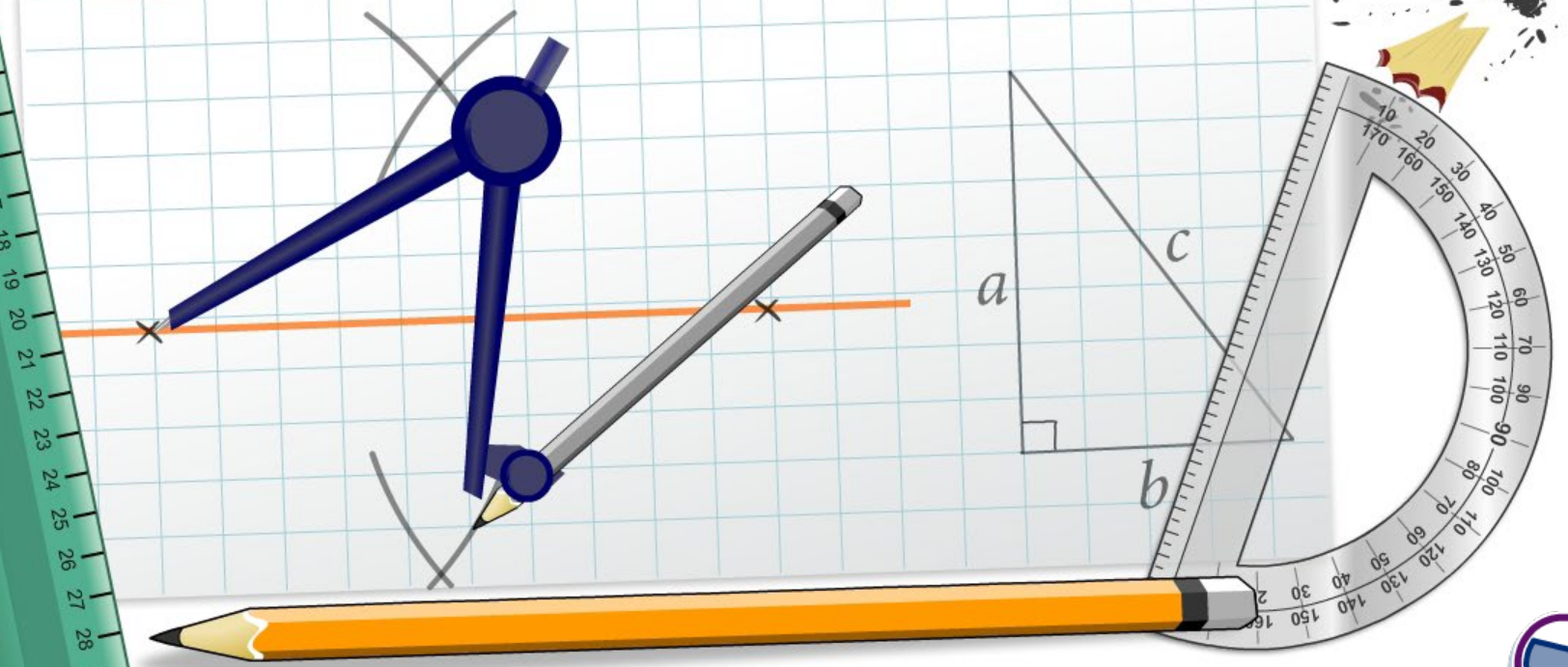
Using the Pythagorean Theorem



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.

These 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.

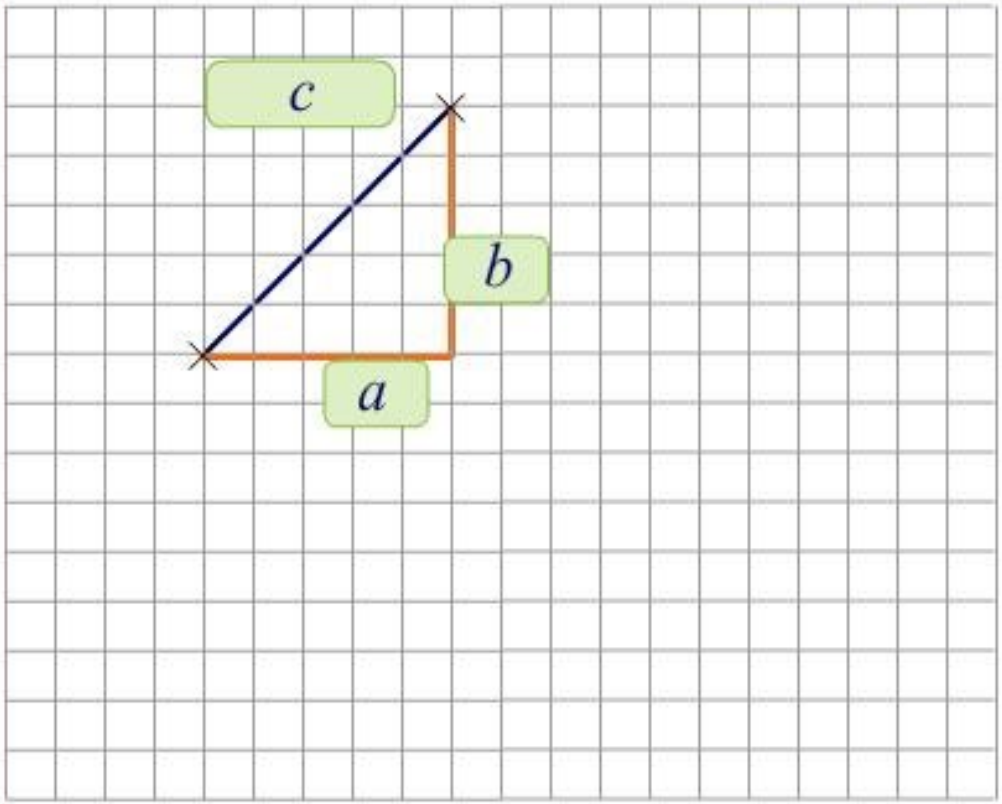
8) Look for and express regularity in repeated reasoning.

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.

Diagonals

Adjust the triangle, then hide/reveal chosen values and calculate the unknowns.



$a^2 + b^2 = c^2$

$\square + \square = \square$

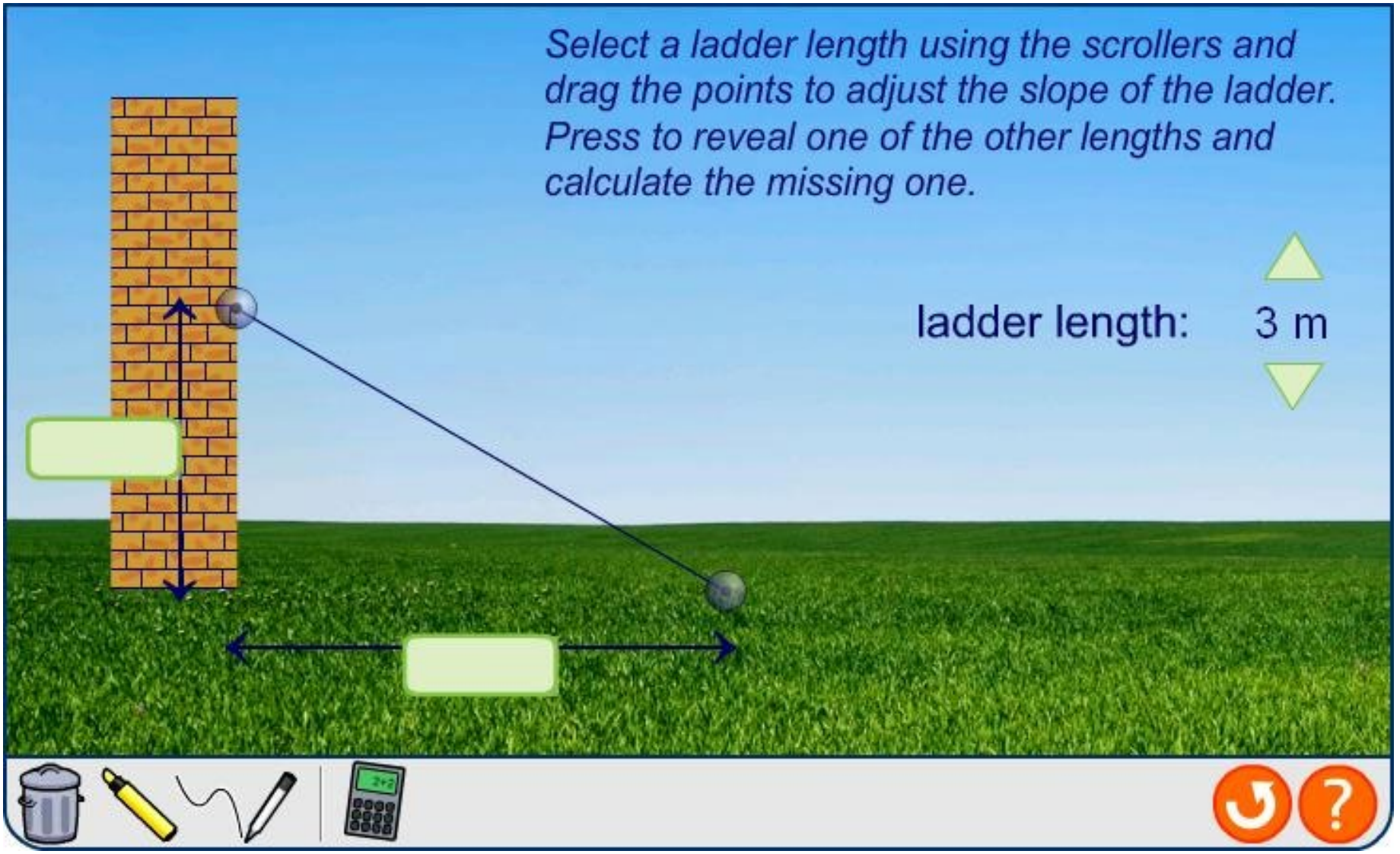
c = reveal

= reveal

= reveal

(to nearest hundredth)

Ladder problem



Flight path problem

Press 'go' to play each stage of the flight path animation. When the green box appears, calculate the missing length before pressing to reveal it.

A plane flies 286km due east.

Go

Using the Pythagorean theorem twice

Find the length of side x.

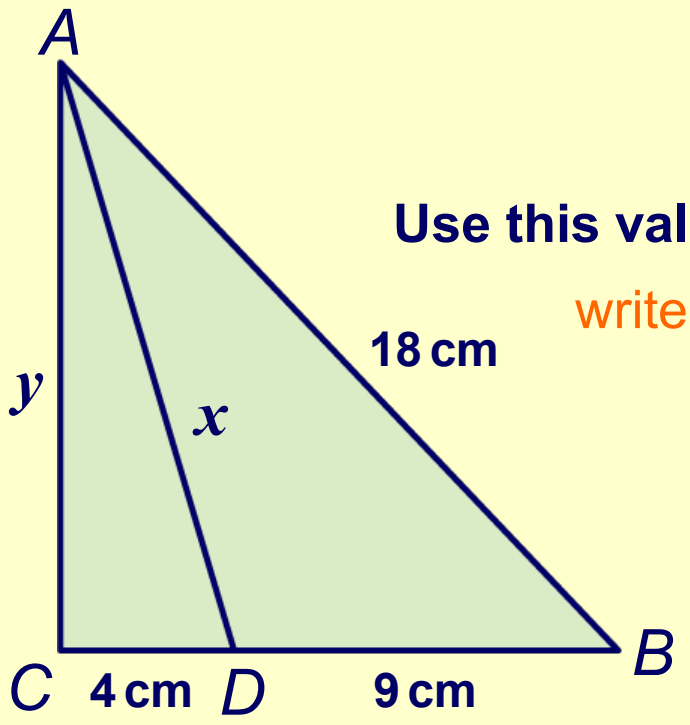
First, find the value of y^2.

write the Pythagorean theorem: $h^2 = a^2 + b^2$

substitute for given values: $18^2 = y^2 + (4 + 9)^2$

rearrange: $y^2 = 18^2 - (4 + 9)^2$

evaluate: $y^2 = 155$



Use this value to find the length of x.

write the Pythagorean theorem: $x^2 = y^2 + 4^2$

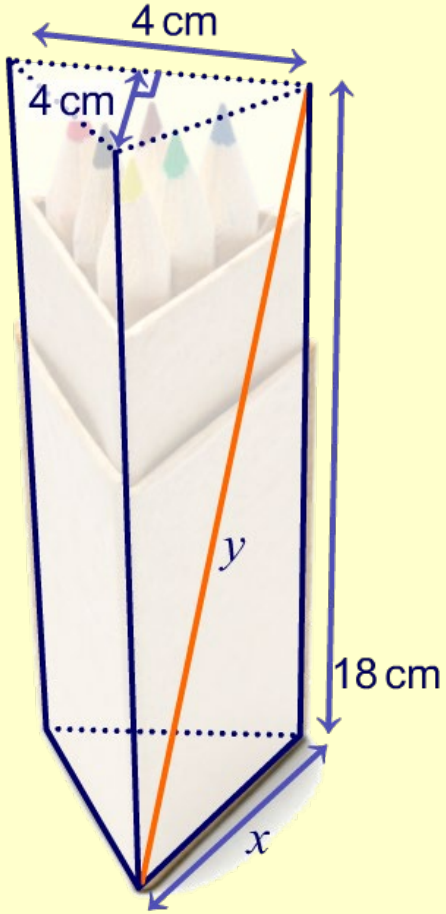
substitute: $x^2 = 155 + 4^2$

evaluate: $x^2 = 171$

square root both sides: **$x = 13.08$ cm (nearest hundredth)**

Pencil box

This is Maria's new pencil case. What is the longest pencil that can fit inside (diagonally) when the lid is on?



The longest diagonal is y.

apply the Pythagorean theorem to find x^2:	$x^2 = 4^2 + 2^2$
evaluate:	$x^2 = 20$
apply the Pythagorean theorem to find y:	$y^2 = 18^2 + x^2$
substitute:	$y^2 = 18^2 + 20$
evaluate:	$y^2 = 344$
square root both sides of the equation:	y **= 18.54 cm (nearest hundredth)**

The longest pencil must be less than 18.54 cm long.

Pythagorean triples

A triangle has sides of length 3 cm, 4 cm and 5 cm. Does this triangle have a right angle?

The Pythagorean theorem states if the sum of the squares on the two shorter sides is equal to the square on the longest side, the triangle has a right angle.

If the triangle has a right angle, then

$3^2 + 4^2$ will be equal to 5^2

(this is the Pythagorean theorem)

evaluating: $3^2 + 4^2 = 9 + 16$ $5^2 = 5 \times 5$

$= 25$ $= 25$

Therefore the triangle has a right angle.

The numbers 3, 4 and 5 form a **Pythagorean triple**.

Pythagorean triples

Three whole numbers a, b and c, where c is the largest, form a **Pythagorean triple** if,

$$a^2 + b^2 = c^2$$

3, 4, 5 is the simplest Pythagorean triple.

Write down every square number from $1^2 = 1$ to $20^2 = 400$.

Use these numbers to find as many Pythagorean triples as you can.

Write down any patterns that you notice.

Pythagorean triples

How many Pythagorean triples did you find?

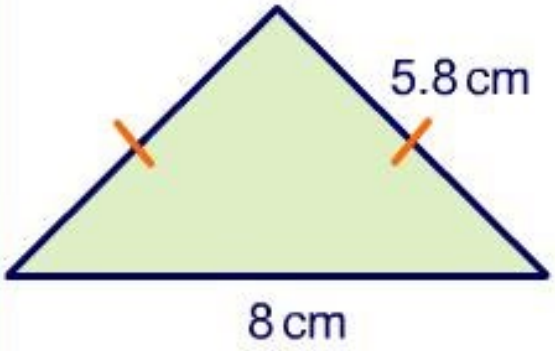
$9 + 16 = 25$	→	$3^2 + 4^2 = 5^2$	→	3, 4, 5
$36 + 64 = 100$	→	$6^2 + 8^2 = 10^2$	→	6, 8, 10
$25 + 144 = 169$	→	$5^2 + 12^2 = 13^2$	→	5, 12, 13
$81 + 144 = 225$	→	$9^2 + 12^2 = 15^2$	→	9,12, 15
$64 + 225 = 289$	→	$8^2 + 15^2 = 17^2$	→	8, 15, 17
$144 + 256 = 400$	→	$12^2 + 16^2 = 20^2$	→	12, 16, 20

The Pythagorean triples 3, 4, 5; 5, 12, 13 and 8, 15, 17 are called **primitive Pythagorean triples** because they are not multiples of another Pythagorean triple.

Finding the height of triangles

Using the Pythagorean Theorem

Question: 1/3 Calculate the height, h, of this isosceles triangle.



Press the "=" button to show the calculations step-by-step.