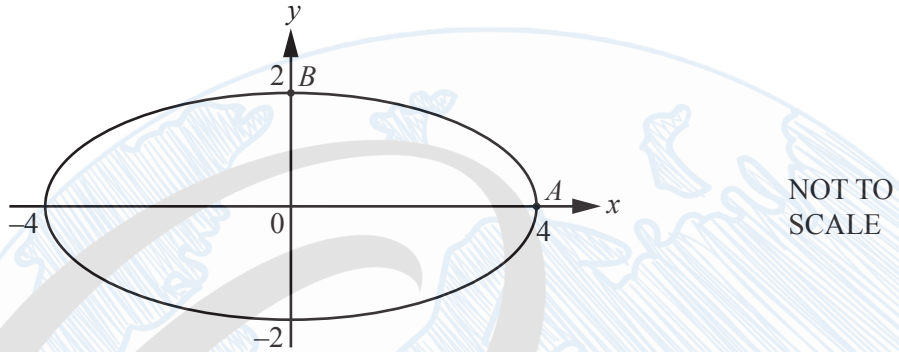




Co-ordinate Geometry and Differentiation

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9



The diagram shows a curve with equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

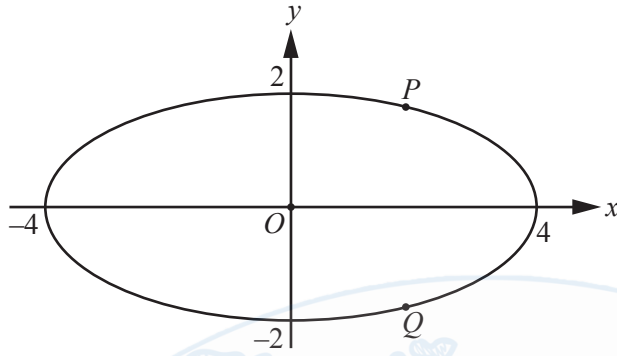
- (a) A is the point $(4, 0)$ and B is the point $(0, 2)$.
 - (i) Find the equation of the straight line that passes through A and B .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

- (ii) Show that $a^2 = 16$ and $b^2 = 4$.

[2]

(b)



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$P(2, k)$ and $Q(2, -k)$ are points on the curve $\frac{x^2}{16} + \frac{y^2}{4} = 1$.

(i) Find the value of k .

$k = \dots\dots\dots [3]$

(ii) Calculate angle POQ .

Angle $POQ = \dots\dots\dots [3]$

(c) The area enclosed by a curve with equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is πab .

(i) Find the area enclosed by the curve $\frac{x^2}{16} + \frac{y^2}{4} = 1$.

Give your answer as a multiple of π .

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$\dots\dots\dots [1]$

(ii) A curve, mathematically similar to the one in the diagrams, intersects the x -axis at $(12, 0)$ and $(-12, 0)$.

Work out the area enclosed by this curve, giving your answer as a multiple of π .

$\dots\dots\dots [2]$

9 A line joins the points $A (-2, -5)$ and $B (4, 13)$.

(a) Calculate the length AB .

$AB = \dots\dots\dots$ [3]

(b) Find the equation of the line through A and B .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

(c) Another line is parallel to AB and passes through the point $(0, -5)$.

Write down the equation of this line.

$\dots\dots\dots$ [2]

(d) Find the equation of the perpendicular bisector of AB .

$\dots\dots\dots$ [5]

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3) June 2017 V1

7 A line joins the points $A(-3, 8)$ and $B(2, -2)$.

(a) Find the co-ordinates of the midpoint of AB .

(.....,) [2]

(b) Find the equation of the line through A and B .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

(c) Another line is parallel to AB and passes through the point $(0, 7)$.
Write down the equation of this line.

..... [2]

(d) Find the equation of the line perpendicular to AB which passes through the point $(1, 5)$.
Give your answer in the form $ax + by + c = 0$ where a , b and c are integers.

..... [4]

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4) June 2019 V2

4 (a) The equation of a straight line is $2y = 3x + 4$.

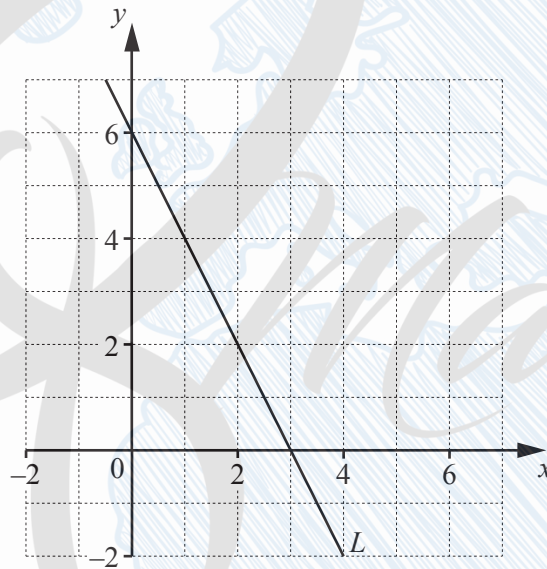
(i) Find the gradient of this line.

..... [1]

(ii) Find the co-ordinates of the point where the line crosses the y-axis.

(..... ,) [1]

(b) The diagram shows a straight line L .



(i) Find the equation of line L .

..... [3]

(ii) Find the equation of the line perpendicular to line L that passes through $(9, 3)$.

..... [3]

(c) A is the point $(8, 5)$ and B is the point $(-4, 1)$.

(i) Calculate the length of AB .

..... [3]

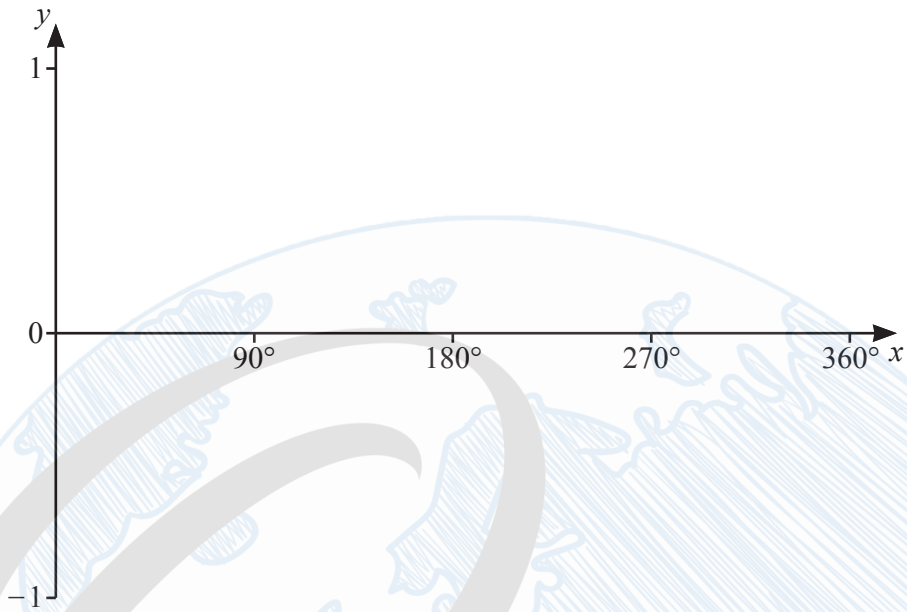
(ii) Find the co-ordinates of the midpoint of AB .

(..... ,) [2]



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8 (a) (i) On the axes, sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

(ii) Describe fully the symmetry of the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

.....
.....

[2]

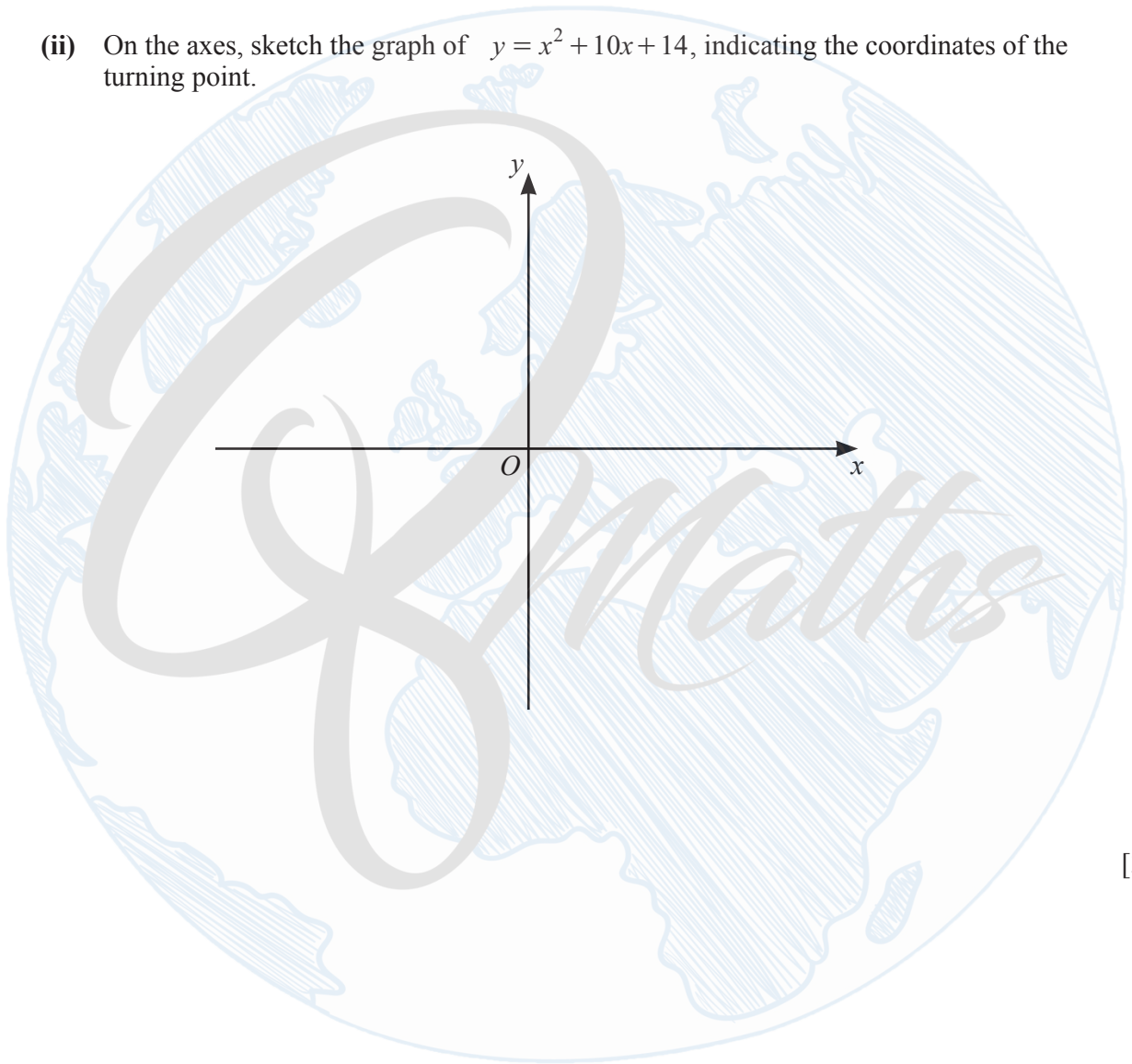
(b) Solve $4 \sin x - 1 = 2$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ and $x = \dots\dots\dots$ [3]

(c) (i) Write $x^2 + 10x + 14$ in the form $(x + a)^2 + b$.

..... [2]

(ii) On the axes, sketch the graph of $y = x^2 + 10x + 14$, indicating the coordinates of the turning point.



[3]

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6) June 2020 V1 _____

10 (a) A rhombus $ABCD$ has a diagonal AC where A is the point $(-3, 10)$ and C is the point $(4, -4)$.

(i) Calculate the length AC .

..... [3]

(ii) Show that the equation of the line AC is $y = -2x + 4$.

[2]

(iii) Find the equation of the line BD .

..... [4]

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(b) A curve has the equation $y = x^3 + 8x^2 + 5x$.

(i) Work out the coordinates of the two turning points.



(.....,) and (.....,) [6]

(ii) Determine whether each of the turning points is a maximum or a minimum.
Give reasons for your answers.

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[3]

10 (a) $y = x^4 - 4x^3$

(i) Find the value of y when $x = -1$.

$y = \dots\dots\dots$ [2]

(ii) Find the two stationary points on the graph of $y = x^4 - 4x^3$.

$(\dots\dots\dots, \dots\dots\dots)$

$(\dots\dots\dots, \dots\dots\dots)$ [6]

(b) $y = x^p + 2x^q$

$\frac{dy}{dx} = 11x^{10} + 10x^4$, where $\frac{dy}{dx}$ is the derived function.

Find the value of p and the value of q .

$www.Q8Maths.com$ $p = \dots\dots\dots$

$q = \dots\dots\dots$ [2]

8) June 2020 V3 _____

9 (a) The equation of line L is $3x - 8y + 20 = 0$.

(i) Find the gradient of line L .

..... [2]

(ii) Find the coordinates of the point where line L cuts the y -axis.

(.....,.....) [1]



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(b) The coordinates of P are $(-3, 8)$ and the coordinates of Q are $(9, -2)$.

(i) Calculate the length PQ .

..... [3]

(ii) Find the equation of the line parallel to PQ that passes through the point $(6, -1)$.

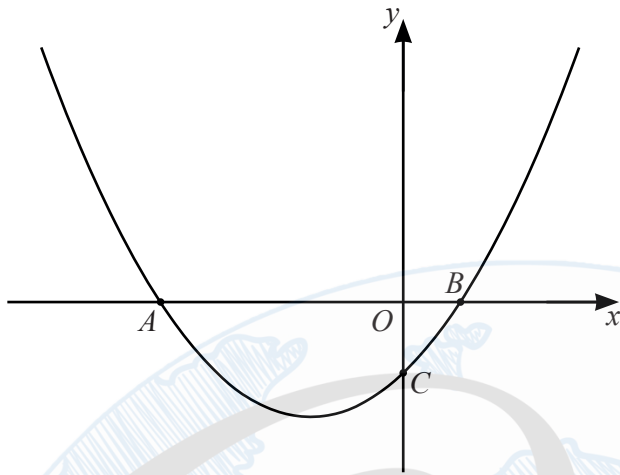
..... [3]

(iii) Find the equation of the perpendicular bisector of PQ .

..... [4]

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10 (a)



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The diagram shows a sketch of the curve $y = x^2 + 3x - 4$.

(i) Find the coordinates of the points A, B and C.

A (.....,))

B (.....,))

C (.....,) [4]

(ii) Differentiate $x^2 + 3x - 4$.

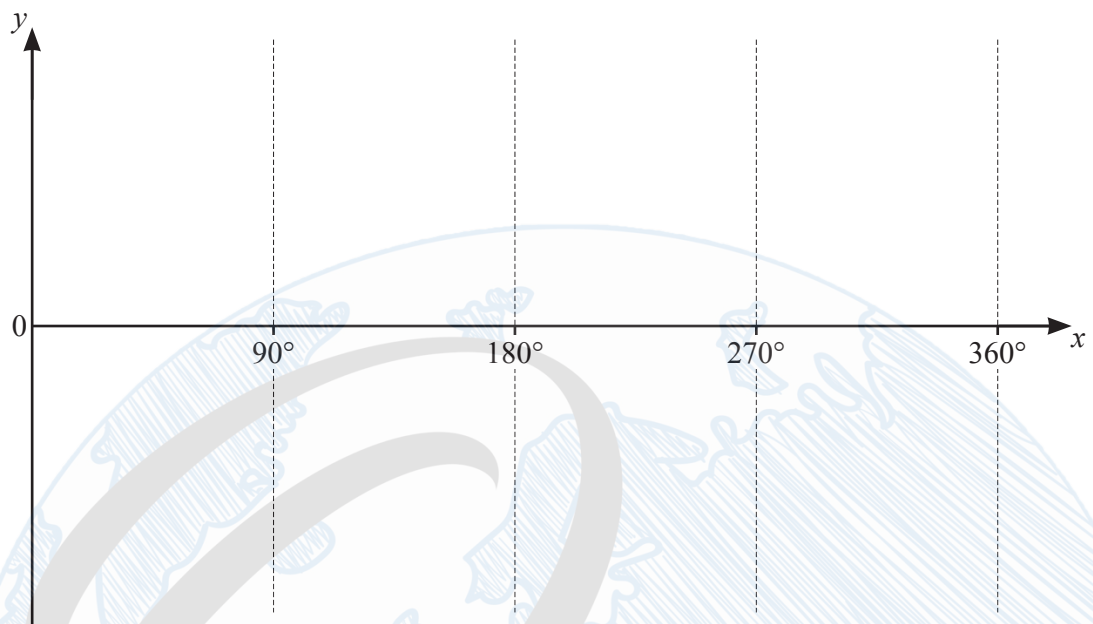
..... [2]

(iii) Find the equation of the tangent to the curve at the point (2, 6).

..... [3]

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(b)



(i) On the diagram, sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$. [2]

(ii) Solve the equation $5 \tan x = -7$ for $0^\circ \leq x \leq 360^\circ$.

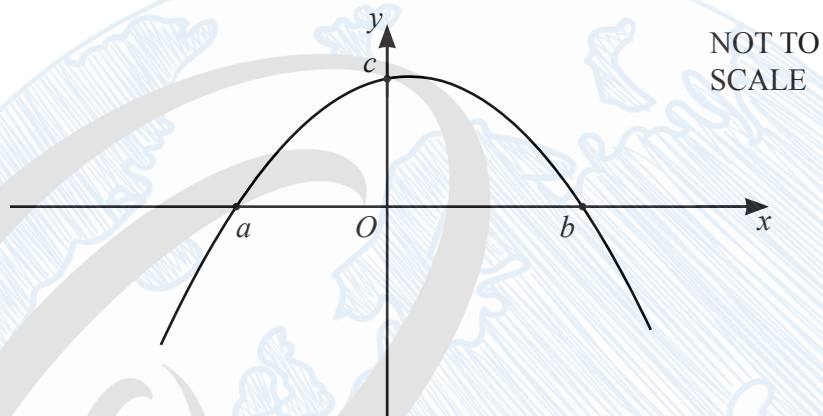
$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

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7 (a) (i) Factorise $24 + 5x - x^2$.

..... [2]

(ii) The diagram shows a sketch of $y = 24 + 5x - x^2$.



Work out the values of a , b and c .

$a =$

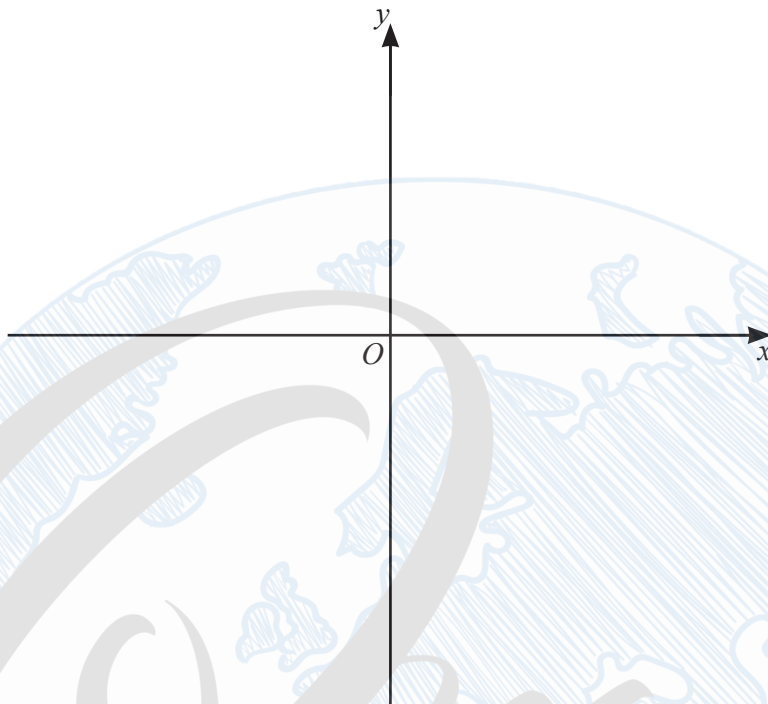
$b =$

$c =$ [3]

(iii) Calculate the gradient of $y = 24 + 5x - x^2$ at $x = -1.5$.

..... [3]

- (b) (i) On the diagram, sketch the graph of $y = (x+1)(x-3)^2$.
Label the values where the graph meets the x -axis and the y -axis.



[4]

- (ii) Write $(x+1)(x-3)^2$ in the form $ax^3 + bx^2 + cx + d$.

..... [3]

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