British Maths

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 8 May 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **WMA11/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Pure Mathematics P1

You must have:
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

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

Instructions

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

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 10 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over

P 7 9 5 8 9 A 0 1 3 2

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1.

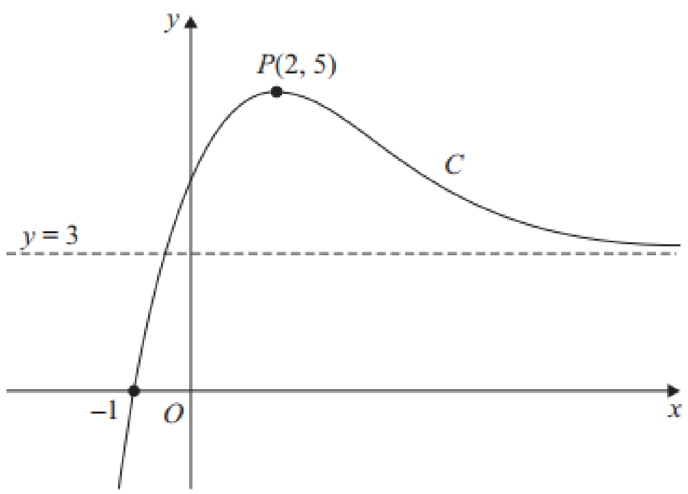

Figure 1

The curve C, shown in Figure 1,

- has equation $y = f(x)$, $x \in \mathbb{R}$
- cuts the x-axis at -1
- has a maximum turning point at $P(2, 5)$
- has a horizontal asymptote with equation $y = 3$

The curve C has no other turning points or asymptotes.

(a) Find the coordinates of the point to which P is transformed when the curve with equation $y = f(x)$ is transformed to the curve with equation

(i) $y = f(x) + 7$

(ii) $y = 3f(x)$

(2)

Given that the line with equation $y = k$, where k is a constant, cuts or meets C exactly once,

(b) state the range of possible values of k.

(2)

(c) Write down the solution of the equation

$$f(x + 4) = 0$$

(1)

(a)(i) (2, 12)

(ii) (2, 15)

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Question 1 continued

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(b) $k < 3$, $k = 5$

(c) $x = -5$

(Total for Question 1 is 5 marks)

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

A vessel that contained some water started to leak from a hole in its base.

The volume of water in the vessel 25 minutes after the leak started was $6\,\text{m}^3$

The volume of water in the vessel 64 minutes after the leak started was $3.3\,\text{m}^3$

The volume of water, $V\,\text{m}^3$, in the vessel t minutes after the leak started, is modelled by the equation

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

where a and b are constants.

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

(4)

(b) Using the equation of the model,

(i) find the initial volume of water in the vessel,

(ii) find the time taken, after the leak started, for the vessel to empty. Give your answer to the nearest minute.

(3)

(a) At $t = 25$ $\quad 6 = a\sqrt{25} + b$

$5a + b = 6$

At $t = 64$ $\quad 3.3 = a\sqrt{64} + b$

$8a + b = 3.3$

$3a = -2.7 \quad a = -0.9$

$5(-0.9) + b = 6 \quad b = 10.5$

(b)(i) Initial $V = -0.9\sqrt{0} + 10.5 = 10.5\ m^3$

(ii) $-0.9\sqrt{t} + 10.5 = 0 \quad \cancel{-}0.9\sqrt{t} = \cancel{-}10.5$

$\sqrt{t} = \frac{35}{3} \quad t = 136.1 \simeq 136$ min

3.

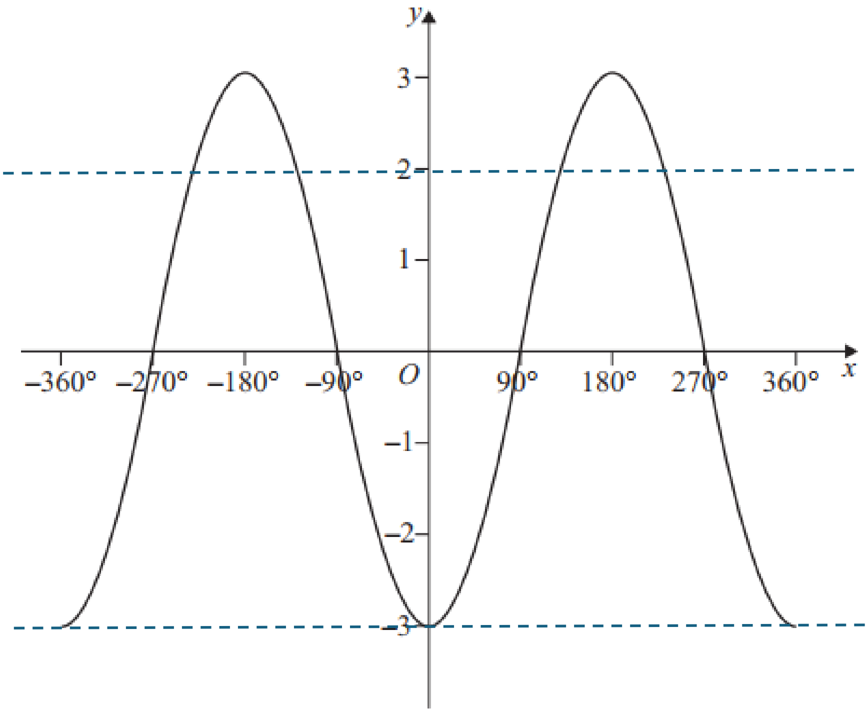

Figure 2

Figure 2 shows part of the graph of the trigonometric function with equation $y = \mathrm{f}(x)$, where x is measured in degrees.

(a) Write down an expression for $\mathrm{f}(x)$.

(2)

(b) State the number of solutions of the equation

(i) $\mathrm{f}(x) = 2$ in the interval $-720° \leqslant x \leqslant 720°$

(ii) $\mathrm{f}(x) = -3$ in the interval $-720° \leqslant x \leqslant 720°$

(2)

(a) $f(x) = -3\cos x$

(b) (i) 8

(ii) 5

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

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(i) Using the laws of indices, solve

$$2^{4k-3} = \frac{8^{1-k}}{4\sqrt{2}}$$

(3)

(ii) Solve the equation

$$\frac{x\sqrt{3}+2}{\sqrt{3}-1} = x\sqrt{3} - 4$$

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

(4)

(i) $2^{4k-3} = \dfrac{(2^3)^{1-k}}{2^2 \times 2^{1/2}}$

$2^{4k-3} = 2^{3-3k-2-1/2}$

$4k - 3 = \frac{1}{2} - 3k$

$7k = \frac{7}{2}$ $\qquad k = 1/2$

(ii) $(x\sqrt{3}+2) = (x\sqrt{3}-4)(\sqrt{3}-1)$

$x\sqrt{3} + 2 = 3x - x\sqrt{3} - 4\sqrt{3} + 4$

$3x - 2\sqrt{3}\,x = 4\sqrt{3} - 2$

$x = \dfrac{(4\sqrt{3}-2)(3+2\sqrt{3})}{(3-2\sqrt{3})(3+2\sqrt{3})}$

$= \dfrac{12\sqrt{3} + 24 - 6 - 4\sqrt{3}}{9-12} = \dfrac{18 + 8\sqrt{3}}{-3}$

$= -6 - \frac{8}{3}\sqrt{3}$

5. $$y = \frac{1}{2}x^4 - 3 + \frac{10}{x^2} \qquad x \neq 0$$

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(a) Find $\int y \, dx$ writing the answer in simplest form.

(3)

(b) (i) Find $\frac{dy}{dx}$ writing the answer in simplest form.

(3)

(ii) Hence find the exact solutions of the equation $\frac{dy}{dx} = 3$

(Solutions relying on calculator technology are not acceptable.)

(4)

(a) $\int \left(\frac{1}{2}x^4 - 3 + 10x^{-2}\right) dx$

$= \frac{1}{2}\frac{x^5}{5} - 3x + \frac{10x^{-1}}{-1} + C$

$= \frac{1}{10}x^5 - 3x - \frac{10}{x} + C$

(b) (i) $y = \frac{1}{2}x^4 - 3 + 10x^{-2}$

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

(ii) $2x^3 - \frac{20}{x^3} = 3 \qquad \times x^3$

$2x^6 - 20 = 3x^3$

$2x^6 - 3x^3 - 20 = 0$

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

$x^3 = 4 \qquad x = \sqrt[3]{4}$

$x^3 = -\frac{5}{2} \qquad x = -\sqrt[3]{\frac{5}{2}}$

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

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The curve C_1 has equation $y = (x+5)(3x+2)(2x-5)$

The curve C_2 has equation $y = 3x^2 - 33x - 50$

Use algebra to find the x coordinates of the points of intersection of C_1 and C_2

(5)

C_1: $y = (3x^2 + 2x + 15x + 10)(2x - 5)$

$= (3x^2 + 17x + 10)(2x - 5)$

$= 6x^3 - 15x^2 + 34x^2 - 85x + 20x - 50$

$= 6x^3 + 19x^2 - 65x - 50$

$6x^3 + 19x^2 - 65x - \cancel{50} = 3x^2 - 33x - \cancel{50}$

$6x^3 + 19x^2 - 3x^2 - 65x + 33x = 0$

$6x^3 + 16x^2 - 32x = 0$

$2x(3x^2 + 8x - 16) = 0$

$2x(3x - 4)(x + 4) = 0$

The two curves intersect at

$x = 0$, $x = 4/3$ and $x = -4$

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7. **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

$$y = \frac{1}{x+6}$$

State on your sketch

- 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 $y = mx - 4$, where m is a constant.

Given that l cuts C at least once,

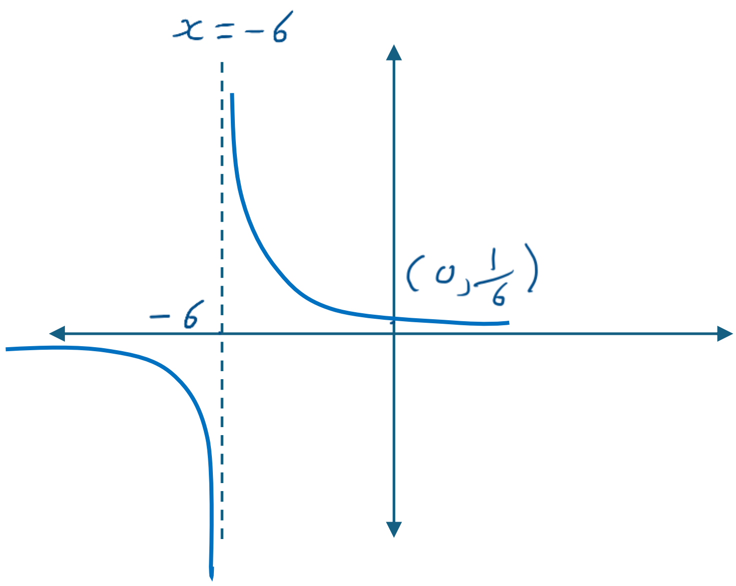
(b) (i) show that

$$9m^2 + 13m + 4 \geqslant 0$$

(ii) find the range of values of m.

(6)

(a)



(b)(i) $\dfrac{1}{x+6} = mx - 4$

$(mx - 4)(x + 6) = 1$

$mx^2 + 6mx - 4x - 24 = 1$

Question 7 continued

$mx^2 + (6m-4)x - 25 = 0$

$b^2 - 4ac \geqslant 0$

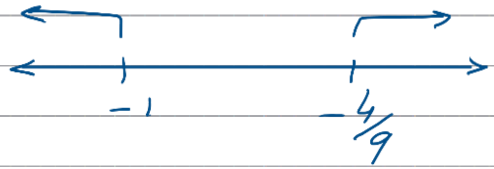
$(6m-4)^2 - 4m(-25) \geqslant 0$

$36m^2 - 48m + 16 + 100m \geqslant 0$

$36m^2 + 52m + 16 \geqslant 0 \quad \div 4$

$9m^2 + 13m + 4 \geqslant 0$

(ii) $(9m+4)(m+1) \geqslant 0$



$m \leqslant -1$

$m \geqslant -\frac{4}{9}$

(Total for Question 7 is 9 marks)

8.

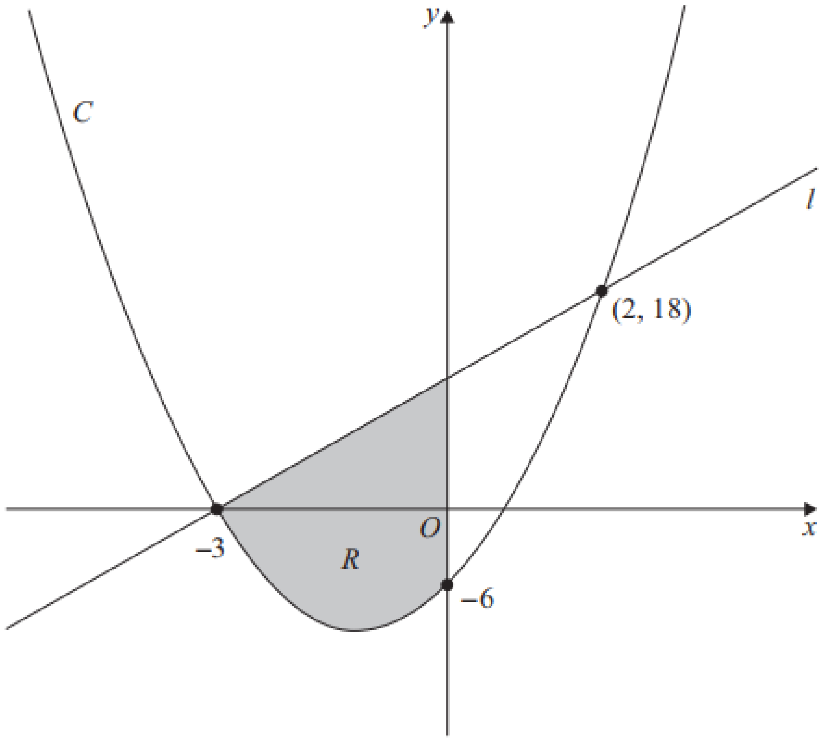


Figure 3

Figure 3 shows a sketch of a line l and a quadratic curve C.

Given that l passes through $(-3, 0)$ and $(2, 18)$

(a) find an equation for l in the form $y = mx + c$ where m and c are constants.

(3)

Given that

- C and l intersect at the points $(-3, 0)$ and $(2, 18)$
- C crosses the y-axis at $(0, -6)$

(b) find an equation for C.

(4)

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

(c) Use inequalities to define R.

(2)

(a) $m_l = \frac{18-0}{2+3} = \frac{18}{5}$

$y = \frac{18}{5}(x+3)$

$y = \frac{18}{5}x + \frac{54}{5}$

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Question 8 continued

(b) $y = ax^2 + bx + c$

At $(-3, 0)$ $\quad 0 = 9a - 3b + c$ — ①

$(0, -6)$ $\quad -6 = 0 + 0 + c \quad c = -6$

in ① $\quad 9a - 3b - 6 = 0 \quad \div 3$

$3a - b - 2 = 0$

$3a - b = 2$

$(2, 18)$ $\quad 18 = 4a + 2b - 6$

$4a + 2b = 24 \quad \div 2$

$2a + b = 12$

$$\begin{array}{r} 3a - b = 2 \\ + \quad 2a + b = 12 \\ \hline 5a = 14 \end{array} \qquad a = \frac{14}{5}$$

$2 \times \frac{14}{5} + b = 12 \qquad b = \frac{32}{5}$

Equ. of c: $\frac{14}{5}x^2 + \frac{32}{5}x - 6$

(c) $x \leq 0$

$y \geq \frac{14}{5}x^2 + \frac{32}{5}x - 6$

$y \leq \frac{18}{5}x + \frac{54}{5}$

(Total for Question 8 is 9 marks)

9.

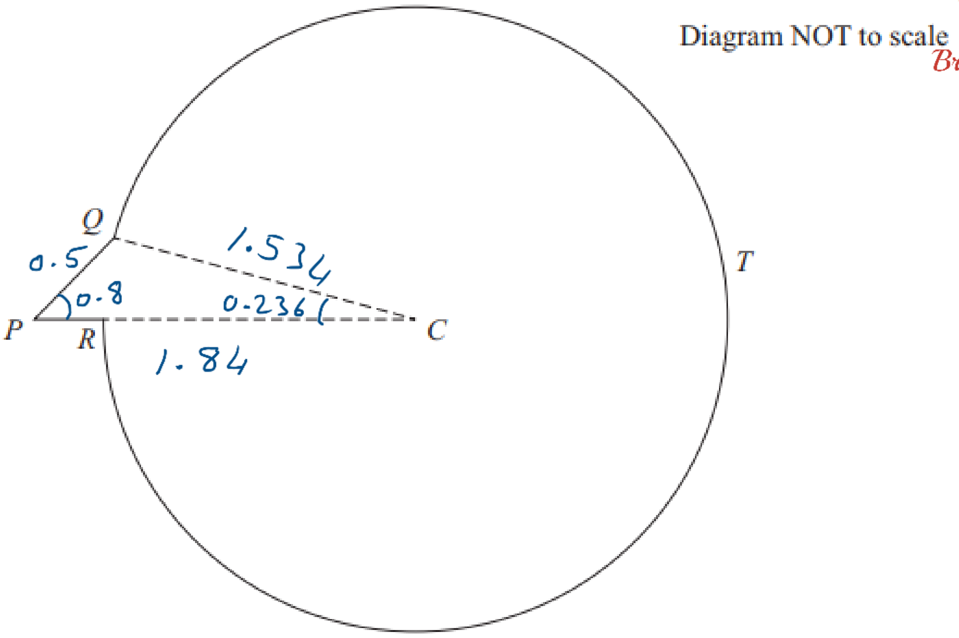


Figure 4

Figure 4 shows the outline of a sign that is used to advertise a bird sanctuary.

The sign is composed of a triangle CPQ joined to a sector $QCRTQ$ of a circle, centre C.

Given that

- angle $QPR = 0.8$ radians
- $PQ = 0.5\,\text{m}$
- $PC = 1.84\,\text{m}$
- PRC is a straight line

(a) find the radius, CQ, of the sector, in metres to 3 decimal places.

(2)

(b) Hence show that angle PCQ is 0.236 radians to 3 decimal places.

(2)

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

(3)

(d) Find the total perimeter of the sign, giving your answer in metres to one decimal place.

(2)

(a) $CQ^2 = 0.5^2 + 1.84^2 - 2 \times 0.5 \times 1.84 \cos 0.8$

$CQ = 1.534\text{ m}$ (3d.p.)

(b) $\dfrac{1.534}{\sin 0.8} = \dfrac{0.5}{\sin \angle PCQ}$

$\angle PCQ = \sin^{-1} \dfrac{0.5 \sin 0.8}{1.534} = 0.236 \text{ rad}$

(c) $\frac{1}{2} r^2 \theta^{rad} = \frac{1}{2} \times 1.534^2 \times (2\pi - 0.236)$

$= 7.11 \text{ m}^2$

$\frac{1}{2} \times 0.5 \times 1.84 \sin 0.8 = 0.33$

Area of the sign $= 7.11 + 0.33 = 7.4 \text{ m}^2$

(d) $L = r\theta = 1.534(2\pi - 0.236) = 9.28$

perimeter $= 9.28 + 0.5 + (1.84 - 1.534)$

$= 10.1 \text{ m}$

(Total for Question 9 is 9 marks)

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

Given that

- $f'(x) = \dfrac{k\sqrt{x}(x-3)}{5}$ where k is a constant
- the point P with x coordinate 4 lies on C
- the equation of the normal to C at P is $y = -\dfrac{5}{4}x + 2$

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

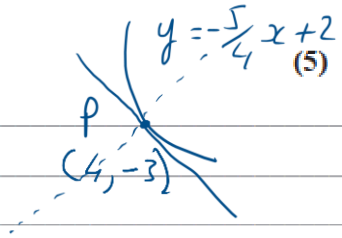
(3)

(b) find the value of k,

(2)

(c) find $f(x)$, writing the answer in simplest form.

(5)



(a) $m_{Normal} = -\dfrac{5}{4}$

$m_{tangent} = \dfrac{4}{5}$

Using the normal at $x = 4$ $\quad y = -\dfrac{5}{4}(4) + 2 = -3$

$y + 3 = \dfrac{4}{5}(x - 4)$

$y + 3 = \dfrac{4}{5}x - \dfrac{16}{5}$

$y = \dfrac{4}{5}x - \dfrac{31}{5}$

(b) $\dfrac{k\sqrt{x}(x-3)}{5} = \dfrac{4}{5}$

at $x = 4$ $\quad 2k(4-3) = 4 \quad 2k = 4$

$k = 2$

Question 10 continued

(c) $y = \int \frac{2\sqrt{x}(x-3)}{5}\,dx$

$= \int \left(\frac{2}{5}x^{3/2} - \frac{6}{5}x^{1/2}\right)dx$

$= \frac{2}{5}x^{5/2} \times \frac{2}{5} - \frac{\cancel{6}^{\,2}}{5}x^{3/2} \times \frac{2}{\cancel{3}} + C$

$= \frac{4}{25}x^{5/2} - \frac{4}{5}x^{3/2} + C$

At $(4, -3)$ $\quad -3 = \frac{4}{25}(4)^{5/2} - \frac{4}{5}(4)^{3/2} + C$

$-3 = \frac{-32}{25} + C \qquad C = \frac{-43}{25}$

$y = \frac{4}{25}x^{5/2} - \frac{4}{5}x^{3/2} - \frac{43}{25}$

(Total for Question 10 is 10 marks)

TOTAL FOR PAPER IS 75 MARKS