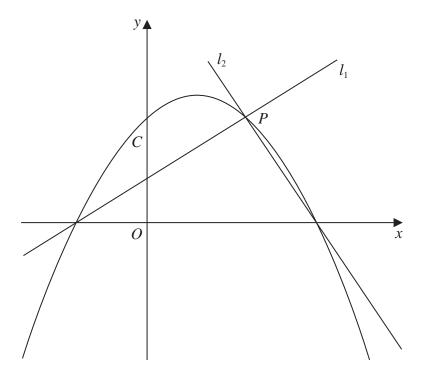**Question 9 continued**

(Total for Question 9 is 9 marks)

10.

Figure 5

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

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

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

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

(2)

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

(2)

Question 10 continued

Question 10 continued

Question 10 continued

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

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

find, in simplest form,

(a) $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

(3)

(b) $\dfrac{\mathrm{d}^2 y}{\mathrm{d}x^2}$

(2)

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

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

(1)

(b) $\frac{16}{b^3}$

(1)

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

(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 $\dfrac{8 - \sqrt{15}}{2\sqrt{3} + \sqrt{5}}$ in the form $a\sqrt{3} + b\sqrt{5}$ where a and b are integers to be found.

(3)

(b) Hence, or otherwise, solve

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

giving your answer in simplest form.

(3)

Question 3 continued

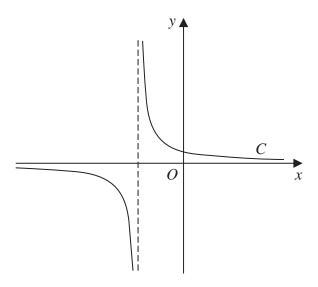**(Total for Question 3 is 6 marks)**

4.

Figure 1

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

(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.
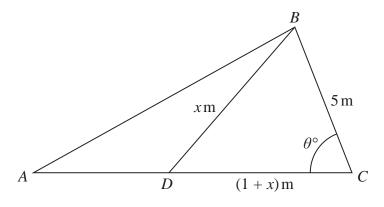

Figure 2

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

- $BD = x\,$m

- $CD = (1 + x)\,$m

- $BC = 5\,$m

- angle $BCD = \theta°$

(a) show that $\cos\theta° = \dfrac{13 + x}{5 + 5x}$

(2)

Given also that

- $x = 2\sqrt{3}$

- angle $BAC = 30°$

- ADC is a straight line

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

(5)

Question 5 continued

Question 5 continued

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

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

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

(a) Show that

$$3p^2 - 10p - 8 > 0$$

(3)

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

(3)

Question 6 continued

(Total for Question 6 is 6 marks)

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

Given that

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

- 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)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 10 marks)

8. <center>**In this question you must show all stages of your working.**</center>

<center>**Solutions relying on calculator technology are not acceptable.**</center>

The curve C_1 has equation

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

The curve C_2 has equation

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

(a) Show that C_1 and C_2 meet when

$$2x^4 - 7x^2 - 15 = 0$$

(2)

Given that C_1 and C_2 meet at points P and Q

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

(5)

Question 8 continued

Question 8 continued

Question 8 continued

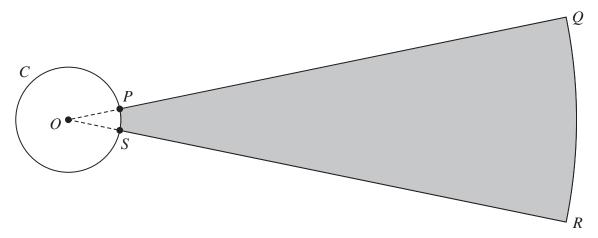**(Total for Question 8 is 7 marks)**

9.

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

Question 9 continued

Question 9 continued

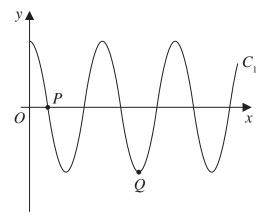**(Total for Question 9 is 7 marks)**

10.

Figure 4

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

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

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

Given that a is a constant less than 90

(c) find the value of k.

(2)
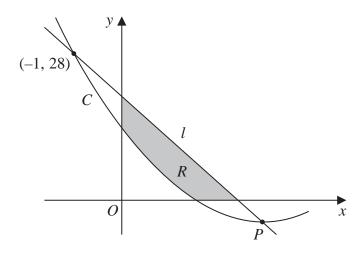
Question 10 continued

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

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

$$\int (2x - 5)(3x + 2)(2x + 5)\,\mathrm{d}x$$

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 cm

- *AC* = 25 cm

- angle *BAC* = $\theta°$

- area triangle *ABC* = 100 cm^2

(a) Find the value of sin $\theta°$

(2)

Given that $\theta > 90$

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

(3)

Question 2 continued

(Total for Question 2 is 5 marks)

3. The curve C has equation

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

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ 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)

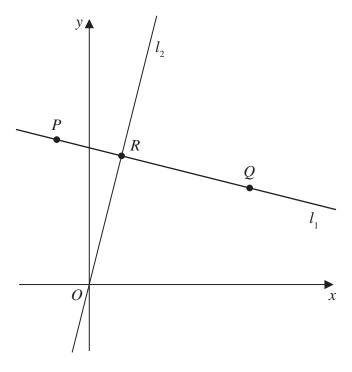**Question 3 continued**

(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

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

Question 5 continued
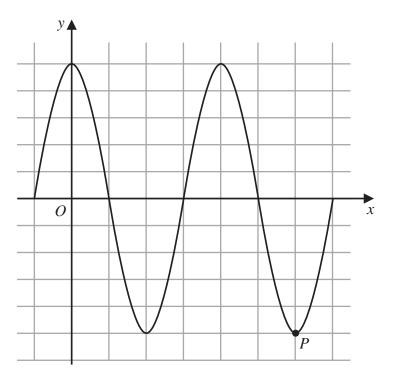
Question 5 continued

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

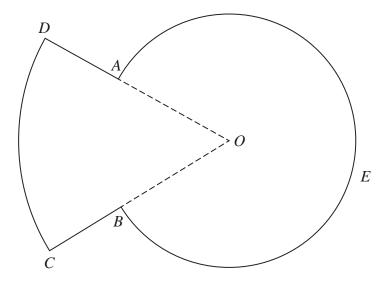**(Total for Question 7 is 9 marks)**

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 m² to the nearest whole number.

(3)

Question 8 continued

Question 8 continued

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

Question 9 continued

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 $P\left(2,\ 8\sqrt{2}\right)$ lies on C

- $f'(x) = 4\sqrt{x^3} + \dfrac{k}{x^2}$ 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)

Question 10 continued

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

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Instructions

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- 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.

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Advice

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- 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

(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}

                                                              (1)

    (b) 16^{3n}

                                                              (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
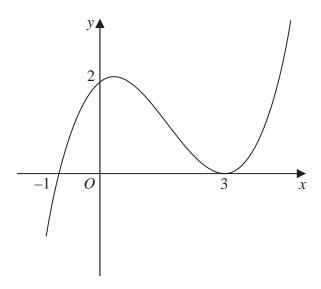
(Total for Question 2 is 6 marks)

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

$$k^2 + 26k + 169 = 0$$

(3)

(b) Hence find the coordinates of P

(3)

Question 4 continued

(Total for Question 4 is 6 marks)

5.

Diagram **NOT** accurately drawn

12.2 m

6 m

1.3 rad

6 m

10.8 m

A B C D E

Figure 2
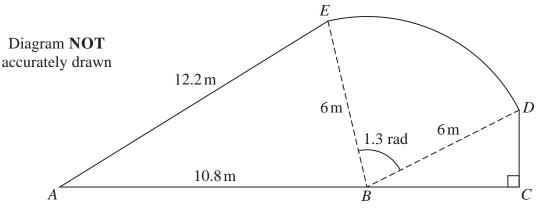
Figure 2 shows the plan view of a garden.

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 $BCD = \dfrac{\pi}{2}$ 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

Question 5 continued

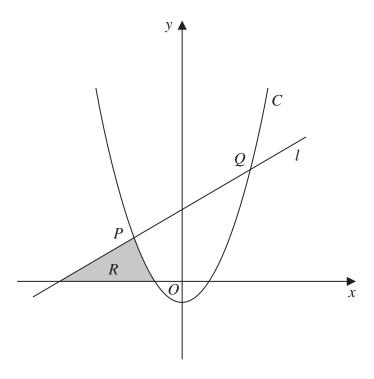**(Total for Question 5 is 7 marks)**

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

Question 6 continued

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 $y = \dfrac{A}{x}$ 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

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

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

- 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

11.

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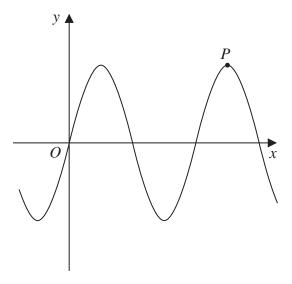
Figure 4 shows a sketch of part of the curve C_1 with equation

$$y = 12 \sin x$$

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 $\left(\dfrac{\pi}{4}, A \right)$, 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

Question 11 continued

(Total for Question 11 is 6 marks)

TOTAL FOR PAPER IS 75 MARKS