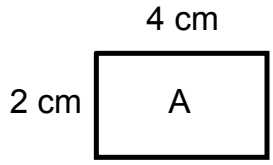
Similarity

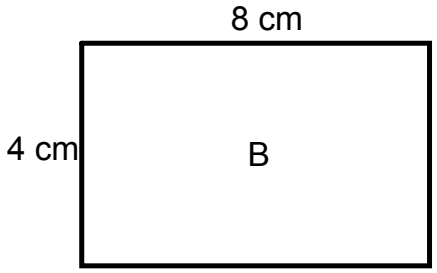
Goal:

- to understand the relationship between similar figures and solids

Which of the following are similar figures?



$P = 12$ cm $A = 8$ cm^2

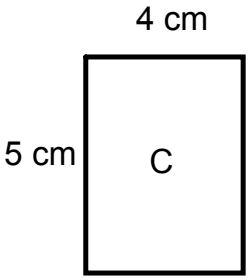


$P = 24$ cm

$A = 32$ cm^2

A and B since the similarity ratio, k, is constant.

$k = \frac{8\text{ cm}}{4\text{ cm}} = 2$ ✓ $k = \frac{4\text{ cm}}{2\text{ cm}} = 2$ ✓



How are the perimeters related? k

How are the areas related? k^2

The ratio of the side lengths of similar figures/solids is called the similarity ratio, *k*.

The perimeter of two similar figures will also be related by *k*.

The area of two similar figures will be related by k^2.

p.110 #4. ratio of areas = $\frac{9}{4}$

$k^2 = \frac{9}{4} = 2.25$

$k = \sqrt{\frac{9}{4}} = \frac{3}{2} = 1.5$

small perimeter = 50 cm

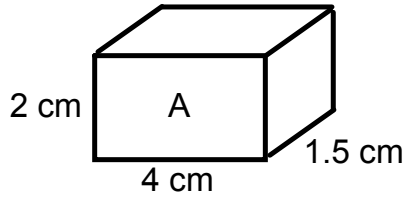
big perimeter = ?

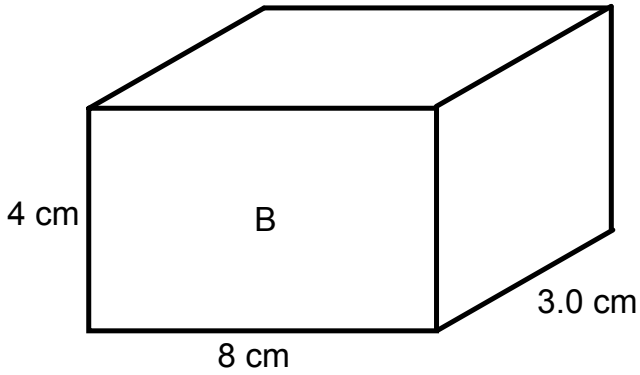
big per = 50 cm · k

= 50 cm (1.5)

= 75 cm

What about similar solids?





$V_A = 4\text{ cm}(1.5\text{ cm})2\text{ cm}$

$= 12\text{ cm}^3$

$V_B = 8\text{ cm}(3.0\text{ cm})4\text{ cm}$

$= 96\text{ cm}^3$

$k^3 = 2^3 = 8$

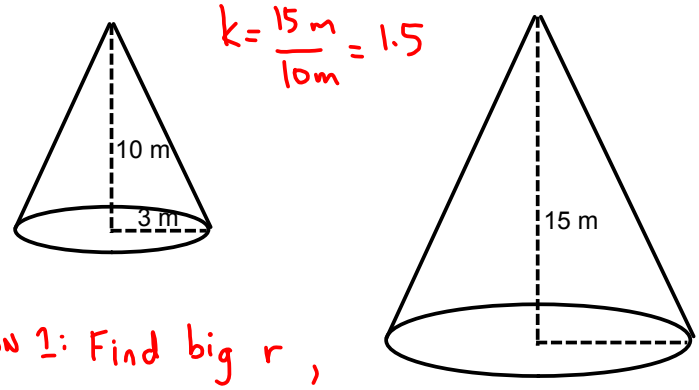
For solids,

The side lengths are related by k.

The surface areas are related by k^2.

The volumes are related by k^3.

Ex: The following two solids are similar. What is the surface area and volume of the larger solid?



$k = \frac{15\text{ m}}{10\text{ m}} = 1.5$

OPTION 1: Find big r, calculate SA and V.

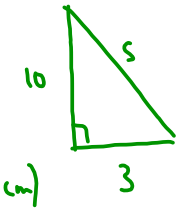
OPTION 2: Find small SA and V use k.

$SA = A_b + A_\ell$

$= \pi r^2 + \pi r s$

$= \pi(3\text{cm})^2 + \pi(3\text{cm})(10.4\text{cm})$

$= 126.3\text{ cm}^2$



$s^2 = 10^2 + 3^2$

$s^2 = 109$

$s = \sqrt{109}$

$s = 10.4\text{ cm}$

big SA $= 12'3\text{cm}^2 \cdot k^2$

$= 126.3\text{cm}^2 (1.5)^2$

$= 284.2\text{ cm}^2$

$V = A_b \cdot h \div 3$

$= \pi r^2 h \div 3$

$= \pi(3\text{cm})^2\, 10\text{cm} \div 3$

$= 30\pi\text{ cm}^3$

$= 94.2\text{ cm}^3$

big volume $= 94.2\text{cm}^3 \cdot k^3$

$= 94.2\text{cm}^3 (1.5)^3$

$= 317.9\text{ cm}^3$

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