Elite Mathematics
Edexcel International A Level

IAL PURE 1 · WMA11

WMA11/01 October 2025 Worked Solutions

October 2025 paper rebuilt with the worked solution after each question.

10	2019–2026	Single-paper solutions
paper questions	19 exam sessions	checked by Dr Eslam



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PAST PAPER

WMA11/01 October 2025

October 2025

10	75	1 h 30
questions	marks	exam time

Each question is followed by its worked solution and final answer.

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Question 1

6 marks | Differentiation

1. The curve C has equation

$$y = 6x^2 + 3\sqrt{x} + \frac{5}{8} \qquad x > 0$$

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ writing the answer in simplest form.

(3)

The point $P\left(\frac{1}{4}, \frac{5}{2}\right)$ lies on C.

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

(3)

(Total for Question 1 is 6 marks)

WORKED SOLUTION

Question 1 · WMA11/01 October 2025

1 Rewrite the curve

$y = 6x^2 + 3x^{1/2} + \frac{5}{8}$.

2 Differentiate

$\frac{dy}{dx} = 12x + \frac{3}{2}x^{-1/2} = 12x + \frac{3}{2\sqrt{x}}$.

3 Find the tangent gradient

At $x = \frac{1}{4}$, $\frac{dy}{dx} = 12\left(\frac{1}{4}\right) + \frac{3}{2}\left(\frac{1}{4}\right)^{-1/2} = 3 + 3 = 6$.

4 Use point P

The tangent passes through $P\left(\frac{1}{4}, \frac{5}{2}\right)$, so $y - \frac{5}{2} = 6\left(x - \frac{1}{4}\right)$.

5 Simplify

$y - \frac{5}{2} = 6x - \frac{3}{2}$, hence $y = 6x + 1$.

FINAL ANSWER

$(a)\ \dfrac{dy}{dx} = 12x + \dfrac{3}{2\sqrt{x}}.\quad (b)\ y = 6x + 1.$

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Question 2

5 marks | Integration

2. Find

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

writing the answer in simplest form.

(5)

(Total for Question 2 is 5 marks)

WORKED SOLUTION

Question 2 · WMA11/01 October 2025

1 Expand the square

$(x-3)^2 = x^2 - 6x + 9$.

2 Multiply out

$(x^2 - 6x + 9)(2x + 5) = 2x^3 + 5x^2 - 12x^2 - 30x + 18x + 45$.

3 Collect terms

$(x-3)^2(2x+5) = 2x^3 - 7x^2 - 12x + 45$.

4 Integrate term by term

$\int (2x^3 - 7x^2 - 12x + 45)dx = \frac{1}{2}x^4 - \frac{7}{3}x^3 - 6x^2 + 45x + c$.

✓ **FINAL ANSWER**

$\frac{1}{2}x^4 - \frac{7}{3}x^3 - 6x^2 + 45x + c$.

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Question 3

5 marks | Basic Trigonometry

3. The sides of a triangle are in the ratio $2:4:5$

(a) Find the size of the **largest** angle of the triangle, in degrees, to one decimal place.

(2)

Given that the area of the triangle is $140\,\text{cm}^2$

(b) find the length of the **shortest** side, in cm, to one decimal place.

(3)

(Total for Question 3 is 5 marks)

WORKED SOLUTION

Question 3 · WMA11/01 October 2025

1 Use the side ratio

Take the side lengths as $2x$, $4x$ and $5x$. The largest angle is opposite the side $5x$.

2 Use the cosine rule

$(5x)^2 = (2x)^2 + (4x)^2 - 2(2x)(4x)\cos\theta$.

3 Find the angle

$25 = 4 + 16 - 16\cos\theta$, so $\cos\theta = -\dfrac{5}{16}$ and $\theta = 108.2°$ to one decimal place.

4 Use the area formula

$140 = \dfrac{1}{2}(2x)(4x)\sin 108.2° = 4x^2 \sin 108.2°$.

5 Find the scale factor

$x^2 = \dfrac{140}{4\sin 108.2°}$, so $x \approx 6.070$.

6 Shortest side

The shortest side is $2x \approx 12.1$ cm.

FINAL ANSWER

$(a)\ 108.2°$. $(b)\ 12.1$ cm.

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Question 4

7 marks | Indices & Surds

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

(i) Using the laws of indices, solve

$$3^{2p-5} = \frac{1}{9}\sqrt{27}$$

(3)

(ii) Find the real roots of the equation

$$x^2 + 1 = \frac{36}{x^2 - 4}$$

(4)

(Total for Question 4 is 7 marks)

WORKED SOLUTION

Question 4 · WMA11/01 October 2025

1 Rewrite the right-hand side

$\frac{1}{9}\sqrt{27} = 3^{-2} \cdot 3^{3/2} = 3^{-1/2}$.

2 Equate powers of 3

$3^{2p-5} = 3^{-1/2}$, so $2p - 5 = -\frac{1}{2}$.

3 Solve for p

$2p = \frac{9}{2}$, hence $p = \frac{9}{4}$.

4 Clear the denominator

$x^2 + 1 = \frac{36}{x^2 - 4}$ gives $(x^2 + 1)(x^2 - 4) = 36$.

5 Form a quadratic in x squared

$x^4 - 3x^2 - 4 = 36$, so $x^4 - 3x^2 - 40 = 0$.

6 **Factor**

$(x^2 - 8)(x^2 + 5) = 0$.

7 **Use real roots**

$x^2 = 8$, so $x = \pm 2\sqrt{2}$. The equation $x^2 = -5$ gives no real roots.

✓ **FINAL ANSWER**

$(i)\ p = \dfrac{9}{4}$. $\quad (ii)\ x = \pm 2\sqrt{2}$.

Question 5

10 marks | Quadratics

5.

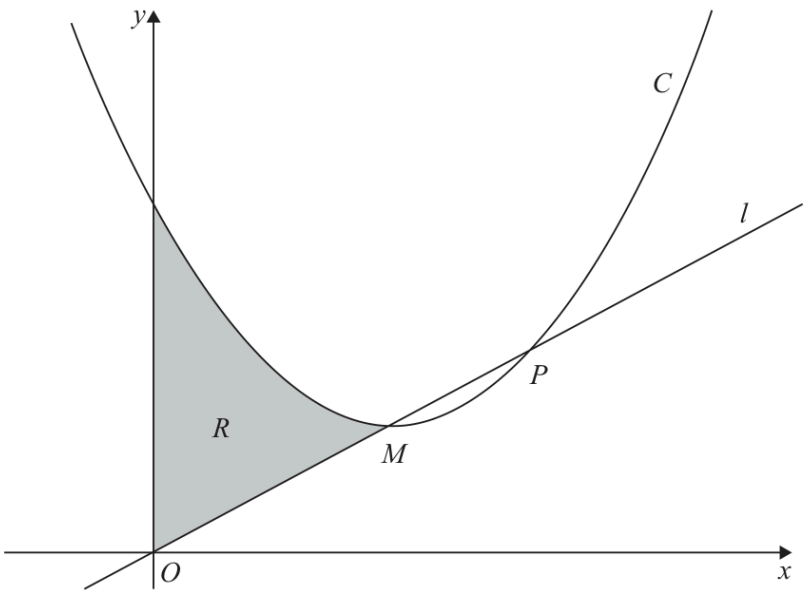


Figure 1

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

(a) Express $2x^2 - 16x + 50$ in the form

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

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

(3)

Figure 1 shows a sketch of the curve C with equation $y = 2x^2 - 16x + 50$

Given that in Figure 1

- M is the minimum point on C
- line l passes through the origin and intersects C at the points M and P

(b) find, using algebra and showing your working, the x coordinate of P.

(5)

The region R is shown shaded in Figure 1.

(c) Use inequalities to fully define R.

(2)

(Total for Question 5 is 10 marks)

1 **Complete the square**

$2x^2 - 16x + 50 = 2(x^2 - 8x) + 50 = 2[(x-4)^2 - 16] + 50$.

2 **Simplify the completed square**

$2x^2 - 16x + 50 = 2(x-4)^2 + 18$.

3 **Find M**

The minimum point is $M = (4, 18)$.

4 **Find the line through O and M**

Since l passes through $(0,0)$ and $(4,18)$, its gradient is $\frac{18}{4} = \frac{9}{2}$, so $l : y = \frac{9}{2}x$.

5 **Find the second intersection**

Set $2x^2 - 16x + 50 = \frac{9}{2}x$.

6 **Form the quadratic**

Multiplying by 2 gives $4x^2 - 32x + 100 = 9x$, so $4x^2 - 41x + 100 = 0$.

7 **Factor and select P**

$4x^2 - 41x + 100 = (x-4)(4x-25) = 0$. The point M has $x = 4$, so P has $x = \frac{25}{4}$.

8 **Define the region**

The shaded region is above the line, below the curve, and between the y-axis and M.

9 **Write inequalities**

$\frac{9}{2}x \le y \le 2x^2 - 16x + 50$ with $0 \le x \le 4$.

✓ **FINAL ANSWER**

$(a)\ 2(x-4)^2 + 18.\quad (b)\ x_P = \frac{25}{4}.\quad (c)\ \frac{9}{2}x \le y \le 2x^2 - 16x + 50,\ 0 \le x \le 4.$

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Question 6

9 marks | Graphs of Functions

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

$$y = \frac{4k}{x - 2k}$$

where k is a positive constant.

On your sketch show

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

(4)

The straight line l has equation

$$y = 6 - 2x$$

Given that there is at least one point of intersection between l and C,

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

(5)

(Total for Question 6 is 9 marks)

WORKED SOLUTION

Question 6 · WMA11/01 October 2025

1 **Find coordinate-axis intersections**

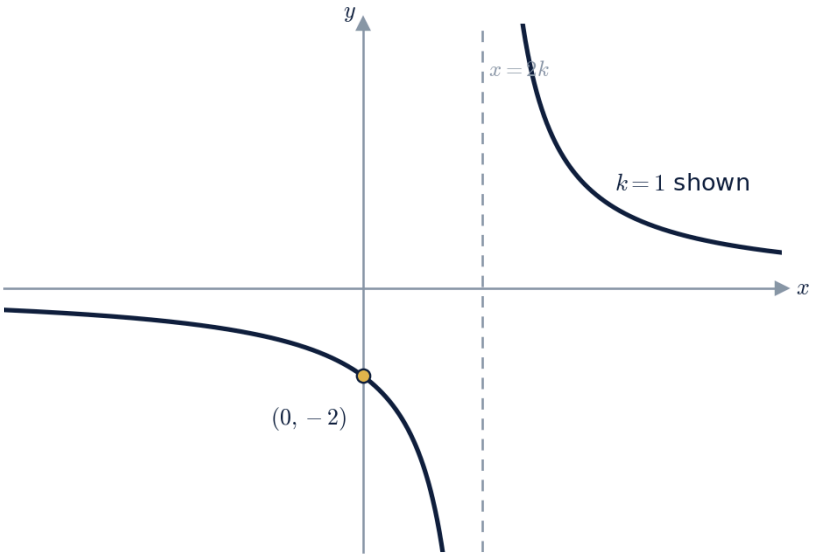
$y = \dfrac{4k}{x - 2k}$ has no x-intercept because the numerator is non-zero. At $x = 0$, $y = \dfrac{4k}{-2k} = -2$, so the y-intercept is $(0, -2)$.

2 **Find the vertical asymptote**

The denominator is zero when $x = 2k$, so the vertical asymptote is $x = 2k$.

3 **Sketch shape**

The curve has one branch in quadrant I to the right of $x = 2k$, and one branch passing through $(0, -2)$ and approaching the x-axis from below as $x \to -\infty$.



4 **Set line and curve equal**

$\dfrac{4k}{x - 2k} = 6 - 2x$.

5 **Form a quadratic in x**

$4k = (6 - 2x)(x - 2k) = 6x - 12k - 2x^2 + 4kx$, so $2x^2 - (4k + 6)x + 16k = 0$.

6 **Use at least one intersection**

For at least one real intersection, the discriminant must satisfy $b^2 - 4ac \geq 0$.

7 **Find the discriminant**

$(4k + 6)^2 - 4(2)(16k) \geq 0$, so $16k^2 - 80k + 36 \geq 0$.

8 **Solve in k**

$4k^2 - 20k + 9 \geq 0$, so $(2k - 1)(2k - 9) \geq 0$.

9 **Use k positive**

Therefore $k \leq \dfrac{1}{2}$ or $k \geq \dfrac{9}{2}$. Since k is positive, $0 < k \leq \dfrac{1}{2}$ or $k \geq \dfrac{9}{2}$.

✓ **FINAL ANSWER**

(a) y-intercept $(0, -2)$, vertical asymptote $x = 2k$.

(b) $0 < k \leq \dfrac{1}{2}$ or $k \geq \dfrac{9}{2}$.

Question 7

9 marks | Radians

7.

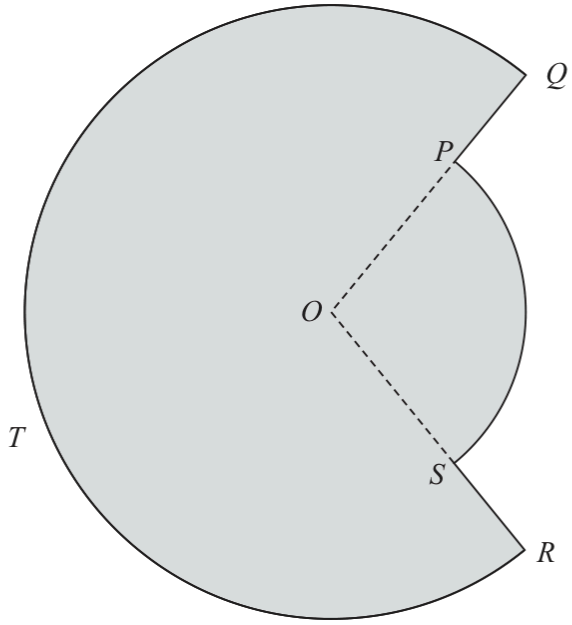


Figure 2

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

Figure 2 shows the plan view of a design for a swimming pool.

The design consists of a sector POS of a circle centre O joined to a major sector $QORTQ$ of a different circle, also with centre O.

Given that

- angle POS is 1.65 radians
- the area of sector POS is $30\,m^2$
- $PQ = 2.8\,m$

(a) show that, to 3 significant figures, $OQ = 8.83\,m$

(3)

(b) Find the total surface area of the swimming pool in m^2 to the nearest integer.

(3)

(c) Find the total perimeter of the swimming pool in metres to 2 significant figures.

(3)

(Total for Question 7 is 9 marks)

1 Find OP from the small sector

Let $OP = r$. The area of sector POS is 30, so $\frac{1}{2}r^2(1.65) = 30$.

2 Calculate OP

$r^2 = \frac{60}{1.65}$, so $r = 6.030...$ m.

3 Show OQ

$OQ = OP + PQ = 6.030... + 2.8 = 8.830...$, so $OQ = 8.83$ m to 3 significant figures.

4 Major sector angle

The major sector $QORTQ$ has angle $2\pi - 1.65$ radians.

5 Total area

$\text{Area} = 30 + \frac{1}{2}(8.830...)^2(2\pi - 1.65) = 210.6...$.

6 Round area

The total surface area is $211\ \text{m}^2$ to the nearest integer.

7 Arc lengths

The inner arc PS has length $6.030...(1.65) = 9.95...$, and the outer major arc has length $8.830...(2\pi - 1.65) = 40.91...$.

8 Add straight sides

The straight sides PQ and SR each have length 2.8 m.

9 Perimeter

$9.95... + 40.91... + 2.8 + 2.8 = 56.46...$, so the perimeter is $56\ \text{m}$ to 2 significant figures.

✓ **FINAL ANSWER**

$(a)\ OQ = 8.83\ \text{m}$. $(b)\ 211\ \text{m}^2$. $(c)\ 56\ \text{m}$.

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Question 8

8 marks | Integration

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

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

Given that

- $f'(x) = 2x + \frac{8}{x^2} + k$, where k is a constant
- the equation of the tangent to the curve at $x = \sqrt{2}$ is $y = 5x - 3\sqrt{2}$

(a) find the exact value of k.

(2)

(b) Find an equation of the normal to the curve at $x = \sqrt{2}$

(2)

(c) Find $f(x)$, writing your answer in simplest form.

(4)

(Total for Question 8 is 8 marks)

WORKED SOLUTION

Question 8 · WMA11/01 October 2025

1 Use tangent gradient

The tangent has equation $y = 5x - 3\sqrt{2}$, so the gradient at $x = \sqrt{2}$ is 5.

2 Find k

$f'(\sqrt{2}) = 2\sqrt{2} + \frac{8}{(\sqrt{2})^2} + k = 2\sqrt{2} + 4 + k = 5$, so $k = 1 - 2\sqrt{2}$.

3 Find the point on the curve

At $x = \sqrt{2}$, the tangent gives $y = 5\sqrt{2} - 3\sqrt{2} = 2\sqrt{2}$.

4 Normal gradient

The tangent gradient is 5, so the normal gradient is $-\frac{1}{5}$.

5 Equation of the normal

$y - 2\sqrt{2} = -\frac{1}{5}(x - \sqrt{2})$, hence $y = -\frac{1}{5}x + \frac{11\sqrt{2}}{5}$.

6 **Integrate f prime**

$$f(x)=\int\left(2x+\frac{8}{x^2}+k\right)dx=x^2-\frac{8}{x}+kx+c.$$

7 **Substitute k**

$$f(x)=x^2-\frac{8}{x}+(1-2\sqrt{2})x+c.$$

8 **Use the point**

$$2\sqrt{2}=2-\frac{8}{\sqrt{2}}+(1-2\sqrt{2})\sqrt{2}+c=-2-3\sqrt{2}+c.$$

9 **Find c**

$c=2+5\sqrt{2}$, so $f(x)=x^2-\dfrac{8}{x}+(1-2\sqrt{2})x+2+5\sqrt{2}$.

✓ **FINAL ANSWER**

$(a)\ k=1-2\sqrt{2}.\quad (b)\ y=-\dfrac{1}{5}x+\dfrac{11\sqrt{2}}{5}.\quad (c)\ f(x)=x^2-\dfrac{8}{x}+(1-2\sqrt{2})x+2+5\sqrt{2}.$

Question 9

6 marks | Transformations

9.

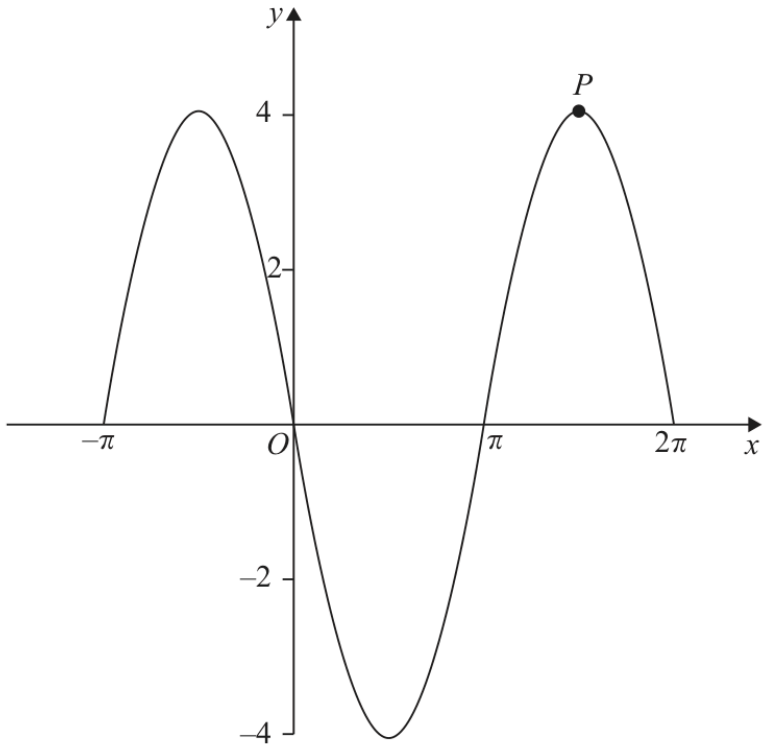


Figure 3

Figure 3 shows a sketch of part of the graph of the trigonometric function with equation $y = \mathrm{f}(x)$

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

(2)

The point P lies on $y = \mathrm{f}(x)$ and is shown in Figure 3.

(b) State the coordinates of the point to which P is transformed when the graph of $y = \mathrm{f}(x)$ is transformed to the graph with equation

(i) $y = \mathrm{f}\left(x - \frac{\pi}{6}\right)$

(2)

(ii) $y = -\frac{1}{2}\mathrm{f}(x)$

(2)

(Total for Question 9 is 6 marks)

1 **Identify amplitude and direction**

The graph has amplitude 4, crosses the origin, and initially moves downwards, so $f(x) = -4\sin x$.

2 **Identify P**

The labelled maximum is at $P = \left(\frac{3\pi}{2}, 4\right)$.

3 **Translate the graph right**

$y = f\left(x - \frac{\pi}{6}\right)$ translates the graph right by $\frac{\pi}{6}$.

4 **New coordinates for part b(i)**

P becomes $\left(\frac{3\pi}{2} + \frac{\pi}{6}, 4\right) = \left(\frac{5\pi}{3}, 4\right)$.

5 **Transform y equals negative half f(x)**

$y = -\frac{1}{2}f(x)$ leaves x-coordinates unchanged and multiplies y-coordinates by $-\frac{1}{2}$.

6 **New coordinates for part b(ii)**

P becomes $\left(\frac{3\pi}{2}, -2\right)$.

FINAL ANSWER

$(a)\ f(x) = -4\sin x.$ $(b)(i)\ \left(\frac{5\pi}{3}, 4\right).$ $(b)(ii)\ \left(\frac{3\pi}{2}, -2\right).$

Question 10

10 marks | Differentiation

10.

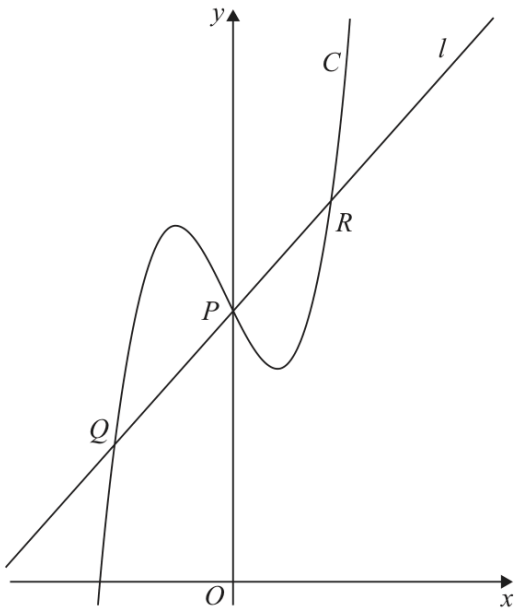


Figure 4

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

Figure 4 shows a sketch of the curve C with equation

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

The line l is the normal to C at the point P where $x = 0$

The line l also intersects C at points Q and R as shown in Figure 4.

(a) Find, using algebra, the x coordinate of point Q.

(6)

The point T lies on C.

Given that

- the tangent to C at T is parallel to l
- the x coordinate of T is positive

(b) find, using algebra, the exact x coordinate of T.

(4)

(Total for Question 10 is 10 marks)

1 **Differentiate C**

$y = 2x^3 + \frac{1}{2}x^2 - 2x + 5$, so $\frac{dy}{dx} = 6x^2 + x - 2$.

2 **Find the tangent gradient at P**

At P, $x = 0$, so the tangent gradient is -2.

3 **Equation of the normal**

The normal gradient is $\frac{1}{2}$ and $P = (0, 5)$, so $l : y = \frac{1}{2}x + 5$.

4 **Find intersections with the normal**

Set $2x^3 + \frac{1}{2}x^2 - 2x + 5 = \frac{1}{2}x + 5$.

5 **Form and factor the cubic**

$2x^3 + \frac{1}{2}x^2 - \frac{5}{2}x = 0$. Multiplying by 2 gives $4x^3 + x^2 - 5x = 0 = x(4x^2 + x - 5)$.

6 **Solve for x**

$x(4x + 5)(x - 1) = 0$, so the intersections have x-coordinates 0, $-\frac{5}{4}$ and 1.

7 **Select point Q**

The point Q is the left-hand intersection, so $x_Q = -\frac{5}{4}$.

8 **Parallel tangent condition**

The tangent at T is parallel to l, so its gradient is $\frac{1}{2}$.

9 **Set derivative equal to one half**

$6x^2 + x - 2 = \frac{1}{2}$, so $12x^2 + 2x - 5 = 0$.

10 **Use the positive solution**

$x = \frac{-2 \pm \sqrt{4 + 240}}{24} = \frac{-1 \pm \sqrt{61}}{12}$. Since x_T is positive, $x_T = \frac{-1 + \sqrt{61}}{12}$.

FINAL ANSWER

$(a)\ x_Q = -\frac{5}{4}$. $\quad (b)\ x_T = \frac{-1 + \sqrt{61}}{12}$.