



ACHIEVE ACADEMY

GCSE Maths — Higher Tier

Quadratic, Cubic & Reciprocal Graphs · Practice Booklet

NAME: _____

CLASS: _____

DATE: _____

☐ Developing

☒ Secure

☐ Greater Depth

Answer every question in the working space provided. Method marks are available for correct working even if the final answer is wrong. Check the time allowed with your tutor before you start.

Quadratic, Cubic & Reciprocal Graphs

Total marks available: 99

● Quadratic, Cubic & Reciprocal Graphs

✓ (a) -2, -4, 2; (b) curve drawn (see below)

Q1 · ● Developing · 4 marks

METHOD

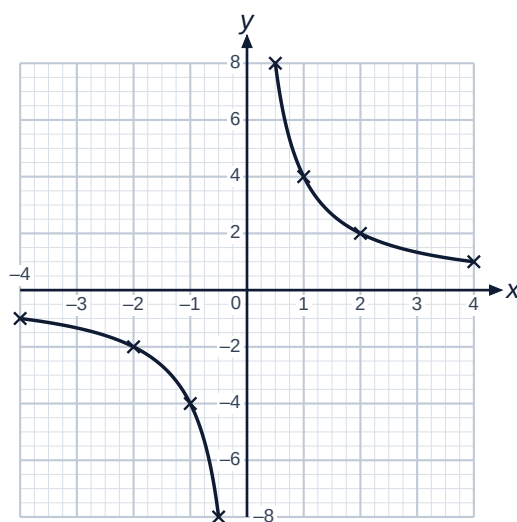
Substitute each x-value: $x = -2: y = -2$; $x = -1: y = -4$; $x = 2: y = 2$

B2 all missing values correct (B1 for at least one)

Plot all 8 points ($\pm \frac{1}{2}$ small square) and join them with a smooth curve – not ruled line segments.

B1 points plotted · B1 smooth curve

x	-4	-2	-1	-0.5	0.5	1	2	4
y	-1	-2	-4	-8	8	4	2	1



✓ (a) $-2, 8, 1$; (b) curve drawn (see below)

Q2 · ● Developing · 4 marks

METHOD

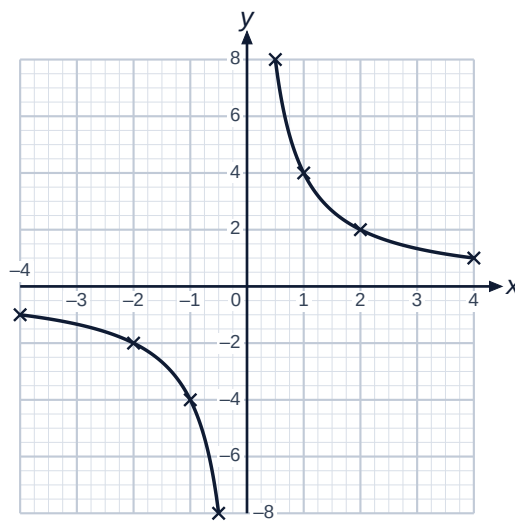
Substitute each x-value: $x = -2$: $y = -2$; $x = 0.5$: $y = 8$; $x = 4$: $y = 1$

B2 all missing values correct (B1 for at least one)

Plot all 8 points ($\pm \frac{1}{2}$ small square) and join them with a smooth curve – not ruled line segments.

B1 points plotted · B1 smooth curve

x	-4	-2	-1	-0.5	0.5	1	2	4
y	-1	-2	-4	-8	8	4	2	1



✓ (a) 2, -2, 2; (b) curve drawn (see below)

Q3 · ● Developing · 4 marks

METHOD

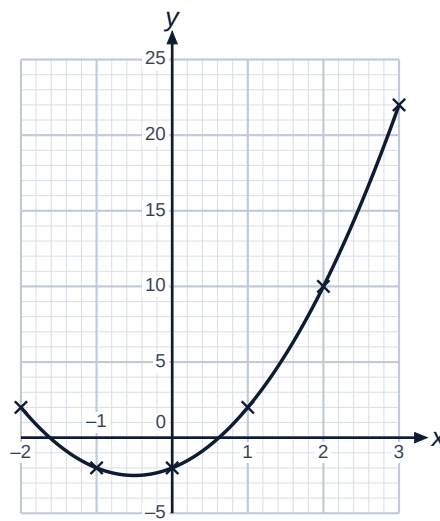
Substitute each x-value: $x = -2$: $y = 2$; $x = 0$: $y = -2$; $x = 1$: $y = 2$

B2 all missing values correct (B1 for at least one)

Plot all 6 points ($\pm \frac{1}{2}$ small square) and join them with a smooth curve – not ruled line segments.

B1 points plotted · B1 smooth curve

x	-2	-1	0	1	2	3
y	2	-2	-2	2	10	22



✓ (a) -5, -2, -10; (b) curve drawn (see below)

Q4 · ● Developing · 4 marks

METHOD

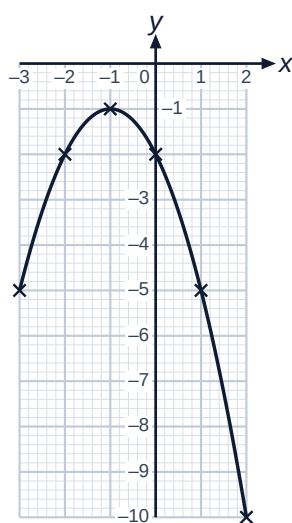
Substitute each x-value: $x = -3: y = -5$; $x = -2: y = -2$; $x = 2: y = -10$

B2 all missing values correct (B1 for at least one)

Plot all 6 points ($\pm \frac{1}{2}$ small square) and join them with a smooth curve – not ruled line segments.

B1 points plotted · B1 smooth curve

x	-3	-2	-1	0	1	2
y	-5	-2	-1	-2	-5	-10



✓ (a) 4, 2, 10; (b) curve drawn (see below)

Q5 · ● Developing · 4 marks

METHOD

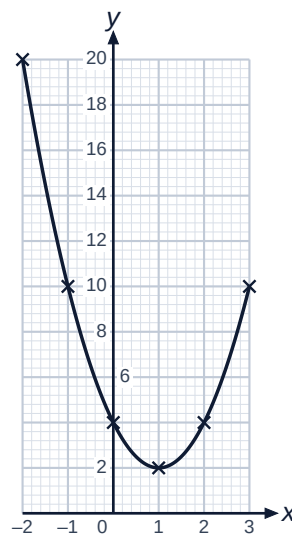
Substitute each x-value: $x = 0: y = 4$; $x = 1: y = 2$; $x = 3: y = 10$

B2 all missing values correct (B1 for at least one)

Plot all 6 points ($\pm \frac{1}{2}$ small square) and join them with a smooth curve – not ruled line segments.

B1 points plotted · B1 smooth curve

x	-2	-1	0	1	2	3
y	20	10	4	2	4	10



✓ (a) -1, -2, 4; (b) curve drawn (see below)

Q6 · ● Developing · 4 marks

METHOD

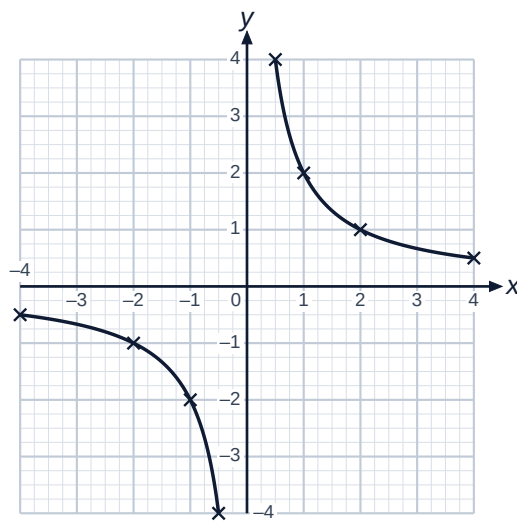
Substitute each x-value: $x = -2$: $y = -1$; $x = -1$: $y = -2$; $x = 0.5$: $y = 4$

B2 all missing values correct (B1 for at least one)

Plot all 8 points ($\pm \frac{1}{2}$ small square) and join them with a smooth curve – not ruled line segments.

B1 points plotted · B1 smooth curve

x	-4	-2	-1	-0.5	0.5	1	2	4
y	-0.5	-1	-2	-4	4	2	1	0.5



✓ (a) -35, -11, -5; (b) curve drawn (see below)

Q7 · ● Developing · 4 marks

METHOD

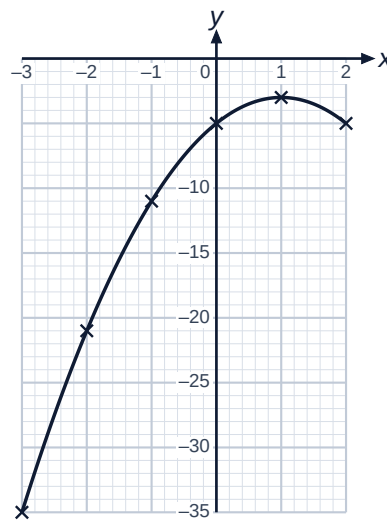
Substitute each x-value: $x = -3$: $y = -35$; $x = -1$: $y = -11$; $x = 0$: $y = -5$

B2 all missing values correct (B1 for at least one)

Plot all 6 points ($\pm \frac{1}{2}$ small square) and join them with a smooth curve – not ruled line segments.

B1 points plotted · B1 smooth curve

x	-3	-2	-1	0	1	2
y	-35	-21	-11	-5	-3	-5



✓ Correct curve drawn (see below)

Q8 · ● Developing · 2 marks

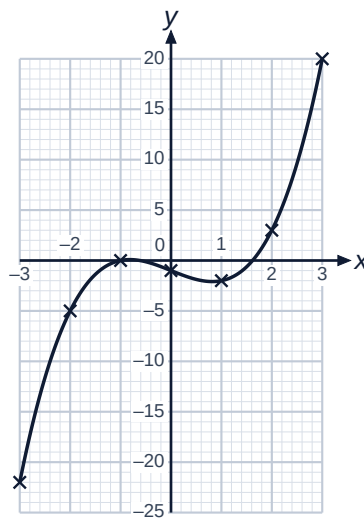
METHOD

Plot the points $(-3, -22)$, $(-2, -5)$, $(-1, 0)$... from the table ($\pm \frac{1}{2}$ small square).

Join them with a smooth curve – not ruled line segments.

B1 all points plotted correctly · B1 smooth curve

x	-3	-2	-1	0	1	2	3
y	-22	-5	0	-1	-2	3	20



✓ Correct curve drawn (see below)

Q9 · ● Developing · 2 marks

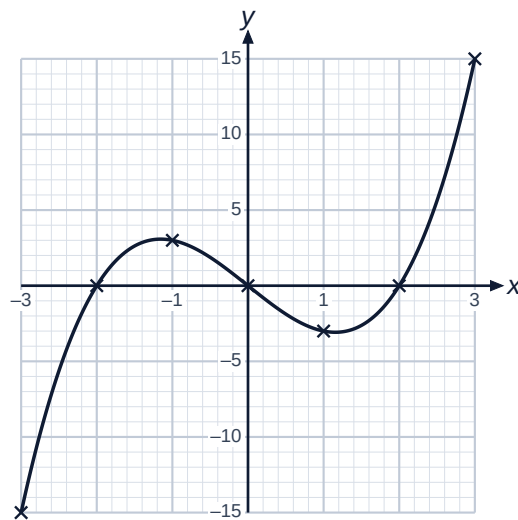
METHOD

Plot the points $(-3, -15)$, $(-2, 0)$, $(-1, 3)$... from the table ($\pm \frac{1}{2}$ small square).

Join them with a smooth curve – not ruled line segments.

B1 all points plotted correctly · B1 smooth curve

x	-3	-2	-1	0	1	2	3
y	-15	0	3	0	-3	0	15



✓ Correct curve drawn (see below)

Q10 · ● Developing · 2 marks

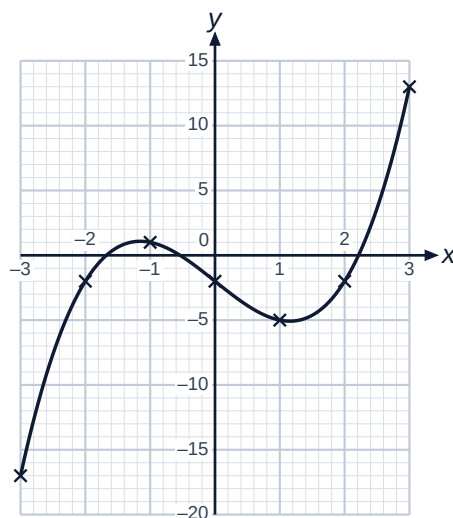
METHOD

Plot the points $(-3, -17)$, $(-2, -2)$, $(-1, 1)$... from the table ($\pm \frac{1}{2}$ small square).

Join them with a smooth curve – not ruled line segments.

B1 all points plotted correctly · B1 smooth curve

x	-3	-2	-1	0	1	2	3
y	-17	-2	1	-2	-5	-2	13



✓ $(5, -32)$

Q11 · ● Secure · 3 marks

METHOD

$$x^2 - 10x = (x - 5)^2 - 25$$

$$y = (x - 5)^2 - 25 - 7 = (x - 5)^2 - 32$$

Turning point = $(5, -32)$

✓ (a) $x = 0.3, x = 3.7$; (b) $(2, -3)$

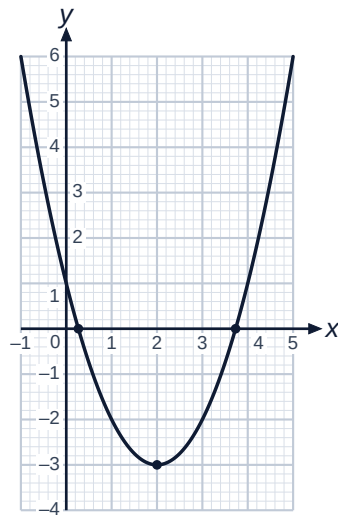
Q12 · ● Secure · 4 marks

METHOD

(a) Read where the curve crosses the x-axis: $x = 0.3$ (accept 0.2 to 0.4) and $x = 3.7$ (accept 3.6 to 3.8)

(b) Turning point: $(2, -3)$

B1 per root (within the accepted range) · B1 per turning point



✓ (a) $x = -1.5$, $x = -0.3$, $x = 1.9$; (b) $(-1, 1)$ and $(1, -3)$

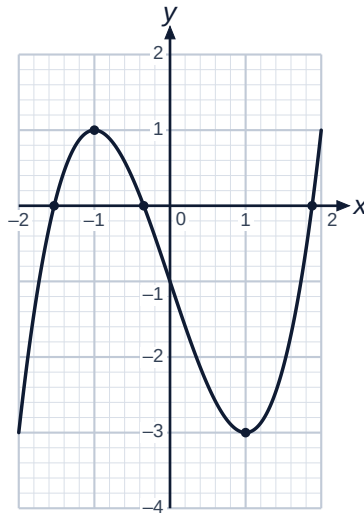
Q13 · ● Secure · 5 marks

METHOD

(a) Read where the curve crosses the x-axis: $x = -1.5$ (accept -1.6 to -1.4) and $x = -0.3$ (accept -0.4 to -0.2) and $x = 1.9$ (accept 1.8 to 2.0)

(b) Turning points: $(-1, 1)$ and $(1, -3)$

B1 per root (within the accepted range) · B1 per turning point



✓ $(-6, 0)$ and $(9, 0)$

Q14 · ● Secure · 3 marks

METHOD

$$x^2 - 3x - 54 = (x + 6)(x - 9)$$

$$y = 0 \text{ when } x = -6 \text{ or } x = 9$$

✓ (a) $x = -2.2, x = 0.2$; (b) $(-1, -3)$

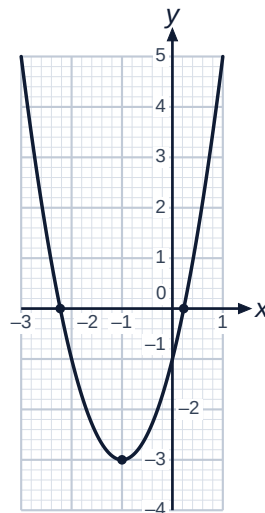
Q15 · ● Secure · 4 marks

METHOD

(a) Read where the curve crosses the x-axis: $x = -2.2$ (accept -2.3 to -2.1) and $x = 0.2$ (accept 0.1 to 0.3)

(b) Turning point: $(-1, -3)$

B1 per root (within the accepted range) · B1 per turning point



✓ $(-7, 0)$ and $(-6, 0)$

Q16 · ● Secure · 3 marks

METHOD

$$x^2 + 13x + 42 = (x + 7)(x + 6)$$

$$y = 0 \text{ when } x = -7 \text{ or } x = -6$$

✓ $(-3, 0)$ and $(7, 0)$

Q17 · ● Secure · 3 marks

METHOD

$$x^2 - 4x - 21 = (x - 7)(x + 3)$$

$$y = 0 \text{ when } x = 7 \text{ or } x = -3$$

✓(1, -8)

Q18 · ● Secure · 3 marks

METHOD

$$x^2 - 2x = (x - 1)^2 - 1$$

$$y = (x - 1)^2 - 1 - 7 = (x - 1)^2 - 8$$

Turning point = (1, -8)

✓(3, -13)

Q19 · ● Secure · 3 marks

METHOD

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

$$y = (x - 3)^2 - 9 - 4 = (x - 3)^2 - 13$$

Turning point = (3, -13)

✓(4, -22)

Q20 · ● Secure · 3 marks

METHOD

$$x^2 - 8x = (x - 4)^2 - 16$$

$$y = (x - 4)^2 - 16 - 6 = (x - 4)^2 - 22$$

Turning point = (4, -22)

✓ Draw $y = -x - 1$ · $x = -2.3$ and $x = 1.3$

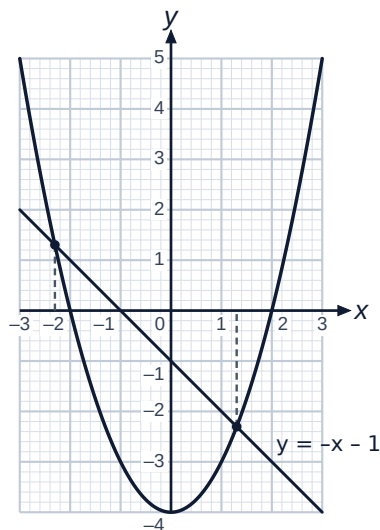
Q21 · ● Greater Depth · 4 marks

METHOD

$x^2 + x - 3 = 0$ rearranges to $x^2 - 4 = -x - 1$

so draw the line $y = -x - 1$ and read the x -values where it crosses the curve: $x = -2.3$ (accept -2.4 to -2.2) and $x = 1.3$ (accept 1.2 to 1.4)

M1 correct line drawn · A1 per solution within the accepted range



✓ (a) (0, 1); (b) $y = 5.2$; (c) $x = 1.3$

Q22 · ● Greater Depth · 3 marks

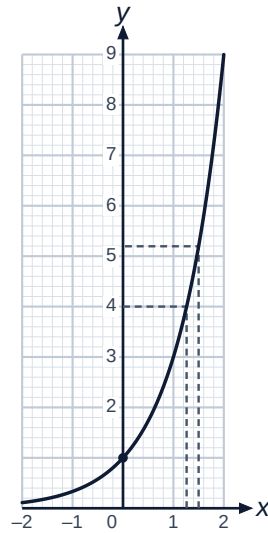
METHOD

(a) Any $3^0 = 1$, so the curve crosses at (0, 1)

(b) Up from $x = 1.5$ to the curve, across to the y-axis: $y = 5.2$ (accept 5.1 to 5.3)

(c) Across from $y = 4$ to the curve, down to the x-axis: $x = 1.3$ (accept 1.2 to 1.4)

B1 · B1 · B1



✓ (a) $(0, 1)$; (b) $y = 2.8$; (c) $x = 2.8$

Q23 · ● Greater Depth · 3 marks

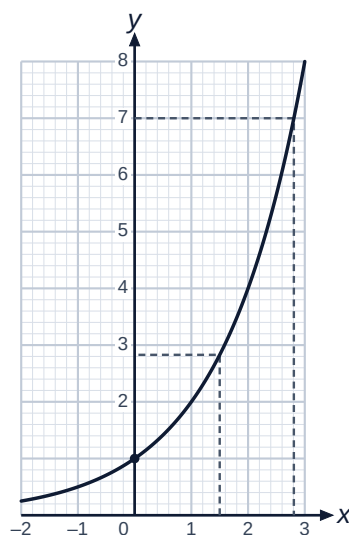
METHOD

(a) Any $2^0 = 1$, so the curve crosses at $(0, 1)$

(b) Up from $x = 1.5$ to the curve, across to the y-axis: $y = 2.8$ (accept 2.7 to 2.9)

(c) Across from $y = 7$ to the curve, down to the x-axis: $x = 2.8$ (accept 2.7 to 2.9)

B1 · B1 · B1



✓ Draw $y = x - 2$ · $x = -0.6$ and $x = 1.6$

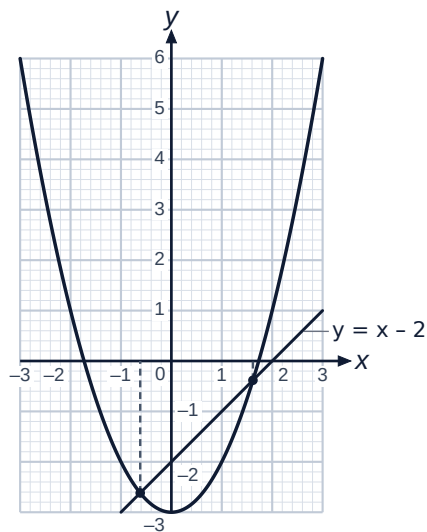
Q24 · ● Greater Depth · 4 marks

METHOD

$x^2 - x - 1 = 0$ rearranges to $x^2 - 3 = x - 2$

so draw the line $y = x - 2$ and read the x -values where it crosses the curve: $x = -0.6$ (accept -0.7 to -0.5) and $x = 1.6$ (accept 1.5 to 1.7)

M1 correct line drawn · A1 per solution within the accepted range



✓ Draw $y = -x + 2$ · $x = -1.6$ and $x = 2.6$

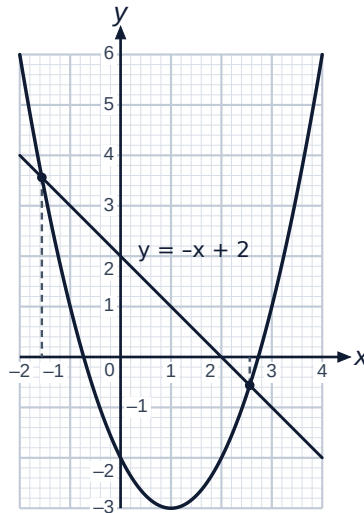
Q25 · ● Greater Depth · 4 marks

METHOD

$x^2 - x - 4 = 0$ rearranges to $x^2 - 2x - 2 = -x + 2$

so draw the line $y = -x + 2$ and read the x -values where it crosses the curve: $x = -1.6$ (accept -1.7 to -1.5) and $x = 2.6$ (accept 2.5 to 2.7)

M1 correct line drawn · A1 per solution within the accepted range



✓ $(-4, 0)$ and $(3, 0)$ and $(5, 0)$

Q26 · ● Greater Depth · 2 marks

METHOD

The graph crosses the x -axis where $y = 0$, i.e. where one of the brackets is zero: $x = 3$, $x = -4$ or $x = 5$

✓ (a) (0, 1); (b) $y = 5.2$; (c) $x = 0.6$

Q27 · ● Greater Depth · 3 marks

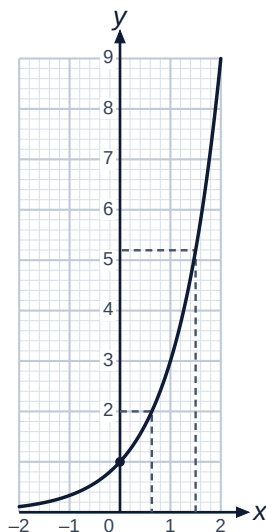
METHOD

(a) Any $3^0 = 1$, so the curve crosses at (0, 1)

(b) Up from $x = 1.5$ to the curve, across to the y-axis: $y = 5.2$ (accept 5.1 to 5.3)

(c) Across from $y = 2$ to the curve, down to the x-axis: $x = 0.6$ (accept 0.5 to 0.7)

B1 · B1 · B1



✓ (-4, 0) and (-3, 0) and (5, 0)

Q28 · ● Greater Depth · 2 marks

METHOD

The graph crosses the x-axis where $y = 0$, i.e. where one of the brackets is zero: $x = -3$, $x = -4$ or $x = 5$

✓ (-5, 0) and (-1, 0) and (4, 0)

Q29 · ● Greater Depth · 2 marks

METHOD

The graph crosses the x-axis where $y = 0$, i.e. where one of the brackets is zero: $x = -5$, $x = -1$ or $x = 4$

✓ Draw $y = -x - 1$ · $x = -3.6$ and $x = 0.6$

Q30 · ● Greater Depth · 4 marks

METHOD

$x^2 + 3x - 2 = 0$ rearranges to $x^2 + 2x - 3 = -x - 1$

so draw the line $y = -x - 1$ and read the x -values where it crosses the curve: $x = -3.6$ (accept -3.7 to -3.5) and $x = 0.6$ (accept 0.5 to 0.7)

M1 correct line drawn · A1 per solution within the accepted range

