

4.1 Enlargements and Reductions

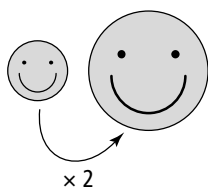
Link the Ideas

Working Example 1: Draw an Enlargement

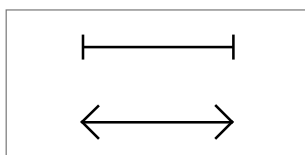
enlargement

- to make an object larger by a constant factor
- can be 2-D or 3-D
- example: this smiley face doubles in size

multiply by the same number



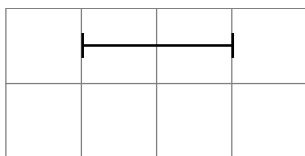
Draw a picture with dimensions that are twice as large as the original.



Solution

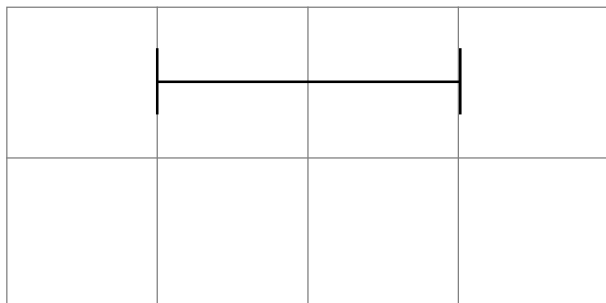
Method 1: Use Grid Paper

Trace the picture on centimetre grid paper.
The top design is done for you. Draw the bottom arrow on the grid.



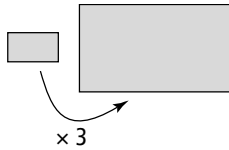
How could you use 1-cm grid paper to draw the enlargement?


Now draw the picture on 2-cm grid paper.
Cover the same amount of each grid square.
The top design is done for you. Draw the bottom arrow on the grid.

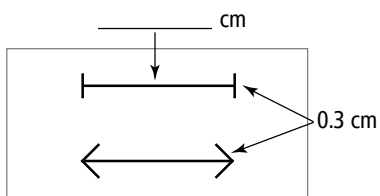


*Method 2: Use a Scale Factor***scale factor**

- the factor by which an object is enlarged or reduced in a scale drawing
- example: the dimensions of this rectangle are multiplied by 3, so the scale factor is 3



Measure the length of each line segment. 



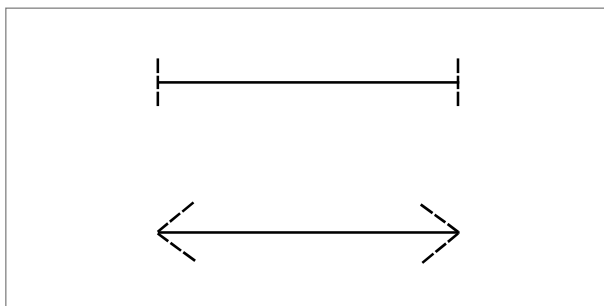
Multiply the length by a **scale factor** of 2.

$$2 \times 2 = \underline{\hspace{2cm}} \text{ cm}$$

$$0.3 \times 2 = \underline{\hspace{2cm}} \text{ cm}$$

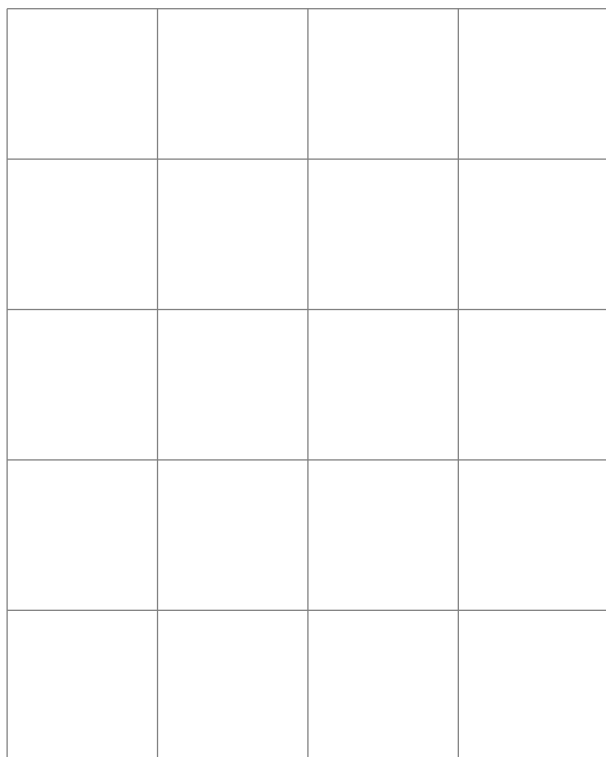
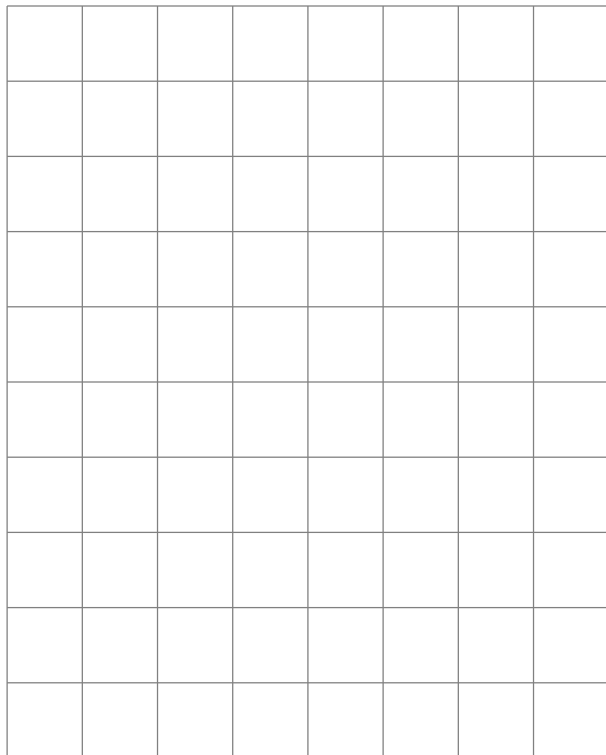
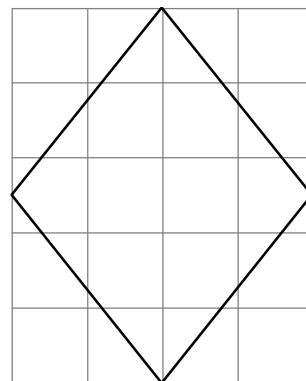
The line lengths for the enlargement are _____ cm and _____ cm.

Use the new lengths to complete the drawing of the enlargement.



Show You Know

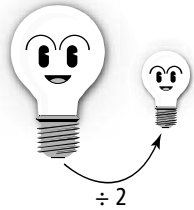
Use 2 methods to draw this picture 2 times larger than the original.



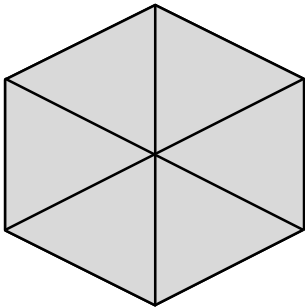
Working Example 2: Draw a Reduction**reduction**

- to make an object smaller by a constant factor
- can be 2-D or 3-D
- example: this light bulb is half the size of the original

FOLDABLES™
Study Tool

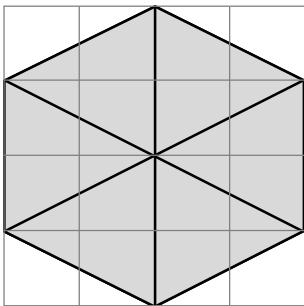


Draw a reduction that is half the size of the original.

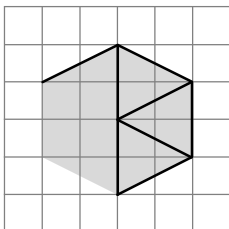
**Solution**

Method 1: Use Grid Paper

Trace the picture on centimetre grid paper.




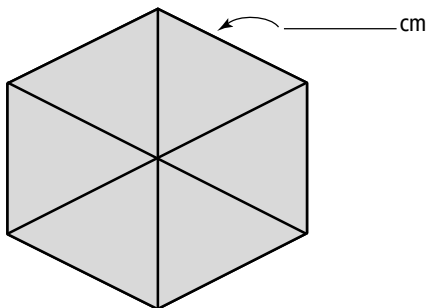
Complete the drawing on 0.5-cm grid paper.
Cover the same amount of each grid square.



What if you only have 1-cm grid paper? How could you draw the reduction?

Method 2: Use a Scale Factor

Measure the length of each line segment. 



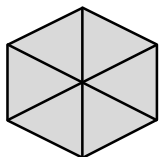
Reduce this shape using a scale factor of 0.5.

Multiply each length by 0.5.

$2 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ cm}$

The length of each line segment for the reduction is 1 cm.

Use the new length of _____ to draw the reduction.



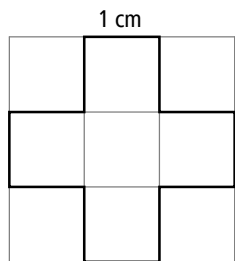
The scale factor tells you whether the object is enlarged or reduced.

- A scale factor greater than 1 is an enlargement.
- A scale factor less than 1 is a reduction.

What is a scale factor of 1?

Show You Know

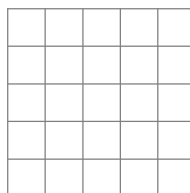
Draw a reduction of this shape using a scale factor of 0.5.



Length of 1 side of the original = _____ cm

Length of 1 side of the reduction = _____ \times 0.5

= _____ cm



4.2 Scale Diagrams

scale

- compares the actual size of an object to the size of its diagram
- can be shown as a ratio, a fraction, a percent, in words, or in a diagram
- example: the scale 1:25 means 1 cm on the diagram is 25 cm on the actual object



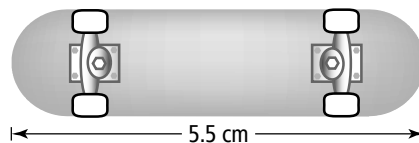
scale diagram

- a drawing that has the same proportions as an actual object
- can be smaller or larger than the actual object

Link the Ideas

Working Example 1: Use the Scale to Determine the Actual Length of an Object

The **scale diagram** of a skateboard has a **scale** of 1:14.
What is the actual length of the skateboard?



Solution

Method 1: Use the Scale

The scale 1:14 means the actual skateboard is 14 times the size of the drawing.
Multiply the length of the drawing by 14.

$$5.5 \times 14 = \underline{\hspace{2cm}} \text{ cm}$$

The actual length of the skateboard is cm.

Method 2: Use a Proportion

Set up a proportion using the scale and the given measurement.

$$\text{scale} = \frac{\text{diagram measurement}}{\text{actual measurement}}$$

$$\begin{array}{c} \times 5.5 \\ \curvearrowright \\ \frac{1}{14} = \frac{5.5}{a} \\ \curvearrowleft \\ \times 5.5 \end{array}$$

The scale is 1:14 or $\frac{1}{14}$.
The diagram is 5.5 cm.

The actual length of the skateboard is cm.

Literacy Link

proportion

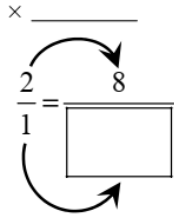
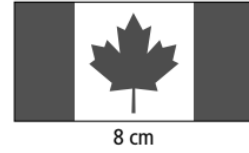
- a relationship that shows that 2 ratios are equal
- can be written as a fraction or ratio
- example: $\frac{1}{4} = \frac{2}{8}$ or $1:4 = 2:8$
- example: 1 apple to 4 pears is the same as 2 apples to 8 pears

Practice Problems:

1.

A Canadian flag is 8 cm long. The ratio of the length to the width is 2:1.

a) How wide is the flag?



Sentence: _____

b) Enlarge the flag by a scale factor of 3. What are the new dimensions?

Use your answer from part a) to answer part b) and c).

Sentence: _____

c) Reduce the flag by a scale factor of 0.25. What are the new dimensions?

Sentence: _____

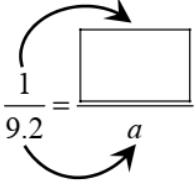
2.

The scale for the diagram of the chinook salmon is 1 : 9.2.

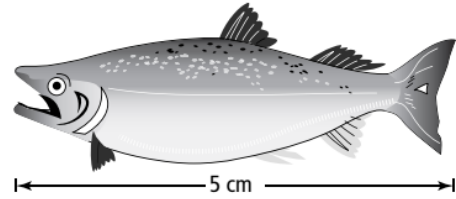
Calculate the actual length of the salmon.

$$\text{scale} = \frac{\text{diagram measurement}}{\text{actual measurement}}$$

× _____



× _____



The actual length of the chinook salmon is _____ cm.

3.

The flying distance from Dawson City to Whitehorse is 540 km.
The distance on the map is 3 cm.

a) Find the scale of the map.

$$\text{scale} = \frac{\text{diagram measurement}}{\text{actual measurement}}$$

$$\frac{3 \text{ cm}}{540 \text{ km}} = \frac{1}{\boxed{}}$$



scale: 1 cm represents _____ km

b) What is the scale factor? Use your answer from part a).

$$1 \text{ km} = 100\,000 \text{ cm}$$

So, 180 km = _____ cm.

So, 1 cm on the map represents _____ cm of actual distance.

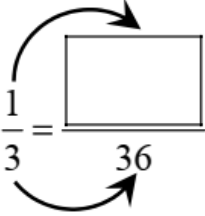
The scale is 1:_____. The scale factor is $\frac{1}{\boxed{}}$.

4.

Complete the proportions.

\times _____

a) $\frac{1}{3} = \frac{\boxed{}}{36}$



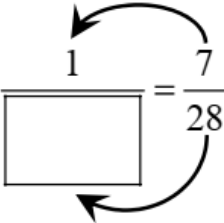
\times _____

c) $\frac{1}{9} = \frac{\boxed{}}{90}$

e) $\frac{1}{7} = \frac{\boxed{}}{1400}$

\div _____

b) $\frac{1}{\boxed{}} = \frac{7}{28}$



\div _____

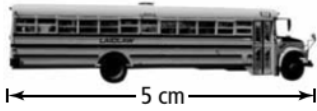
d) $\frac{1}{\boxed{}} = \frac{4}{48}$

f) $\frac{1}{\boxed{}} = \frac{12}{1200}$

5.

Find the actual length of each object.

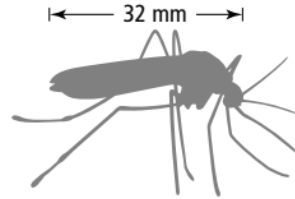
- a) The image of the school bus is 5 cm long.
The scale is 1:300.



$$\frac{1}{300} = \frac{5}{\boxed{}}$$

× _____

- b) The diagram of the mosquito is 32 mm long. The scale is 1:0.5.



$$\frac{1}{0.5} = \frac{32}{\boxed{}}$$

× 32