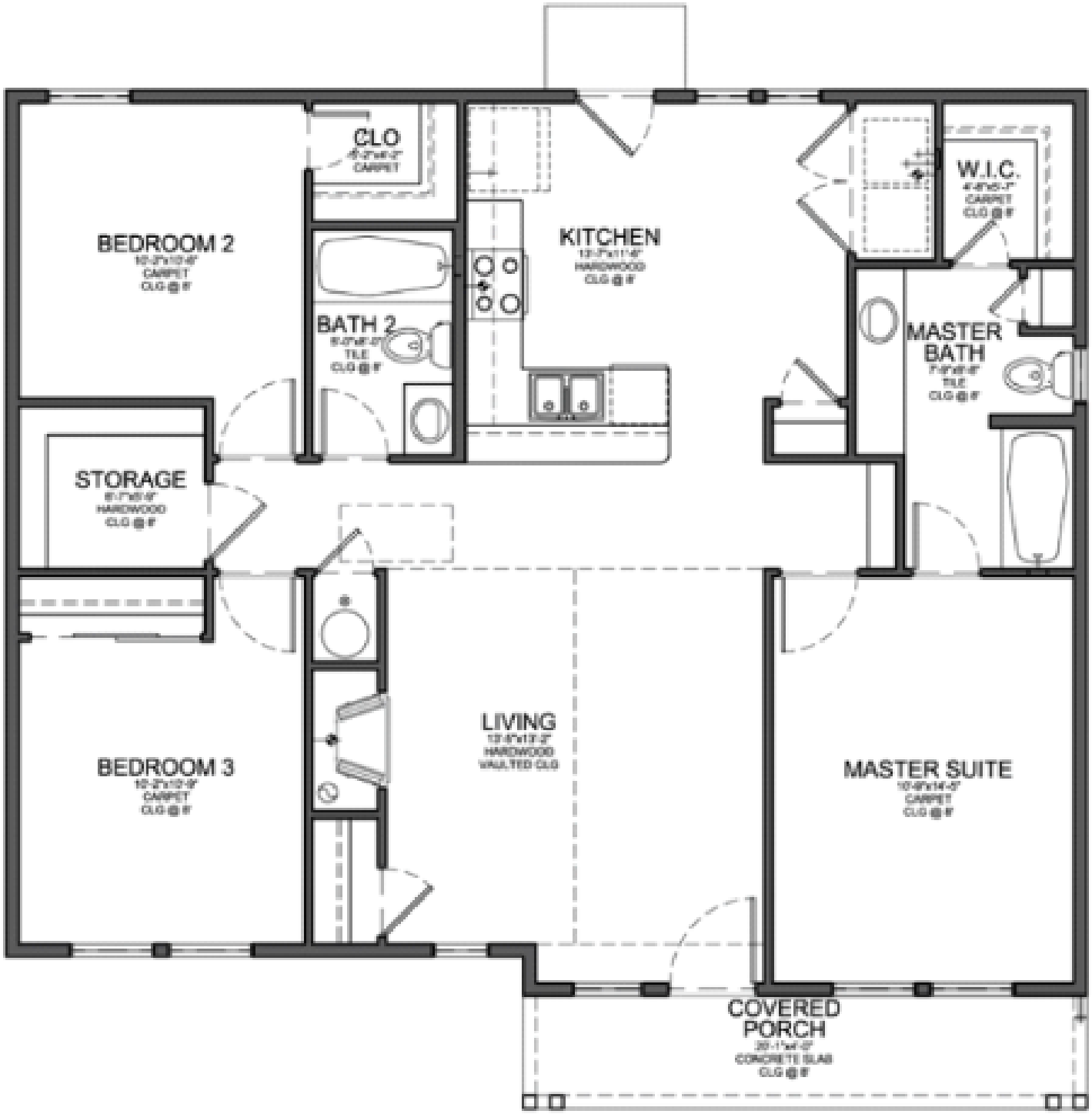
Lesson 2:

Scale Factors

Learning Targets:

1. Understand how a scale factor relates an **original** figure with a **similar changed** figure.
2. Understand how scale factors can create **enlargements** and **reductions**.
3. Using a scale factor to calculate changed measurements.
4. Determining a scale factor from diagrams.
5. Calculating a scale factor from given measurements.
6. Using a scale factor to create the changed figure.

Scale Factors are used to create reductions (such as floor plans and maps) that allow us to see all of something that is very large, and enlargements that allow us to see detail in objects that are very small in real life.


CLO
BEDROOM 2
CARPET
CLG @ 8'
KITCHEN
HARDWOOD
CLG @ 8'
W.I.C.
CARPET
CLG @ 8'
BATH 2
TILE
CLG @ 8'
MASTER
BATH
TILE
CLG @ 8'
STORAGE
HARDWOOD
CLG @ 8'
LIVING
HARDWOOD
VAULTED CLG
BEDROOM 3
CARPET
CLG @ 8'
MASTER SUITE
CARPET
CLG @ 8'
COVERED
PORCH
CONCRETE SLAB
CLG @ 8'


NORTHWEST TERRITORIES
SASKATCHEWAN
MANITOBA
Fort McMurray
Lloydminster
Prince Albert
North Battleford
Humboldt
Saskatoon
Yorkton
Moose Jaw
Regina
Swift Current
Weyburn
Estevan
U.S.A.

Key Term: *Scale Factor*

A number that tells us how much larger an enlargement is, or how much smaller a reduction is, compared to the original.

A scale factor greater than one creates an enlargement of the original.

A scale factor less than one creates a reduction of the original.

A scale factor equal to one does not make any change in the size of the original.

Key Term: *Scale Factor*

Scale Factor Formula: $$k = \frac{\textit{length found in the changed figure}}{\textit{corresponding length in the original figure}}$$

* both lengths must be measured in the same units (m, cm, mm, etc)

*Scale factors can be represented as integers, fractions, decimals, or percents.

less than 100% = red.
greater than 100% = enl.

enlargements

less than 1 = red.
greater than 1 = enl.

proper = reduction
improper = enlargement

Example:

If we used the scale factor given, would it create an enlargement or a reduction of the original object?

$k = \frac{8}{3}$ enlargement

$k = 0.97$ reduction

$k = \frac{1}{4}$ reduction

$k = 6$ enlargement

$k = 15\ \%$ reduction

(0.15)

$k = 180\ \%$ enlargement

(1.8)

Example:

Write each of the following scale factor ratios so that they are fractions in lowest terms, decimals, and percents:

a) $\frac{15}{200}$ $\div 5$ $\div 5$

$= \frac{3}{40}$

$= 0.075$

$= 7.5\%$

b) $\frac{6.3}{27}$ $\times 10$ $\times 10$

$= \frac{63}{270}$ $\div 9$ $\div 9$ $= \frac{7}{30}$

$= 0.2\overline{3}$

$= 23.\overline{3}\ \%$

Using Scale Factors to determine measurements in the changed figure

Scale factors are MULTIPLIERS. In order to determine the measurements in a changed figure, you multiply the measurements in the original figure by the scale factor:

length in changed figure = (k) x (length in original figure)

Example:

Suppose you have a pencil that is 6 cm long. If you were to draw a picture of the pencil, how long would it be if the scale factor you use is:

a) k = 20 $20 \times 6\text{ cm} = 120\text{ cm}$

b) k = 0.75 $0.75 \times 6\text{ cm} = 4.5\text{ cm}$

c) k = 1/3 $\frac{1}{3} \times 6\text{ cm} = 2\text{ cm}$

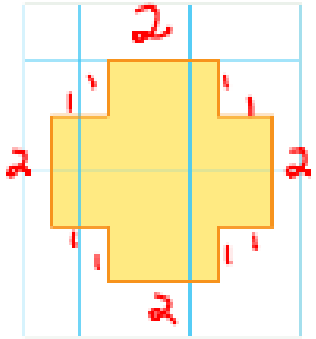
d) k = 250%

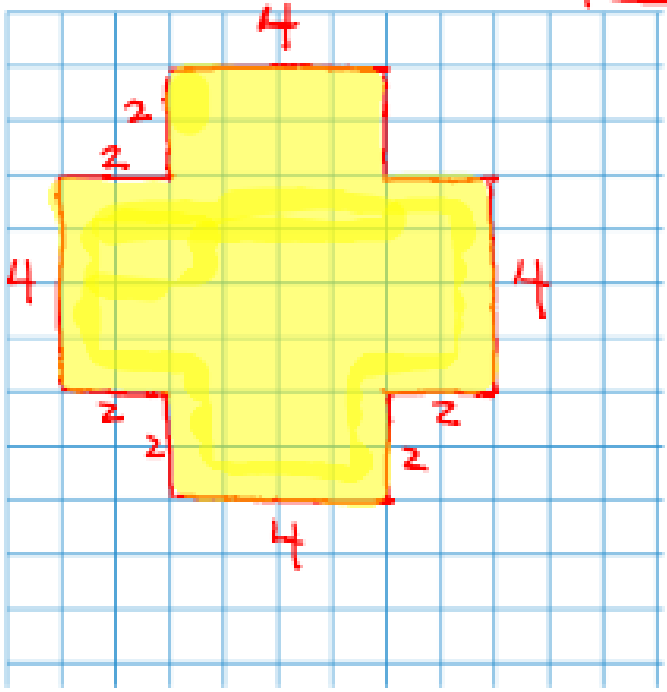
↳ $k = 2.5$ $2.5 \times 6\text{ cm} = 15\text{ cm}$

Using Scale Factors to draw the changed figure

When a figure is drawn on grid paper, it becomes easier to produce an enlargement or reduction.

Draw the enlargement of the figure below using a scale factor of 2:



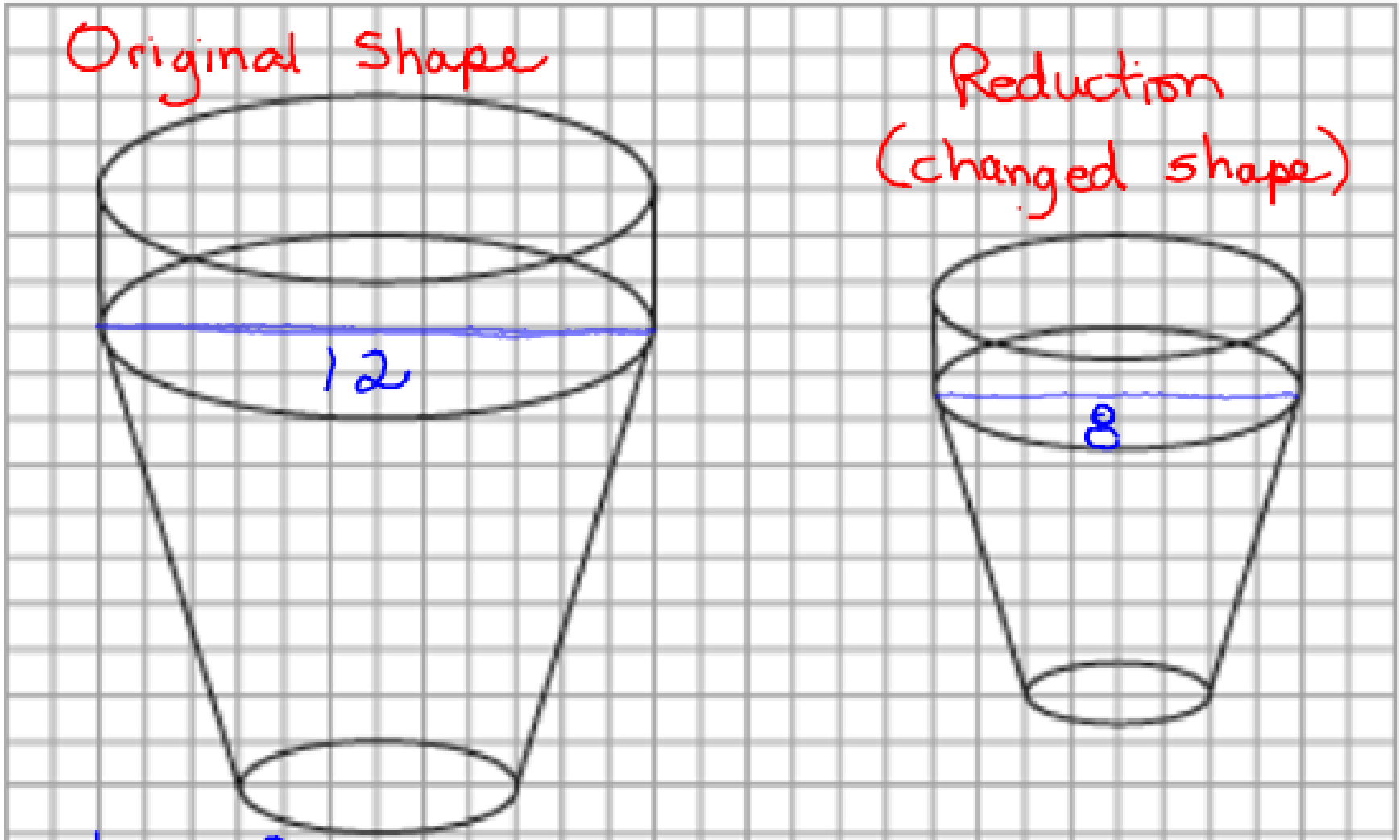


Calculating a scale factor

When you have been given a pair of corresponding measurements from the changed figure and the original figure, the scale factor can be determined by substituting the numbers into the scale factor formula.

$$k = \frac{\textit{length found in the changed figure}}{\textit{corresponding length in the original figure}}$$

Example: What scale factor was used to create the reduction shown in the diagram below?



$$k = \frac{8}{12} = \frac{2}{3} = 0.\overline{6} = 66.\overline{6}\%$$

Example:

The length of a Formula One race car cannot be more than 550 cm. A HotWheels model of a Formula One race car has a length of 11 cm.

What scale factor was used to make the HotWheels model?

$$k = \frac{11}{550} \quad \begin{matrix} \text{model} \\ \text{real car} \end{matrix}$$

$$k = \frac{1}{50} = 0.02 = 2\%$$

Example:

On a package of Tylenol, a picture of the pill is 25 mm long. A real pill measures 15 mm long. What scale factor was used to create the picture on the package?

$$k = \frac{25}{15} \quad \begin{matrix}\text{picture} \\ \text{real pill}\end{matrix}$$

$$k = \frac{5}{3} = 1.\overline{6} = 166.\overline{6}\,\%$$

Example:

A house is 12.5 m wide. On a blueprint, the width of the house is 40 cm. What scale factor was used to draw the blueprints?

$12.5\ m = ?\ cm$

$\times 100$

$= 1250\ cm$

$$k = \frac{40}{1250} = \frac{4}{125} = 0.032 = 3.2\%$$

Check your understanding:

Sec. 4.1, pg. 136 - 138
#5, 8, 9, 17

Sec. 4.2, pg. 142 - 145
#8 - 12, 14(a), 15, 18, 19(a)