

Name: _____

Lesson 2.3 – Scale

Definitions

- 1) Scale: *comparison of new object : actual original object*
- 2) Scale Factor: *scale without units*

The scale factor can be written as a ratio, fraction, decimal, or percentage

Formula: $Scale = New : Original$

Formula: $Original \times Scale\ Factor = New$

Example #1: A small electronic part measures 2mm wide. A scale diagram is drawn to magnify the object, and the diagram is 3cm wide. *(1 cm = 10 mm)*

- a) What is the scale? *New: Original
3cm : 2mm*
- b) What is the scale factor? *30 : 2*

Ratio	Fraction	Decimal	Percentage
<i>30 : 2 = 15 : 1</i>	<i>15/1</i>	<i>15</i>	<i>1500%</i>

Example #2: On a map, an actual length of 50 m is represented by 4 cm
(1m = 100cm)

- a) What is the scale for this map? *New: Original
4cm : 50m*
- b) What is the scale factor? *4 : 5000*

Ratio	Fraction	Decimal	Percentage
<i>4 : 5000 = 1 : 1250</i>	<i>1/1250</i>	<i>0.0004</i>	<i>0.04%</i>

Assignment:

1) A small metal part is 4.5mm long. In the scale diagram it is magnified to 3cm.
(1cm = 10mm)

c) What is the scale? $3\text{cm} : 4.5\text{mm}$

d) What is the scale factor? $30 : 4.5$

Ratio	Fraction	Decimal	Percentage
$30 : 4.5$ $= 20 : 3$	$\frac{20}{3}$	6.67	666.67%

2) On a map, an actual length of 150m is represented by 5cm
(1m = 100cm)

c) What is the scale for this map? $5\text{cm} : 150\text{m}$
 $= 1\text{cm} : 30\text{m}$

d) What is the scale factor? $= 1\text{cm} : 3000\text{cm}$

Ratio	Fraction	Decimal	Percentage
$1 : 3000$	$\frac{1}{3000}$	0.00033	0.033%

3) On a plan, an actual length of 6 feet is represented by 6 inches. (1 foot = 12 inches)

a) Determine the scale of the plan: $6'' : 6'$
 $= 1'' : 1'$

b) Determine the scale factor used to make the plan $.5 : 6$

Ratio	Fraction	Decimal	Percentage
$1 : 12$	$\frac{1}{12}$.0833	8.33%

4) Determine the **scale factor** used in each situation:

a) The actual diameter of a penny is 19mm. In a scale diagram, the diameter of a penny is 5.7 cm. (1cm = 10mm)

$$5.7 \text{ cm} : 19 \text{ mm}$$

$$57 : 19$$

Ratio	Fraction	Decimal	Percentage
$57 : 19$ $= 3 : 1$	$\frac{3}{1}$	3	300%

b) The actual width of a door is 30 in. In a scale diagram, the width of the door is $1\frac{1}{2}$ inches.

$$1.5'' : 30''$$

Ratio	Fraction	Decimal	Percentage
$1.5 : 30$ $= 1 : 20$	$\frac{1}{20}$	0.05	5%

c) The diagonal of an actual stamp is 2.5 cm long. In a scale diagram, the diagonal is 1.0 m long. (1m = 100cm)

$$1.0 \text{ m} : 2.5 \text{ cm}$$

$$100 : 2.5$$

Ratio	Fraction	Decimal	Percentage
$100 : 2.5$ $= 40 : 1$	$\frac{40}{1}$	40	4000%

d) The height of an actual communications tower is 55 ft. In a scale diagram, the height of the tower is 6 inches.

$$6'' : 55'$$

$$.5 : 55$$

Ratio	Fraction	Decimal	Percentage
$.5 : 55$ $= 1 : 110$	$\frac{1}{110}$	$.0091$	0.91%

RULE: Scale factor bigger than $\frac{1.0}{100\%}$ makes object get bigger
 Scale factor smaller than $\frac{1.0}{100\%}$ makes object get smaller

Example #3: You are looking at a map of the Fraser Valley that does not indicate any scale factor. However, you happen to know the distance between two places is exactly 60 km in real life and it measures 10 cm on the map. You want to know the distance between two points on the map that are 18 cm apart.

$$\frac{60\text{km}}{10\text{cm}} = \frac{?}{18\text{cm}}$$

108km

Example #4: A floor plan uses a scale factor of 0.005. The bedroom measures 2.0 cm by 2.5 cm. What are the actual dimensions of this bedroom?

$$\text{Actual} \times \underset{.005}{0.005} = \underset{.005}{2.0\text{cm}}$$

$$\text{Actual} = 400\text{cm}$$

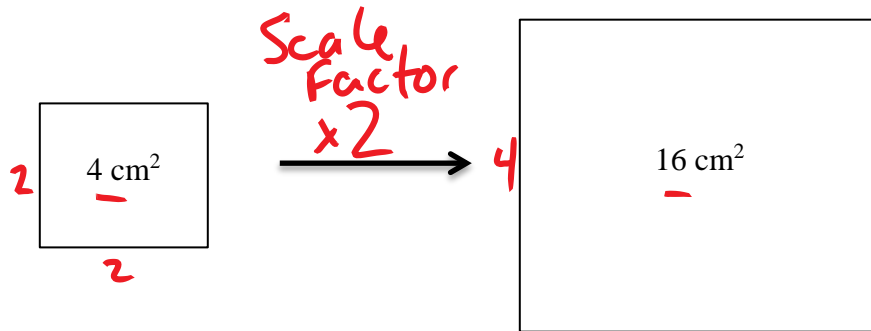
OR = 4m

$$\text{Actual} \times \underset{.005}{.005} = \underset{.005}{2.5\text{cm}}$$

$$\text{Actual} = 500\text{cm}$$

OR = 5m

Example #5: What scale factor was used to magnify this object?



Remember: Scale factors apply in each DIRECTION ⁴ separately!

Example #6: The area of a circle is 576π . It is going to be reduced by a scale factor of $\frac{1}{8}$. Determine the area of the reduced circle.

$$576\pi \xrightarrow{\times \frac{1}{8}} 9\pi$$

For Area
use scale factor
twice!

Assignment:

5) Determine if the original will be larger or smaller than the scale diagram after the given scale factor is applied.

a) scale factor: 112%

bigger

b) scale factor: 0.75

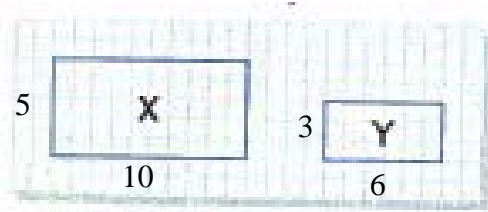
smaller

c) scale factor: $\frac{4}{9}$

smaller

6) Determine the scale factor that was used to transform diagram X into diagram Y. Express you scale factor as a fraction and as a percent.

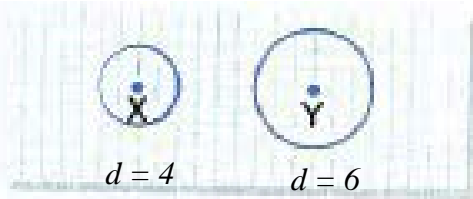
a)



NEW: ORIGINAL

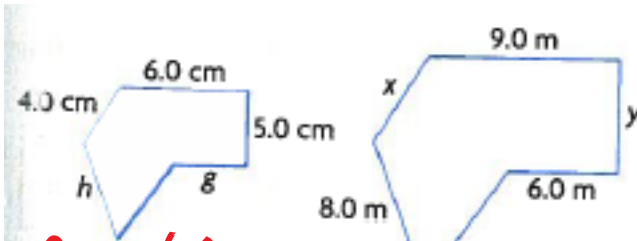
= 6:10 = $\frac{6}{10} = \frac{3}{5}$ OR 60%

b)



$\frac{3}{2}$ OR 150%

7) The following two polygons are similar. Determine the lengths of sides g, h, x, and y to the nearest tenth of a unit.



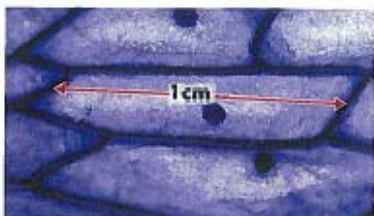
$\frac{9.0m}{6.0cm} = \frac{y}{5.0cm}$ y = 7.5 m

$\frac{9.0m}{6.0cm} = \frac{x}{4.0cm}$ x = 6.0 m

$\frac{g}{6.0m} = \frac{6.0cm}{9.0m}$ g = 4.0 cm

$\frac{h}{8.0m} = \frac{9.0m}{6.0cm}$ h = 120 m

8) Sara has a microscope with a lens that magnifies by a factor of 40. She was able to capture the image of a slide containing onion cells, as shown. In the image, the cell was about 1 cm long. How long is the actual onion cell, to nearest hundredth of a millimeter?



Actual \times 40 = 1.0 cm

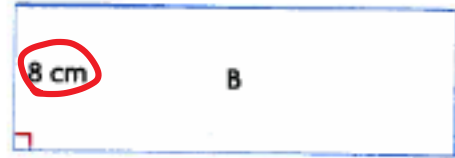
Actual = .025 cm

OR 0.25 mm

8) Two similar rectangles are pictured

a) Determine the scale factor that produced the enlargement

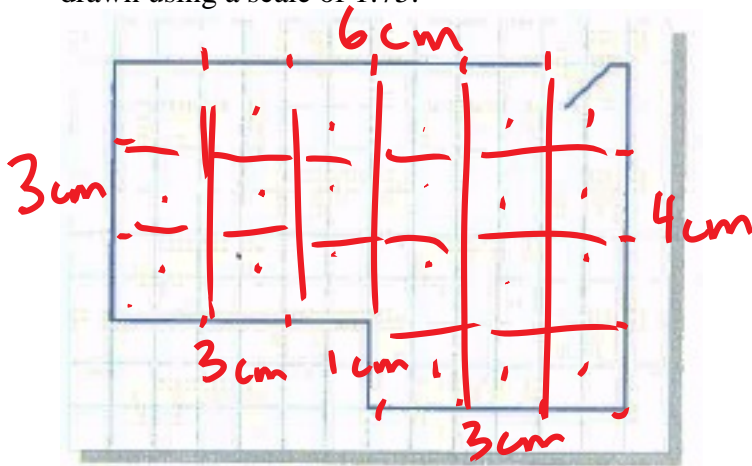
4



b) Determine the areas of the two rectangles

$$12 \times 4 \times 4 = 192 \text{ cm}^2$$

9) This scale diagram, drawn on 0.5 cm grid paper, shows the floor plan of a greenhouse, drawn using a scale of 1:75.



a) Determine the perimeter of the greenhouse (HINT: count the boxes and multiply by the scale)

20 cm

$$\text{Actual} \times \frac{1}{75} = 20 \text{ cm}$$

Actual = 1500 cm

b) Determine the area of the floor of the greenhouse. (HINT: count the boxes and multiply by the scale)

21 cm²

$$\text{Actual} \times \frac{1}{75} \times \frac{1}{75} = 21 \text{ cm}^2$$

Actual = 118 125 cm²

10) The parallelogram shown to the right has an area of 42 cm². It is going to be enlarged by a scale factor of 5. Determine the area of the enlarged parallelogram.

$$42 \times 5 \times 5 = 1050 \text{ cm}^2$$

