Name	Date started	Target end date

REVISE
.wales

3.08 — Graphical solutions to quadratics

Spec 2.4.10 — Unit 3 (calculator allowed)

Using a graphical method to solve equations of the form $ax^2 + bx + c = dx + e$ (and $ax^3 + bx^2 + cx + d = ex + f$) — drawing the straight line $y = dx + e$ on the quadratic curve, identifying intersections, and matching sketched curves to their equations. Sourced from legacy WJEC GCSE Mathematics Higher calculator-allowed papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~27 minutes

*Derived from the GCSE Higher pace of **~1.5 min/mark** (18 marks across 9 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.
A calculator is allowed on every question in this pack (Unit 3 is the calculator-allowed paper).

Graphical solutions to quadratics — what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 3: calculator-allowed.

Graphical solutions to $f(x) = g(x)$ 2.4.10

- Draw the line $y = g(x)$ on the same axes as the curve.
- Intersection x-values solve $f(x) = g(x)$.
- Works for cubic curves too: solve $ax^3 + bx^2 + cx + d = ex + f$ graphically.

Quadratic = linear 2.4.10

- $ax^2 + bx + c = dx + e$ becomes $ax^2 + (b - d)x + (c - e) = 0$ algebraically.
- Graphically: read the x-coordinate where the curve meets the line.
- Always state the values to the accuracy the grid allows.

Reading intersections 2.4.10

- Two intersections give two solutions; one intersection → repeated root; none → no real solutions.
- Use a ruler to draw the line accurately.
- Read each crossing to 1 d.p. unless the question asks otherwise.

Matching equation to a sketch 2.4.10

- Identify the shape (∪ or ∩) from the sign of the leading coefficient.
- Use y-intercept ($x = 0$) and roots ($y = 0$) to distinguish equations.
- Eliminate options that contradict the sketch.

Graphical solutions to quadratics in one page

Quick-reference notes — revisit before each question. Don't use during the questions.

Shape of a parabola

$y = ax^2 + bx + c$ is a ∪-shape (opens up) if $a > 0$.

It is a ∩-shape (opens down) if $a < 0$.

The graph has a single turning point — minimum (if ∪) or maximum (if ∩).

Completing the table

Substitute each x into the formula, one at a time.

Watch signs: $x = -2$ in $y = 2x^2 - 5x - 1$ gives $2(4) - 5(-2) - 1 = 8 + 10 - 1 = 17$.

Mistakes here propagate — always recheck a couple of values.

Drawing the curve

Plot every point from your table carefully.

Join with a *smooth curve* — never ruled segments.

The curve should pass through every plotted point exactly.

Finding roots graphically

The roots of $f(x) = 0$ are the x-coordinates where the curve crosses the x-axis.

Read them off to 1 d.p. if the question asks for two-decimal precision (the grid usually shows tenths).

Solving $f(x) = k$

To solve $f(x) = k$ graphically: draw the line $y = k$ on top of the curve.

The x-coordinates of the intersections are the solutions.

To solve $f(x) = mx + c$: draw that line and read where it cuts the curve.

Equation matching

Given a sketch with no scale, match it to one of several equations by looking at: shape (∪ vs ∩), y-intercept (where it crosses y-axis), and roots (where it crosses x-axis).

Worked example

$y = x^2 - 4x - 3$, find where curve meets $y = 1$.

This is the same as solving $x^2 - 4x - 3 = 1$, i.e. $x^2 - 4x - 4 = 0$.

Graphically: draw $y = 1$, read off the two crossing x-values.

Common traps

- Joining points with a ruler instead of a smooth curve.
- Sign slip in the table for negative x values.
- Forgetting that 'circle the equation whose solutions are your x-values' tests both root-reading *and* equation manipulation.
- Reading off intersections only to the nearest whole number when 1 d.p. is asked.

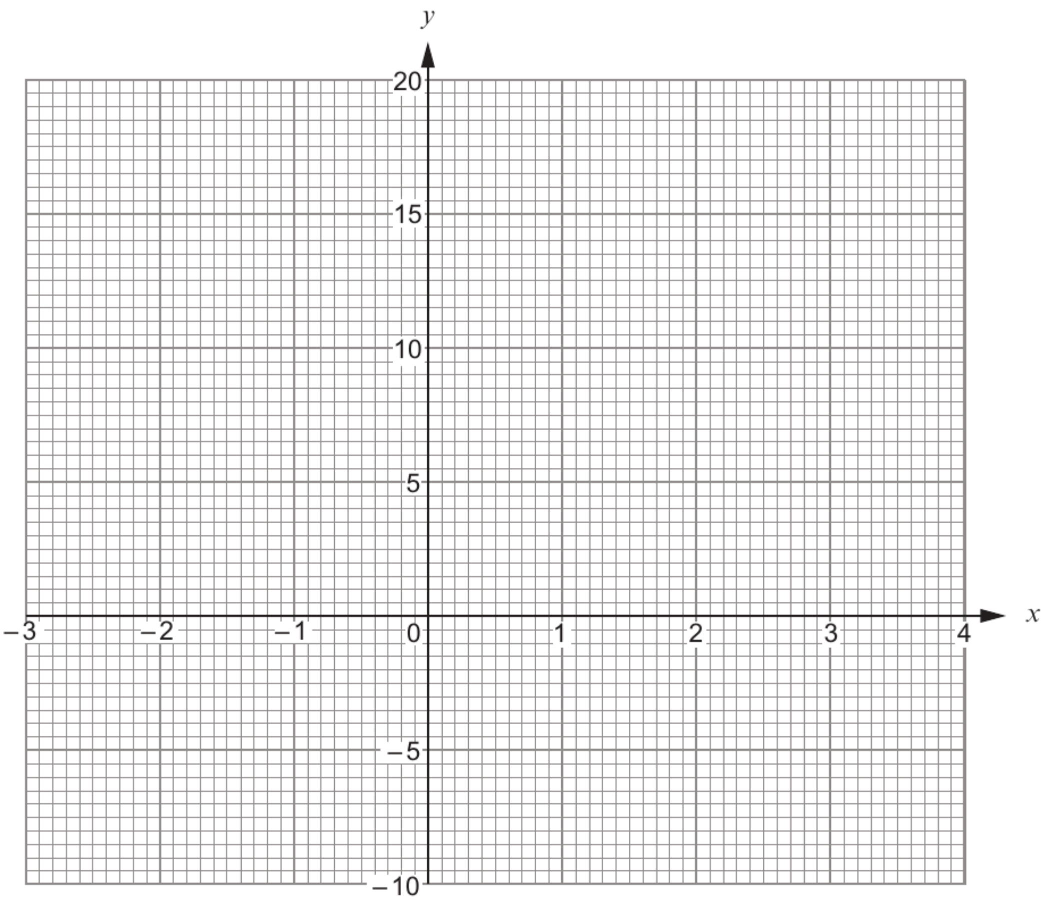
Examiner only

2. *(a)* The table below shows some of the values of $y = 2x^2 - 5x - 1$ for values of x from –2 to 4.

Complete the table by finding the value of y for x = −1 and for x = 2. [2]

x	−2	−1	0	1	2	3	4
$y = 2x^2 - 5x - 1$	17		−1	−4		2	11

(b) On the graph paper below, draw the graph of $y = 2x^2 - 5x - 1$ for values of x from –2 to 4. [2]



Examiner only

(c) Draw the line $y = 5$ on the graph paper.

Write down the values of x where the line $y = 5$ cuts the curve $y = 2x^2 - 5x - 1$.
Give your answers correct to 1 decimal place. [2]

Values of x are .... and ....

(d) Circle the equation below whose solutions are the values you have given in *(c)*. [1]

$2x^2 - 5x - 1 = 0$ $2x^2 - 5x - 6 = 0$ $2x^2 - 5x - 5 = 0$

$2x^2 - x - 1 = 0$ $2x^2 - 5x + 4 = 0$

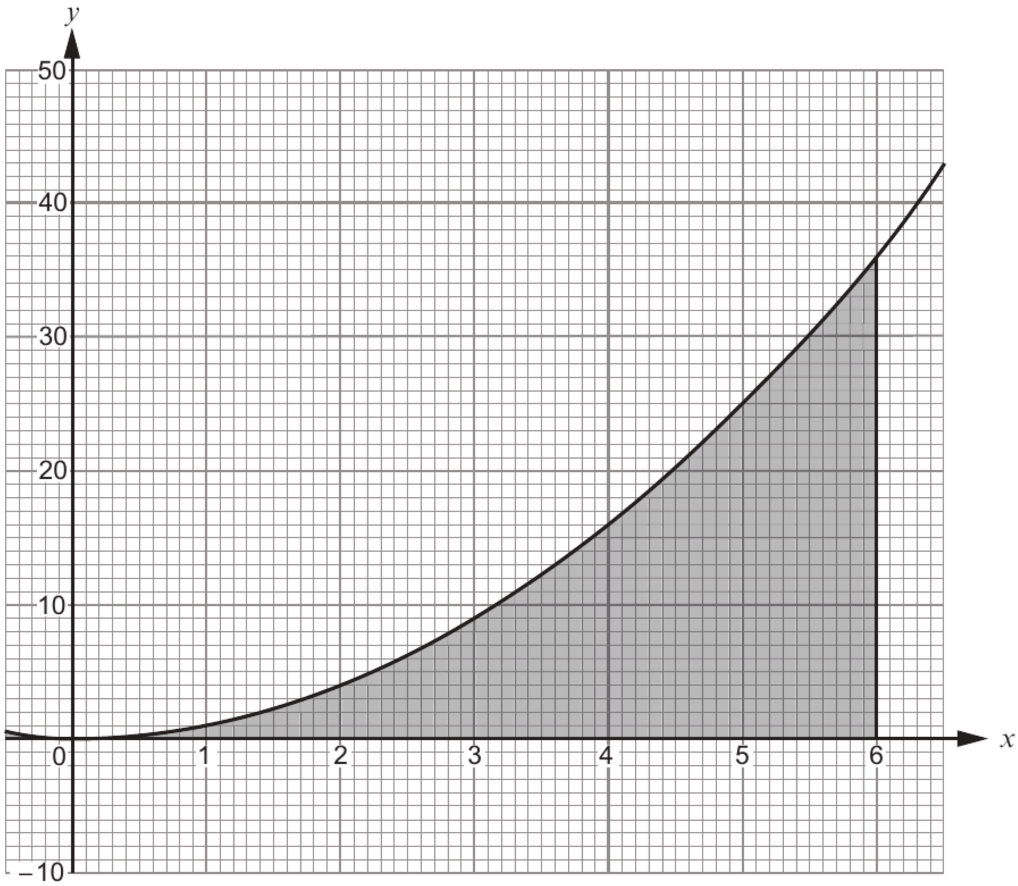
....

....

....

Examiner only

18. The graph of $y = x^2$ has been drawn below, for values of x from $x = 0$ to $x = 6$.

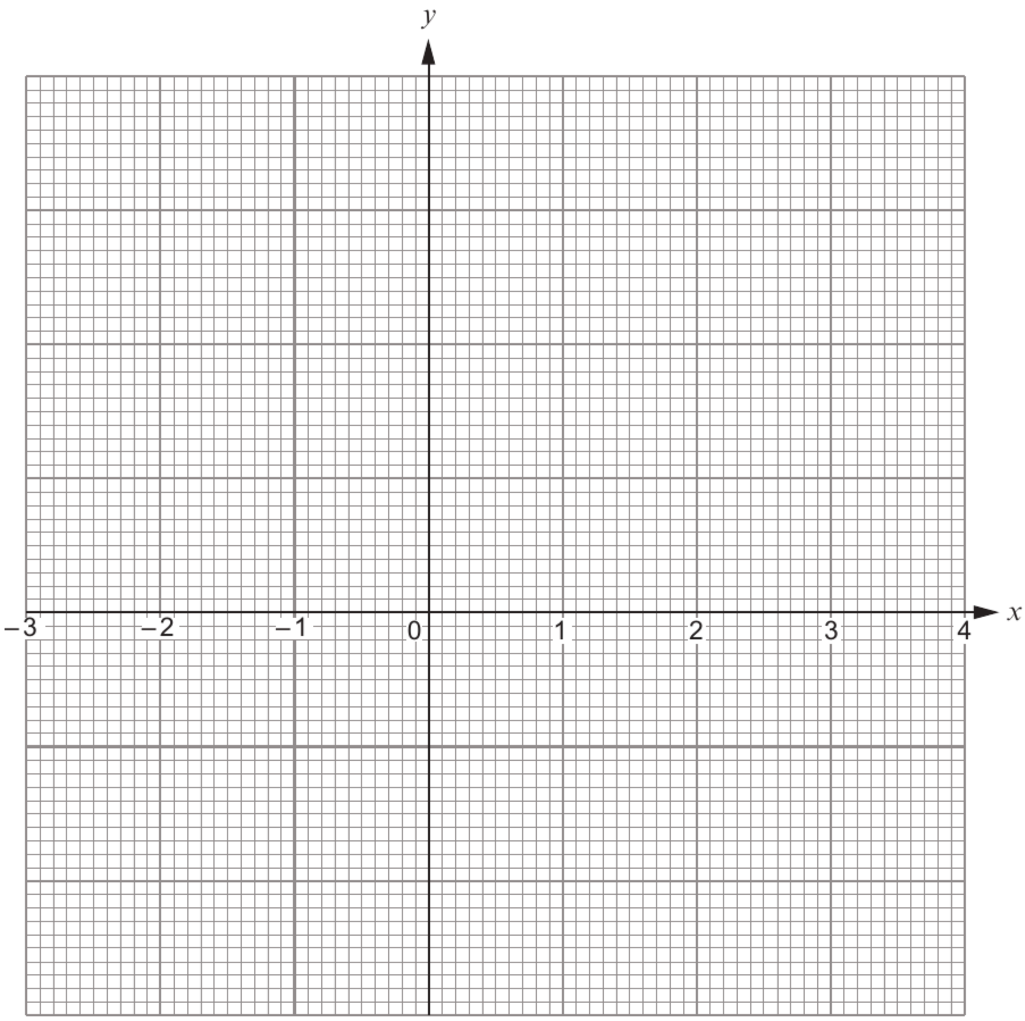


Use the trapezium rule, with the ordinates $x = 0$, $x = 1$, $x = 2$, $x = 3$, $x = 4$, $x = 5$ and $x = 6$, to estimate the area of the shaded region shown above. [4]

Examiner only

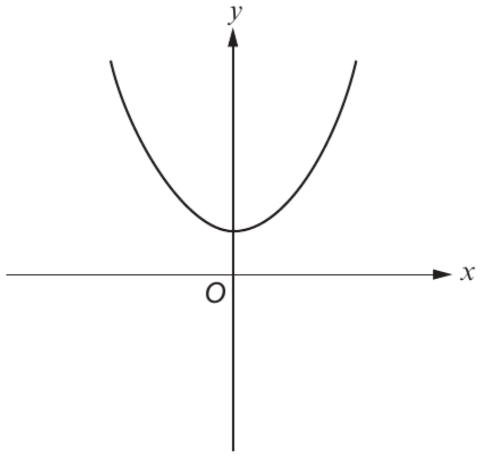
2. *(a)* Complete the table below.
Draw the graph of $y = 2x^2 - 5$ for values of x between –2 and 3.
Use the graph paper below.
Choose a suitable scale for the y-axis. [4]

x	–2	–1	0	1	2	3
$y = 2x^2 - 5$	3		–5	–3	3	13



Examiner only

(b)



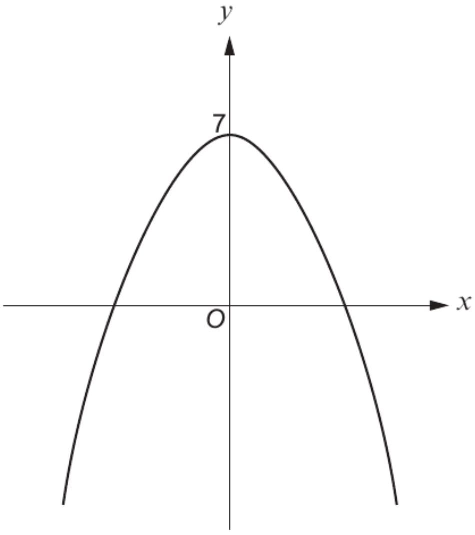
The sketch above can represent only one of the equations given below.
Circle this equation. [1]

$y = x^2$ $\quad$ $y = x^2 - 3$ $\quad$ $y = -x^2$ $\quad$ $y = x^2 + 3$ $\quad$ $y = 3x$

Examiner only

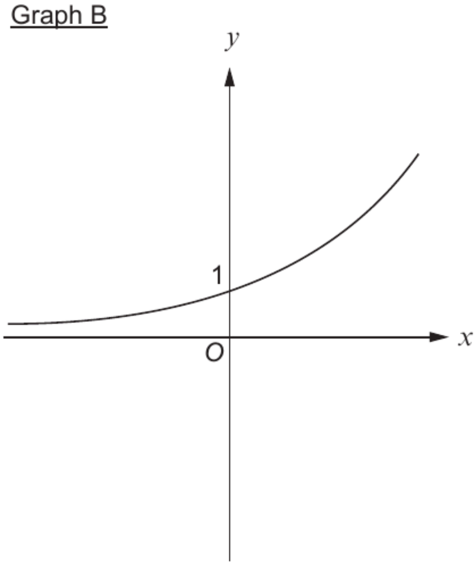
16. Each of the two graphs below is described by **one** of the equations on the right.
Put a **tick** in the box next to the equation which correctly describes each graph. [2]

Graph A



	Equation describing graph A
$y = 7x^2$	
$y = -(x + 7)^2$	
$y = (x - 7)^2$	
$y = 7 - x^2$	
$y = x^2 + 7$	

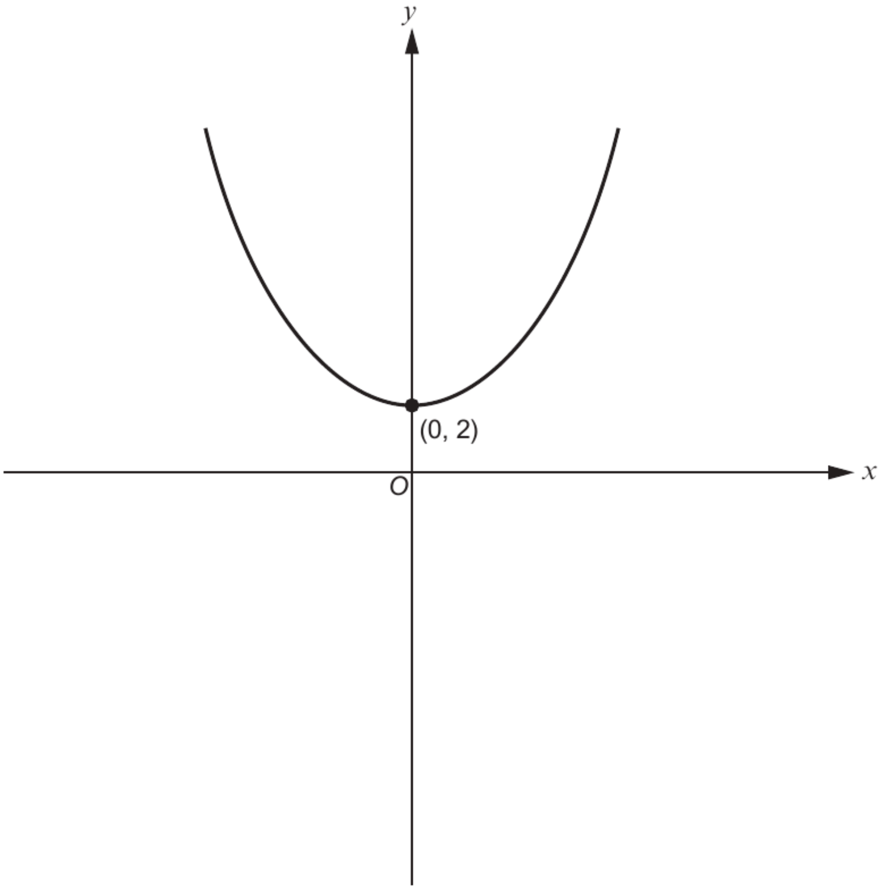
Graph B



	Equation describing graph B
$y = x^2 + 1$	
$y = 2^x$	
$y + 1 = x^2$	
$y = \frac{1}{x}$	
$y = x^0$	

Examiner only

18. The graph shows a sketch of the curve with equation $y = x^2 + 2$.
The lowest point of the curve has coordinates (0, 2).



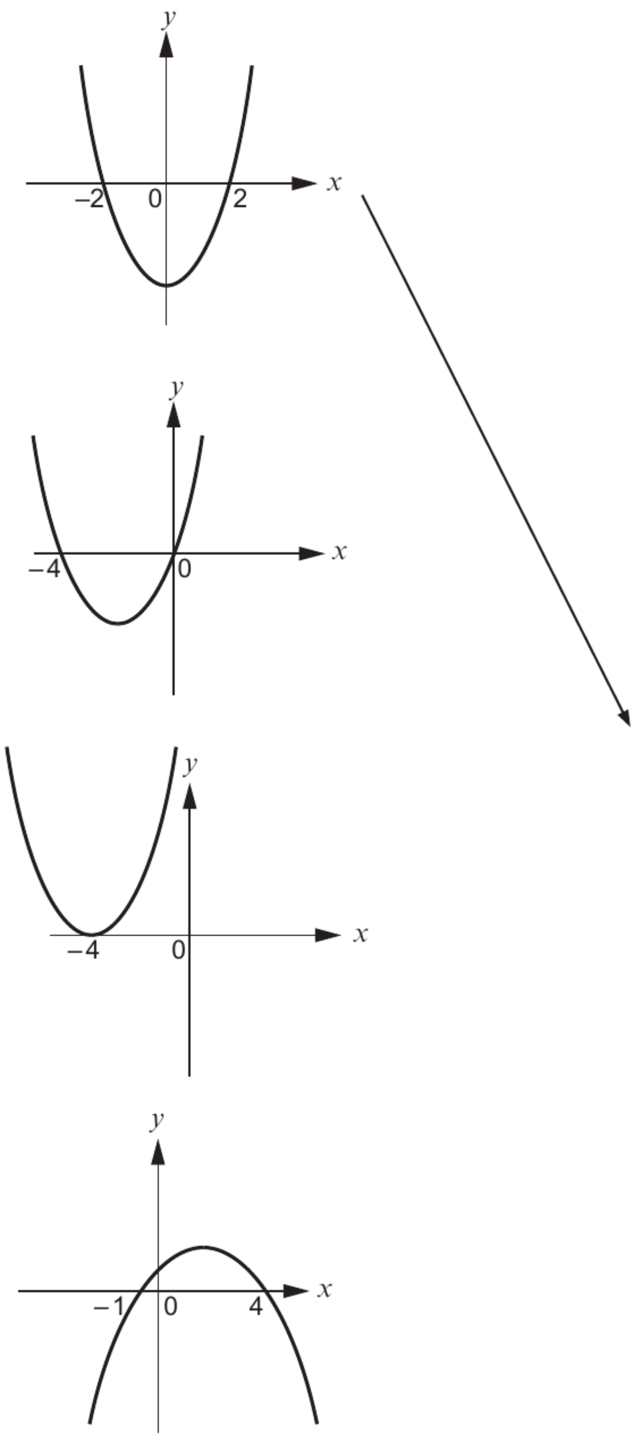
On the same axes, sketch the graph of the curve with equation $y = (x - 4)^2 + 2$.
Indicate clearly the coordinates of the lowest point on the new curve. [2]

END OF PAPER

Examiner only

15. Four quadratic graphs are sketched below.
Draw a line connecting each graph to its equation.
One has been completed for you. [2]

<u>Graph</u> <u>Equation</u>



$y = (x + 1)(x - 4)$

$y = (x - 4)^2$

$y = x(x + 4)$

$y = (x - 1)(x + 4)$

$y = (x - 2)(x + 2)$

$y = x(x - 4)$

$y = (x + 1)(4 - x)$

$y = (1 - x)(x + 4)$

$y = (x + 4)^2$

Examiner only

3. The table below shows some of the values of $y = x^2 - 2x - 4$ for values of x from –3 to 4.

x	−3	−2	−1	0	1	2	3	4
$y = x^2 - 2x - 4$	11	4	−1	−4		−4	−1	4

(a) Complete the table by finding the value of y when $x = 1$. [1]

....

....

(b) On the graph paper opposite, draw the graph of $y = x^2 - 2x - 4$ for values of x from –3 to 4. [2]

(c) (i) Draw the line $y + x = 4$ on the graph paper. [2]

....

....

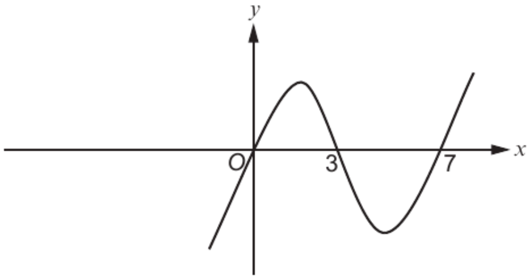
....

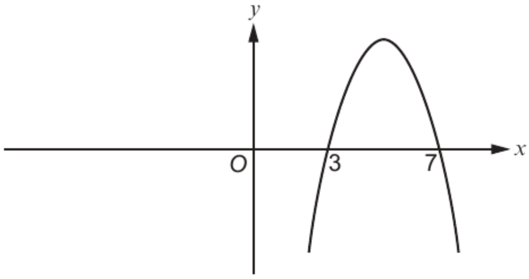
(ii) Write down the values of x where the line $y + x = 4$ cuts the curve $y = x^2 - 2x - 4$. [1]

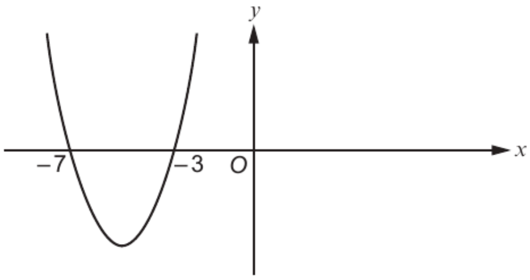
Values of x are .... and ....

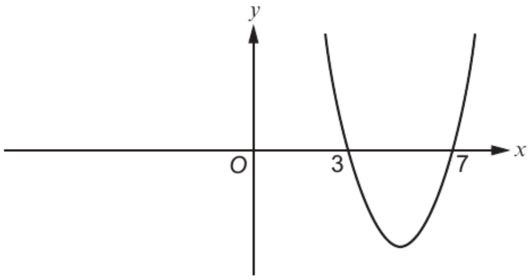
Examiner only

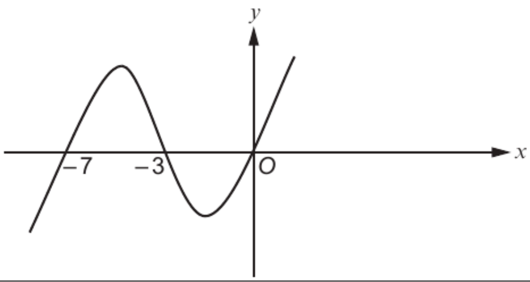
17. The equation $y = (x-3)(x-7)$ describes only **one** of the graphs below.
Put a tick (✓) in the box next to the graph that correctly shows this equation. [1]











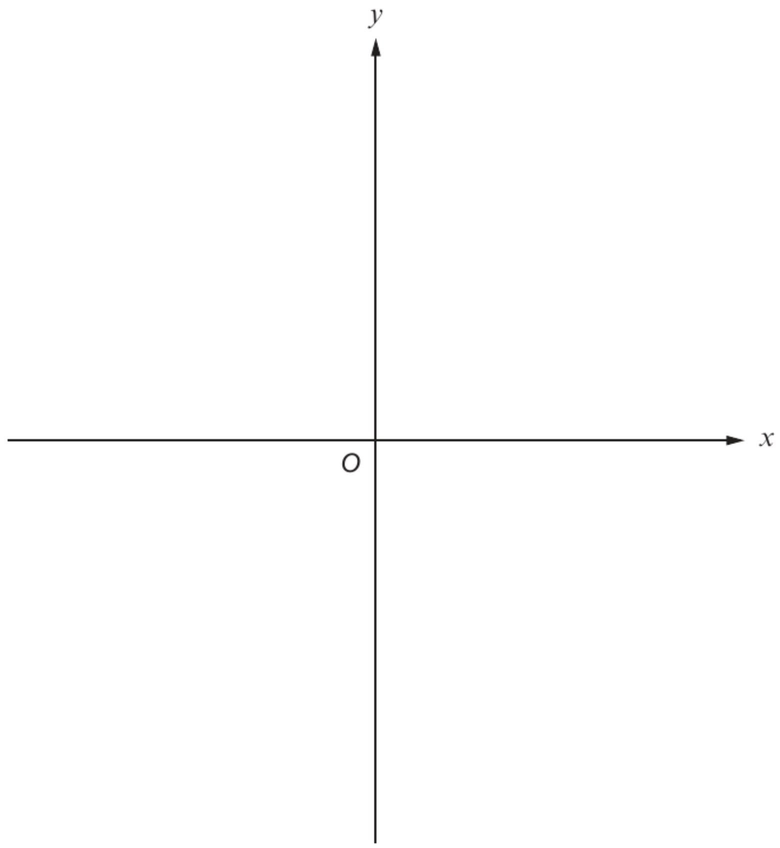
Examiner only

12. (a) Factorise $8x^2 - 18$. [3]

(b) Hence solve $8x^2 - 18 = 0$. [1]

Examiner only

(c) Hence, sketch the graph of $y = 8x^2 - 18$ on the axes below.
Mark clearly the coordinates of any point where this graph crosses an axis. [2]



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