

Quadratics Equations - Completing the Square - PDF Copy

The presentation contains the slides below with the objective of showing how to: **Be able to solve a quadratic by completing the square.** There are animated explanations and questions with answers..

Quadratics - Completing the Square

Objective: Be able to solve a quadratic by completing the square

B → A* Topic

1 ☆

Completing the Square

$x^2 + 6x - 8 = 0$

Here is a quadratic equation. One of the methods that we can use to solve it is called **completing the square**.

This method has several steps that will work for all quadratic equations

We do it like this...

2 ☆

$x^2 + 6x - 8 = 0$
 $\rightarrow (x \quad)^2 - 8 - \quad = 0$

The first line of working always looks like this and the spaces are filled by...

Half the value of the x terms. In this case this is 3

Subtract the value of half the x terms number when it has been squared. In this case $3^2 = 9$

3 ☆

$x^2 + 6x - 8 = 0$
 $\rightarrow (x+3)^2 - 8 - 9 = 0$
 $\rightarrow (x+3)^2 - 17 = 0$
 $\rightarrow (x+3)^2 = 17$
 $\rightarrow x+3 = \pm\sqrt{17}$
 $\rightarrow x+3 = \pm 4.12$

Now we can tidy up

Rearrange like this

Find the square root of both sides

Using + 4.12

Using - 4.12

$x+3 = 4.12$ $x+3 = -4.12$
 $\rightarrow x = 4.12 - 3$ $\rightarrow x = -4.12 - 3$
 $\rightarrow x = 1.12$ $\rightarrow x = -7.12$

4 ☆

$x^2 - 8x + 5 = 0$

Here is another quadratic that we are going to solve by completing the square...

5 ☆

$x^2 - 8x + 5 = 0$
 $\rightarrow (x \quad)^2 + 5 - \quad = 0$

The first line of working always looks like this and the spaces are filled by...

Half the value of the x terms number. In this case this is -4

Subtract the value of half the x terms number when it has been squared. In this case $(-4)^2 = 16$

Any number squared is always positive

6 ☆

$x^2 - 8x + 5 = 0$
 $\rightarrow (x-4)^2 + 5 - 16 = 0$
 $\rightarrow (x-4)^2 - 11 = 0$
 $\rightarrow (x-4)^2 = 11$
 $\rightarrow x-4 = \pm\sqrt{11}$
 $\rightarrow x-4 = \pm 3.32$

Now we can tidy up

Rearrange like this

Find the square root of both sides

Using + 3.32

Using - 3.32

$x-4 = 3.32$ $x-4 = -3.32$
 $\rightarrow x = 3.32 + 4$ $\rightarrow x = -3.32 + 4$
 $\rightarrow x = 7.32$ $\rightarrow x = 0.68$

7 ☆

The pattern for the working out

8 ☆

$x^2 - 10x + 7 = 0$
 $\rightarrow (x \quad)^2 + 7 - \quad = 0$
 $\rightarrow (x \quad)^2 - 18 = 0$
 $\rightarrow (x \quad)^2 = 18$
 $\rightarrow x \quad = \pm \sqrt{18}$
 $\rightarrow x \quad = \pm 4.24$

You have the answers, but what are the missing numbers for the working out hidden under the grey rectangles?

$x \quad = \quad$ $x \quad = \quad$
 $\rightarrow x = 9.24$ $\rightarrow x = 0.76$

9 ☆

$x^2 + 5x - 9 = 0$
 $\rightarrow (x \quad)^2 - 9 - \quad = 0$
 $\rightarrow (x \quad)^2 - 15.25 = 0$
 $\rightarrow (x \quad)^2 = 15.25$
 $\rightarrow x \quad = \pm \sqrt{15.25}$
 $\rightarrow x \quad = \pm 3.91$

Find the missing numbers for the working out

$x \quad = \quad$ $x \quad = \quad$
 $\rightarrow x = 1.41$ $\rightarrow x = -6.41$

10 ☆

1. $x^2 + 6x + 2 = 0$
 2. $x^2 - 4x - 1 = 0$
 3. $x^2 + 6x - 3 = 0$
 4. $x^2 + 2x - 5 = 0$
 5. $x^2 - 8x + 5 = 0$
 6. $x^2 + 6x - 2 = 0$
 7. $x^2 - 3x - 5 = 0$
 8. $x^2 - 5x - 2 = 0$
 9. $x^2 + 7x - 13 = 0$
 10. $x^2 - 5x - 7 = 0$

Working to 2 d.p. solve these by completing the square.

11 ☆

1. $x^2 + 6x + 2 = 0$ - 0.35 and - 5.65
 2. $x^2 - 4x - 1 = 0$ 0.27 and 3.73
 3. $x^2 + 6x - 3 = 0$ - 6.46 and 0.46
 4. $x^2 + 2x - 5 = 0$ - 3.45 and 1.45
 5. $x^2 - 8x + 5 = 0$ -0.58 and 8.58
 6. $x^2 + 6x - 2 = 0$ -6.32 and 0.32
 7. $x^2 - 3x - 5 = 0$ -1.19 and 4.19
 8. $x^2 - 5x - 2 = 0$ 0.44 and 4.56
 9. $x^2 + 7x - 13 = 0$ - 8.52 and 1.52
 10. $x^2 - 5x - 7 = 0$ - 1.14 and 6.14

12 ☆

How we can find the turning point of a quadratics graph using completed square

13 ☆

Here is the graph of $y = x^2 - 4x + 1$. Often, we want to find the turning point of the graph

By writing $y = x^2 - 4x + 1$ in completed square form we can find the coordinates of the point like this...

14 ☆

Write in completed square form

$y = x^2 - 4x + 1$
 $\rightarrow y = (x - 2)^2 - 3$

It will have a value on the x-axis that is the number with the opposite sign i.e. $-2 \rightarrow +2$

15 ☆

Write in completed square form

$y = x^2 - 4x + 1$
 $\rightarrow y = (x - 2)^2 - 3$

It will have a value on the y-axis that is the number with the same sign

16 ☆

Write in completed square form

$y = x^2 - 4x + 1$
 $\rightarrow y = (x - 2)^2 - 3$

Notice the coordinates of the turning point are (2, -3)

17 ☆