

SKILL BUILDER

Converting Between Metric Units of Length

This table shows the relationships among some of the units of length.

$1 \text{ m} = 100 \text{ cm}$ $1 \text{ m} = 1000 \text{ mm}$
$1 \text{ cm} = 0.01 \text{ m}$ $1 \text{ cm} = 10 \text{ mm}$
$1 \text{ mm} = 0.001 \text{ m}$ $1 \text{ mm} = 0.1 \text{ cm}$

To convert 2.3 m to centimetres:

$$1 \text{ m} = 100 \text{ cm}$$

So, to convert metres to centimetres, multiply by 100.

$$\begin{aligned} 2.3 \text{ m} &= 2.3(100 \text{ cm}) \\ &= 230 \text{ cm} \end{aligned}$$

To convert 255 cm to metres:

$$1 \text{ cm} = 0.01 \text{ m}$$

So, to convert centimetres to metres, multiply by 0.01.

$$\begin{aligned} 255 \text{ cm} &= 255(0.01 \text{ m}) \\ &= 2.55 \text{ m} \end{aligned}$$

1. Convert each measure to centimetres.

a) 7 m

$$1 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$$

$$\begin{aligned} \text{So, } 7 \text{ m} &= 7(\underline{\hspace{2cm}}) \\ &= \underline{\hspace{2cm}} \end{aligned}$$

b) 21 mm

$$1 \text{ mm} = \underline{\hspace{2cm}}$$

$$\begin{aligned} \text{So, } 21 \text{ mm} &= \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \end{aligned}$$

2. Convert each measure to metres.

a) 346 cm

$$1 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$$

$$\begin{aligned} \text{So, } 346 \text{ cm} &= 346(\underline{\hspace{2cm}}) \\ &= \underline{\hspace{2cm}} \end{aligned}$$

b) 1800 mm

$$1 \text{ mm} = \underline{\hspace{2cm}}$$

$$\begin{aligned} \text{So, } 1800 \text{ mm} &= \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \end{aligned}$$

3. Convert each measure to millimetres.

a) 6.5 cm

$$1 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$$

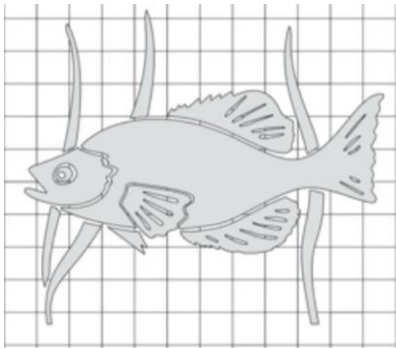
$$\begin{aligned} \text{So, } 6.5 \text{ cm} &= 6.5(\underline{\hspace{2cm}}) \\ &= \underline{\hspace{2cm}} \end{aligned}$$

b) 3.8 m

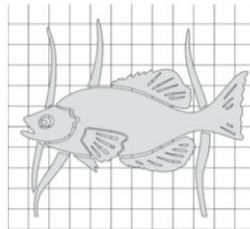
$$1 \text{ m} = \underline{\hspace{2cm}}$$

$$\begin{aligned} \text{So, } 3.8 \text{ m} &= \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \end{aligned}$$

FOCUS 1: Draw and interpret scale diagrams that represent enlargements and reductions.



Scale Diagrams:



A diagram that is an enlargement or reduction of another diagram.

The measurements in each diagram are compared.



$$\text{Scale Factor} = \frac{\text{Length of Scale Diagram}}{\text{Length of Original Diagram}}$$



The **scale factor** can be written as a fraction or decimal.

- If the scale factor is **greater than 1**, the diagram is an **enlargement**
- If the scale factor is **less than 1**, the diagram is a **reduction**

The pictures on the left is the original are these reductions or enlargements

1.



2.

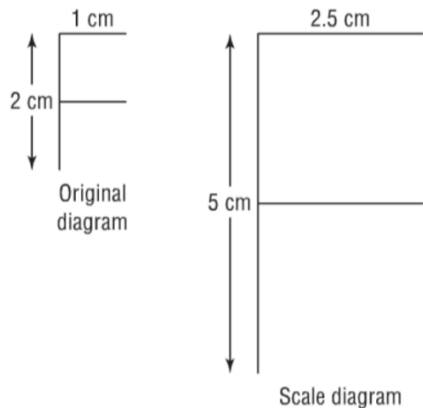
3.

ABCD...

ABCD...

The answers are at the end of the lesson

Example 1: ENLARGEMENT - Determine the scale factor.



Compare the matching lengths in the scale diagram and original diagram. **When the scale diagram is larger than the original diagram it is an enlargement.**

Using the vertical line segments, we can find the scale factor

$$\begin{aligned} \text{Scale Factor} &= \frac{\text{length of scale diagram}}{\text{length of original diagram}} \\ &= \frac{5}{2} \\ &= \mathbf{2.5} \quad \text{Greater than one, so it is an enlargement} \end{aligned}$$

We could also have used the horizontal line segments

$$\begin{aligned} \text{Scale Factor} &= \frac{\text{length of scale diagram}}{\text{length of original diagram}} \\ &= \frac{2.5}{1} \\ &= \mathbf{2.5} \quad \text{Greater than one, so it is an enlargement} \end{aligned}$$

Each length on the original diagram was multiplied by 2.5 to get the lengths on the scale diagram.

- When corresponding lengths have the same scale factor, we say that the corresponding lengths are **proportional**.

NOTE: To calculate the scale factor, the units of length must be the same.

Example 2: REDUCTION - Determine the scale factor.



Original Diagram



Scale Diagram

Compare the matching lengths in the scale diagram and original diagram. **When the scale diagram is smaller than the original diagram it is a reduction.**

Measure and compare the corresponding sides.

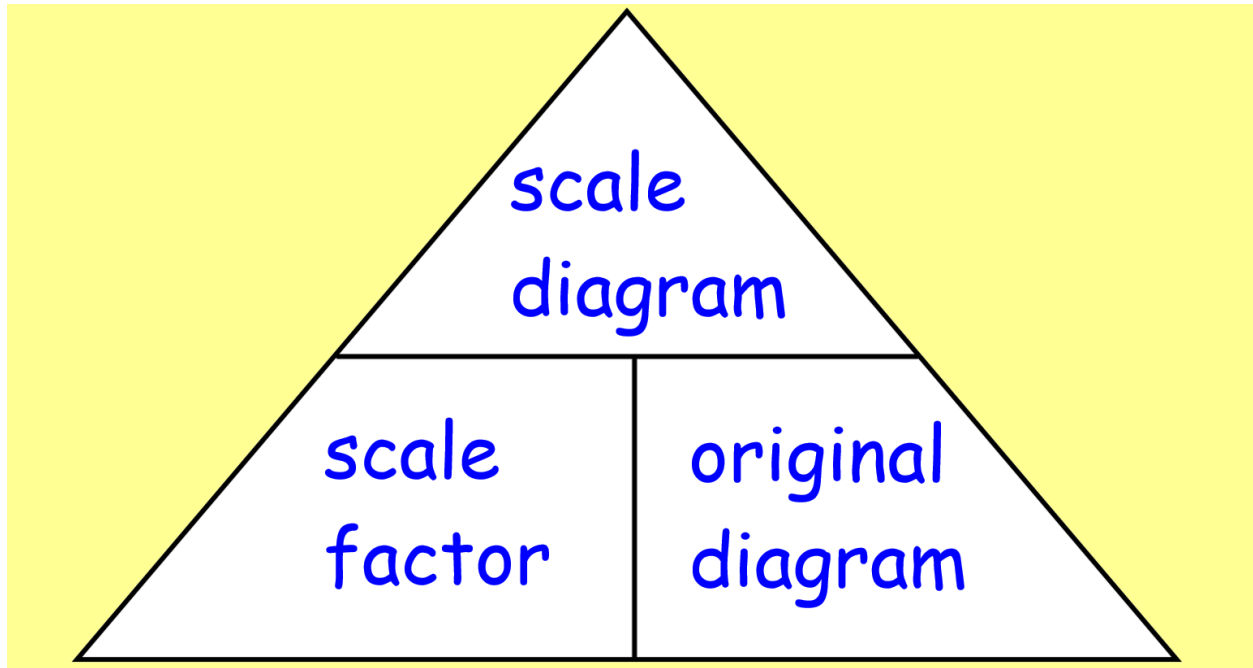
The word MATH is 3.5 cm long on the scale diagram and 7.2 cm on the original diagram

$$\begin{aligned} \text{Scale Factor} &= \frac{\text{length of scale diagram}}{\text{length of original diagram}} \\ &= \frac{3.5}{7.2} \\ &= 0.48 \quad \text{Less than one, so it is a reduction} \end{aligned}$$

From the top of the W to the bottom of the M is 7.2 cm on the original and 3.4 cm on the scale diagram.

$$\begin{aligned} \text{Scale Factor} &= \frac{3.4}{7.1} \\ &= 0.48 \quad \text{Less than one so it is a reduction} \end{aligned}$$

Pairs of corresponding sides are proportional and the scale factor is 0.48.



This triangle may help you to remember formulas. Sometimes you are asked to calculate the size of the scale diagram or the original length.

Look at the triangle above. If you want the formula for **Scale Factor**, cover scale factor and you will see scale diagram over original diagram, so the formula is:

$$\text{Scale Factor} = \frac{\text{scale diagram}}{\text{original diagram}}$$

If you want to calculate **Scale Diagram**, using the triangle above, cover it and you will see factor beside original diagram, so you multiply these two.

$$\text{Scale Diagram} = \text{scale factor} \times \text{original length}$$

If you want the formula for **Original Length**, cover it and you will see scale diagram over scale factor, so the formula is:

$$\text{Original Length} = \frac{\text{scale length}}{\text{scale factor}}$$

Example 3 – Using Scale Factor to Determine Dimensions

This photo of longhouses has dimensions 9 cm by 6 cm.

The photo is to be enlarged by a scale factor of $\frac{7}{2}$.

Calculate the dimensions of the enlargement.



Method 1

$$\begin{aligned} \text{Length on scale diagram} &= 9 \times \frac{7}{2} \\ &= 31.5 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Width on scale diagram} &= 6 \times \frac{7}{2} \\ &= 21 \text{ cm} \end{aligned}$$

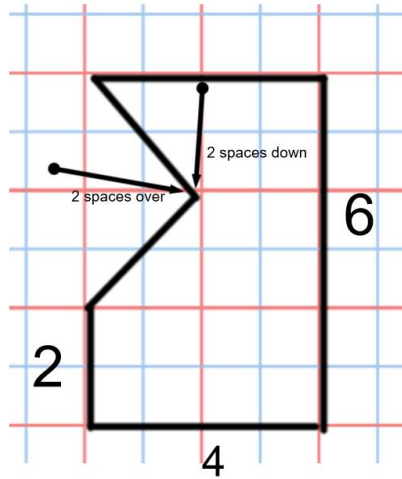
Method 2

$$\begin{aligned} \text{Length of Scale Diagram} &= 9 \times 3.5 \\ &= 31.5 \text{ cm} \end{aligned}$$

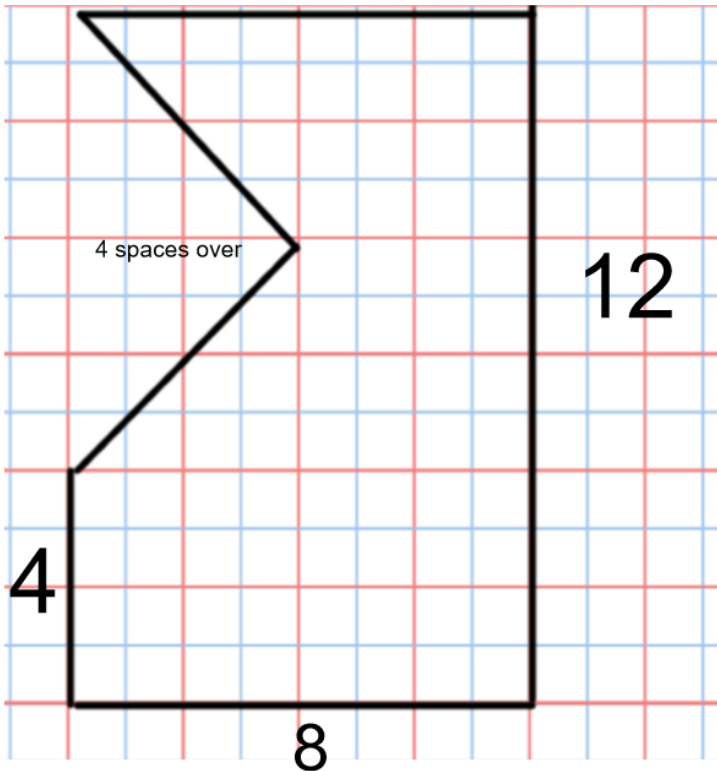
$$\begin{aligned} \text{Width of Scale Diagram} &= 6 \times 3.5 \\ &= 21 \text{ cm} \end{aligned}$$

The dimensions of the scale diagram are 31.5 cm by 21 cm.

Example 4 - Draw the diagram below with a scale factor of 2



- First measure the sides in the original diagram.
- Multiply each side by 2. Then draw the scale diagram.



Original Size x
Scale Factor =
Scale Diagram

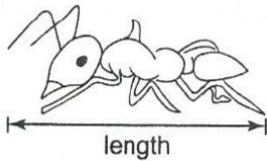
$$2 \times 2 = 4$$

$$4 \times 2 = 8$$

$$6 \times 2 = 12$$

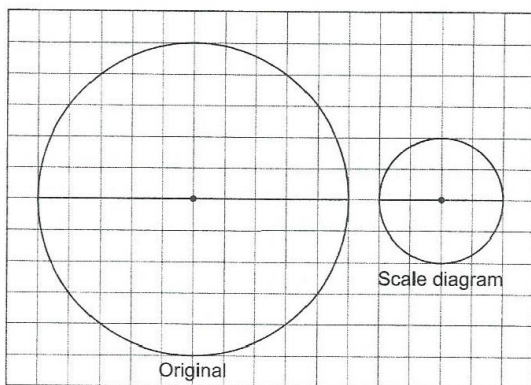
You Try # 1

If the length of diagram was 3.3 cm and the actual ant is 6 mm. What is the scale factor? Reminder: your units must be the same.

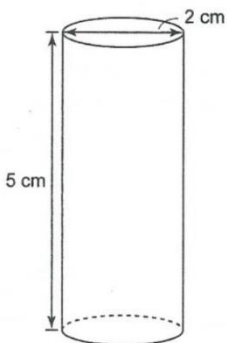


You Try # 2

Determine the scale factor.



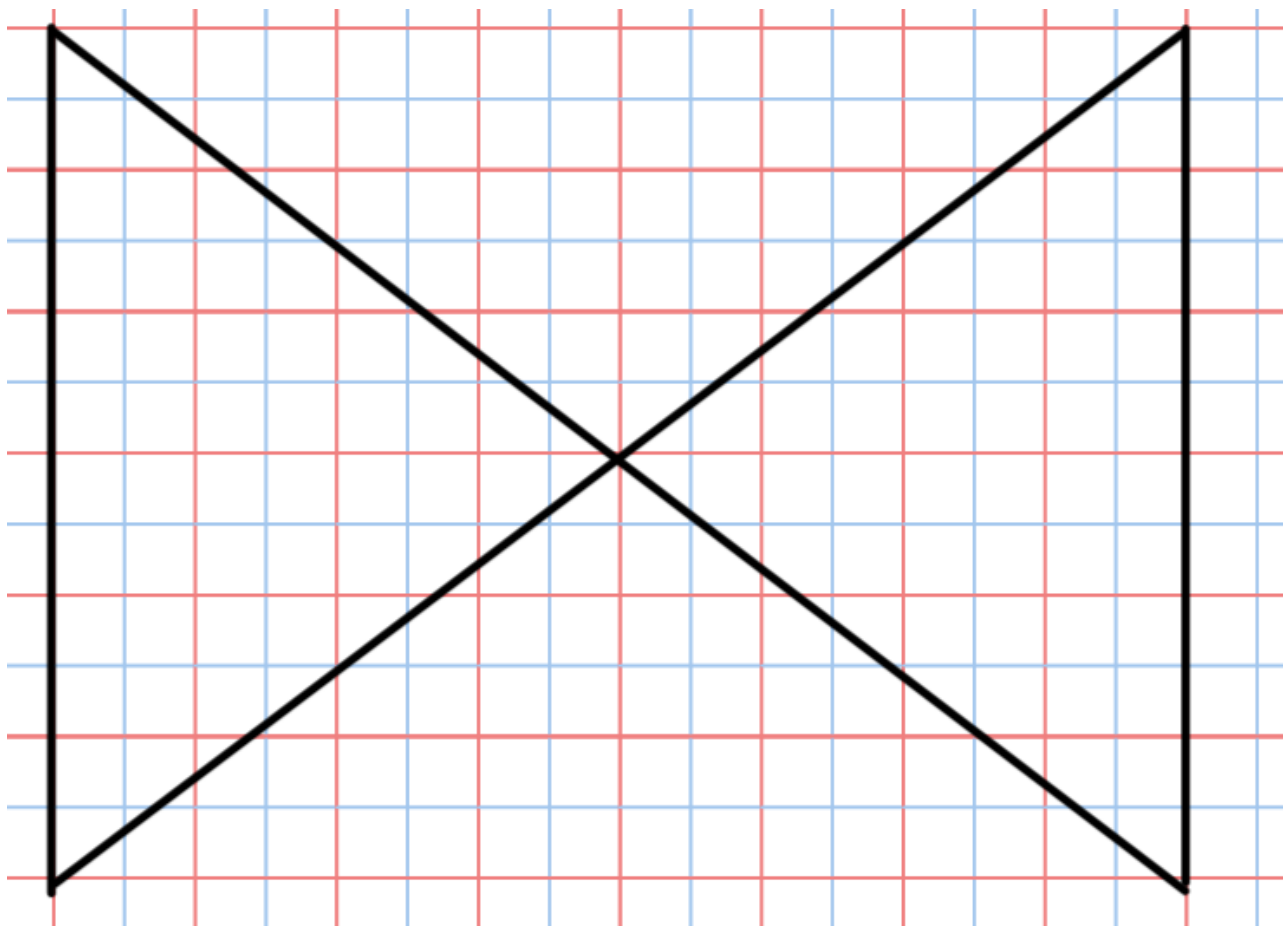
You Try # 3



The cylinder is to be enlarged by a scale factor of $\frac{5}{2}$

Find the dimensions of the enlargement.

You Try 4: Draw a scale diagram of the figure below with a scale factor of 0.25.



ANSWERS

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1 a) 700 cm

b) 2.1 cm

2 a) 3.46 m

b) 1.8 m

3 a) 650 mm

b) 3800 mm

Page 4

1) Reduction

2) Enlargement

3) Enlargement

You Try # 1

3.3 cm = 33 mm

$$\text{Scale Factor} = \frac{\text{length of scale}}{\text{length of original}}$$

$$SF = \frac{33}{6}$$

$$SF = 5.5 \quad \text{Enlargement}$$

You Try # 2

$$\text{Scale Factor} = \frac{\text{width of scale}}{\text{width of original}}$$

$$SF = \frac{1}{5} = 0.20 \quad \text{Reduction}$$

You Try # 3

Scale Diagram = Scale Factor x Original

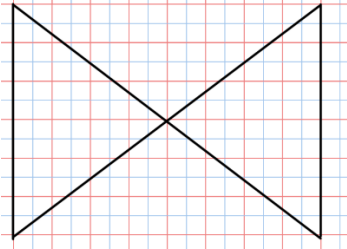
$$SD = \frac{5}{2} \times 2$$

$$SD = \frac{5}{2} \times 5$$

$$SD = 5\text{cm}$$

$$SD = 12.5 \text{ cm}$$

The enlargement has diameter of 5cm and height of 12.5 cm

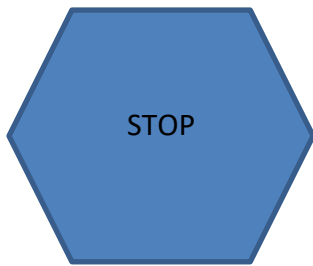


Your Try #5

This can be done by measuring or counting the squares if you use the same size grid paper

length $12 \times 0.25 = 3$

Width $16 \times 0.25 = 4$



Time to Practice

Complete Page 323-324 Questions # 4 – 9 and 11 – 14

and

Page 329-330 Questions #4 to 15

Go to assignments