

Solving quadratic equations by drawing graphs

Year 8 About 70 minutes No calculator 45 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/ks3-year-8-solving-quadratic-equations-by-drawing-graphs/

Date _____

A Do Now

Quick questions to start.

- A1** Last lesson [1 mark]

The lines $y = 2x + 1$ and $y = 7$ cross at one point. Write down the coordinates of that point.

A2 Needed today [1 mark]

Work out the value of $x^2 - 3x$ when $x = -2$.

Answer _____

Answer _____

- A3** From chapter 9 [1 mark]

A length is 7.4 cm, correct to 1 decimal place. Write down its lower bound.

A4 Year 7 [1 mark]

Expand $x(x + 5)$.

Answer _____

Answer _____

B Example, then your turn

Year 8

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

Complete the table of values for $y = x^2 + x - 2$. Use it to solve $x^2 + x - 2 = 0$.

x	x^2	y
-2	4	0
-1		
0	0	-2
1		

Hint For each x , add x^2 and x , then take away 2. The solutions are where $y = 0$.

B1 Complete the table of values [3 marks]

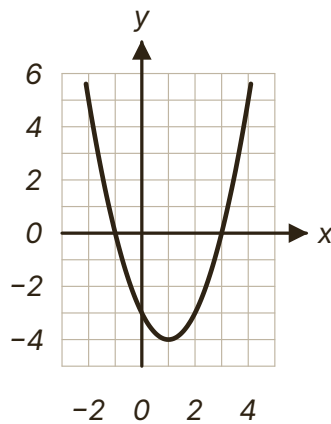
for $y = x^2 - 3x + 2$. Use it to solve $x^2 - 3x + 2 = 0$.

x	x^2	y
0	0	2
1		
2	4	
3		

Answer $x = \dots\dots$ or $x = \dots\dots$

EXAMPLE 2

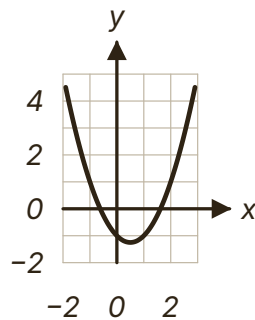
The graph of $y = x^2 - 2x - 3$ is drawn. (a) Use it to solve $x^2 - 2x - 3 = 5$. (b) How many solutions do $x^2 - 2x - 3 = -4$ and $x^2 - 2x - 3 = -5$ have?



Hint Draw each line $y = 5$, $y = -4$, $y = -5$. Count where each meets the curve. The lowest point is $(1, -4)$.

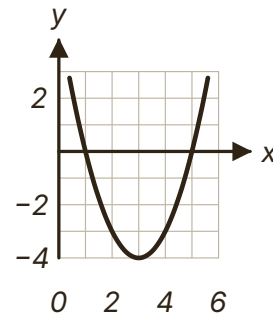
EXAMPLE 3

The graph of $y = x^2 - x - 1$ is drawn. Use it to solve $x^2 - x - 3 = 0$. Give your answers to 1 decimal place.



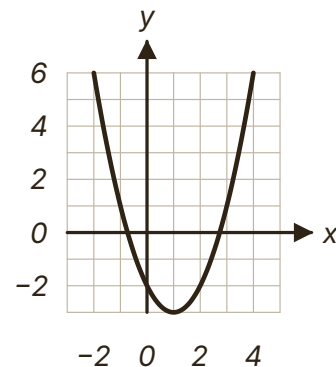
Hint Add 2 to both sides to get $x^2 - x - 1 = 2$. Draw the line $y = 2$. Each crossing is between gridlines: estimate how far along the square it is.

- B2** The graph of $y = x^2 - 6x + 5$ [3 marks]
is drawn. (a) Use it to solve $x^2 - 6x + 5 = -3$. (b) How many solutions does $x^2 - 6x + 5 = -4$ have?



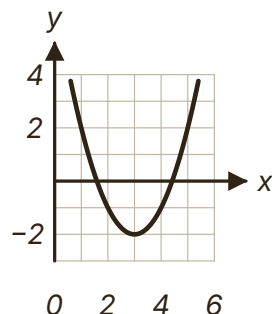
Answer

- B3** The graph of $y = x^2 - 2x - 2$ [3 marks]
is drawn. Draw a suitable line and use it to solve $x^2 - 2x - 7 = 0$. Give your answers to 1 decimal place.



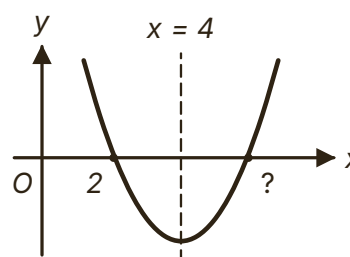
Answer $x = \dots\dots$ or $x = \dots\dots$

- C1** The graph of $y = x^2 - 6x + 7$ is drawn. Write down the coordinates of its turning point, and the equation of its line of symmetry. [2 marks]



Answer

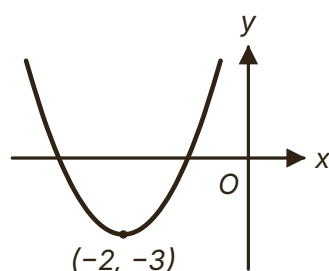
- C2** One solution of $x^2 - 8x + 12 = 0$ is $x = 2$. The line of symmetry of $y = x^2 - 8x + 12$ is $x = 4$. Work out the other solution. [2 marks]



Not drawn accurately

Answer

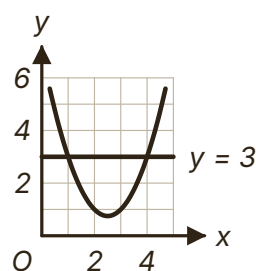
- C3** The lowest point of $y = x^2 + 4x + 1$ is $(-2, -3)$. For which value of k does $x^2 + 4x + 1 = k$ have exactly one solution? For which values of k does it have no solution? [2 marks]



Not drawn accurately

Answer

- C4** The line $y = 3$ and the curve $y = x^2 - 5x + 7$ are drawn. Which equation do their crossing points solve? Write it in the form $x^2 + bx + c = 0$, and write down its solutions. [2 marks]



Answer

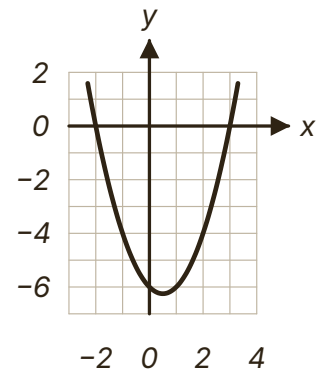
D1

Jo uses the graph of $y = x^2 - x - 6$ to solve $x^2 - x - 6 = 0$. She says, "The solution is $x = -6$, because that is where the curve crosses the y -axis."

[4 marks]

Explain what Jo has done wrong. Find the correct solutions.

Answer $x = \dots\dots$ or $x = \dots\dots$



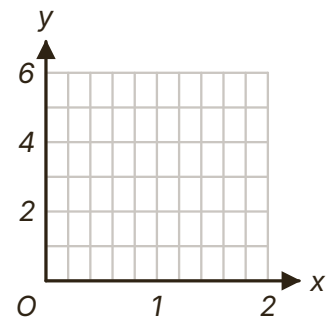
D2 A rectangle is x cm wide. Its length is 1 cm more than its width. Its area is 5 cm^2 .

(a) Show that $x^2 + x = 5$.

[1 mark]

(b) Work out the value of $x^2 + x$ when $x = 0, 1$ and 2 .
Plot the points on the grid and draw the graph of $y = x^2 + x$ through them.

[2 marks]



(c) Use your graph to find the width of the rectangle. Give your answer to 1 decimal place.

[2 marks]

Answer

Total for D2: 5 marks

D3 The graph of $y = x^2 + 2x + 1$ is drawn on the grid.

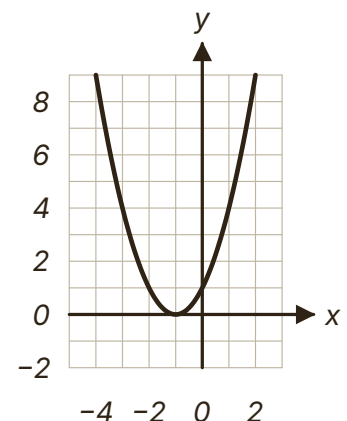
(a) Use the graph to solve $x^2 + 2x + 1 = 9$.

[2 marks]

Answer $x = \dots\dots$ or $x = \dots\dots$

(b) By drawing a suitable line, solve $x^2 + 2x - 2 = 0$.
Give your answers to 1 decimal place.

[2 marks]



Answer $x = \dots\dots$ or $x = \dots\dots$

(c) Explain why $x^2 + 2x + 1 = -2$ has no solution.

[2 marks]

Total for D3: 6 marks

D4 A ball is thrown up. Its height, h metres, after t seconds is $h = 4t - t^2$. The graph of h against t is drawn.

(a) At what two times is the ball 3 m high?

[2 marks]

Answer

(b) For how many seconds is the ball higher than 3 m?

[1 mark]

Answer

(c) Write down the greatest height of the ball.

[1 mark]

Answer

Total for D4: 4 marks

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 The equation $x^2 - 6x + k = 0$ has exactly one solution. Work out the value of k , and the solution. [5 marks]

Answer $k = \dots\dots$ $x = \dots\dots$

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Write it as $x^2 - 6x = -k$. Where does the curve $y = x^2 - 6x$ cross the x -axis?
- Hint 2** It crosses at $x = 0$ and $x = 6$, so its line of symmetry is $x = 3$. Work out y when $x = 3$.
- Hint 3** The lowest point is $(3, -9)$. One solution means the line $y = -k$ just touches it.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can complete a table of values and read solutions where $y = 0$. ☐ ☐ ☐
- I can draw a line $y = k$ on a curve and read the solutions. ☐ ☐ ☐
- I can say whether a quadratic equation has two, one or no solutions. ☐ ☐ ☐