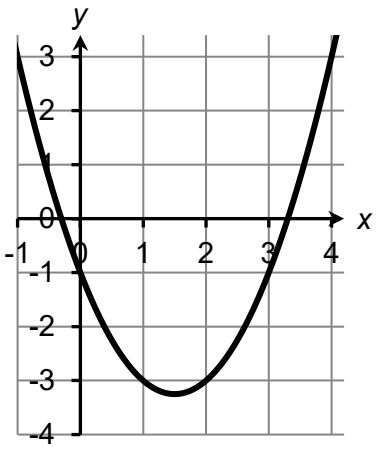
Higher Check In - 6.03 Algebraic equations

1. The graph shows the curve $y = x^2 - 3x - 1$.

   Use the graph to find the approximate roots of $x^2 - 3x = 1$.



2. Solve these simultaneous equations algebraically.

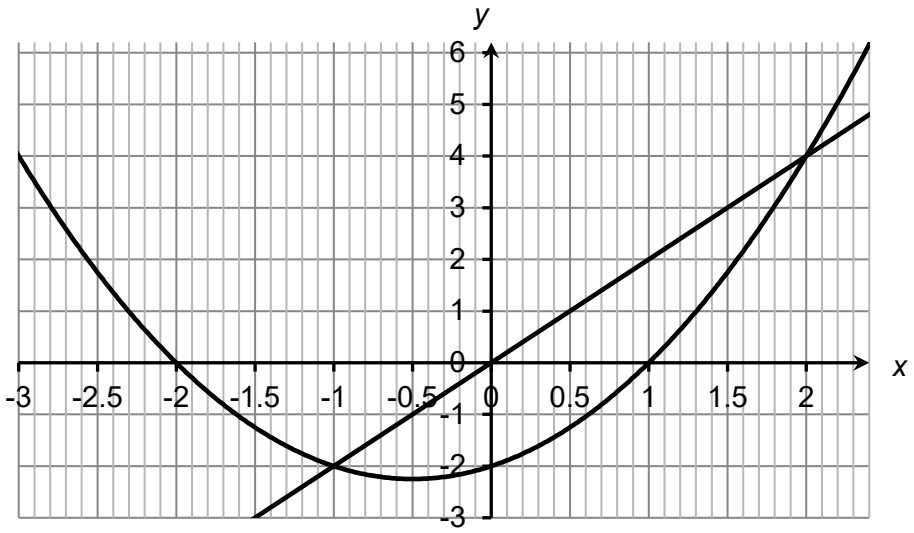
$$3x = 2 - 4y$$
$$9 - 2x = -5y$$

3. Solve $5x + 12 = \frac{1}{2}x^2$.

4. Solve $8 - \frac{2}{x-1} = \frac{2}{3}$.

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

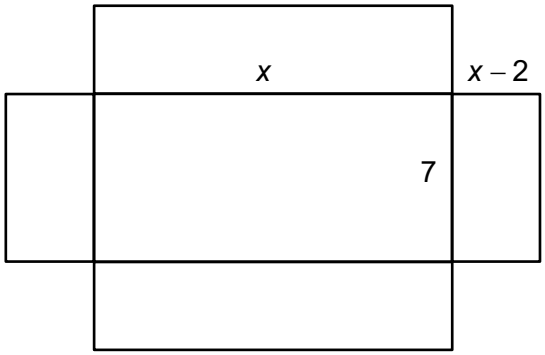
6. The graph below shows the curve $y = x^2 + x - 2$ and the line $y = 2x$.
   Tom says, "The simultaneous solutions for these graphs are $x = -2$, $x = 1$."
   Explain why he must be wrong.



7. Show that the equation $x^3 - 2x^2 + 3x - 5 = 0$ has an approximate solution between $x = 1$ and $x = 2$, giving your answer correct to 2 decimal places.

8. Express $x^2 + 4x + 10$ in the form $(x + a)^2 + b$. Use your answer to show whether the graph of $y = x^2 + 4x + 10$ crosses the x-axis.

9. The diagram shows the net of an open cuboid, with dimensions 7 cm, x cm and $(x - 2)$ cm. The volume of the cuboid is 840 cm³.
Find the dimensions of the cuboid.



10. The revenue for a company producing mobile phone cases is given by $R = -6x^2 + 180x - 5$, where x is the price in pounds of each phone case. The cost of production is given by $C = 80x - 20$. Determine the price that will allow the company to break-even (make neither a profit nor a loss).

Extension

In the diagram below each of the rows and columns add up to the numbers shown. Find the values of the letters A to E and hence find the value of x.

A	B	C	A	16
D	D	B	B	22
C	B	A	C	22
E	B	E	E	22
	19		x	

Answers

1. $x = -0.3$, $x = 3.3$

2. $x = 2$, $y = -1$

3. $x = -2$, $x = 12$

4. $x = 1\frac{3}{11}$

5. $x = -\frac{1}{2}$, $x = 2$

6. Tom has given the roots of the quadratic equation. The simultaneous solutions are where the two graphs intersect: $x = -1$, $y = -2$ and $x = 2$, $y = 4$.

7.

x	f(x)
1	-3
1.2	-2.552
1.4	-1.976
1.6	-1.224
1.8	-0.248
2	1

x	f(x)
1.8	-0.248
1.81	-0.192
1.82	-0.136
1.83	-0.079
1.84	-0.022
1.85	0.037

x	f(x)
1.84	-0.022
1.842	-0.010
1.844	0.0015

Therefore $x = 1.84$ to 2 decimal places.

8. $(x+2)^2 + 6$. Solving $(x+2)^2 + 6 = 0$ gives $(x+2)^2 = -6$ so $x + 2 = \sqrt{-6}$.
It is not possible to find the square root of a negative number, so the graph does not cross the x-axis.

9. Solving $7x^2 - 14x - 840 = 0$ gives $x = 12$ and $x = -10$.
A dimension must be positive so $x = 12$ and the dimensions of the cuboid are 7 cm, 12 cm and 10 cm.

10. £16.82

Extension

$A = 2$, $B = 4$, $C = 8$, $D = 7$ and $E = 6$, therefore $x = 20$.

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GCSE (9–1)
MATHEMATICS

Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Use a graph to find the approximate roots of a quadratic equation			
AO1	2	Solve two linear simultaneous equations in two variables			
AO1	3	Rearrange and solve a quadratic equation			
AO1	4	Solve a linear equation involving an algebraic fraction			
AO1	5	Rearrange and solve a quadratic equation			
AO2	6	Use a graph to find the approximate solutions to the simultaneous equations for a line and a curve			
AO2	7	Find an approximate solution using a sign-change method			
AO2	8	Use the completed square form of a quadratic equation			
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