Chapter 3

Coordinate geometry

01.0580_s24_qp_42 Q:10

(a) *A* is the point $(6, 2)$ and *B* is the point $(3, -4)$.

   (i) Find the coordinates of the midpoint of *AB*.

                                                        (...................... , ...) [2]

   (ii) Calculate the length *AB*.

                                                        .... [3]

(b) The equation of line *l* is $\quad 4x + 3y - 12 = 0$.

   (i) Find the gradient of *l*.

                                                        .... [2]

   (ii) Find the coordinates of the point where *l* crosses the *y*-axis.

                                                      (...................... , ...) [2]

   (iii) Line *p* is perpendicular to *l* and passes through $(6, 5)$.

       Find the equation of *p* in the form $y = mx + c$.

                                         $y = $ .... [3]
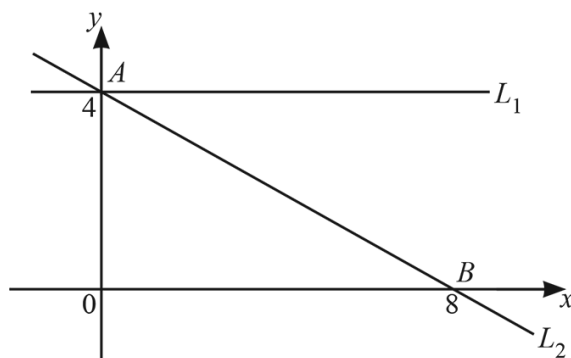
A is the point $(0, 4)$ and B is the point $(8, 0)$.
The line L_1 is parallel to the x-axis.
The line L_2 passes through A and B.

(a) Write down the equation of L_1.

.... [1]

(b) Find the equation of L_2.
Give your answer in the form $y = mx + c$.

$y = $ .... [2]

(c) C is the point $(2, 3)$.
The line L_3 passes through C and is perpendicular to L_2.

(i) Show that the equation of L_3 is $y = 2x - 1$.

[3]

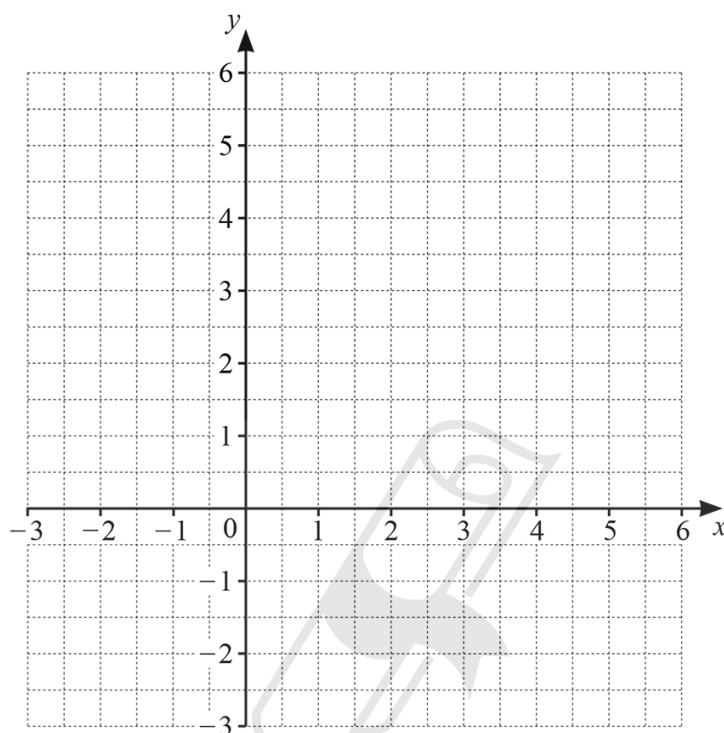**(ii)** L_3 crosses the *x*-axis at *D*.

Find the length of *CD*.

.... [5]

(a) In the square *ABCD*, *A* has coordinates $(-2, 1)$ and *B* has coordinates $(1, 5)$.
C has coordinates (a, b), where *a* and *b* are both positive integers.

Find the coordinates of *C* and the coordinates of *D*.
You may use the grid to help you.

C (...................... , ...)

D (...................... , ...) [4]

(b) P has coordinates $(-1, 3)$ and Q has coordinates $(6, 4)$.

    (i) Find the coordinates of the midpoint of PQ.

(........................ , ...) [2]

    (ii) Find the length PQ.

.... [3]

    (iii) Find the gradient of PQ.

.... [2]

    (iv) Find the equation of the line parallel to PQ that crosses the x-axis at $x = 2$.

.... [3]

(a) **(i)** Show that the equation $y = (x-4)(x+1)(x-2)$ can be written as $y = x^3 - 5x^2 + 2x + 8$.

[2]

(ii) On the diagram, sketch the graph of $y = x^3 - 5x^2 + 2x + 8$, indicating the values where the graph crosses the axes.
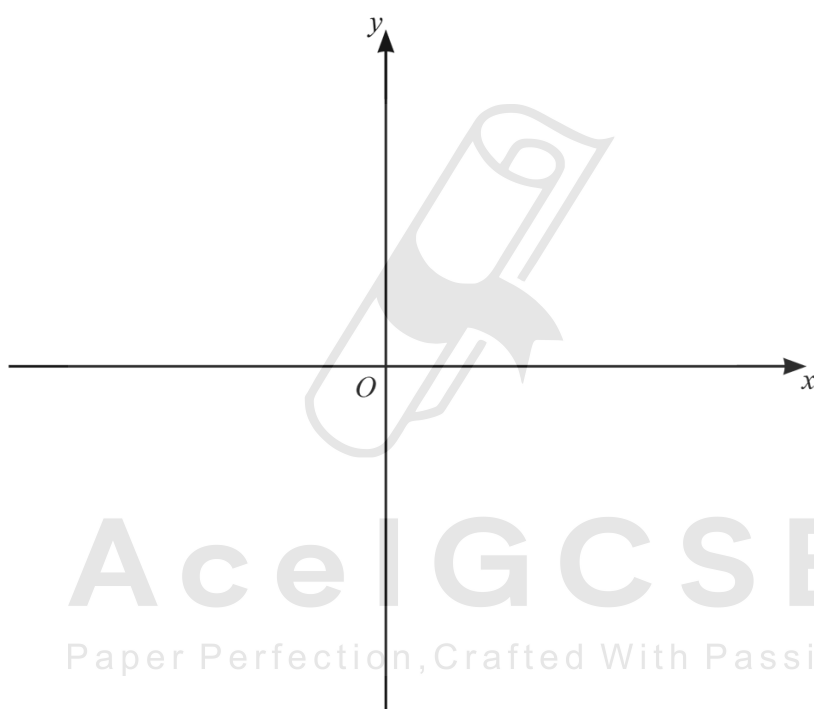
[4]

(b) The graph of $y = x^3 - 5x^2 + 2x + 8$ has two tangents with a gradient of 10.

Find the equations of these two tangents.
You must show all your working and give your answers in the form $y = mx + c$.

$y =$ ....

$y =$ .... [7]

M has coordinates (4, 1) and *N* has coordinates (−2, −7).

(a) Find the length of *MN*.

.... [3]

(b) Find the gradient of *MN*.

.... [2]

(c) Find the equation of the perpendicular bisector of *MN*.

.... [4]

06. 0580_s23_qp_43 Q: 12

The equation of a curve is $y = x^4 - 8x^2 + 5$.

(a) Find the derivative, $\left(\dfrac{\mathrm{d}y}{\mathrm{d}x}\right)$, of $y = x^4 - 8x^2 + 5$.

.... [2]

(b) Find the coordinates of the three turning points.
You must show all your working.

(.......... , ...) and (.......... , ...) and (.......... , ...) [4]

(c) Determine which one of these turning points is a maximum.
Justify your answer.

[2]
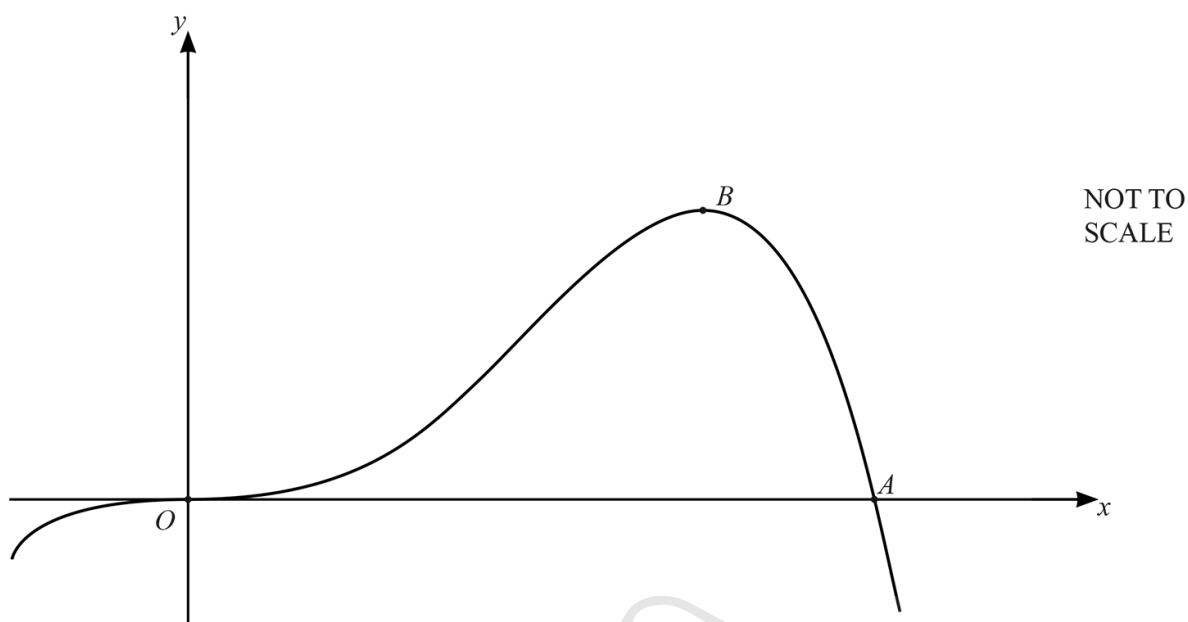
The diagram shows a sketch of the graph of $y = 4x^3 - x^4$.
The graph crosses the x-axis at the origin O and at the point A.
The point B is a maximum point.

(a) Differentiate $4x^3 - x^4$.

.... [2]

(b) Find the coordinates of B.

(........................ , ...) [3]

(c) Find the gradient of the graph at the point A.

.... [3]

08.0580_w23_qp_43 Q:9

A is the point (0, 2), *B* is the point (3, 3) and *C* is the point (4, 0).

(a) Determine if triangle *ABC* is scalene, isosceles or equilateral.
You must show all your working.

[4]

(b) (i) Find the equation of the line *AC*.
Give your answer in the form $y = mx + c$.

$y =$ .... [3]

(ii) Find the equation of the perpendicular bisector of *AC*.
Give your answer in the form $y = mx + c$.

$y =$ .... [4]

(iii) *ABCD* is a kite.
The point *D* has coordinates $(w, 4w+1)$.

Find the coordinates of *D*.

(...................... , ...) [3]

09. 0580_w23_qp_43   Q: 11
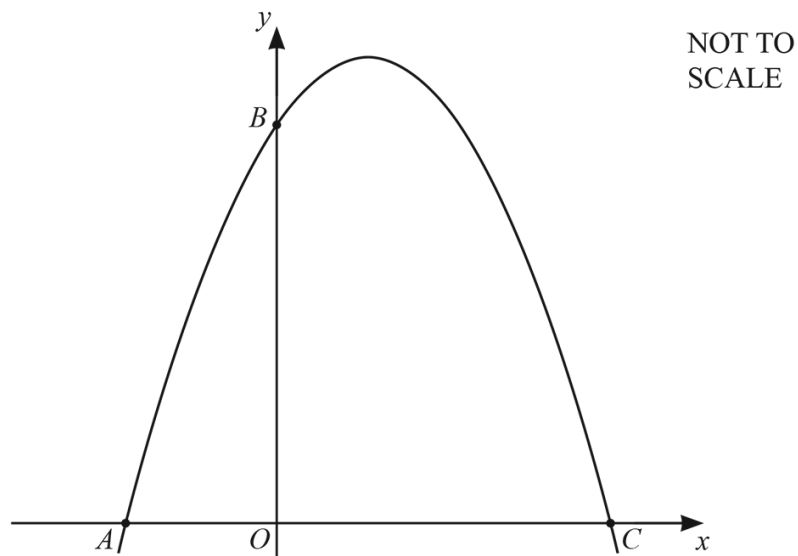
The diagram shows a sketch of $y = 18 + 5x - 2x^2$.

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

A (.................... , ...)

B (.................... , ...)

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

(b)   Differentiate $18 + 5x - 2x^2$.

.... [2]

(c)   Find the coordinates of the point on $y = 18 + 5x - 2x^2$ where the gradient is 17.

(.................... , ...) [3]

10. 0580_s22_qp_42 Q: 3

A line, l, joins point F (3, 2) and point G (− 5, 4).

(a) Calculate the length of line l.

.... [3]

(b) Find the equation of the perpendicular bisector of line l in the form $y = mx + c$.

$y =$ .... [5]

(c) A point H lies on the y-axis such that the distance $GH = 13$ units.

Find the coordinates of the two possible positions of H.

(................ , ...) and (................ , ...) [4]

11. 0580_s22_qp_43 Q: 8

(a) A has coordinates $(-2, 7)$, B has coordinates $(1, -5)$ and C has coordinates $(5, 4)$.

    (i) Find the coordinates of the midpoint of the line AB.

                                                         (...................... , ...) [2]

    (ii) Find $\overrightarrow{AC}$.

$$\overrightarrow{AC} = \begin{pmatrix} \\ \end{pmatrix}$$ [2]

    (iii) Find $\left| \overrightarrow{AC} \right|$.

                                         .... [2]

    (iv) Find the equation of the line AB.
           Give your answer in the form $y = mx + c$.

                            $y =$ .... [3]

(v) Find the equation of the line perpendicular to AB that passes through C.
Give your answer in the form $y = mx + c$.

$y =$ .... [3]

(b) The graphs of $y + 5x = 8$ and $y = 2x^2 + 6x - 13$ intersect at the points P and Q.

Find the coordinates of P and the coordinates of Q.
Show all your working.

P (.................. , ...)

Q (.................. , ...) [6]

12. 0580_w22_qp_42 Q: 8

AB is a line with midpoint *M*.
A is the point (2, 3) and *M* is the point (12, 7).

(a) Find the coordinates of *B*.

(........................ , ...) [2]

(b) Show that the equation of the perpendicular bisector of *AB* is $2y + 5x = 74$.

[4]

(c) The perpendicular bisector of *AB* passes through the point *N*.
The point *N* has coordinates (2, *n*).

Find the value of *n*.

$n = $ .... [1]

(d) Points *A*, *M* and *N* form a triangle.

Find the area of the triangle.

.... [2]

(a) Find the gradient of the curve $y = 2x^3 - 7x + 4$ when $x = -2$.

.... [3]

(b) A is the point $(7, 2)$ and B is the point $(-5, 8)$.

   (i) Calculate the length of AB.

.... [3]

   (ii) Find the equation of the line that is perpendicular to AB and that passes through
the point $(-1, 3)$.
Give your answer in the form $y = mx + c$.

$y = $ .... [4]

(iii) AB is one side of the parallelogram $ABCD$ and

- $\overrightarrow{BC} = \begin{pmatrix} -a \\ -b \end{pmatrix}$ where $a > 0$ and $b > 0$

- the gradient of BC is 1

- $\left| \overrightarrow{BC} \right| = \sqrt{8}$.

Find the coordinates of D.

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

(a) (i) The equation $y = x^3 - 4x^2 + 4x$ can be written as $y = x(x-a)^2$.

Find the value of a.

$a =$ .... [2]

(ii) On the axes, sketch the graph of $y = x^3 - 4x^2 + 4x$, indicating the values where the graph meets the axes.
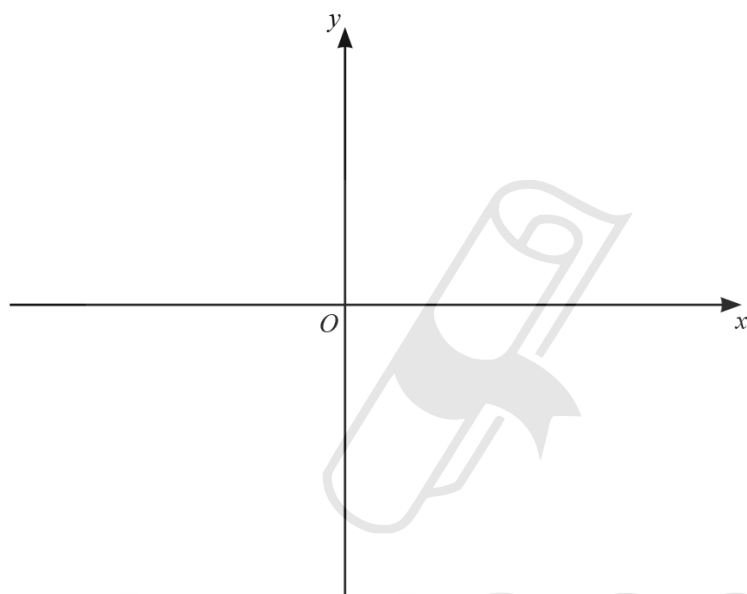
[4]

(b) Find the equation of the tangent to the graph of $y = x^3 - 4x^2 + 4x$ at $x = 4$.
Give your answer in the form $y = mx + c$.

$y =$ .... [7]

(a) The table shows some values for $y = 2x^3 - 4x^2 + 3$.

x	-1	-0.5	0	0.5	1	1.5	2
y	-3	1.75				0.75	3

  (i) Complete the table. [3]

  (ii) On the grid, draw the graph of $y = 2x^3 - 4x^2 + 3$ for $-1 \leqslant x \leqslant 2$.
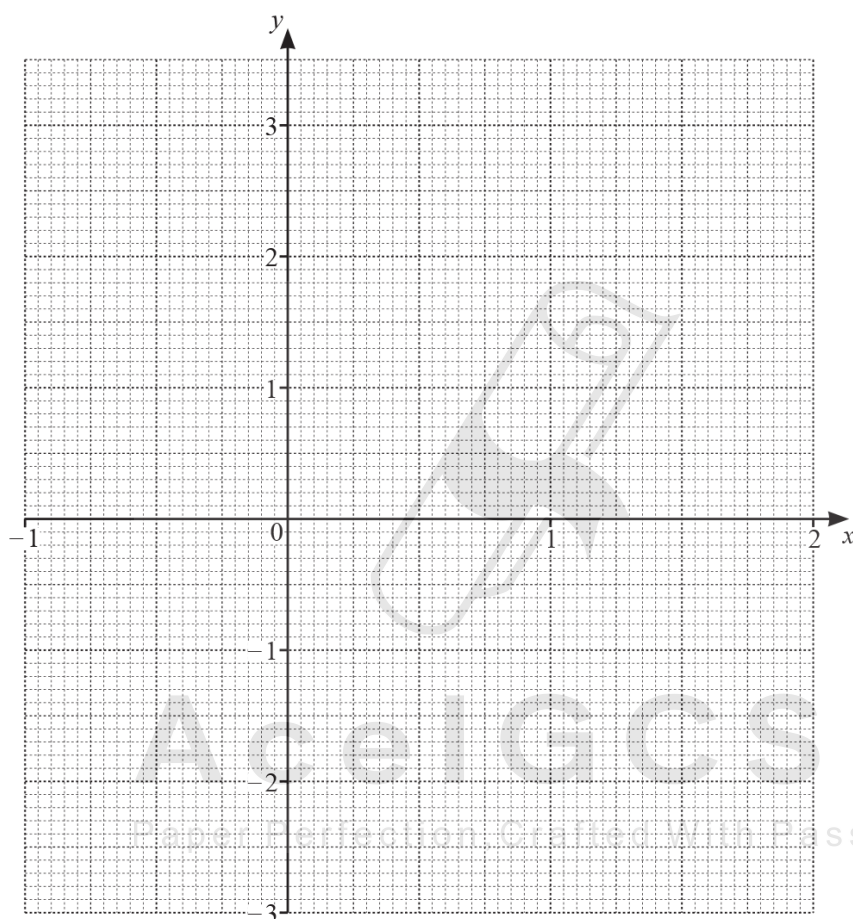
[4]

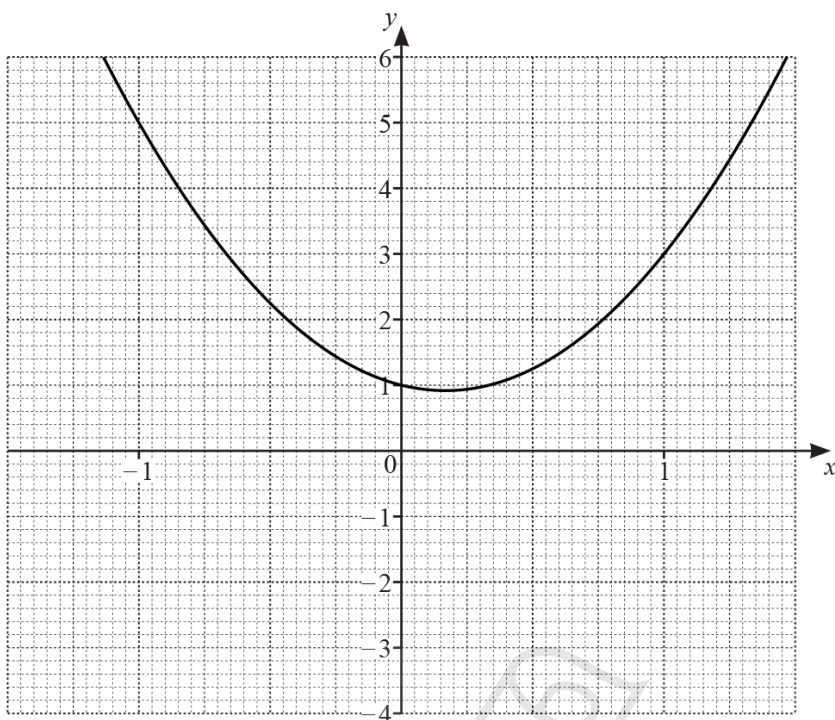 **(iii)** Use your graph to solve the equation $2x^3 - 4x^2 + 3 = 1.5$.

$x = $ .... or $x = $ .... or $x = $ .... [3]

  (iv) The equation $2x^3 - 4x^2 + 3 = k$ has only one solution for $-1 \leqslant x \leqslant 2$.

  Write down a possible integer value of k.

.... [1]

(b)

(i) On the grid, draw the tangent to the curve at $x = 1$. [1]

(ii) Use your tangent to estimate the gradient of the curve at $x = 1$.

.... [2]

(iii) Write down the equation of your tangent in the form $y = mx + c$.

$y =$ .... [2]

16. 0580_p20_qp_40   Q: 3

$f(x) = \dfrac{20}{x} + x, x \neq 0$

(a) Complete the table.

x	−10	−8	−5	−2	−1.6		1.6	2	5	8	10
$f(x)$	−12	−10.5	−9	−12	−14.1		14.1	12			12

[2]

(b) On the grid, draw the graph of $y = f(x)$ for $-10 \leqslant x \leqslant -1.6$ and $1.6 \leqslant x \leqslant 10$.
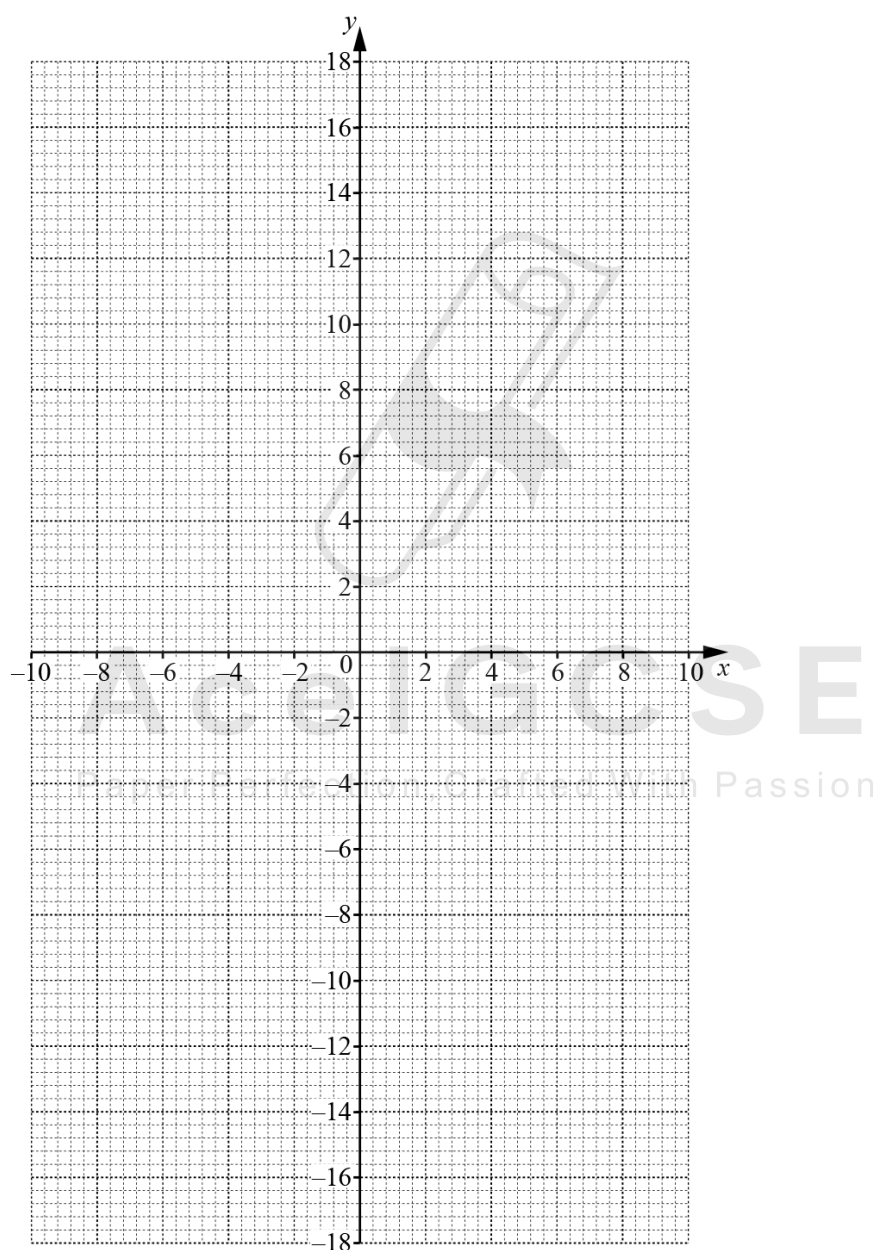
[5]

(c) Using your graph, solve the equation $f(x) = 11$.

$x =$ .... or $x =$ .... [2]

(d) k is a prime number and $f(x) = k$ has no solutions.

Find the possible values of k.

.... [2]

(e) The gradient of the graph of $y = f(x)$ at the point (2, 12) is −4.

Write down the coordinates of the other point on the graph of $y = f(x)$ where the gradient is −4.

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

(f) **(i)** The equation $f(x) = x^2$ can be written as $x^3 + px^2 + q = 0$.

Show that $p = -1$ and $q = -20$.

[2]

(ii) On the grid opposite, draw the graph of $y = x^2$ for $-4 \leqslant x \leqslant 4$. [2]

(iii) Using your graphs, solve the equation $x^3 - x^2 - 20 = 0$.

$x =$ .... [1]

(iv)
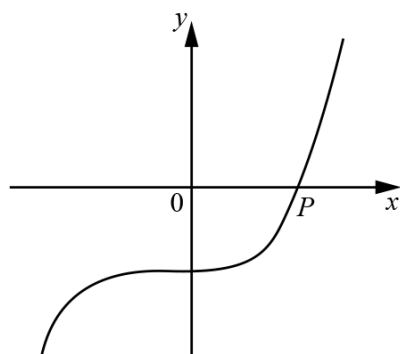
NOT TO SCALE

The diagram shows a **sketch** of the graph of $y = x^3 - x^2 - 20$.
P is the point $(n, 0)$.

Write down the value of n.

$n =$ .... [1]

17. 0580_s20_qp_41   Q: 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]

(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.

[3]

18. 0580_s20_qp_42 Q: 9

(a) (i) Write $x^2 + 8x - 9$ in the form $(x + k)^2 + h$.

.... [2]

(ii) Use your answer to **part (a)(i)** to solve the equation $x^2 + 8x - 9 = 0$.

$x = $ .... or $x = $ .... [2]

(b) The solutions of the equation $x^2 + bx + c = 0$ are $\dfrac{-7 + \sqrt{61}}{2}$ and $\dfrac{-7 - \sqrt{61}}{2}$.

Find the value of b and the value of c.
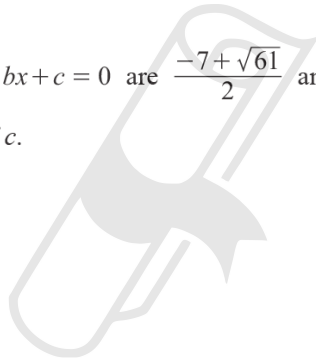
$b = $ ....

$c = $ .... [3]

(c) (i)
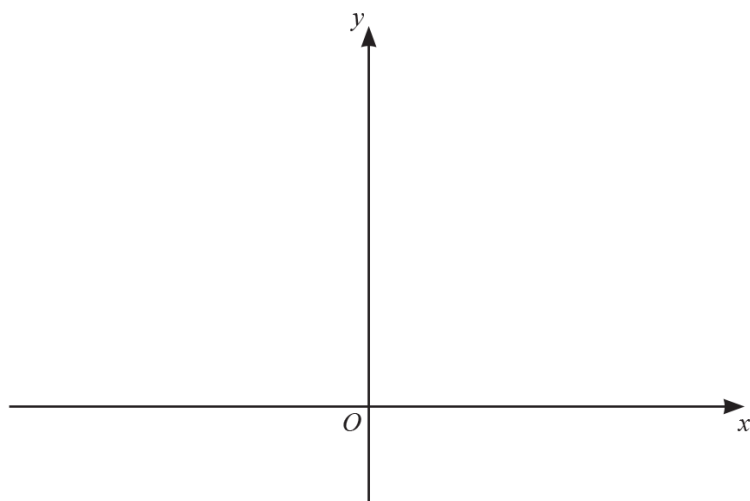
On the diagram,

(a) sketch the graph of $y = (x-1)^2$, [2]

(b) sketch the graph of $y = \dfrac{1}{2}x + 1$. [2]

(ii) The graphs of $y = (x-1)^2$ and $y = \dfrac{1}{2}x + 1$ intersect at A and B.

Find the length of AB.

$AB = $ .... [7]

19. $0580\_s20\_qp\_43$ Q: 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]

(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]

20. 0580_s19_qp_42 Q: 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.
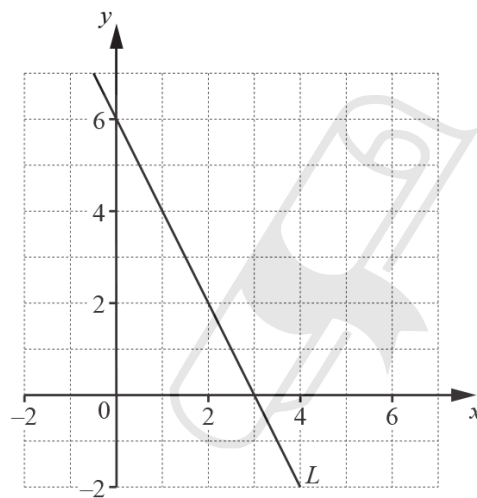
    (i) Find the equation of line L.

.... [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]

21. 0580_s19_qp_43 Q:7

A straight line joins the points A (-2, -3) and C (1, 9).

(a) Find the equation of the line AC in the form $y = mx + c$.

$y =$ .... [3]

(b) Calculate the acute angle between AC and the x-axis.

.... [2]

(c) *ABCD* is a kite, where AC is the longer diagonal of the kite.
B is the point (3.5, 2).

(i) Find the equation of the line BD in the form $y = mx + c$.

$y =$ .... [3]

(ii) The diagonals AC and BD intersect at (-0.5, 3).

Work out the co-ordinates of D.

(...................... , ...) [2]

(a)
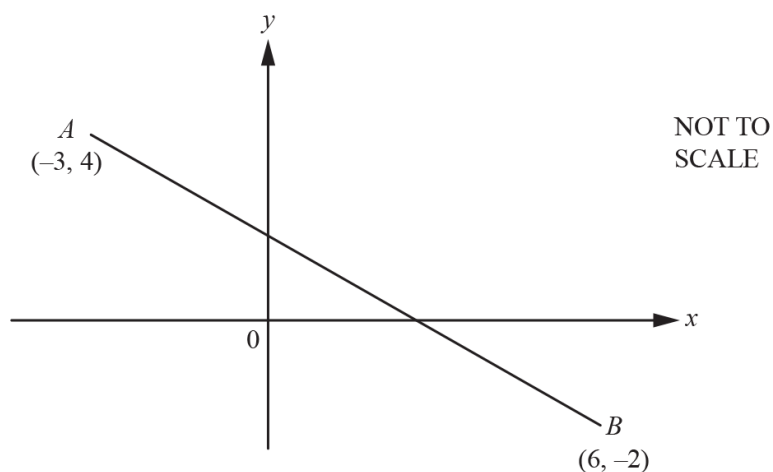
Calculate the length of *AB*.

.... [3]

(b) The point *P* has co-ordinates $(10, 12)$ and the point *Q* has co-ordinates $(2, -4)$.

Find

(i) the co-ordinates of the mid-point of the line *PQ*,

(.................... , ...) [2]

(ii) the gradient of the line *PQ*,

.... [2]

(iii) the equation of a line perpendicular to *PQ* that passes through the point $(2, 3)$.

.... [3]

23. 0580_s18_qp_43 Q: 2

(a) (i) $y = 2^x$

Complete the table.

x	0	1	2	3	4
y		2	4	8	

[2]

(ii) $y = 14 - x^2$

Complete the table.

x	0	1	2	3	4
y		13	10	5	

[2]

(b) On the grid, draw the graphs of $y = 2^x$ and $y = 14 - x^2$ for $0 \leqslant x \leqslant 4$.
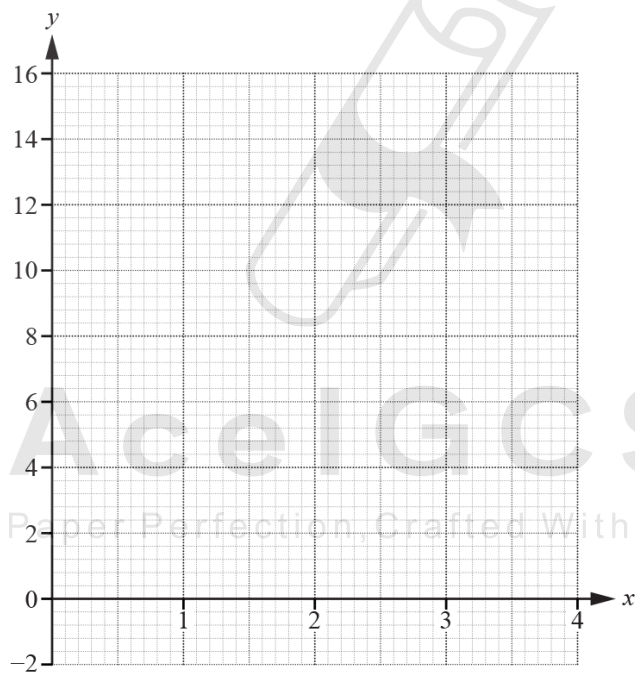
[6]

(c) Use your graphs to solve the equations.

(i) $2^x = 12$

$x =$ .... [1]

(ii) $2^x = 14 - x^2$

$x =$ .... [1]

(d) **(i)** On the grid, draw the line from the point $(4, 2)$ that has a gradient of -4. [1]

(ii) Complete the statement.

This straight line is a .... to the graph of $y = 14 - x^2$

at the point (.......... , ...). [2]

24. 0580_s18_qp_43 Q: 9

(a) Find the equation of the straight line that is perpendicular to the line $y = \frac{1}{2}x + 1$ and passes through the point (1, 3).

.... [3]

(b)
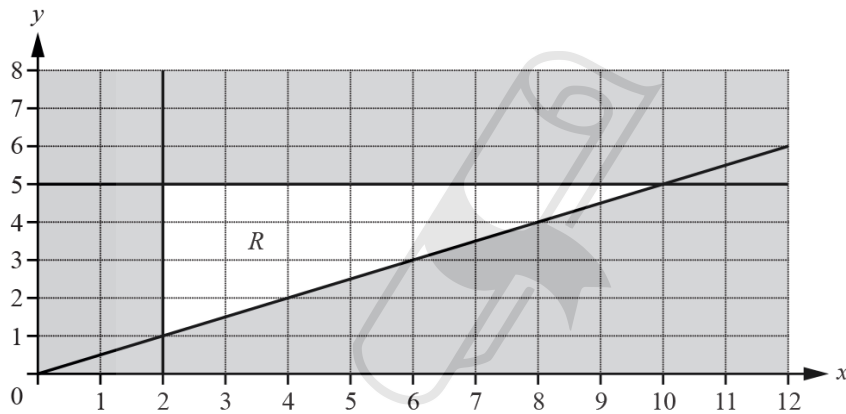
(i) Find the three inequalities that define the region *R*.

....

....

.... [4]

(ii) Find the point (x, y), with integer co-ordinates, inside the region *R* such that $3x + 5y = 35$.

(.................... , ...) [2]

The table shows some values of $y = x^3 - 3x^2 + x$.

x	-0.75	-0.5	-0.25	0	0.5	1	1.5	2	2.5	2.75
y	-2.9	-1.4	-0.5		-0.1	-1	-1.9		-0.6	

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = x^3 - 3x^2 + x$ for $-0.75 \leqslant x \leqslant 2.75$. [4]
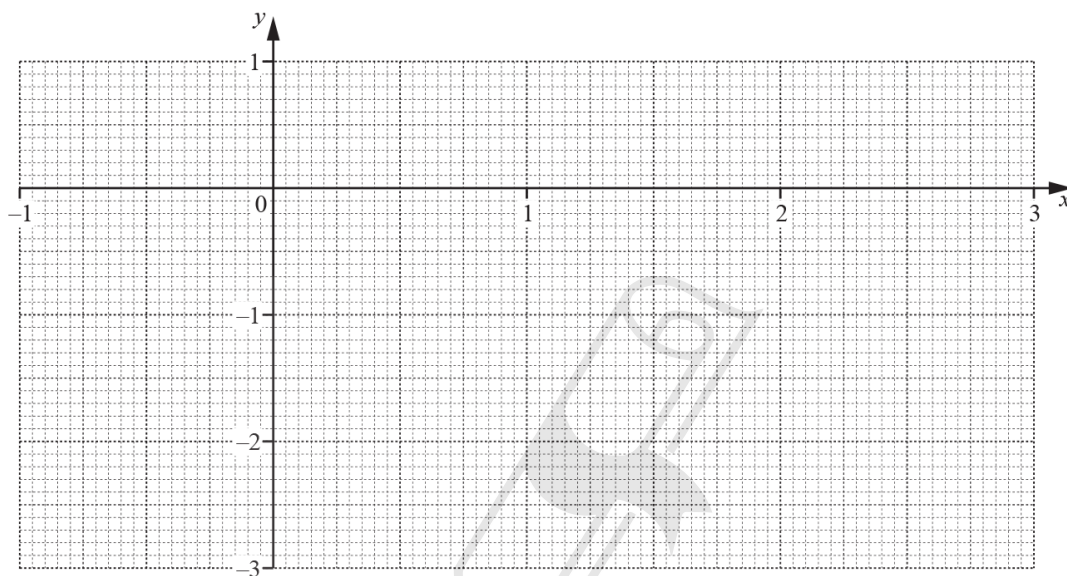
(c) Use your graph to complete the inequalities in x for which $y > -1$.

.... $< x <$ .... and $x >$ .... [3]

(d) The equation $x^3 - 3x^2 + 2x - 1 = 0$ can be solved by drawing a straight line on the grid.

(i) Write down the equation of this line.

.... [2]

(ii) On the grid, draw this line and use it to solve the equation $x^3 - 3x^2 + 2x - 1 = 0$.

$x =$ .... [3]

(e) By drawing a suitable tangent, find an estimate for the gradient of the graph of $y = x^3 - 3x^2 + x$ at $x = -0.25$.

.... [3]
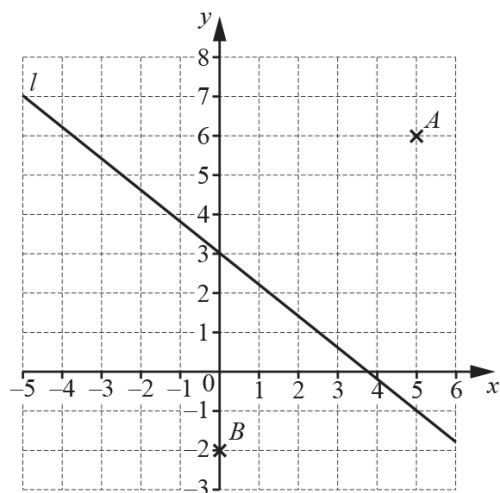
(a) Write down the co-ordinates of *A*.

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

(b) Find the equation of line *l* in the form $y = mx + c$.

y = ... [3]

(c) Write down the equation of the line parallel to line *l* that passes through the point *B*.

.... [2]

(d) *C* is the point (8, 14).

   (i) Write down the equation of the line perpendicular to line *l* that passes through the point *C*.

.... [3]

   (ii) Calculate the length of *AC*.

.... [3]

   (iii) Find the co-ordinates of the mid-point of *BC*.

(...................... , ...) [2]

27. 0580_w18_qp_42   Q: 5

The table shows some values of $y = x^3 - 3x - 1$.

x	−3	−2.5	−2	−1.5	−1	0	1	1.5	2	2.5	3
y	−19	−9.1		0.1	1	−1	−3	−2.1	1	7.1	

(a) Complete the table of values. [2]

(b) Draw the graph of $y = x^3 - 3x - 1$ for $-3 \leqslant x \leqslant 3$.
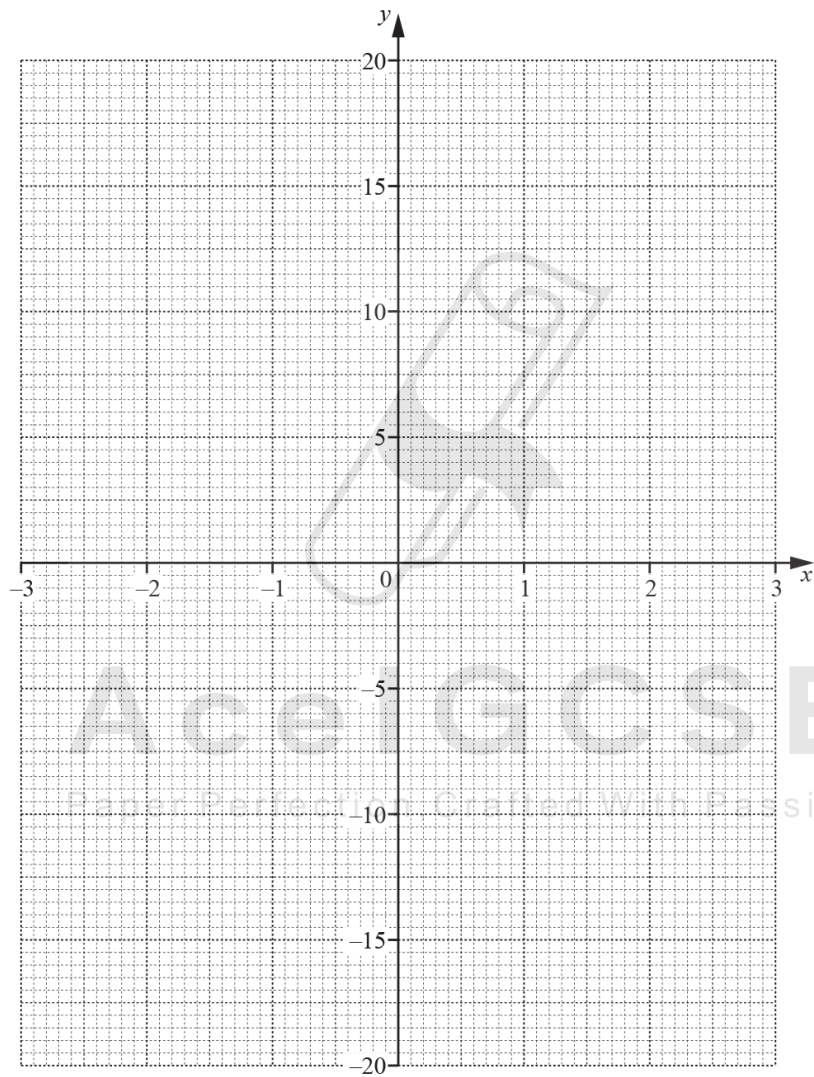
[4]

(c) A straight line through (0, –17) is a tangent to the graph of $y = x^3 - 3x - 1$.

    (i) On the grid, draw this tangent. [1]

    (ii) Find the co-ordinates of the point where the tangent meets your graph.

$$(\text{................} , \text{................}) \ [1]$$

    (iii) Find the equation of the tangent.
            Give your answer in the form $y = mx + c$.

$$y = \text{..} \ [3]$$

(d) By drawing a suitable straight line on the grid, solve the equation $x^3 - 6x - 3 = 0$.

$$x = \text{.................} \ \text{or} \ x = \text{.................} \ \text{or} \ x = \text{.................} \ [4]$$

28. 0580_m17_qp_42   Q: 3

The table shows some values for $y = 1.5^x - 1$.

x	-2	-1	0	1	2	3	4	5
y	-0.56	-0.33				2.38	4.06	6.59

(a) Complete the table.   [3]

(b) Draw the graph of $y = 1.5^x - 1$ for $-2 \leqslant x \leqslant 5$.

[4]
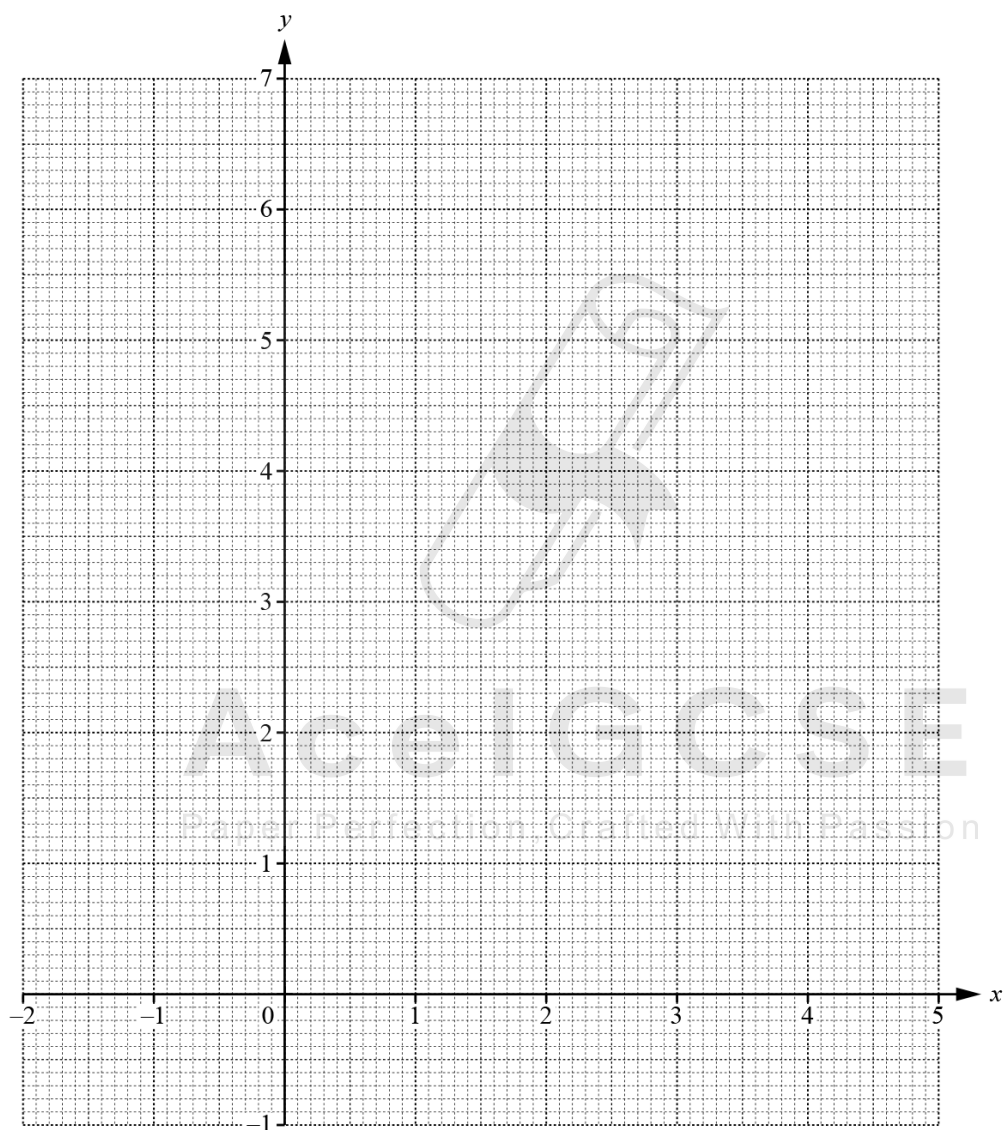
(c) Use your graph to solve the equation $1.5^x - 1 = 3.5$.

$$x = \text{..} \; [2]$$

(d) By drawing a suitable straight line, solve the equation $1.5^x - x - 2 = 0$.

$$x = \text{............................} \text{ or } x = \text{............................} [3]$$

(e) **(i)** On the grid, plot the point A at (5, 5). [1]

(ii) Draw the tangent to the graph of $y = 1.5^x - 1$ that passes through the point A. [1]

(iii) Work out the gradient of this tangent.

$$\text{...} \; [2]$$

29. 0580_s17_qp_41 Q: 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 $y = mx + c$.

$y =$ .... [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]

Line A has equation $y = 5x - 4$.
Line B has equation $3x + 2y = 18$.

(a) Find the gradient of

    (i) line A,

.... [1]

    (ii) line B.

.... [1]

(b) Write down the co-ordinates of the point where line A crosses the x-axis.

(....................... , ...) [2]

(c) Find the equation of the line perpendicular to line A which passes through the point $(10, 9)$.
Give your answer in the form $y = mx + c$.

$y = $ .... [4]

(d) Work out the co-ordinates of the point of intersection of line A and line B.

(....................... , ...) [3]

(e) Work out the area enclosed by line A, line B and the y-axis.

.... [3]

01.0580_s24_ms_42 Q: 10

Question	Answer	Marks	Partial Marks
(a)(i)	$(4.5, -1)$	2	**B1** for each

Question	Answer	Marks	Partial Marks
(a)(ii)	6.71 or 6.708...	3	**M2** for $(6-3)^2 + (2--4)^2$ oe or better or **M1** for $[-](6-3)$ and $[-](2--4)$ oe or for $([-]3)^2$ and $([-]6)^2$ oe
(b)(i)	$-\dfrac{4}{3}$	2	**M1** for $3y = -4x + 12$ or $\dfrac{4}{3}x + y - \dfrac{12}{3}$ $[= 0]$ or better seen
(b)(ii)	$(0, 4)$	2	**B1** for each or for $y = 4$ not in coordinate form
(b)(iii)	$[y =]\dfrac{3}{4}x + \dfrac{1}{2}$ final answer	3	**M1** for gradient $\dfrac{3}{4}$ or $\dfrac{-1}{their\,\textbf{(b)(i)}}$ oe or better **M1** for (6, 5) substituted into $y = \dfrac{3}{4}x + c$ or $y = their\,mx + c$ oe

Question	Answer	Marks	Partial Marks
(a)	$y = 4$ oe	1	
(b)	$[y =] -\dfrac{1}{2}x + 4$ final answer	2	**B1** for grad $= -\dfrac{4}{8}$ oe soi or $[y =] kx + 4$
(c)(i)	Gradient $= \dfrac{-1}{their \text{ gradient in} (b)}$	M1	Accept e.g. $2 \times -\dfrac{1}{2} = -1$ oe or states negative reciprocal of $-\dfrac{1}{2} = 2$
	Substituting (2, 3) in *their* equation.	M1	$3 = 2 \times their\ m + c$
	leading to $y = 2x - 1$	A1	No errors or omissions
(c)(ii)	3.35 or 3.354...	5	**B2** for $\left(\dfrac{1}{2}, 0\right)$ soi or x-coordinate of $D = \dfrac{1}{2}$ or **M1** for $2x - 1 = 0$ **M2** for $(2 - their\ \tfrac{1}{2})^2 + (3 - their\ 0)^2$ oe or **M1** for $(2 - their\ \tfrac{1}{2})$ and $(3 - their\ 0)$ oe
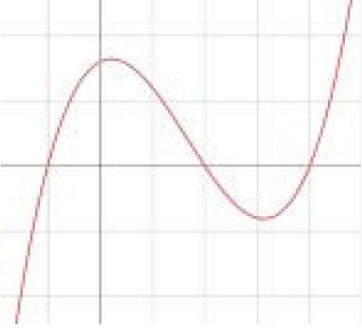
03. 0580_s23_ms_41 Q: 6

Question	Answer	Marks	Partial Marks
(a)	(5, 2) (2, −2)	4	**B3** for 3 correct values or answers for C and D reversed or correct coordinates given on diagram wrongly labelled or **B2** for one correct coordinate pair correctly labelled or **M2** for A,B,C and D correctly plotted or **M1** for A and B correctly plotted If 0 or 1 scored instead award **SC2** for answers (−3, 8) and (−6, 4) or answers (1.5,1.5) and (−2.5, 4.5)
(b)(i)	(2.5, 3.5) oe	2	**B1** for each
(b)(ii)	7.07 or 7.071...	3	**M2** for $(6--1)^2 + (4-3)^2$ oe or **M1** for $(6--1)$ or $(4-3)$ oe
(b)(iii)	$\dfrac{1}{7}$	2	**M1** for $\dfrac{4-3}{6--1}$ oe
(b)(iv)	$y = \dfrac{1}{7}x - \dfrac{2}{7}$ or $7y = x - 2$ oe final answer	3	**M1** for gradient = *their* (iii) **M1dep** for substituting (2, 0) in a linear equation with their m allow if (2,0) satisfies y=(*their***(b)(iii)** gradient)x+c

04. 0580_s23_ms_42 Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)	Correct expansion of a pair of brackets $x^2 - 4x + [1]x - 4$ or $x^2 - 4x - 2x + 8$ or $x^2 + [1]x - 2x - 2$	M1	accept $x^2 - 3x - 4$ or $x^2 - 6x + 8$ or $x^2 - [1]x - 2$
	$x^3 - 4x^2 + x^2 - 4x - 2x^2 + 8x - 2x + 8$ leading to and stating $[y =] x^3 - 5x^2 + 2x + 8$	A1	Accept $x^3 - 3x^2 - 4x - 2x^2 + 6x + 8$ or $x^3 - 6x^2 +[1] x^2 + 8x - 6x + 8$ or $x^3 -[1] x^2 - 2x - 4x^2 + 4x + 8$ leading to and stating $[y =] x^3 - 5x^2 + 2x + 8$

Question	Answer	Marks	Partial Marks
(a)(ii)	Correct labelled sketch positive cubic Crossing x-axis at -1, 2 and 4 only Crossing y – axis at 8 only 	**4**	**B1** for positive cubic **B2** for three intercepts only with x-axis labelled at -1, 2 and 4 or **B1** for 1 or 2 correctly labelled x – intercepts **B1** for a single intercept on y-axis labelled at 8 but not if line $y = 8$
(b)	$3x^2 - 10x - 8 \ [= 0]$	**M3**	**B2** for derivative $= 3x^2 - 10x + 2$ isw OR **B1** for derivative with $3x^2$ or $-10x$ given in expression isw **M1dep on B1** for *their* first derivative $= 10$
	$x = 4$ and $x = -\dfrac{2}{3}$	**B1**	
	$(4, 0)$ and $\left(-\dfrac{2}{3}, \dfrac{112}{27}\right)$ oe	**B1**	
	$[y =]\ 10x - 40$ and $[y =]\ 10x + \dfrac{292}{27}$	**B2**	**B1** for each or for two different equations of the form $[y =]\ 10x + c$ (c must be numeric) or for $c = -40$ and $\dfrac{292}{27}$

05. 0580_s23_ms_43 Q: 11

Question	Answer	Marks	Partial Marks
(a)	10	3	**M2** for $(1--7)^2 + (4--2)^2$ oe or **M1** for $(1--7)$ or $(4--2)$ oe
(b)	$\dfrac{4}{3}$ or $\dfrac{8}{6}$	2	**M1** for $\dfrac{1--7}{4--2}$ oe
(c)	$y = -\dfrac{3}{4}x - \dfrac{9}{4}$ or $4y + 3x + 9 = 0$ oe **final answers**	4	**B3** for $-\dfrac{3}{4}x - \dfrac{9}{4}$ OR **B1** for midpoint $(1, -3)$ **M1** for gradient $-\dfrac{3}{4}$ or $-\dfrac{1}{their \textbf{ (b)}}$ **M1** for substituting *their* $(1, -3)$ into $y = (their\ m)x + c$ or for *their* $m = \dfrac{y--3}{x-1}$ oe

06. 0580_s23_ms_43 Q: 12

Question	Answer	Marks	Partial Marks
(a)	$4x^3 - 16x$ cao	2	**M1** for $4x^3 + kx$ or $kx^3 - 16x$ or $4x^3 - 16x + k$ or $4x^3 - 16$ as final answers

Question	Answer	Marks	Partial Marks
b	*Their* $\dfrac{dy}{dx} = 0$ or stating $\dfrac{dy}{dx} = 0$	**B1**	
	Correct method to solve *their* $4x^3 - 16x = 0$	**M1**	e.g. $4x(x^2 - 4)$ or $4x(x - 2)(x + 2)$ oe
	[$x =$] $0, -2, 2$	**A1**	Or **B1** for $(-2, -11)$ and $(2, -11)$
	$(0, 5)$ $(-2, -11)$ $(2, -11)$	**A1**	
(c)	$(0, 5)$ with correct reasoning	**2**	**M1** for any of • correct use of 2nd derivative $12x^2 - 16$ • evaluates correctly both values of y on either side • evaluates correctly the gradient on either side • reasonable correct sketch

07. 0580_w23_ms_42   Q: 9

Question	Answer	Marks	Partial Marks
(a)	$12x^2 - 4x^3$ oe final answer	**2**	**B1** for $12x^2$ or $-4x^3$ in final answer or for correct answer seen

Question	Answer	Marks	Partial Marks
(b)	$(3, 27)$	**3**	**B2** for $x = 3$ OR **M1** for *their* $12x^2 - 4x^3 = 0$ or better or states $\dfrac{dy}{dx} = 0$ **M1dep** for substituting *their* x into $y = 4x^3 - x^4$ shown
(c)	-64	**3**	**M1** for $4x^3 - x^4 = 0$ **B1** for $x = 4$

08.0580_w23_ms_43 Q:9

Question	Answer	Marks	Partial Marks
(a)	$[AB^2 =] (3-0)^2 + (3-2)^2$ oe or better	**M1**	or $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ oe
	$[AC^2 =] (0-2)^2 + (4-0)^2$ oe or better	**M1**	or $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$ oe
	$[BC^2 =] (0-3)^2 + (4-3)^2$ oe or better	**M1**	or $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$ oe

Question	Answer	Marks	Partial Marks
	Triangle is isosceles [with 10, 20 and 10 or better shown]	**A1**	or Triangle is isosceles and only vector AB and BC have the same magnitude [because they have the same components]
(b)(i)	$[y =] -\dfrac{1}{2}x + 2$ oe	**3**	**M1** for $\dfrac{0-2}{4-0}$ oe **M1** for substituting $(0, 2)$ or $(4, 0)$ into $y = their\ mx + c$ oe or **B1** for answer $y = kx + 2$
(b)(ii)	$[y =] 2x - 3$	**4**	**M1** for $\dfrac{-1}{their\ \text{grad (b)(i)}}$ **B1** for $(2, 1)$ **M1** for substituting *their* $(2, 1)$ into $y = their\ px + d$ oe
(b)(iii)	$(-2, -7)$	**3**	**B2** for $w = -2$ or **M1** for $4w + 1 = 2w - 3$ FT *their* **(b)(ii)** or for $2 = \dfrac{4w+1-3}{w-3}$

09. 0580_w23_ms_43   Q: 11

Question	Answer	Marks	Partial Marks
(a)	(–2, 0) (0, 18) (4.5, 0) oe	4	**B1** for $B = (0, 18)$ **B3** for $A = (–2, 0)$ and $C = (4.5, 0)$ oe or **B2** for $x = –2$ and $x = 4.5$ oe or **B1** for $(9 – 2x)(2 + x)$ oe or either A or C correct
(b)	$5 – 4x$ final answer	2	**B1** for one correct term when simplified
(c)	$(– 3, –15)$	3	**B2FT** for $x = – 3$ OR **M1** for *their* **(b)** = 17 **M1 dep** for correct substitution of *their x* into $18 + 5x – 2x^2$ shown

10. 0580_s22_ms_42   Q: 3

Question	Answer	Marks	Partial Marks
(a)	8.25 or 8.246…	3	**M2** for $(3 – –5)^2 + (2 – 4)^2$ oe or better or **M1** for $(3 – –5)$ and $(2 – 4)$ oe seen
(b)	$[y =] 4x + 7$	5	**B1** for [midpoint] $(– 1, 3)$ soi **M1** for [gradient of $l =$] $\dfrac{4 – 2}{–5 – 3}$ oe **M1** for gradient $–1$ / *their* $\left(–\dfrac{1}{4}\right)$ **M1dep on at least M1** for *their* $(– 1, 3)$ substituted into $y = their\ m \times x + c$ oe

Question	Answer	Marks	Partial Marks
(c)	$(0, -8)$ and $(0, 16)$	4	**B3** for $(0, -8)$ or $(0, 16)$ or for -8 and 16 OR **B2** for distance = $[\pm]12$ soi or **M1** for $13^2 - (5[-0])^2$ oe **B1** for both answers $(0, k)$, $k \neq 0$ or 4 **ALT METHOD** **B3** for $(0, -8)$ or $(0, 16)$ or for -8 and 16 OR **M2** for $y^2 - 8y - 128 \; [= 0]$ or for $(y - 4)^2 = 144$ or better or **M1** for $13^2 = (-5 - 0)^2 + (4 - y)^2$ oe **B1** for both answers $(0, k)$, $k \neq 0$ or 4

11. 0580_s22_ms_43   Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)	$(-0.5, 1)$	2	**B1** for each
(a)(ii)	$\begin{pmatrix} 7 \\ -3 \end{pmatrix}$	2	**B1** for each
(a)(iii)	7.62 or 7.615 to 7.616	2	**FT** *their* **(a)(ii)** **M1** for $(their \; 7)^2 + (their \; -3)^2$ oe
(a)(iv)	$[y =] -4x - 1$ final answer	3	**B2** for answer $-4x + c$ [oe] or for correct equation in different form or for $-4x + -1$ or for $-4m - 1$ OR **M1** for $\dfrac{-5 - 7}{1 - -2}$ oe **M1** for correct substitution shown of $(-2, 7)$ or $(1, -5)$ or *their* $(-0.5, 1)$ into $y = (their \; m)x + c$ oe OR **M1** for $7 = -2m + c$ and $-5 = m + c$ **A1** for $m = -4$ and $c = -1$
(a)(v)	$[y =] \dfrac{1}{4}x + \dfrac{11}{4}$ final answer	3	**M1** for grad = $\dfrac{1}{4}$ oe nfww soi, FT negative reciprocal of *their* gradient from **(iv)** **M1** for correct substitution shown of $(5, 4)$ into $y = (their \; m)x + c$ oe or, if no substitution shown, $(5, 4)$ satisfies *their* final linear equation.

Question	Answer	Marks	Partial Marks
(b)	$2x^2 + 11x - 21 \, [= 0]$	**M2**	or **M1** for $8 - 5x = 2x^2 + 6x - 13$ oe or better
	$(2x - 3)(x + 7) \, [= 0]$ oe or $\dfrac{-11 \pm \sqrt{11^2 - 4 \times 2 \times (-21)}}{2 \times 2}$ or $-\dfrac{11}{4} \pm \sqrt{\dfrac{21}{2} + \left(\dfrac{11}{4}\right)^2}$ oe	**M2**	Allow correct method to solve *their* quadratic equation e.g. formula, complete the square but not for $2x^2 + 6x - 13$ **M1** FT *their* equation for $2x(x + 7) - 3(x + 7) \, [= 0]$ or $x(2x - 3) + 7(2x - 3) \, [= 0]$ or $(2x + a)(x + b) \, [= 0]$ where $ab = -21$ or $2b + a = 11$ **OR** **M1** for $\sqrt{11^2 - 4 \times 2 \times -21}$ or for $\dfrac{-11 + \sqrt{k}}{2 \times 2}$ or $\dfrac{-11 - \sqrt{k}}{2 \times 2}$ **OR** **M1** for $\left(x + \dfrac{11}{4}\right)^2$
	$\left(\dfrac{3}{2}, \dfrac{1}{2}\right)$ and $(-7, 43)$	**B2**	**B1** for one correct pair or for 2 correct *x*-values or 2 correct *y*-values

12. 0580_w22_ms_42 Q: 8
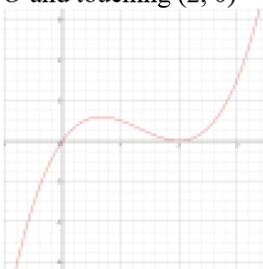
Question	Answer	Marks	Partial Marks
(a)	(22, 11)	2	**B1** for each value
(b)	$\dfrac{their 11 - 3}{their 22 - 2}$ oe or better	M1	
	$-\dfrac{1}{their \, m}$	M1	
	Substitution of (12, 7) into $y = (their \, m)x + c$	M1	Accept $y - 7 = their \, m(x - 12)$ oe
	leading to $2y + 5x = 74$ final answer	A1	Without error or omission
(c)	32	1	
(d)	145	2	**M1** for $\dfrac{1}{2} \times (their \, 32 - 3) \times 10$ oe or $\dfrac{1}{2} \times \sqrt{(7-3)^2 + (12-2)^2} \times \sqrt{(their \, 32 - 7)^2 + (2-12)^2}$ oe

13. 0580_m21_ms_42 Q: 12

	Answer	Mark	Partial Marks
(a)	17	3	**M2** for $3 \times 2x^2 - 7$ or better isw or **M1** for $3 \times 2x^2$ oe or $kx^2 - 7$ seen

	Answer	Mark	Partial Marks
(b)(i)	13.4 or 13.41 to 13.42	3	**M2** for $\sqrt{(-5-7)^2 + (8-2)^2}$ oe or **M1** for $(-5-7)^2 + (8-2)^2$ oe
(b)(ii)	$[y =] 2x + 5$ final answer	4	**M1** for [gradient of $AB =$] $\dfrac{8-2}{-5-7}$ oe **M1dep** for gradient $p = -1 \div their -\dfrac{1}{2}$ oe **M1dep** on previous M1 for substituting $(-1, 3)$ into $y = their\ px + c$ oe where $their\ p \neq 0$
(b)(iii)	(5, 0)	4	**B3** for $\overrightarrow{AD} = \begin{pmatrix} -2 \\ -2 \end{pmatrix}$ or $\overrightarrow{DA} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ or coordinates of C $(-7, 6)$ and $\left[\overrightarrow{CD} =\right] \begin{pmatrix} 12 \\ -6 \end{pmatrix}$ oe seen or **B2** for $a = b = 2$ soi or coordinates of C $(-7, 6)$ or **M1** for $a = b$ oe soi or for $a^2 + b^2 = \left(\sqrt{8}\right)^2$ oe or $\cos 45 = \dfrac{a}{\sqrt{8}}$ oe or for $\left[\overrightarrow{DC} =\right] \begin{pmatrix} -12 \\ 6 \end{pmatrix}$ or $\left[\overrightarrow{CD} =\right] \begin{pmatrix} 12 \\ -6 \end{pmatrix}$ seen or $\dfrac{y-8}{x--5} = 1$ oe or $\dfrac{y-2}{x-7} = 1$

	Answer	Mark	Partial Marks
(a)(i)	2	2	**M1** for $x(x^2 - 4x + 4)$ or $x(x - 2)^2$ or $(x^2 - 2x)(x - 2)$ or $x^3 - 2ax^2 + a^2x$
(a)(ii)	Correct sketch with curve passing through O and touching (2, 0)	4	**B1** for any positive cubic **B1** for sketch through or touching O **B1** for sketch with min or max touching x-axis once only but not at (0, 0) **B1FT** *their* **(a)(i)** for sketch with min or max touching x-axis at (*their* 2, 0) and *their* 2 is labelled or clearly indicated
(b)	$y = 20x - 64$ final answer nfww	7	**B6** for equivalent correct equation OR **B2** for $3x^2 - 8x + 4$ isw or **B1** for $3x^2$ or $-8x$ seen **M2dep** for [grad =] 20 soi nfww or **M1dep** for substituting 4 into *their* derivative isw **B1** for (4, 16) soi **M1dep** for $16 = their\ 20 \times 4 + c$ oe

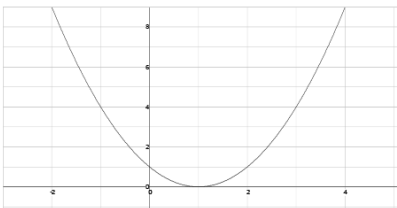|	Answer	Mark	Partial Marks
(a)(i)	3 2.25 1	3	**B1** for each
(a)(ii)	Fully correct smooth curve	4	**B3FT** for 7 or 6 correct plots **B2FT** for 5 or 4 correct plots **B1FT** for 3 correct plots
(a)(iii)	−0.6 to −0.51, 0.75 to 0.85, 1.7 to 1.85	3	**B1** for each If 0 scored, **SC1** for $y = 1.5$ drawn
(a)(iv)	−3 or −2 or −1 or 0	1	
(b)(i)	Tangent ruled at $x = 1$	1	
(b)(ii)	4.4 to 5.6	2	Dep on tangent at $x = 1$ or close attempt **M1** for rise/run for *their* line

	Answer	Mark	Partial Marks
(b)(iii)	$y = (4.4 \text{ to } 5.6)x - (1.8 \text{ to } 2.2)$ or $[y =]$ *their* **(b)(ii)**x + *their*(y-intercept)	2	**FT** for any line but not horizontal or vertical line for 2 marks or **B1** **B1FT** for $[m =]$ *their* 5 or for *their* y-intercept
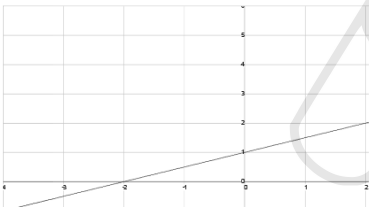
16. 0580_p20_ms_40 Q: 3

	Answer	Mark	Partial Marks
(a)	9 10.5	2	**B1** for each
(b)	Fully correct curve	5	**SC4** for correct curve, but branches joined **B3 FT** for 9 or 10 points plotted or **B2 FT** for 7 or 8 points plotted or **B1 FT** for 5 or 6 points plotted **and B1** for two separate branches not touching or cutting y-axis
(c)	2.1 to 2.6 8.5 to 9	2	**B1** for each
(d)	2, 3, 5, 7	2	**SC1** for correct 4 values and no more than one extra positive integer or $\pm 2, \pm 3, \pm 5, \pm 7$ or 3 correct values and no extras
(e)	$(-2, -12)$	1	
(f)(i)	$20 + x^2 = x^3$	M1	for multiplication by x
	$x^3 - x^2 - 20 = 0$	A1	for no errors or omissions
(f)(ii)	Fully correct curve $y = x^2$	2	**SC1** for U-shaped parabola, vertex at origin
(f)(iii)	3.1 to 3.6	1	
(f)(iv)	3.[0] to 3.1 or **FT** *their* answer to **(f)(iii)**	1	**FT** dep on **(f)(iii)** > 0

	Answer	Mark	Partial Marks
(a)(i)	15.7 or 15.65...	3	**M2** for $\sqrt{(4-10)^2 + (4--3)^2}$ oe or **M1** for $(-4-10)^2 + (4--3)^2$ oe
(a)(ii)	$\dfrac{-10-4}{4--3}[=-2]$ oe	**M1**	
	$10 = -2(-3) + c$ Or $-4 = -2(4) + c$ and correct completion to $y = -2x + 4$	**A1**	
(a)(iii)	$y = \dfrac{1}{2}x + \dfrac{11}{4}$ oe	4	**M1** for grad = ½ soi **M1** for [midpoint =] (½, 3) **M1** for substitution of (1/2, 3) into *their* $y = mx + c$ oe
(b)(i)	$\left(-\dfrac{1}{3}, -\dfrac{22}{27}\right)$ oe and (–5, 50)	6	**B2** for $3x^2 + 16x + 5$ Or **B1** for one correct **M1** for derivative = 0 or *their* derivative = 0 **M1** for $[x =] -\dfrac{1}{3}$ and $[x =] -5$ **B1** for $-\dfrac{22}{27}$ and 50
(b)(ii)	$\left(-\dfrac{1}{3}, -\dfrac{22}{27}\right)$ minimum (–5, 50) maximum with correct reasons	3	**B2** for one correct with reason or **M1** for correct attempt e.g. 2ⁿᵈ derivatives, gradients or sketching

18. 0580_s20_ms_42 Q: 9

	Answer	Mark	Partial Marks
(a)(i)	$(x+4)^2 - 25$	**2**	**B1** for $(x+k)^2 - 9 - (their\ k)^2$ or $(x+4)^2 - h$ or $k = 4$
(a)(ii)	$x + 4 = [\pm] 5$	**M1**	**FT** *their* **(a)(i)**
	−9 and 1	**A1**	
(b)	$[b =]\ 7$ $[c =] -3$	**3**	**B1** for $[b =]\ 7$ **M1** for $b^2 - 4c = 61$
(c)(i)(a)	Correct sketch	**2**	**B2** for correct quadratic curve with min touching x-axis or **B1** for parabola vertex downwards

	Answer	Mark	Partial Marks
(c)(i)(b)	Correct sketch	**2**	**B2** for correct straight line intersecting curve on y-axis or **B1** for straight line with positive gradient and positive y-intercept
(c)(ii)	2.8[0] or 2.795...	**7**	**B3** for $x^2 - \dfrac{5}{2}x = 0$ oe or **M1** for $(x-1)^2 = \dfrac{1}{2}x + 1$ **B1** for $[(x-1)^2 =] x^2 - x - x + 1$ AND **B2** for (0, 1) and $\left(\dfrac{5}{2}, \dfrac{9}{4}\right)$ oe or **B1** $[x =] 0$ and $\dfrac{5}{2}$ oe AND **M1** for (difference in x)^2 + (difference in y)^2

	Answer	Mark	Partial Marks
(a)(i)	$\dfrac{3}{8}$	2	**M1** for $8y = 3x + 20$ or better
(a)(ii)	(0, 2.5) oe	1	
(b)(i)	15.6 or 15.62…	3	**M2** for $\sqrt{(9--3)^2 + (-2-8)^2}$ oe seen or **M1** for $(9--3)^2$ or $(-2-8)^2$ oe seen
(b)(ii)	$y = -\dfrac{5}{6}x + 4$ oe	3	**M1** for gradient $\dfrac{-2-8}{9--3}$ oe **M1** for substituting $(6, -1)$ into a linear equation oe
(b)(iii)	$y = \dfrac{6}{5}x - \dfrac{3}{5}$ oe	4	**M1** for gradient $-1 \,/\, their\left(-\dfrac{5}{6}\right)$ **B1** for midpoint at $(3, 3)$ **M1** for *their* midpoint substituted into $y = their\, m \times x + c$ oe

	Answer	Mark	Partial Marks
(a)(i)	1.5 oe	1	
(a)(ii)	(0, 2)	1	
(b)(i)	$y = -2x + 6$ oe final answer	3	**B2** for $y = -2x + c$ oe or $y = mx + 6$ oe $m \neq 0$ or for answer $-2x + 6$ or **B1** for [gradient =] $-\dfrac{6}{3}$ oe or $c = +6$ soi
(b)(ii)	$y = 0.5x - 1.5$ oe final answer	3	**B1** for [gradient =] -1 divided by *their* gradient from **(b)(i)** evaluated soi **M1** for substitution of $(9, 3)$ into $y = (their\,m)x + c$ seen in working
(c)(i)	12.6 or 12.64 to 12.65	3	**M2** for $\sqrt{(8--4)^2 + (5-1)^2}$ oe or **M1** for $(8--4)^2 + (5-1)^2$ oe
(c)(ii)	(2, 3)	2	**B1** for each

21. 0580_s19_ms_43 Q: 7

	Answer	Mark	Partial Marks
(a)	$[y =]\ 4x + 5$	3	**B2** for answer $[y =]\ 4x + c$ oe (c can be numeric or algebraic) **OR** **M2** for $\dfrac{y-9}{x-1} = \dfrac{9-(-3)}{1-(-2)}$ oe **OR** **M1** for $\dfrac{9--3}{1--2}$ oe or for **M1** for correct substitution of $(-2, -3)$ or $(1, 9)$ into $y = (their\ m)x + c$ oe
(b)	76[.0] or 75.96...	2	**M1** for $\tan[\ ] = 4$ oe

	Answer	Mark	Partial Marks
(c)(i)	$[y =]\ -\dfrac{1}{4}x + \dfrac{23}{8}$ oe	3	**B2FT** for $[y =]\ -\dfrac{1}{their\ \text{gradient from }(a)}x + c$ oe (c can be numeric or algebraic) **OR** **M2** for $\dfrac{y-2}{x-3.5} = -\dfrac{1}{their\ \text{gradient from }(a)}$ oe **OR** **M1** for $-\dfrac{1}{their\ \text{gradient from }(a)}$ soi **M1** for correct substitution of $(3.5, 2)$ into $y = (their\ m)x + c$ oe
(c)(ii)	$(-4.5, 4)$	2	**B1** for each value or for $\begin{pmatrix} -8 \\ 2 \end{pmatrix}$ seen

22. 0580_m18_ms_42 Q: 10

	Answer	Mark	Partial Marks
(a)	10.8 or 10.81 to 10.82	3	**M2** for $\sqrt{(6--3)^2 + (-2-4)^2}$ oe or **M1** for $(6--3)^2 + (-2-4)^2$ oe
(b)(i)	$(6, 4)$	2	**B1** for each
(b)(ii)	2	2	**M1** for $\dfrac{12-(-4)}{10-2}$ oe
(b)(iii)	$y = -\dfrac{1}{2}x + 4$ oe final answer	3	**M1** for gradient $= -\dfrac{1}{2}$ or $-\dfrac{1}{their\ (b)(ii)}$ **M1** for $(2, 3)$ substituted into $their\ y = mx + c$ or $y - y_1 = m(x - x_1)$ oe

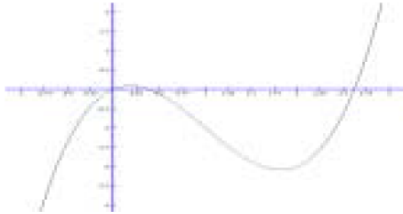|		Answer	Mark	Partial Marks
(a)(i)		1, ….., ….., ….., 16	**2**	**B1** for each
(a)(ii)		14, ….., ….., ….., − 2	**2**	**B1** for each
(b)		Fully correct smooth curves	**6**	**B3** for correct curve of $y = 2^x$ or **B2FT** for 4 or 5 correct points or **B1FT** for 2 or 3 correct points **B3** for correct curve of $y = 14 - x^2$ or **B2FT** for 4 or 5 correct points or **B1FT** for 2 or 3 correct points
(c)(i)		3.5 to 3.7	**1**	
(c)(ii)		2.65 to 2.8	**1**	

		Answer	Mark	Partial Marks
(d)(i)		Correct line	**1**	Ruled, through (4, 2) and gradient −4
(d)(ii)		Tangent (2, 10)	**2**	**B1** for each

		Answer	Mark	Partial Marks
(a)		$y = -2x + 5$ oe	**3**	**B2** for $-2x + 5$ or **M1** for gradient $= -1 \div \frac{1}{2}$ or better **M1** for substituting (1, 3) into $y = (\textit{their } m)x + c$ oe If 0 scored **SC1** for (1, 3) satisfying their wrong equation $(c \neq 0)$ with gradient $\neq \frac{1}{2}$
(b)(i)		$x \geqslant 2$ oe $y \leqslant 5$ oe $y \geqslant \frac{1}{2}x$ oe	**4**	**SC3** for $x > 2$ and $y < 5$ and $y > \frac{1}{2}x$ OR **B1** for $x \geqslant 2$ **B1** for $y \leqslant 5$ **B2** for $y \geqslant \frac{1}{2}x$ or **M1** for $y \geqslant kx$ $(k > 0)$ OR **SC2** for all three boundary lines identified but with incorrect sign(s) If 0 scored **SC1** for one or two correct boundary lines with incorrect sign(s)

	Answer	Mark	Partial Marks
(b)(ii)	(5, 4)	2	**M1** for one trial of an integer point inside region or for $3x + 5y = 35$ drawn

25. 0580_w18_ms_41   Q: 3

	Answer	Mark	Partial Marks
(a)	0 –2 0.9	3	**B1** for each
(b)	Correct curve	4	**B3 FT** for 9 or 10 points or **B2 FT** for 7 or 8 points or **B1 FT** for 5 or 6 points
(c)	–0.45 to –0.35 1 2.35 to 2.45	3	**FT** *their* graph **B1** for each in the correct position If zero scored, **SC1FT** for 3 correct values
(d)(i)	$y = 1 - x$ oe	2	**B1** for $y = 1 - kx$ oe, $k \neq 0$ or $y = k - x$ oe or $1 - x$
(d)(ii)	Correct ruled line and 2.25 to 2.4	3	**B2FTdep** for correct ruled line or **B1 dep** for line through (0, 1) when extended but not $y = 1$ or with gradient –1.1 to –0.9 or correct line but freehand or **SC2** for $y = x - 1$ ruled after answer $[y =] x - 1$ in **(d)(i)** **and** **B1** for 2.25 to 2.4
(e)	Correct tangent and 1.7 to 3.7	3	No daylight between tangent and curve at $x = -0.25$. Point of contact is the midpoint between two vertices of daylight and this point of contact must be between –0.35 and –0.15 **B2** for close attempt at tangent at $x = -0.25$ and answer in range OR **B1** for ruled tangent at $x = -0.25$, no daylight Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = -0.35$ and -0.15 and **M1** dep on **B1** or close attempt at tangent at $x = -0.25$ for $\dfrac{rise}{run}$

	Answer	Mark	Partial Marks
(a)	(5, 6)	1	
(b)	$[y =] -\dfrac{4}{5}x + 3$ nfww	3	**B2** for $[y =] -\dfrac{4}{5}x + c$ nfww or **M1** for $\dfrac{rise}{run}$ using any two of (–5, 7) (0, 3) and (5, –1) **and B1** for $[y =] mx + 3$ $(m \neq 0)$

	Answer	Mark	Partial Marks
(c)	$y = -\dfrac{4}{5}x - 2$ oe	2	FT *their* gradient from **8(b)** **B1** for $y = (their$ gradient$)x + c$ (c not 0) or for $y = mx - 2$ $(m \neq 0)$ or for $-\dfrac{4}{5}x - 2$ alone
(d)(i)	$y = \dfrac{5}{4}x + 4$ oe	3	**M1** for $-\dfrac{1}{their\ \text{gradient}}$ from **8(b)** **M1** for (8, 14) substituted into *their* $y = mx + c$ or $\dfrac{y - 14}{x - 8} = m$ or better
(d)(ii)	8.54 or 8.544...	3	**M2** for $(14 - their\,6)^2 + (8 - their\,5)^2$ or better or **M1** for $14 - their\,6$ and $8 - their\,5$ seen
(d)(iii)	(4, 6)	2	**B1** for each

27. 0580_w18_ms_42 Q: 5

	Answer	Mark	Partial Marks
(a)	–3, 17	**2**	**B1** for each
(b)	Fully correct curve	**4**	**B3 FT** for 10 or 11 points or **B2 FT** for 8 or 9 points or **B1 FT** for 6 or 7 points
(c)(i)	Correct ruled tangent for *their* curve through $(0, -17)$	**1**	
(c)(ii)	(1.7 to 2.2, –1 to 2.5)	**1**	
(c)(iii)	[$y =$] $9x - 17$ final answer	**3**	**M2dep** for answer [$y =$] $9x[+] - c$ OR **M1dep** for gradient = $\dfrac{rise}{run}$ for *their* tangent at any point **B1** for answer [$y =$] $kx[+] - 17$ ($k \neq 0$)
(d)	$y = 3x + 2$ ruled correctly and $-2.2 \dots$ to -2.1 -0.6 to -0.4 2.6 to 2.8	**4**	**B2** for $y = 3x + 2$ ruled or **B1** for [$y =$] $3x + 2$ soi or $y = 3x + k$ ruled or $y = kx + 2$ but not $y = 2$ **B2** for all 3 values or **B1** for 2 values

	ANSWER	MARK	PARTIAL MARKS
(a)	0 0.5 oe 1.25 oe	**1, 1, 1**	
(b)	Fully correct smooth curve	**4**	**B3 FT** for 7 or 8 points or **B2 FT** for 5 or 6 points or **B1 FT** for 3 or 4 points
(c)	3.6 to 3.8	**2**	**M1** for $y = 3.5$ soi
(d)	line $y = x + 1$ ruled	**M1**	
	-1.55 to -1.40 4.55 to 4.8	**A1 A1**	If 0 scored **SC1** for $y = x + 1$ stated or implied or for 2 correct values given
(e) (i)	Point plotted at (5, 5)	**1**	
(ii)	Tangent ruled from A	**1**	
(iii)	1.2 to 1.4	**B2**	B2 and M1 dep on reasonable attempt at tangent from (5, 5) **M1** for change in y/ change in x of *their* ruled line

	ANSWER	MARK	PARTIAL MARKS
(a)	(−0.5, 3)	2	**B1** for one correct value
(b)	$[y =] -2x + 2$ final answer	3	**M1** for $\dfrac{-2-8}{2--3}$ or better **M1** for substitution of (−3, 8) or (2, −2) or *their* midpoint into $y = mx + c$ with *their* m
(c)	$y = -2x + 7$ oe	**2FT**	**FT** *their* **(b)** **M1** for $y = (their{-}2)x + k$ ($k \neq 2$) or $y = kx + 7$ ($k \neq 0$) If zero scored, **SC1** for $(their - 2)x + 7$
(d)	$x - 2y + 9 = 0$ or $2y - x - 9 = 0$ oe	4	**B3** for any correct equivalent in wrong form Or **M2** for $y = \frac{1}{2}x + k$ oe (**FT** negative reciprocal of *their* gradient in **(b)**) or **M1** for grad $= \frac{1}{2}$ (**FT** negative reciprocal of *their* gradient in **(b)**) **M1** for substitution of (1, 5) into $y = mx + c$ oe with *their* m

30. 0580_w17_ms_43 Q: 8

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	5	**1**	
(a)(ii)	$-\dfrac{3}{2}$ oe	**1**	
(b)	$\left(\dfrac{4}{5},\ 0\right)$ oe	**2**	**M1** for $5x - 4 = 0$ soi

	ANSWER	MARK	PARTIAL MARKS
(c)	$y = -0.2x + 11$ final answer	**4**	**M2** for $y = -0.2x + c$ oe (any form) **FT** *their* **(a)** or **B1FT** for grad $= \dfrac{-1}{their\ \textbf{(a)(i)}}$ soi and **M1** for substitution of (10, 9) into *their* equation
(d)	(2, 6)	**3**	**M1** for elimination of one variable **A1** for $x = 2$ or $y = 6$
(e)	13	**3**	**M2** for $(4 + 9) \times their\ 2 \div 2$ oe or **B1** for 9 oe or 4 or –4 seen