Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Thursday 14 May 2026

Afternoon (Time: 2 hours)

Paper reference **8MA0/01**

Mathematics

Advanced Subsidiary

PAPER 1: Pure Mathematics

You must have:
Mathematical Formulae and Statistical Tables (Green), 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 14 questions in this question paper. The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

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

Turn over ▶

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

Find the values of x for which

(a) $4(x-3) > 8-2x$ **(2)**

(b) $(2x+5)(x-8) < 0$ **(2)**

(c) both $4(x-3) > 8-2x$ and $(2x+5)(x-8) < 0$ **(1)**

(a) $x > \frac{10}{3}$

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

(c) $10/3 < x < 8$

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Question 1 continued

(Total for Question 1 is 5 marks)

2. (a) Find the first 4 terms, in ascending powers of x, of the binomial expansion of

$$(2 - 3x)^6$$

giving each coefficient in simplest form.

(4)

A student wishes to use this expansion to find an approximation for 2.03^6

(b) State the value of x that should be used.

(*There is no need to carry out this calculation*.)

(1)

(a) $64 - 288x + 540x^2 - 540x^3$

(b) $x = 0.01$

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Question 2 continued

(Total for Question 2 is 5 marks)

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

(a) Fully factorise

$$8x^3 + 31x^2 - 4x$$

(2)

(b) Hence solve

$$8 \times 64^y + 31 \times 16^y - 4 \times 4^y = 0$$

(2)

(a) $8x^3 + 31x^2 - 4x$
$= x(8x^2 + 31x - 4)$
$= x(8x-1)(x+4)$

(b) $y = -\frac{3}{2}$ //

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Question 3 continued

(Total for Question 3 is 4 marks)

4. Water is leaking from the bottom of a barrel.

- 4 minutes after the leak starts, there are 50 litres of water in the barrel
- 9 minutes after the leak starts, there are 20 litres of water in the barrel

The volume, V litres, of water in the barrel, t minutes after the leak started is modelled by the equation

$$V = a + b\sqrt{t}$$

where a and b are constants.

(a) Find a complete equation for the model. **(3)**

Given that, initially, the barrel was **half** full of water,

(b) use the equation to find the capacity of the barrel. **(1)**

(c) Find a limitation on the values of t. **(2)**

(a) $b = -30$

$a = 110$

$V = 110 - 30\sqrt{t}$

(b) $t = 0 \rightarrow V = 110 \rightarrow$ capacity $= 220$ litres.

(c) $V \geq 0 \rightarrow 110 - 30\sqrt{t} \geq 0 \rightarrow \sqrt{t} \leq \frac{11}{3} \rightarrow 0 \leq t \leq \left(\frac{11}{3}\right)^2 = \frac{121}{9}$

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Question 4 continued

(Total for Question 4 is 6 marks)

5.

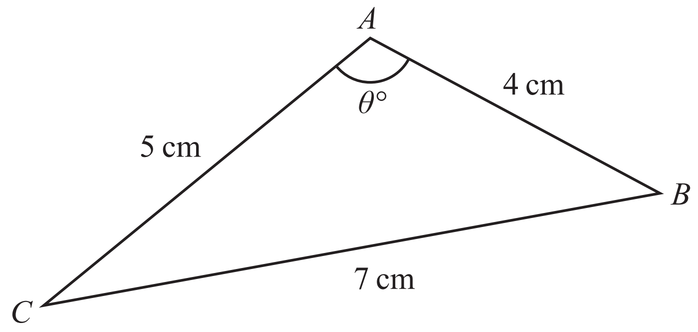

Figure 1

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

Figure 1 is a sketch of a triangle ABC with $AB = 4$ cm, $BC = 7$ cm and $AC = 5$ cm.

Given that angle $BAC = \theta°$

(a) show that $\cos\theta° = -\frac{1}{5}$

(2)

(b) Hence find the area of triangle ABC, giving your answer in cm^2 as a fully simplified surd.

(4)

(a) $\cos \angle BAC = (AB^2 + AC^2 - BC^2)/(2.AB.AC)$

$= (16+25-49)/(2.4.5) = (-8)/40 = -\frac{1}{5}$ //

(b) $A = (\frac{1}{2}).AB.AC.\sin\theta$

$\sin\theta = \sqrt{(1-\cos^2\theta)} = \sqrt{(1-\frac{1}{25})}$

$= \sqrt{\left(\frac{24}{25}\right)} = (2\sqrt{6})/5$

$A = (\frac{1}{2}).4.5.(2\sqrt{6})/5 = 4\sqrt{6}$ cm^2

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Question 5 continued

(Total for Question 5 is 6 marks)

6. Vectors **a**, **b**, **c** and **d** are given by

$$\mathbf{a} = \begin{pmatrix} 4 \\ -6 \end{pmatrix} \qquad \mathbf{b} = \begin{pmatrix} 10 \\ p \end{pmatrix} \qquad \mathbf{c} = \begin{pmatrix} q \\ 3 \end{pmatrix} \qquad \mathbf{d} = \begin{pmatrix} 30 \\ 6 \end{pmatrix}$$

where p and q are constants.

Given that vectors **a** and **b** are parallel,

(a) find the value of p.

(2)

Given that

$$2|\mathbf{a} + \mathbf{c}| = |\mathbf{d}|$$

(b) find all possible values for q.

(4)

(a) $p = -15$

(b) $|a+c| = |(4+q, -6+3)| = |(4+q, -3)|$

$2\sqrt{[(4+q)^2+9]} = |d|$

$= \sqrt{(900+36)} = \sqrt{936} = 6\sqrt{26}$

$\sqrt{[(4+q)^2+9]} = 3\sqrt{26}$

$(4+q)^2 + 9 = 234$

$(4+q)^2 = 225$

$4+q = \pm 15$

$q = 11$ or $q = -19$

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Question 6 continued

(Total for Question 6 is 6 marks)

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

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

(a) Write $f(x)$ in the form $Ax^m + Bx^n + Cx^p$ where A, B, C, m, n and p are simplified constants.

(3)

(b) Hence find $\int f(x)\,dx$ writing the answer in simplest form.

(3)

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

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

(ii) Hence find the x coordinate of the stationary point on the curve with equation $y = f(x)$.

(4)

(a) $2x^{3/2} - 20x^{1/2} + 50x^{-1/2}$

(b) $4/5\, x^{5/2} + \frac{260}{3} x^{1/2} + C$

(c)(i) $f'(x) = 3x^{1/2} - 10x^{-1/2} - 25x^{-3/2}$

Multiply by $x^{3/2}$

$\therefore 3x^2 - 10x - 25 = 0$

(ii) $3x^2 - 10x - 25 = 0$

$x = [10 \pm \sqrt{(100+300)}]/6 = [10 \pm 20]/6$

$x = 5$ or $x = -5/3$

$x = 5$

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Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 10 marks)

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

(i) Solve, for $0 < \theta \leqslant 270°$, the equation

$$2\tan\theta - 5\sin\theta\cos\theta = 0$$

giving your answers, in degrees, to one decimal place where appropriate.

(5)

(ii) The height above the ground, H metres, of a passenger on a fairground ride, t seconds after the start of the ride is modelled by the equation

$$H = 40\sin(0.3t + 2)° \qquad 0 \leqslant t \leqslant 590$$

Use the equation of the model to answer parts (a) and (b).

(a) Find the initial height of the passenger above the ground.

(2)

The passenger is exactly 25 metres above the ground for the second time T seconds after the start of the ride.

(b) Find the value of T.

(4)

(i) $\theta = 0°, 10.9°, 100.9°, 180°$

(ii) (a) $t=0$: $H = 40\sin(2°) \approx 1.40$m

(b) $T \approx 465.1$

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Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 11 marks)

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

(a) Sketch the curve C with equation

$$y = \frac{1}{4 - x} \qquad x \neq 4$$

On your sketch show

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

(3)

The straight line l has equation $y = 2x + k$, where k is a constant.

Given that l cuts C at least once,

(b) (i) show that

$$k^2 + 16k + 56 \geqslant 0$$

(4)

(ii) find the range of values of k, giving your answer in set notation.

(2)

(a)

(a) Vertical asymptote: $x = 4$

y-intercept: $(0, 1/4)$ or $(0, 0.25)$

(b) (i) $2x + k = 1/(4-x)$

$(2x + k)(4 - x) = 1$

$-2x^2 + (8 - k)x + 4k - 1 = 0$

$2x^2 + (k - 8)x - 4k + 1 = 0$

Discriminant $D = (k-8)^2 + 8(4k - 1) = k^2 - 16k + 64 + 32k - 8 = k$

$2x^2 + 16k + 56 \geq 0$

(ii)

Discriminant ≥ 0 for all k (roots real)

$k \in \mathbb{R}$

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Question 9 continued

Question 9 continued

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Question 9 continued

(Total for Question 9 is 9 marks)

10. The circle C has equation

$$x^2 + y^2 - 8x + 5y - 20 = 0$$

(a) Find

(i) the coordinates of the centre of C,

(ii) the exact radius of C.

(3)

Given that the point P

- lies on C
- lies on the positive x-axis

(b) find an 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.

(5)

(a)(i)

$x^2 - 8x + y$

$x^2 + 5y = 20$

$(x - 4)^2 - 16 + (y + 5/2)^2 - 25/4 = 20$

$(4, -5/2)$

(ii)

$r^2 = 16 + 25/4 + 20 = 64/4 + 25/4 + 80/4 = 169/4$

$r = 13/2$

(b)

P on positive x-axis: solve y=0, on circle → x=8 (other root negative)

P(8, 0)

Tangent: $(x - 4)(8 - 4) + (y + 5/2)(0 + 5/2) = (13/2)^2$

$4(x - 4) + (5/2)y = 169/4$

$16x + 10y - 64 = 169 \rightarrow 16x + 10y - 233 = 0$

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 8 marks)

11. $$2\log_2(x-4)+\log_2\left(\frac{4}{3}x\right)=2+\log_2(x+2)$$

(a) Show that the given equation can be written in the form

$$x^3-8x^2+13x-6=0$$

(4)

(b) Use the factor theorem to show that $(x-1)$ is a factor of $x^3-8x^2+13x-6$

(1)

(c) Hence, using algebra and showing your working, solve the equation

$$x^3-8x^2+13x-6=0$$

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

(3)

(d) Hence solve

$$2\log_2(x-4)+\log_2\left(\frac{4}{3}x\right)=2+\log_2(x+2)$$

(1)

(a) $2\log_2(x-4) + \log_2(4x/3) = 2 + \log_2(x+2)$

$\log_2[(x-4)^2 \cdot (4x/3)] = \log_2[4(x+2)]$

$(x-4)^2(4x/3) = 4(x+2)$

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

$x^3 - 8x^2 + 16x = 3x + 6$

$x^3 - 8x$

$^2 + 13x - 6 = 0$ (shown)

(b) $f(1) = 1 - 8 + 13 - 6 = 0 \rightarrow (x-1)$ factor (shown)

(c) $(x-1)(x^2 - 7x + 6) = 0$

$(x-1)(x-1)(x-6) = 0$

$x = 1$ (double), $x = 6$

(d) $x = 1$ invalid (log of 0 or negative)

$x = 6$

Question 11 continued

Question 11 continued

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Question 11 continued

(Total for Question 11 is 9 marks)

12.

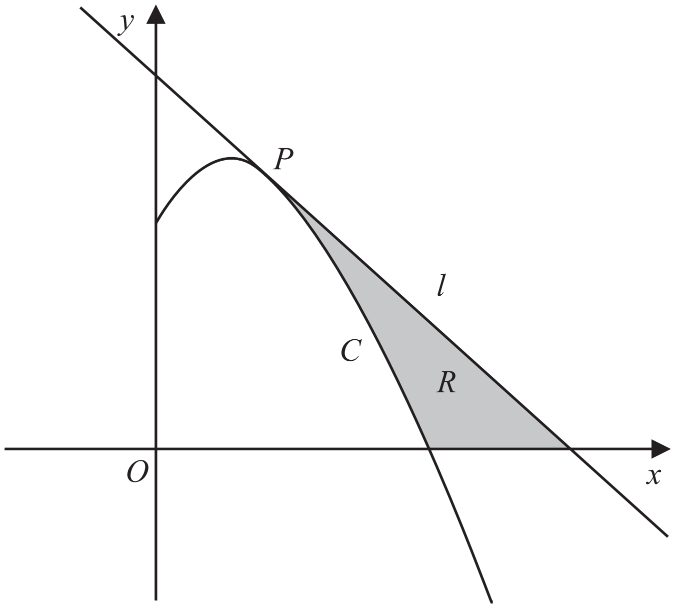

Figure 2

Figure 2 shows a sketch of the curve C with equation

$$y = 6\sqrt{x} - \frac{1}{2}x^2 + \frac{45}{2} \qquad x \geqslant 0$$

The point $P\left(4, \frac{53}{2}\right)$ lies on C.

The line l is the tangent to C at P.

(a) Show, using calculus, that an equation for l is

$$5x + 2y = 73$$

(5)

(b) Verify that C cuts the x-axis at $x = 9$

(1)

The region R, shown shaded in Figure 2, is bounded by C, l and the x-axis.

(c) Find, by algebraic integration, the area of R.

(5)

(a) $y - \frac{53}{2} = -\frac{5}{2}(x-4)$

$y - \frac{53}{2} = -\frac{5}{2}x + 10$

$y = -\frac{5}{2}x + 10 + \frac{53}{2} = -\frac{5}{2}x + \frac{73}{2}$

$5x + 2y = 73$ //

Question 12 continued

(b) $y = 6\sqrt{9} - \frac{1}{2}(81) + \frac{45}{2} = 18 - 40.5 + 22.5 = 0$

(c) Area of R = 611/3

Question 12 continued

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Question 12 continued

(Total for Question 12 is 11 marks)

13 The value of a car, £V, where V is measured in thousands, is modelled by the equation

$$V = A + 12e^{-0.2t} + 9e^{-0.1t} \qquad t \geqslant 0$$

where A is a constant and the age of the car is t years.

Given that the initial value of the car was £23 000

(a) find a complete equation for the model.

(2)

At $t = T$, the value of the car is £5000

(b) Find the value of T, giving your answer to 2 decimal places.

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

(4)

(a) $t=0 : V=23$

$23 = A + 12e^{0} + 9e^{0} = A + 12 + 9$

$A + 21 = 23 \rightarrow A = 2$

$V = 2 + 12e^{-0.2t} + 9e^{-0.1t}$

(b) $T = 13.86$ //

Question 13 continued

Question 13 continued

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Question 13 continued

(Total for Question 13 is 6 marks)

14 Show, using algebra, that for values of $n \in \mathbb{N}$ where n is **not** a multiple of 3

$$n^2 + 2 \text{ is always a multiple of 3}$$

(4)

Case 1 : $n \equiv 1 \pmod 3$

$n = 3K + 1$

$n^2 + 2 = (3K+1)^2 + 2 = 9K^2 + 6K + 1 + 2 = 9K^2 + 6K + 3$

$= 3(3K^2 + 2K + 1)$

case 2: $n \equiv 2 \pmod 3$

$n = 3K + 2$

$n^2 + 2 = (3K+2)^2 + 2 = 9K^2 + 12K + 4 + 2$

$= 9K^2 + 12K + 6 = 3(3K^2 + 4K + 2)$

In both cases, $n^2 + 2$ is a multiple of 3.

Question 14 continued

Question 14 continued

(Total for Question 14 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS