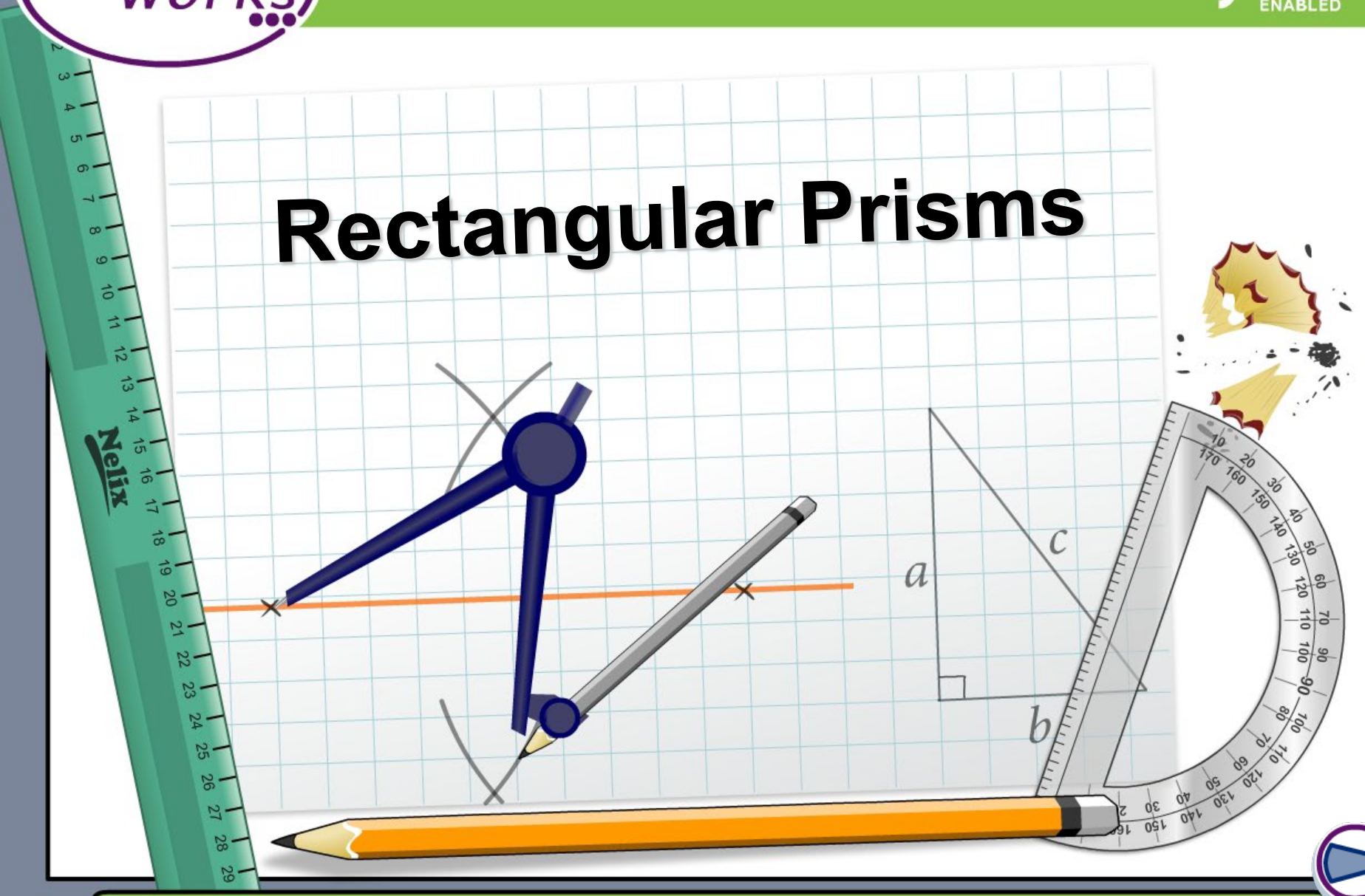
Rectangular Prisms



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.

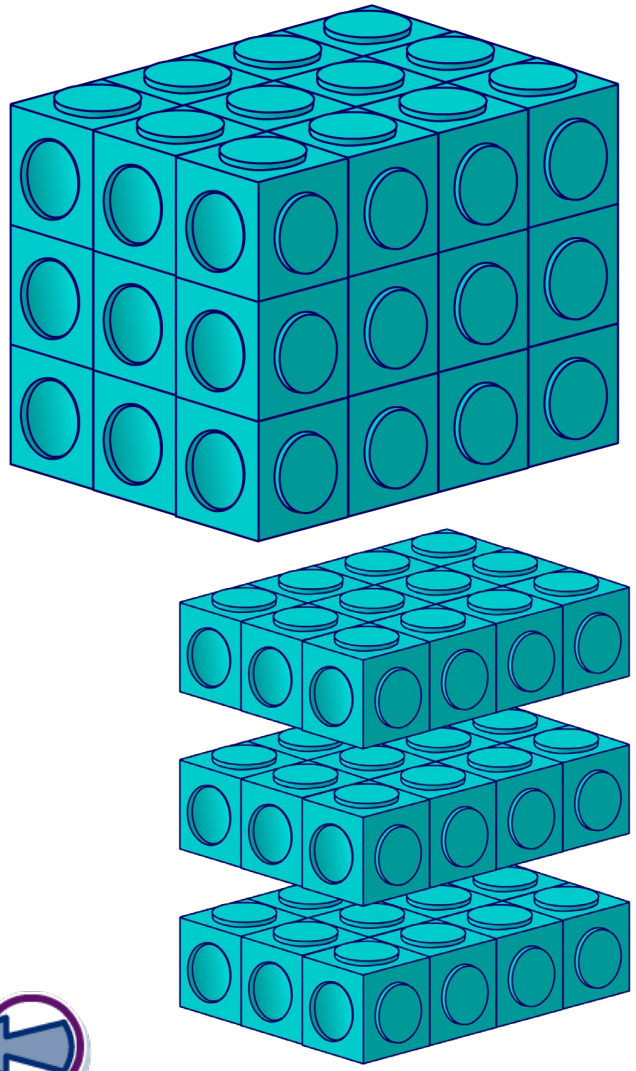
8) Look for and express regularity in repeated reasoning.

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.

How many cubes?

The following rectangular prism is made of interlocking cubes.



How many cubes does it contain?

Divide the rectangular prism into layers.

calculate the number of small cubes in a layer:

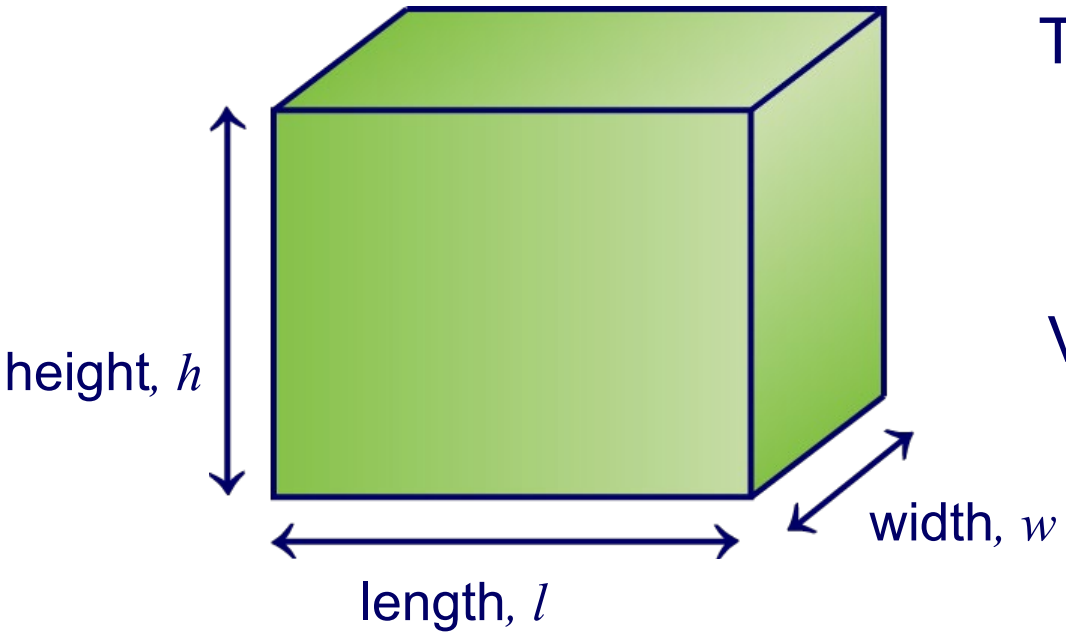
multiple the length
by the width: $3 \times 4 = 12$ cubes

find the number of cubes in the whole prism:

multiple the number of
cubes in one layer by
the height: $12 \times 3 =$ **36 cubes**

Volume of a rectangular prism

The volume of a rectangular prism can be found by multiplying the area of the base by the height.



The area of the base:

= length × width

= lw

Volume of the prism:

= base × height

= lwh

The volume of a rectangular prism

= length × width × height

= lwh

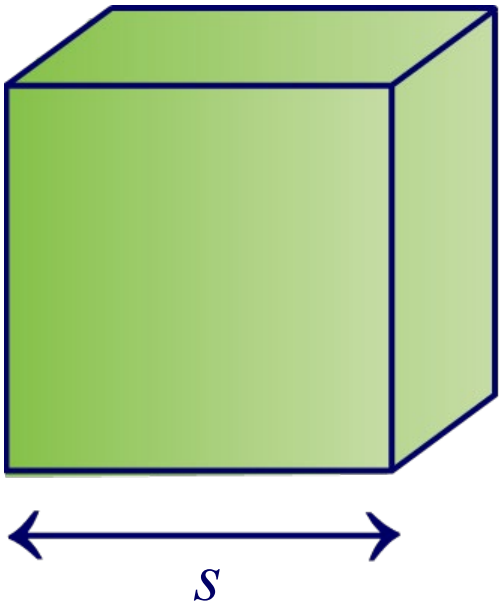
What is the volume?

Match the prism dimensions with their volumes.

2 by 5 by 3	64 units^2
3 by 4 by 3	25 units^2
4 by 4 by 4	30 units^2
1 by 5 by 5	36 units^2

Volume of a cube

How can the volume of a cube of side length s be found?



The length, width and height of a cube are all the same.

write the equation for the volume of a rectangle: $= l \times w \times h$

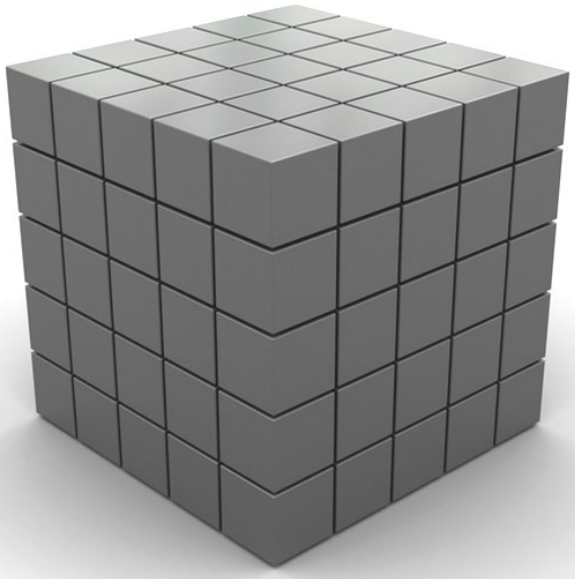
substitute: $= s \times s \times s$

combine terms: $= s^3$

The volume of a cube
= (length of one edge)^3
= s^3

What is the surface area?

This cube is made from 125 cubes. Each of the smaller cubes is 1 cm long.



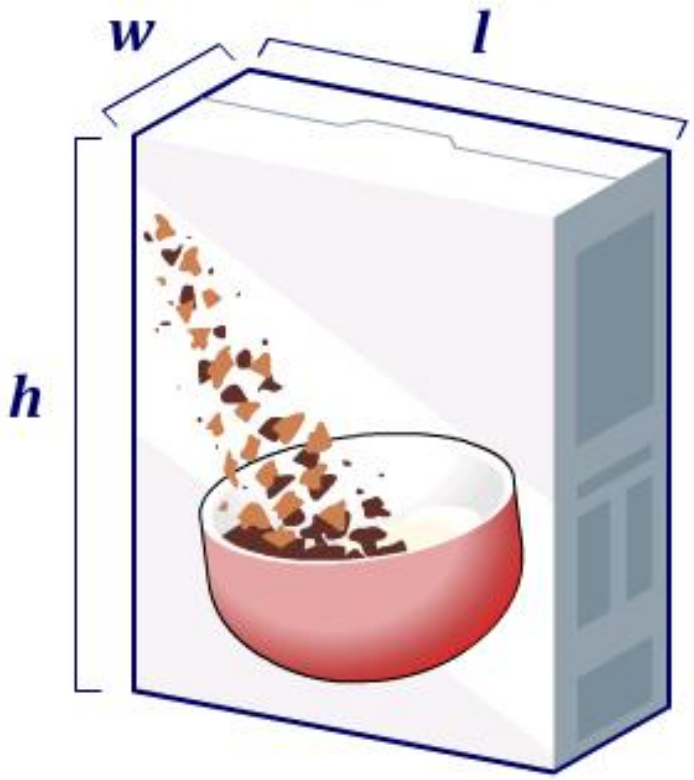
What is the surface area of the larger cube?

surface area of one side:	$5 \times 5 = 25\,\text{cm}^2$
multiply by the number of sides:	$25 \times 6 = \mathbf{150\,cm^2}$

Formula for the surface area of a rectangular prism

To find the surface area of a rectangular prism, you need to calculate the total area of all of the faces of the shape.

Press **play** to find out more.



Surface area formula

The **surface area** of a rectangular prism is the combined area of all its sides.

top and bottom +

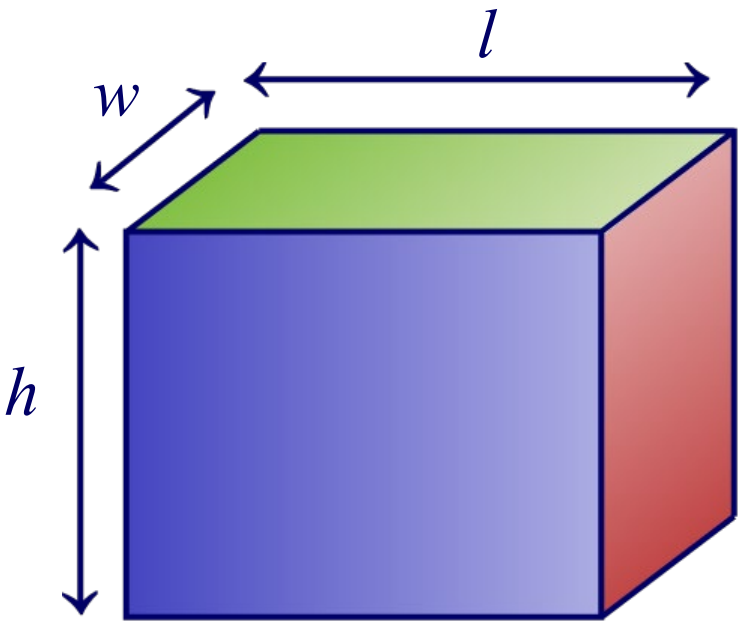
$2 \times lw$ +

front and back +

$2 \times lh$ +

left and right side

$2 \times hw$



The surface area of a rectangular prism

$= 2lw + 2hw + 2lh$

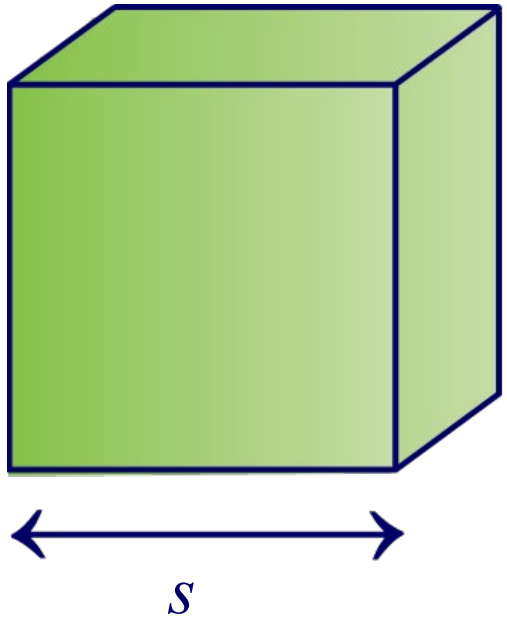
Special rectangular prisms

Rectangular prisms can have a variety of lengths and widths. They can range from short and fat to long and thin.

Find a rectangular prism (with edges of integer lengths) that has a surface area of exactly 100 cm^2.

Surface area of a cube

How can the surface area of a cube of side length s be found?



write equation for surface area of one face:	$= l \times w$
substitute:	$= s \times s$
combine terms:	$= s^2$
multiple by the number of sides:	$= \mathbf{6}s^2$

The surface area of a cube
$= 6s^2$

Volume and surface area

surface area = volume

surface area ≠ volume

Drag the dimensions of the rectangular prisms to the correct place depending on whether their surface area and volume are the same or not.

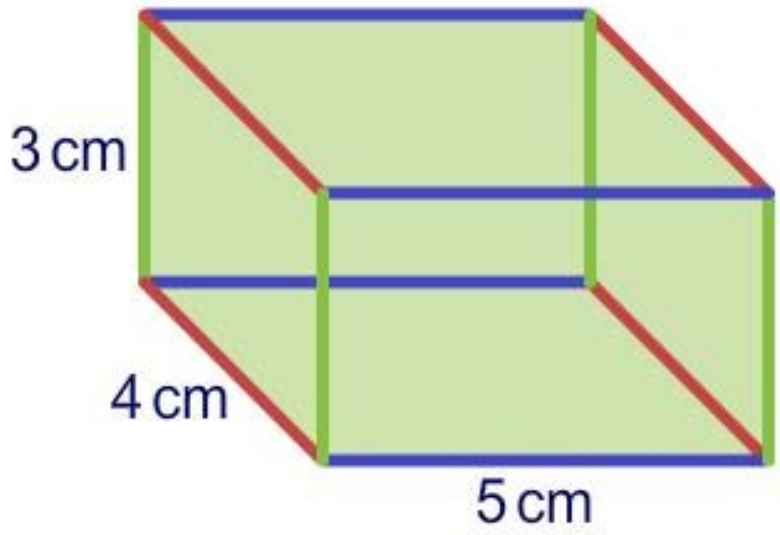
Press **start** to begin.

start

Length around the edges

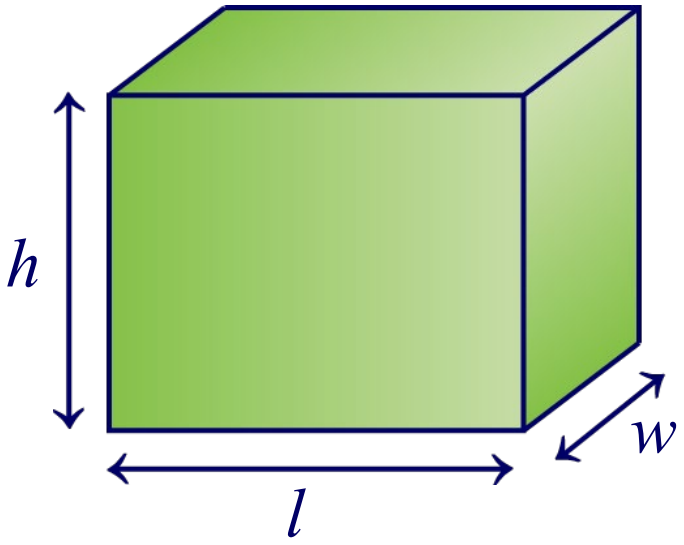
A rectangular prism has the dimensions:
length 5 cm
width 4 cm
height 3 cm
What is the total length around the edges?

Press **play** to find out more.



Length around the edges

To find the length around the edges of a rectangular prism of length l, width w and height h, use the formula:



Length around the edges of a rectangular prism

$$= 4l + 4w + 4h$$

$$= 4(l + w + h)$$

To find the length around the edges of a cube with side length l, use the formula:

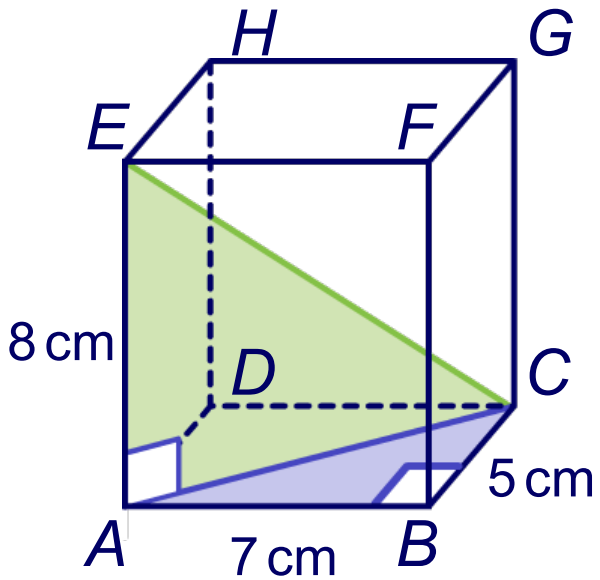
Length around the edges of a cube:

$$= 12l$$

Longest diagonal

The Pythagorean theorem can be applied to 3D problems.

What is the length of the longest diagonal in a rectangular prism measuring 5 cm by 7 cm by 8 cm?



identify the longest diagonal: CE

We could also use AG, BH or DF.

use the Pythagorean theorem to find the AC: $AC^2 = CB^2 + AB^2$

substitute values: $AC^2 = 25 + 49$

evaluate: $AC = 8.60$ cm

the Pythagorean theorem, to find the CE: $CE^2 = AE^2 + AC^2$

substitute values: $CE^2 = 8^2 + 74$

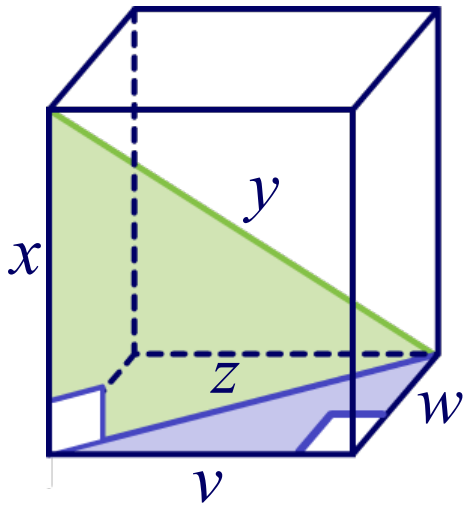
evaluate: $\mathbf{CE = 11.75}$ **cm**

(to nearest hundredth)

Formula for the longest diagonal

Show that the longest diagonal y in a rectangular prism measuring v by w by x is given by the formula:

$$y = \sqrt{(v^2 + w^2 + x^2)}$$



use Pythagorean theorem to find z:

$$z^2 = v^2 + w^2$$

use the Pythagorean theorem to find y:

$$y^2 = z^2 + x^2$$

substitute in the equation for z:

$$y^2 = (v^2 + w^2) + x^2$$

$$y = \sqrt{(v^2 + w^2 + x^2)}$$

Rectangular prism diagonals

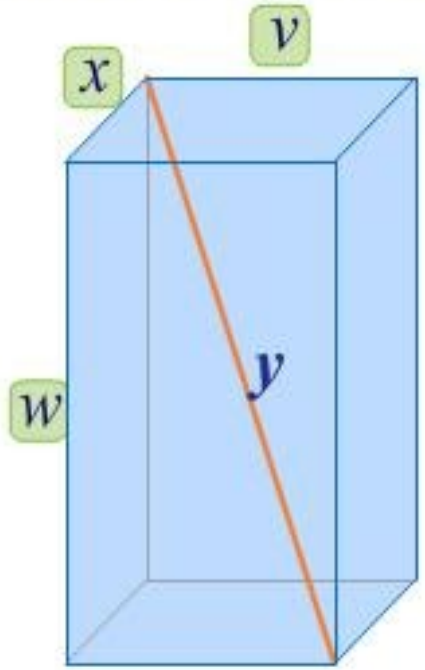
Adjust the prism and hide/reveal chosen values. Calculate the unknowns.

$$y = \sqrt{v^2 + w^2 + x^2}$$

$$= \text{reveal}$$

$$= \text{reveal}$$

(to nearest hundredth)



Longest diagonal

A rectangular prism has side lengths of 8 cm, 10 cm and 11 cm.

Use the formula $y = \sqrt{(v^2 + w^2 + x^2)}$ to find the length of the longest diagonal y to the nearest hundredth.

Substitute the values into the formula:

$$y = \sqrt{(8^2 + 10^2 + 11^2)}$$

$$y = \sqrt{(64 + 100 + 121)}$$

$$y = \sqrt{285}$$

$$y = 16.88 \text{ cm}$$

(to the nearest hundredth)