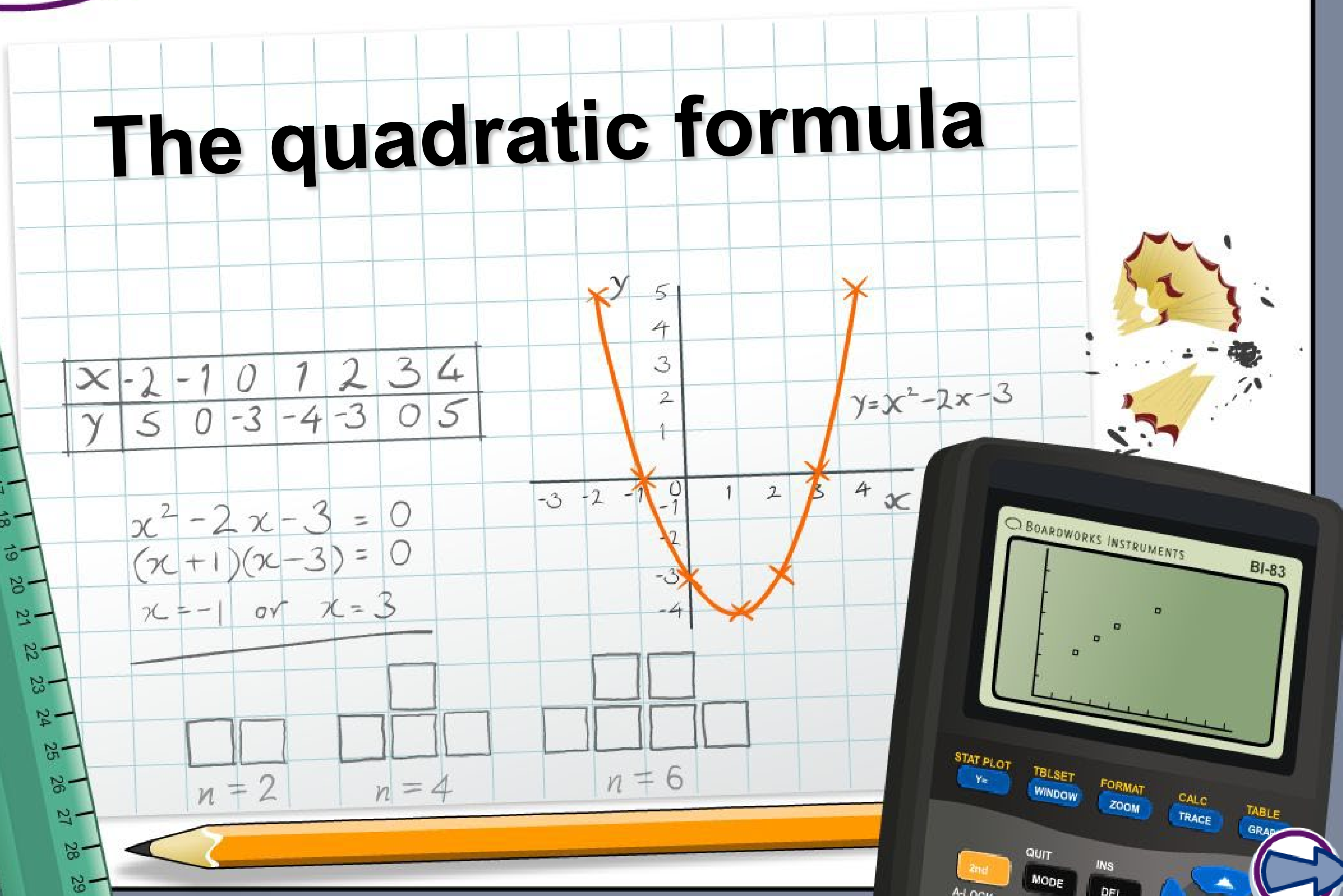
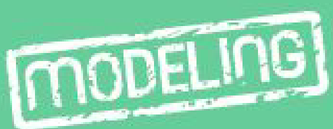
The quadratic formula



Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.



Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

They are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

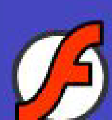
4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

8) Look for and express regularity in repeated reasoning.

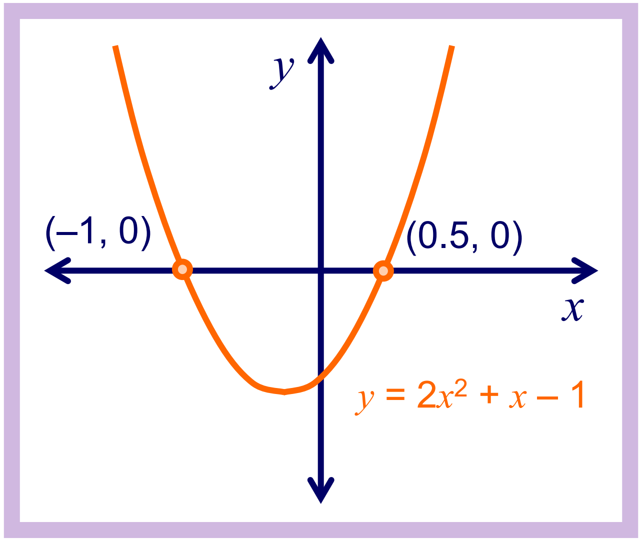


This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

What does it mean, both graphically and algebraically, to solve an equation such as $2x^2 + x - 1 = 0$?

Graphically, solving the equation means finding the intersection of the curve $y = 2x^2 + x - 1$ and the line $y = 0$ (the x-axis).



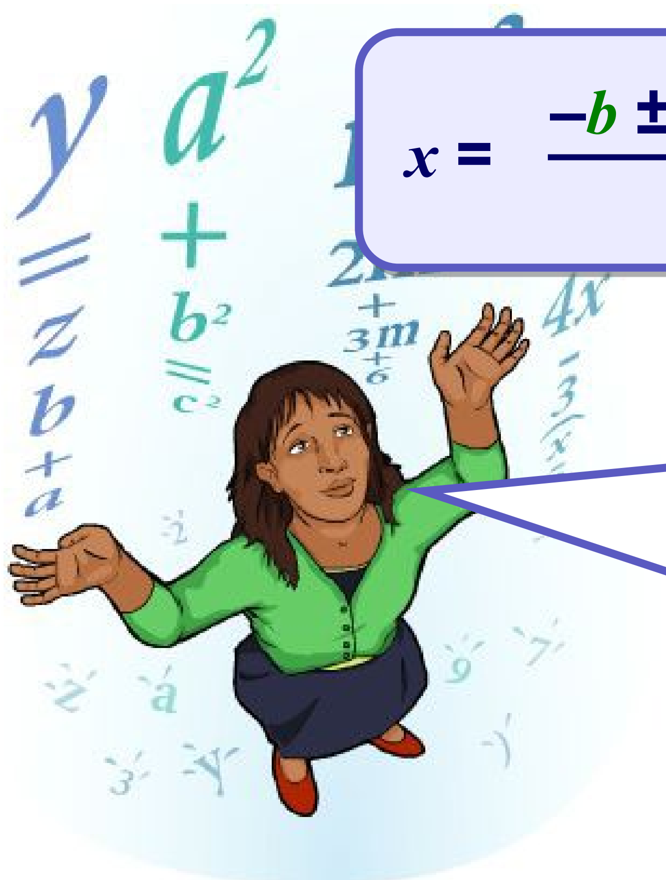
Algebraically, solving the equation means finding the values of x that make it true.

We can do this by factoring the equation, completing the square, or trial and error.

We can also use the **quadratic formula**.

The quadratic formula

Any quadratic equation of the form $ax^2 + bx + c = 0$ can be solved by substituting the values of a, b and c into the formula:



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

This equation can be derived by completing the square on the general form of the quadratic equation.

Deriving the quadratic formula

$$ax^2 + bx + c = 0$$

We can complete the square on the general form of a quadratic equation in order to find a general solution for any quadratic equation that can be written in this form.

Press the "=" button to see how...

Use the quadratic formula to solve these equations

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

1.	$x^2 - 7x + 8 = 0$	?	W
2.	$2x^2 + 5x = 1$	?	W
3.	$9x^2 + 4 = 12x$	?	W
4.	$x^2 + x + 3 = 0$	?	W

The determinant

The expression under the square root sign in the quadratic formula, $b^2 - 4ac$, shows how many solutions the equation has. This expression is sometimes called the **determinant**.

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

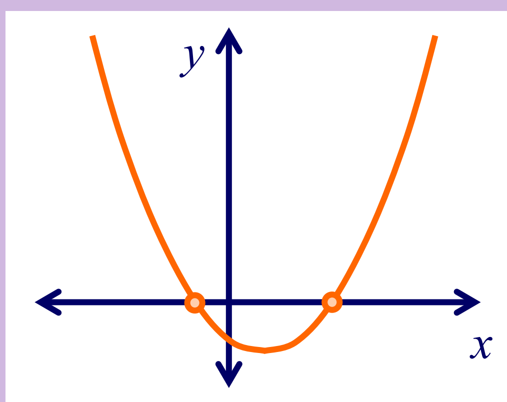
- When $b^2 - 4ac$ is **positive**, there are **two** roots.
- When $b^2 - 4ac$ is equal to **zero**, there is **one** root.
- When $b^2 - 4ac$ is **negative**, there are **no** roots.

The roots of a graph

We can demonstrate each of these possibilities using graphs.

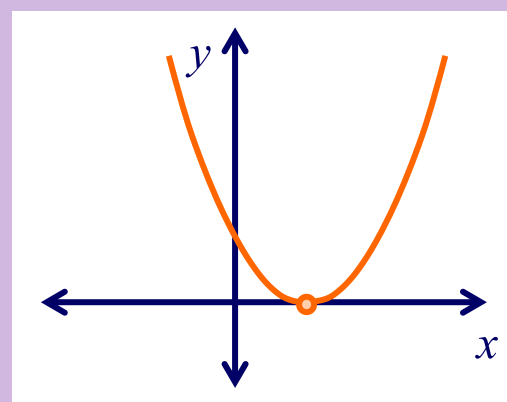
Remember, if we plot the graph of $y = ax^2 + bx + c$, the solutions to the equation $ax^2 + bx + c = 0$ are given by the points where the graph crosses the x-axis.

$b^2 - 4ac$ is positive



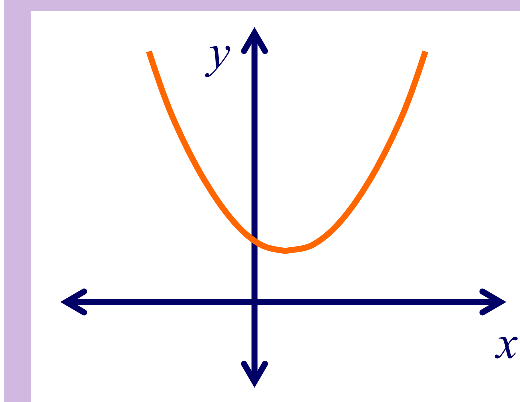
two solutions

$b^2 - 4ac$ is zero



one solution

$b^2 - 4ac$ is negative



no real solution

Using $b^2 - 4ac$

How many solutions does this equation have?

$$9x^2 - 6x + 6 = 0$$

$b^2 - 4ac =$