

Quadratic Equations - Solve by Factorising - PDF Copy

The presentation contains the slides below with the objectives of showing how to: i. Understanding that to solve a quadratic equation we find the x values that make $y = 0$, ii. Be able to factorise simple quadratic expressions. There is an animated explanation and problems with answers.

Factorising Quadratic Equations

Objective

Understand that to solve a quadratic equation we find the x values that make $y = 0$

Be able to factorise simple quadratic expressions

Grade B Topic

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A quadratic equation is one that has the form:

The a , b and c letters can be any numbers

$y = ax^2 + bx + c$

Here are three examples...

If $a = 1$, $b = 3$ and $c = 1$ we get... $y = x^2 + 3x + 1$

If $a = 1$, $b = 1$ and $c = -9$ we get... $y = x^2 - 9$

If $a = 1$, $b = 1$ and $c = 6$ we get... $y = x^2 + x + 6$

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Here is an example of a quadratic equation's graph...

The graph of $y = x^2 - x - 1$

The graph is a curve called a parabola

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All quadratic equations will have a graph with a parabolic curve

The graph of $y = x^2 - x - 1$

It's called a parabola

The graph is a curve called a parabola

quadratics

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We solve the equation $1 = x^2 - x - 1$

The graph of $y = x^2 - x - 1$

$y = 0$

Notice that the line $y = 1$ is the x -axis

So we need the two values of x where $y = 1$

From the graph the values are $x = -2$ and $x = 3$

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Solving by Factorising

One of the algebraic methods for solving quadratic equations requires the factorising of the equation.

$y = ax^2 + bx + c$

Here is an example of a quadratic that has been factorised

$y = x^2 + 5x + 6$

$\Rightarrow y = (x + 3)(x + 6)$

We will show how this can be solved later

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Multiplying out the brackets, gives the original quadratic

$y = (x + 3)(x + 2)$

Tidy up the middle

$y = x^2 + 2x + 3x + 6$

$y = x^2 + 5x + 6$

So to factorise any quadratic means that we put into a pair of brackets

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Here is an example of how to factorise and solve a quadratic

$y = x^2 + 7x + 12$

We need to find the terms that fit into the brackets

$y = (x + 3)(x + 4)$

The $3x$ term is produced by a x in both brackets

The 12 and the 7 require two numbers that make 12 when multiplied and 7 when added

$3 \times 4 = 12$ and $3 + 4 = 7$

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Here is an example of how to factorise and solve a quadratic

$y = x^2 + 7x + 12$

We can check that it's right by multiplying out the brackets

$y = (x + 3)(x + 4)$

$\Rightarrow x^2 + 4x + 3x + 12$

$\Rightarrow x^2 + 7x + 12$

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Here is an example of how to factorise and solve a quadratic

$y = x^2 + 7x + 12$

We solve for $y = 0$

$0 = (x + 3)(x + 4)$

Multipled together so to equal 1 one set of brackets must be 1

So either $x + 3 = 1$ or $x + 4 = 1$

$x + 3 = 0 \Rightarrow x = -3$ or $x + 4 = 0 \Rightarrow x = -4$

$\Rightarrow x = -3$ and -4

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Quite a lot to remember so here are three examples of how we suggest you use a systematic method to factorise:

$y = x^2 + 5x + 12$

$y = x^2 - 7x - 18$

$y = x^2 + 6x - 27$

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$0 = x^2 + 5x + 6$

Write down all the factor pairs with a product (multiply) of $+6$

From this list choose the factor pair that have a sum (add) of $+5$

2 and 3 have a product of 6 and a sum of 5

$1 \times 6 = 6$
 $2 \times 3 = 6$
 $-1 \times -6 = 6$
 $-2 \times -3 = 6$

$1 + 6 = 7$
 $2 + 3 = 5$
 $-1 + -6 = -7$
 $-2 + -3 = -5$

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Continued...

$0 = x^2 + 5x + 6$

$0 = (x+2)(x+3)$

We use x terms and these numbers in the brackets

$1 \times 6 = 6$
 $2 \times 3 = 6$
 $-1 \times -6 = 6$
 $-2 \times -3 = 6$
 $1 + 6 = 7$
 $2 + 3 = 5$
 $-1 + -6 = -7$
 $-2 + -3 = -5$

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$0 = x^2 + 5x + 6$

$0 = (x+2)(x+3)$

The brackets are multiplied, and to be equal to 1...

either $x+2=1$ or $x+3=1$

$x+2=0 \Rightarrow x=-2$ or $x+3=0 \Rightarrow x=-3$

$\Rightarrow x = -2$ and -3

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Next, we factorise

$y = x^2 - 7x - 18$

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$0 = x^2 - 7x - 18$

Write down all the factor pairs with a product (multiply) of -18

From this list choose the factor pair that have a sum (add) of -7

2 and -9 have a product of -18 and a sum of -7

$1 \times -18 = -18$
 $2 \times -9 = -18$
 $3 \times -6 = -18$
 $-2 \times 9 = -18$
 $-3 \times 6 = -18$
 $-1 \times 18 = -18$
 $1 + -18 = -17$
 $2 + -9 = -7$
 $3 + -6 = -3$
 $-2 + 9 = 7$
 $-3 + 6 = 3$
 $-1 + 18 = 17$

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$0 = x^2 - 7x - 18$

$0 = (x+2)(x-9)$

We use x terms and these numbers in the brackets

$1 \times -18 = -18$
 $2 \times -9 = -18$
 $3 \times -6 = -18$
 $-2 \times 9 = -18$
 $-3 \times 6 = -18$
 $-1 \times 18 = -18$
 $1 - 18 = -17$
 $2 - 9 = -7$
 $3 - 6 = -3$
 $-2 + 9 = 7$
 $-3 + 6 = 3$
 $-1 + 18 = 17$

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$0 = x^2 - 7x - 18$

$0 = (x+2)(x-9)$

The brackets are multiplied, and to be equal to 1...

either $x+2=1$ or $x-9=1$

$x+2=0 \Rightarrow x=-2$ or $x-9=0 \Rightarrow x=9$

$\Rightarrow x = -2$ and 9

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Finally, we factorise

$y = x^2 + 6x - 27$

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$0 = x^2 + 6x - 27$

Write down all the factor pairs with a product (multiply) of -27

From this list choose the factor pair that have a sum (add) of 6

9 and -3 have a product of -27 and a sum of 6

$1 \times -27 = -27$
 $3 \times -9 = -27$
 $9 \times -3 = -27$
 $27 \times -1 = -27$
 $1 + -27 = -26$
 $3 + -9 = -6$
 $9 + -3 = 6$
 $27 + -1 = 26$

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$0 = x^2 + 6x - 27$

$0 = (x+9)(x-3)$

We use x terms and these numbers in the brackets

$1 \times -27 = -27$
 $3 \times -9 = -27$
 $9 \times -3 = -27$
 $27 \times -1 = -27$
 $1 + -27 = -26$
 $3 + -9 = -6$
 $9 + -3 = 6$
 $27 + -1 = 26$

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$0 = x^2 + 6x - 27$

$0 = (x+9)(x-3)$

The brackets are multiplied, and to be equal to 1...

either $x+9=1$ or $x-3=1$

$x+9=0 \Rightarrow x=-9$ or $x-3=0 \Rightarrow x=3$

$\Rightarrow x = -9$ and $+3$

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Factorise and solve these quadratics

- $x^2 + 7x + 10 = 0$
- $x^2 - x - 6 = 0$
- $x^2 + 8x + 12 = 0$
- $x^2 + x - 12 = 0$
- $x^2 - 8x + 15 = 0$
- $x^2 + 3x - 21 = 0$
- $x^2 - 3x - 18 = 0$
- $x^2 - 10x - 24 = 0$
- $x^2 + 8x + 16 = 0$
- $x^2 - 4x - 60 = 0$

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Factorise and solve these quadratics

- $x^2 + 7x + 10 = 0 \Rightarrow (x+2)(x+5) \Rightarrow -2 \text{ \& } -5$
- $x^2 - x - 6 = 0 \Rightarrow (x-3)(x+2) \Rightarrow 3 \text{ \& } -2$
- $x^2 + 8x + 12 = 0 \Rightarrow (x+2)(x+6) \Rightarrow -2 \text{ \& } -6$
- $x^2 + x - 12 = 0 \Rightarrow (x-3)(x+4) \Rightarrow 3 \text{ \& } -4$
- $x^2 - 8x + 15 = 0 \Rightarrow (x-3)(x-5) \Rightarrow 3 \text{ \& } 5$
- $x^2 + 3x - 21 = 0 \Rightarrow (x+7)(x-4) \Rightarrow -7 \text{ \& } 4$
- $x^2 - 3x - 18 = 0 \Rightarrow (x-6)(x+3) \Rightarrow 6 \text{ \& } -3$
- $x^2 - 10x - 24 = 0 \Rightarrow (x-12)(x+2) \Rightarrow 12 \text{ \& } -2$
- $x^2 + 8x + 16 = 0 \Rightarrow (x+4)(x+4) \Rightarrow -4 \text{ \& } -4$
- $x^2 - 4x - 60 = 0 \Rightarrow (x-10)(x+6) \Rightarrow 10 \text{ \& } -6$

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