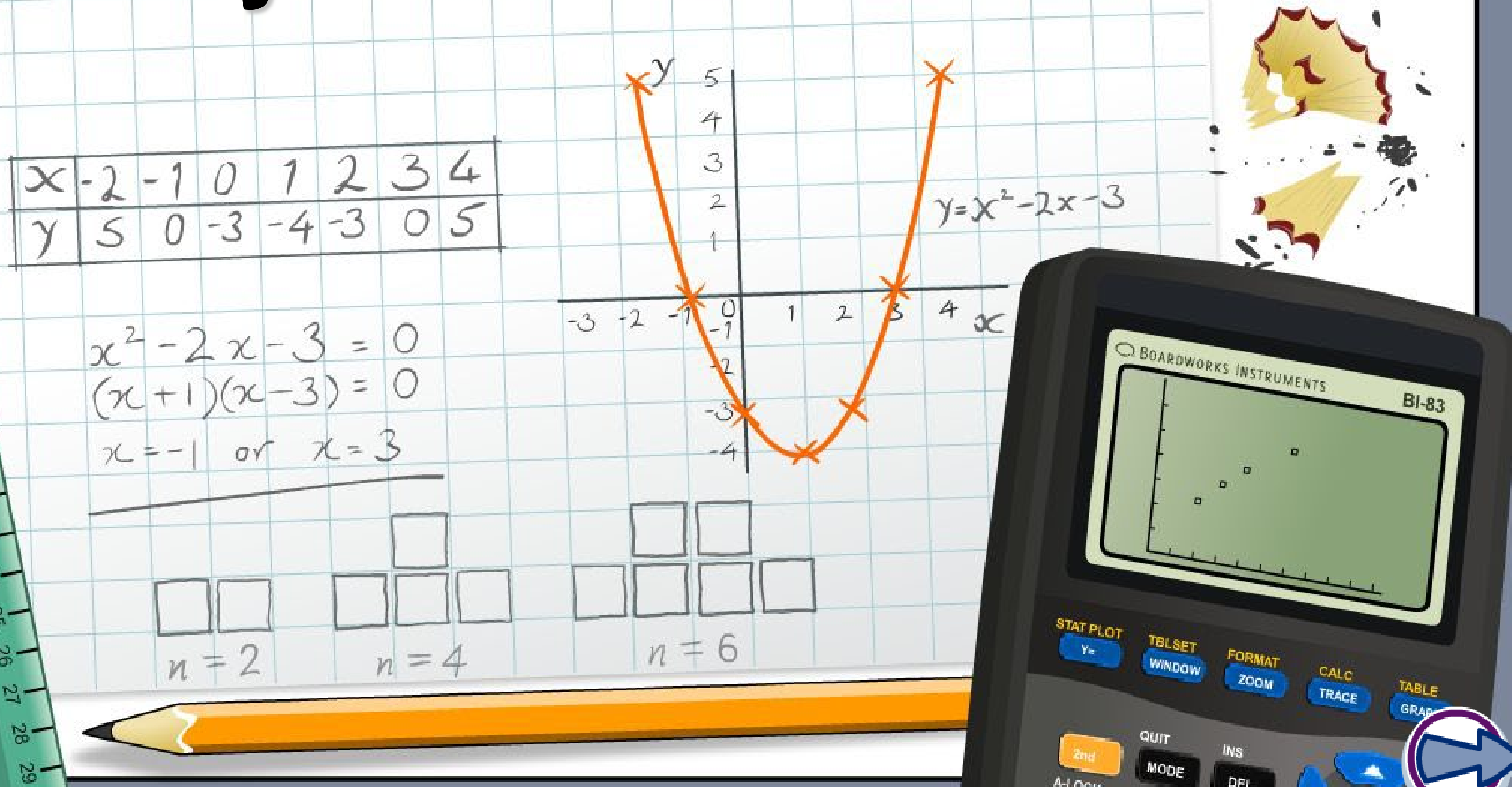
Solving equations by trial and error



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.

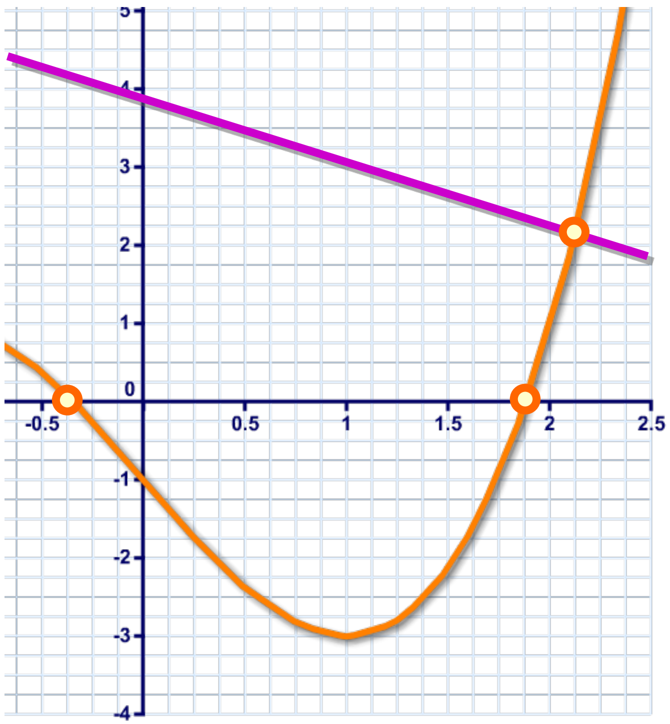
This icon indicates that the slide contains activities created in Flash. These activities are not editable.

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

Trial and error

Sometimes we know an approximate value for a solution of an equation, but we need to find it to a greater degree of accuracy.

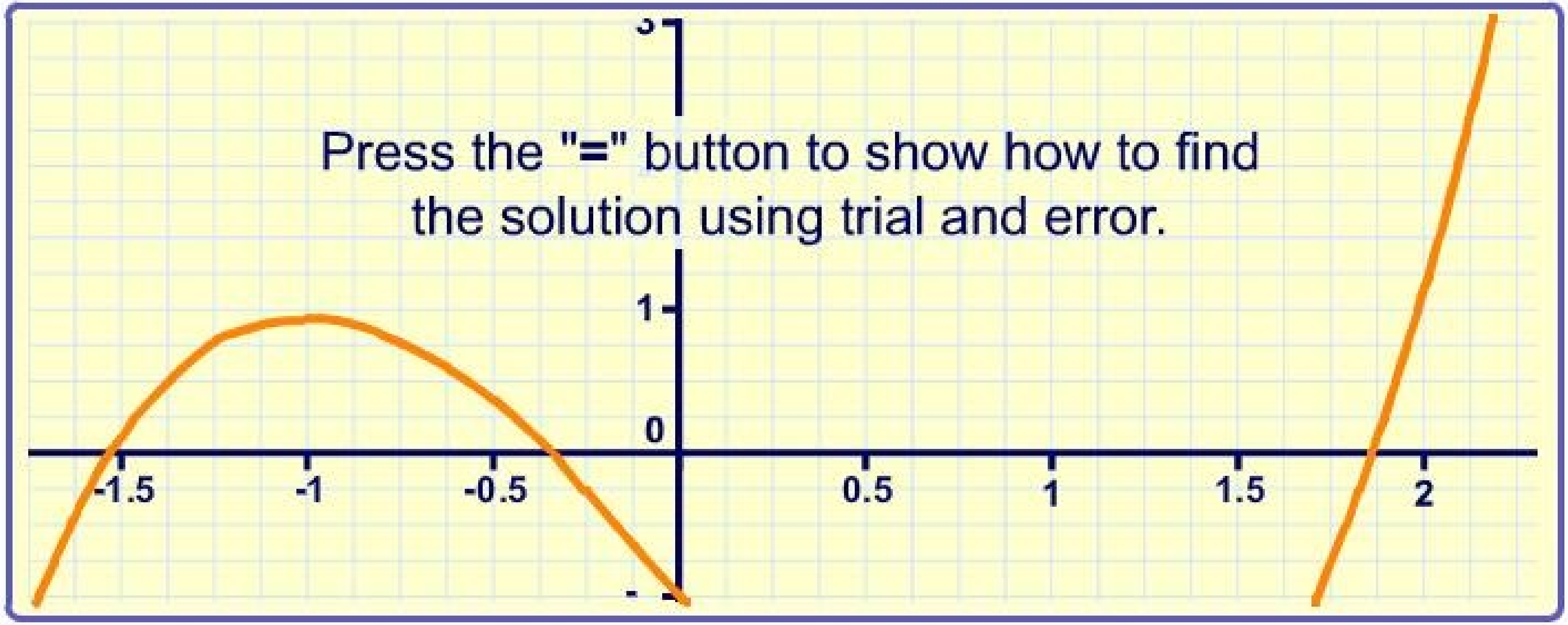
This can happen when we have seen a graph and can read off an approximate value for a **root** of a function or the **intersection** of two functions.



We can improve the accuracy of our answer by substituting successive approximations into the equation and seeing whether they make it true.

This method of finding a solution is called **trial and error**.

The equation $x^3 - 3x = 1$ has a solution when x is approximately equal to 1.9.
Find this solution to the nearest thousandth.



Tennis

Dana hits a ball so that its height can be modeled by the equation $h = –16t^2 + 8t + 4$, where h is height in feet and t is time in seconds since Dana hit it.

The ball hits the ground after less than a second. Find this time to the nearest hundredth.

When the ball hits the ground, its height is 0 feet.

We need to solve the equation $\mathbf{0 = –16t^2 + 8t + 4}$.

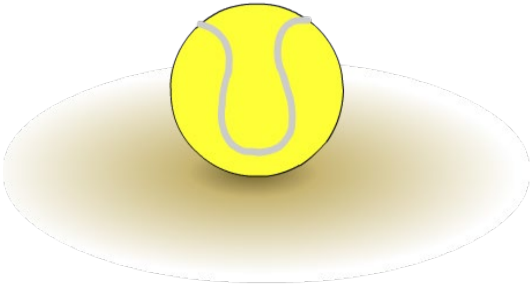
As x is the time since Dana hit the ball,
we are only interested in **positive** values for t.

We need a value of t such that $\mathbf{0 \le t < 1}$.

Tennis solution

x	$-16x^2 + 8x + 4$	≈ 0?
1	-4	too low
0.9	-1.76	too low
0.8	0.16	too high
0.81	-.0176	too low
0.805	0.0716	too high

This shows the solution is between 0.805 and 0.810, so it is 0.81 to the nearest hundredth.



The ball hits the ground 0.81 seconds after Dana hit it.

Trial and error can also be used to find the **intersection** of two functions.

The functions $y = 3x^3 + x^2 + x + 7$ and $y = –2x^3 + x^2 – 68$ intersect between $x = 2$ and $x = 3$.
Find the x-coordinate of the point of intersection, correct to 2 decimal places.

Write the functions as equal to each other:

$$3x^3 + x^2 + x – 7 = –2x^3 + x^2 + 68$$

Rearrange so all variables are on the same side:

$$3x^3 + 2x^3 + x^2 – x^2 + x = 68 + 7$$

$$5x^3 + x = 75$$

Now solve this equation by trial and error.

Intersection solution

x	$5x^3 + x$	≈ 75?
2.5	80.63	too high
2.4	71.52	too low
2.45	75.98	too high
2.44	75.07	too high
2.43	74.17	too low
2.435	74.62	too low

The functions $y = 3x^3 + x^2 + x + 7$ and $y = -2x^3 + x^2 - 68$ intersect at $x = 2.44$, correct to 2 decimal places.

Practice

$4x^2 - 5x = 92$. Find x.

0 • 0		

Answer to the nearest hundredth: 0 • 0 0