



Advanced Mathematics  
Support Programme®

## Solving Quadratics

?

**Did you know?**

?

I have picked two numbers that multiply to make zero.

What can you say about my numbers?

At least one of them must be zero

This is useful when using factorising to solve equations.

If  $a \times b = 0$ , then either  $a = 0$  or  $b = 0$  (or both!)

Historically zero wasn't accepted as a number until fairly recently!



## Solving with Quadratics 1



Solve the following

1.  $x^2 = 16$

2.  $x^2 - 16x = 0$

3.  $(x + 1)(2x - 3) = 0$

4.  $x^2 - 3x + 2 = 0$

5.  $(2x - 5)(4x + 3) = 0$

6.  $3x^2 + 14x - 5 = 0$

7.  $(x + 3)^2 = 25$

8.  $\frac{3}{x} + \frac{4}{x-1} = 10$



## Solving with Quadratics 2



Solve the following

1.  $x^2 - 4x - 12 = 0$

2.  $x^2 - x = 6$

3.  $2x^2 - 11x + 12 = 0$

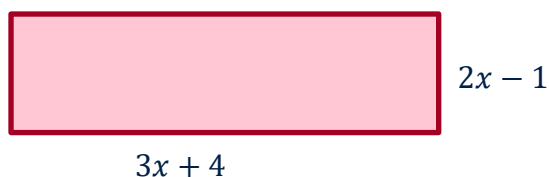
4.  $6x^2 + x - 12 = 0$

5.  $3 + 2x - x^2 = 0$

6.  $x^2 - 4x - 1 = 0$

7.  $\frac{8}{x+2} - \frac{14}{x-3} = 9$

8. The area of this rectangle is  $30m^2$

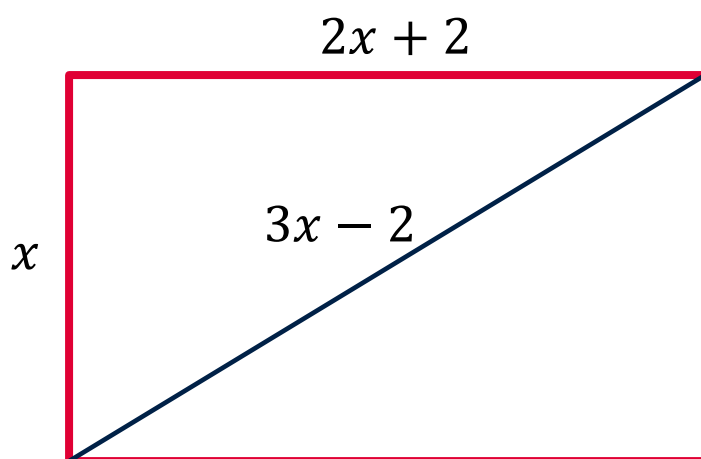


- a) Show that  $6x^2 + 5x - 34 = 0$   
b) Find any possible values for  $x$



## Quadthagoras

Find the length, width and diagonal of this rectangle



## Up in the air!



An object is launched from a cliff that is  $58.8m$  high.

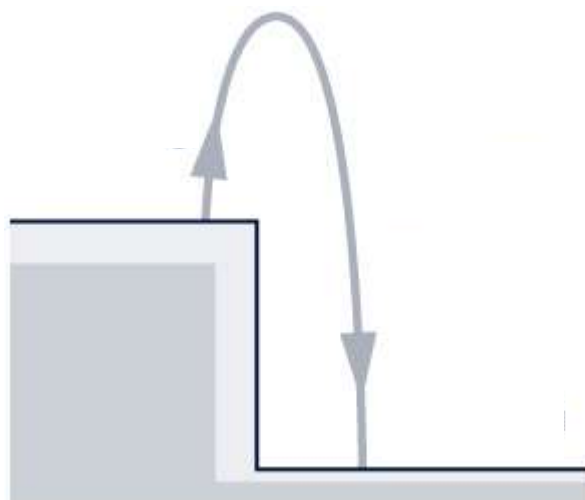
The speed of the object is  $19.6$  metres per second ( $m/s$ ).

The equation for the object's height  $h$  above the ground at time  $t$  seconds after launch is

$$h = -4.9t^2 + 19.6t + 58.8$$

where  $h$  is in metres.

- When does the object strike the ground?





## Which Way?

In the skills check you saw how we can solve quadratic equations by factorising or completing the square.

We can also use the quadratic formula. For a quadratic  $ax^2 + bx + c = 0$  the solutions are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Try solving  $x^2 + 4x - 21 = 0$  using each of the three methods.

Try solving  $3x^2 + 4x - 2 = 0$  using each of the three methods.

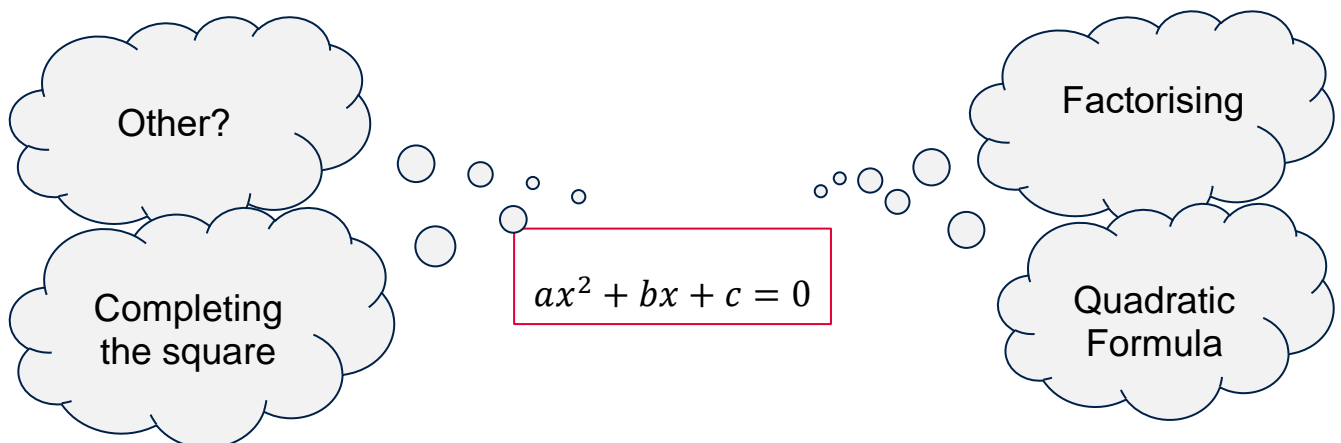


## Which Way Now?

There is not always one best way to solve a quadratic.

Some methods are better than others for different equations

How can you spot which is the right method for each equation?



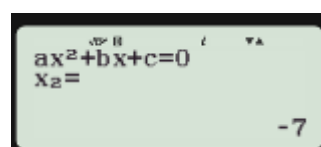
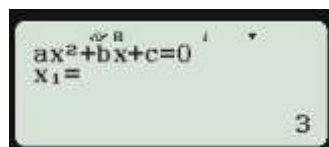
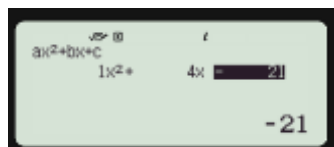
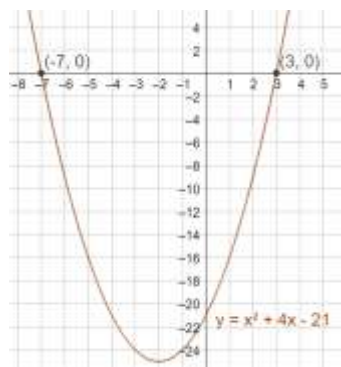
<https://undergroundmathematics.org/quadratics/quad-solving-sorter> is a really good activity for improving your skills in sorting quadratic equations. You or your teacher may be able to print the cards out to help.



## Another Way?

And of course, there are the methods of solving using graphs and/or your calculator

$$x^2 + 4x - 21 = 0$$



## Using Graphs

Use the graphs to solve

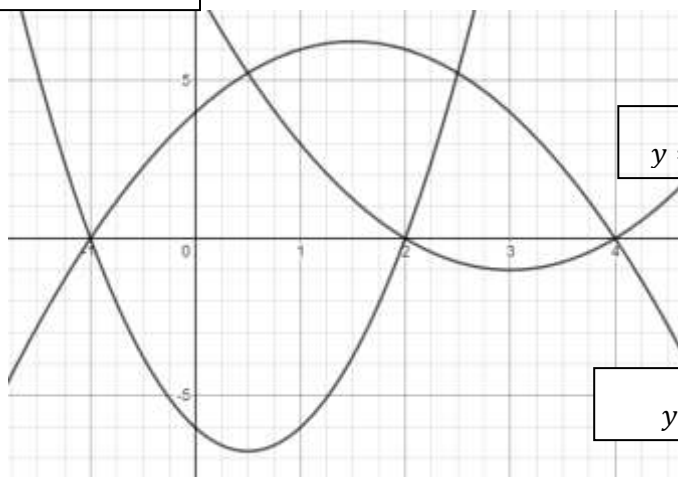
$$4 + 3x - x^2 = 0$$

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

$$3x^2 - 3x - 6 = 0$$

$$4 + 3x - x^2 = 4$$

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



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

$$y = 4 + 3x - x^2$$



## Simultaneously

Solve these pairs of equations

1.  $y = x^2 + 6x - 9$     2.  $y = x^2 + 2x + 2$     3. A rectangle has length  $(a + b)$  and width  $3a$ .

$$y = 3x + 1$$

$$y - 4x = 1$$

The area is  $60\text{cm}^2$  and perimeter is  $32\text{ cm}$ .

Calculate, algebraically, the values of  $a$  and  $b$ .

4. In how many places does the line  $y = 2x + 2$  intersect the circle  $(x + 2)^2 + y^2 = 25$ ?

What are the co-ordinates of these intersections?



## Lines and Curves



The diagram shows the graphs of

$$y^2 = x \text{ and } y = x - 2$$

The graphs cross at the points A and B.

The point C has co-ordinates (6,0)

- Without the use of a calculator, find the exact area of triangle ABC

