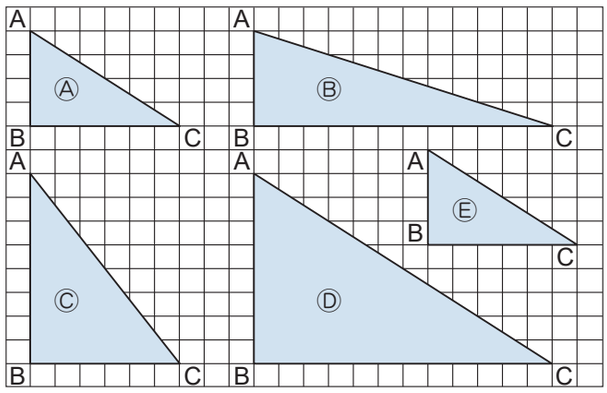
11 – 1 Enlarged and Reduced Drawings

Introduction to Enlarged and Reduced Drawings

Example From the following figures Ⓑ, Ⓒ, Ⓓ, and Ⓔ which has the same shape as figure Ⓐ below?



Each size of angle B is 90°.
If the length of side AB and BC are the same, these are congruent.

1 Complete the table below.

	Length of sides (Number of square)	
	Side AB	Side BC
A	4	6
B	4	12
C	8	6
D	8	12
E	4	6

Figure A and E are congruent.
What about Figure A and D?

2 Represent the length of the corresponding sides of Figure A to E with simplified ratios. Let the corresponding sides of Figure A be 1.

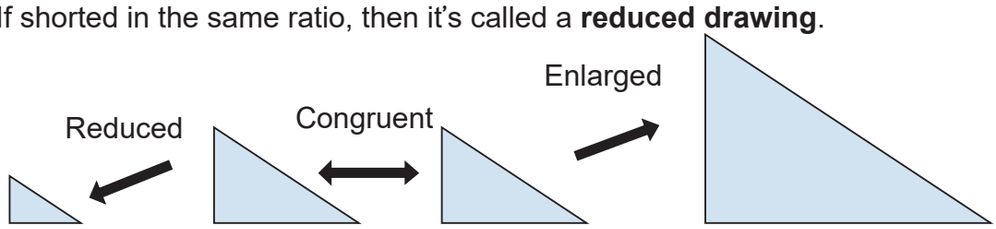
	Ratio of the lengths	
	Side AB	Side BC
A	1	1
B	1	2
C	2	1
D	2	2
E	1	1

What about the size of the corresponding angles?

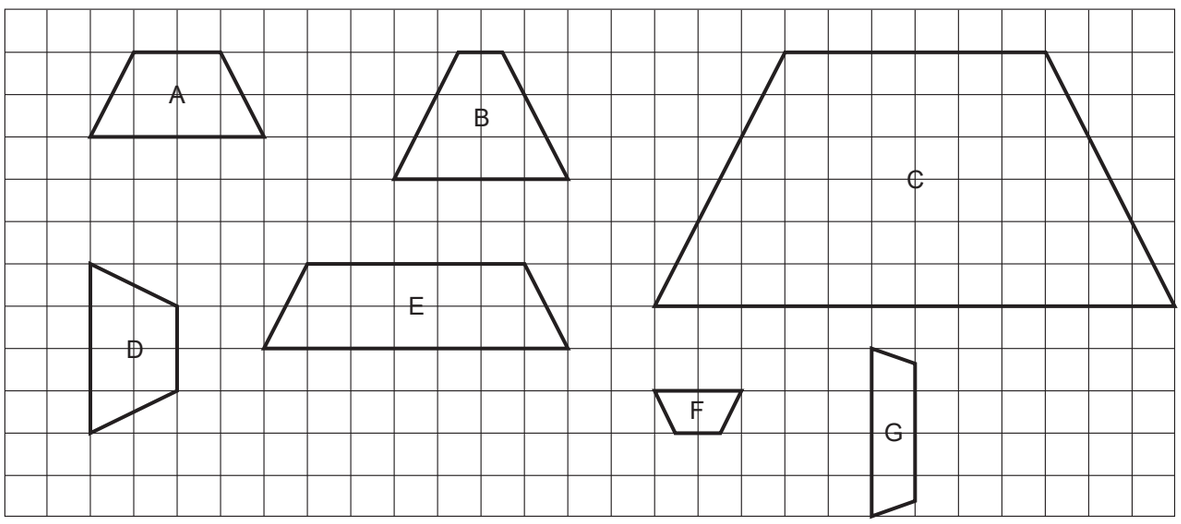
3 How many times the length of the corresponding side of Figure D is the length of the side of Figure A?

2 times

- When all the lengths of corresponding sides are extended in the same ratio and the corresponding angles are respectively equal, then it is called an **enlarged drawing**.
- If shorted in the same ratio, then it's called a **reduced drawing**.



Look at the figures below and answer the following questions.



1 Which of the following figures is an enlarged drawing of Figure A? Also, how many times is it enlarged?

Enlarged drawing ☐ How many times ☐

2 Which of the following figures is a reduced drawing of Figure A? Also, how much is it reduced?

Reduced drawing ☐ How much reduced ☐

2 Figure B is a reduced drawing of Figure A. Answer the following questions.

1 Represent the length of the corresponding sides of BC to FG with simplified ratios.

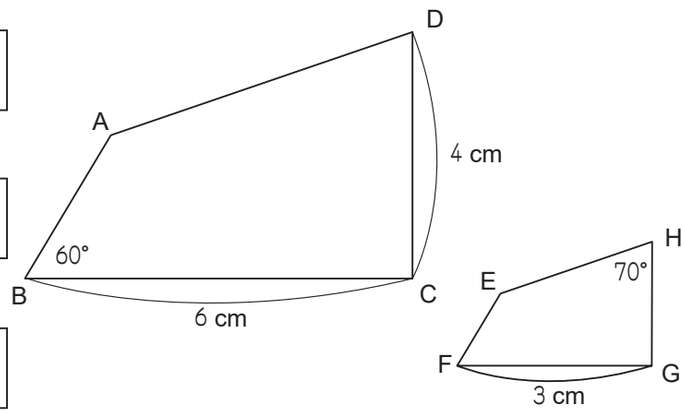
6 : 3 = ☐ : ☐

2 Find the length of side GH.

☐

3 Find the size of angle D.

☐

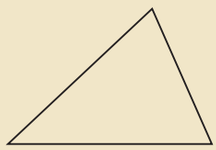


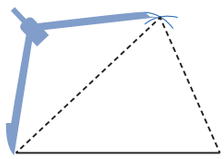
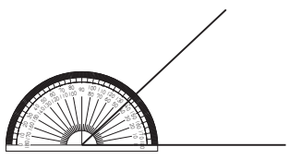
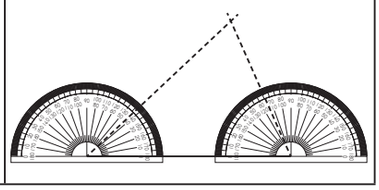
11 - 2 Enlarged and Reduced Drawings

How to Draw Enlarged Drawings (1)

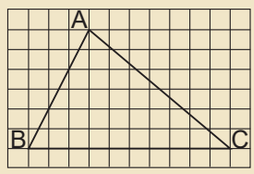
Instruction How to draw congruent figures.

When you draw enlarged figures, the method of drawing a congruent triangle can be helpful. Review how to draw the congruent triangle with the figure on the right.

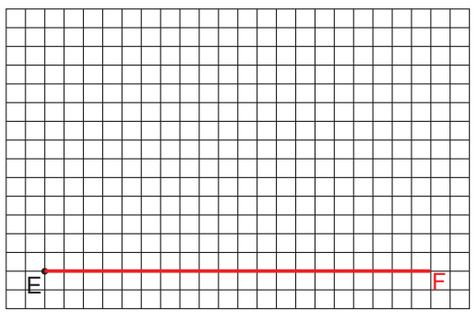


Method 1	Method 2	Method 3
Measure all the sides and draw.	Measure two sides and angle and draw.	Measure two angles, the side, and draw.
		

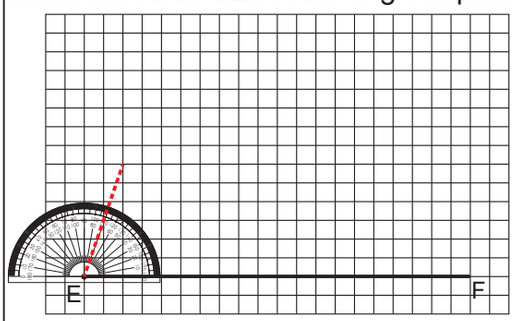
Example 1 Draw enlarged triangle DEF which is 2 times as large as triangle ABC. Point E, corresponding to point B, is already located on the grid paper below.



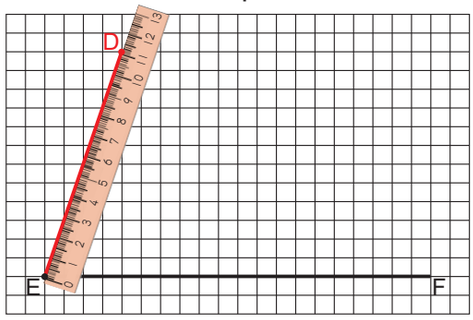
1. Draw point F at twice the length of side BC and connect point E and F.



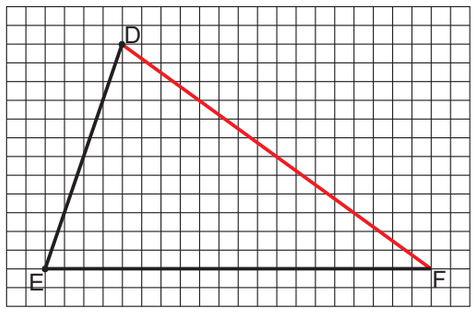
2. Measure the size of the angle B and make the same size of the angle at point E.



3. Draw point D at twice the length of side AB and connect point D and E.

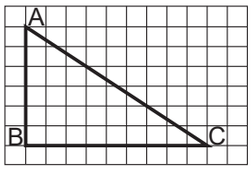


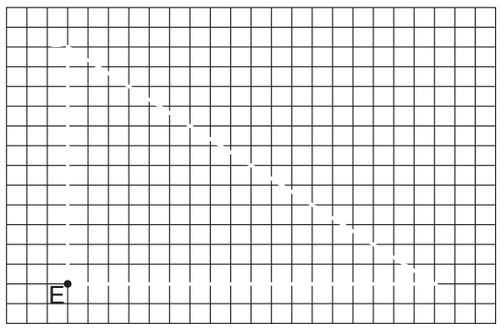
4. Connect point D and F.



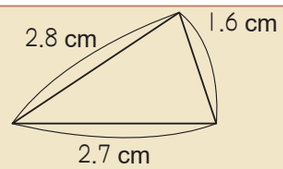
This is an example using Method 2. You can also draw with Method 1 or 3.

1 Draw enlarged triangle DEF which is 2 times as large as triangle ABC. Point E, corresponding to point B is already located on the grid paper below.

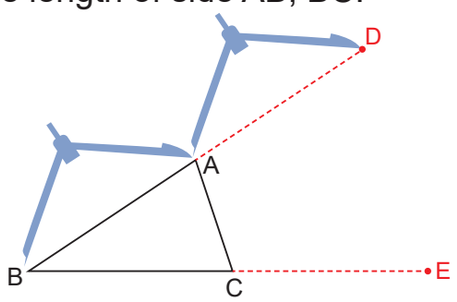




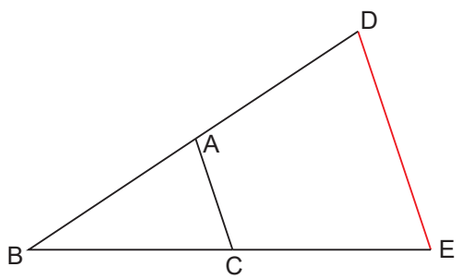
Example 2 Draw enlarged triangle DBE which is 2 times as large as triangle ABC.



1. Measure the length of side AB, BC and draw point D and E at twice the length of side AB, BC.

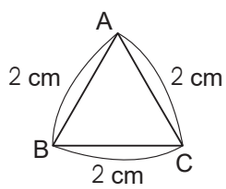


2. Extend side AB, BC to point D, E respectively and connect point D and E.

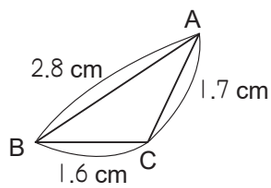


2 Draw enlarged triangle DBE which is 2 times as large as triangle ABC.

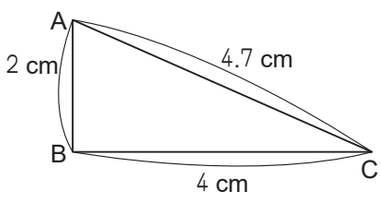
1



2



3 Draw enlarged triangle DBE which is 1.5 times as large as triangle ABC.

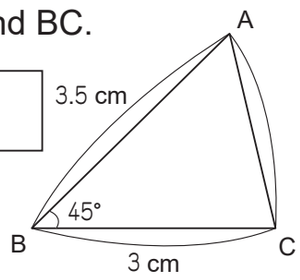


You can enlarge drawings using 1 point like point B, and its connected lines. This reference point is called the centre point.

11 – 3 Enlarged and Reduced Drawings

How to Draw Enlarged Drawings (2)

Example 1 When you draw enlarged triangle DEF 2 times as large as triangle ABC, answer the following questions.



1 Find the length of the corresponding sides AB and BC.

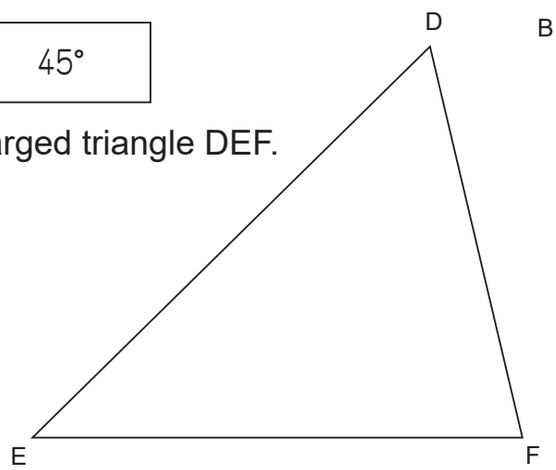
Corresponding Side AB: 7 cm

Corresponding Side BC: 6 cm

2 Find the size of the corresponding angle B.

Corresponding Angle B: 45°

3 Draw the enlarged triangle DEF.



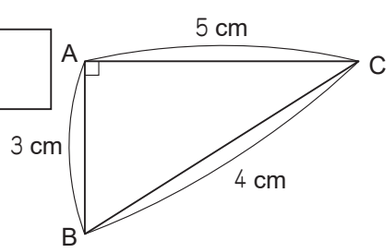
1 Draw the enlarged triangle DEF 2 times as large as triangle ABC. Answer the following questions.

1 Find the length of the corresponding sides AB and BC.

Corresponding Side AB: ____

Corresponding Side BC: ____

Corresponding Side AC: ____

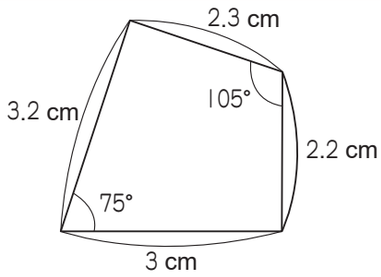


2 Find the size of the corresponding angle A.

Corresponding Angle A: ____

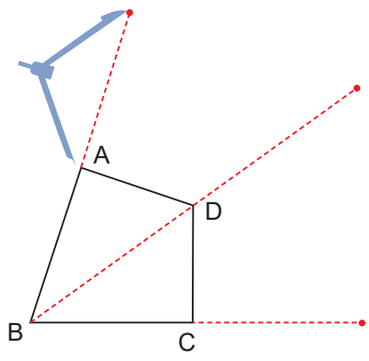
3 Draw the enlarged triangle DEF.

Example 2 Draw a 2 times enlarged drawing of the following quadrilateral. Use point B as a centre point.

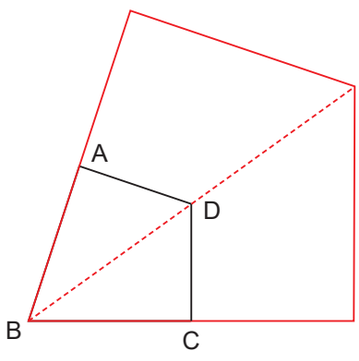


You can draw it using the same method when drawing an enlarged triangle.

1. Measure the length of AB, BC, and BD, then take points at twice the length of them.

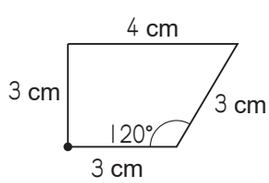


2. Extend side AB, BC to the plotted points and connect them.

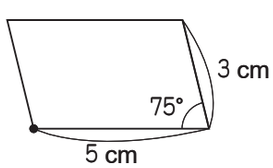


2 Draw a 2 times enlarged drawing of the following quadrilateral using the point as a centre point.

1. trapezoid

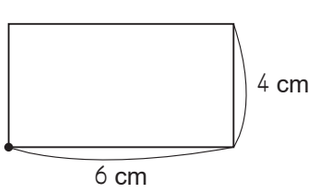


2. parallelogram



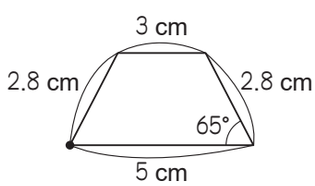
3 Draw a 1.5 times enlarged drawing of the following quadrilateral.

1. rectangle



2. trapezoid

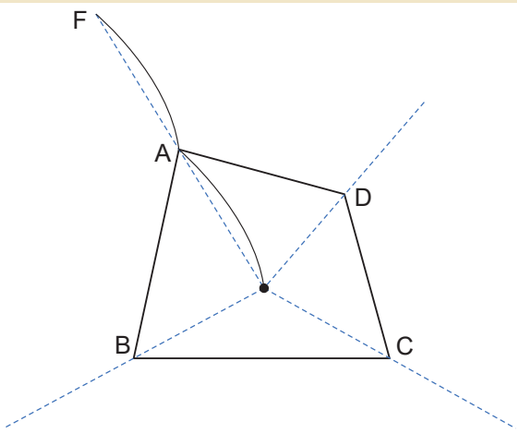
You can measure the length using a ruler easily.



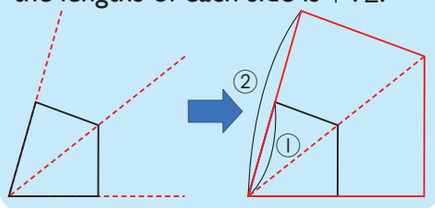
11 – 4 Enlarged and Reduced Drawings

How to Draw Enlarged Drawings (3)

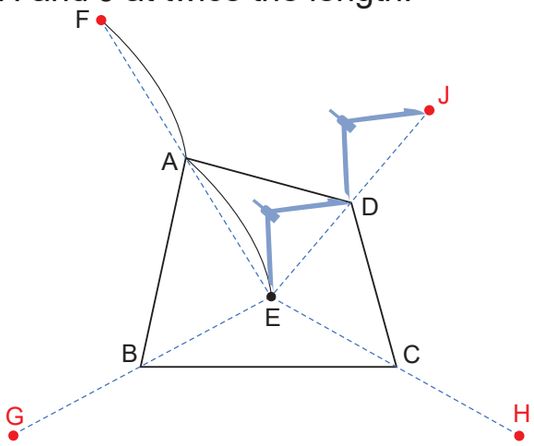
Example 1 Consider point E as the centre point and draw an enlarged quadrilateral FGHJ that is 2 times as large as quadrilateral ABCD.



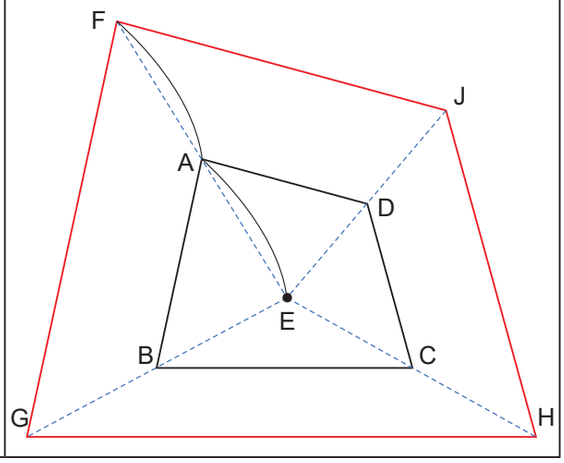
Previously, we consider from one of points, like point B. The ratio of the lengths of each side is 1 : 2.



1. Measure the length from point E and each point. Then, draw point G, H and J at twice the length.

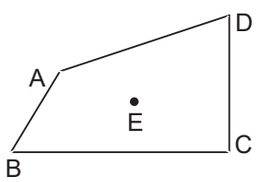


2. Connect these points.

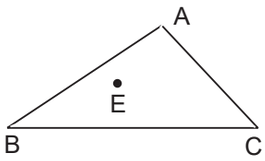


1 Consider point E as the centre point and draw the following enlarged figures

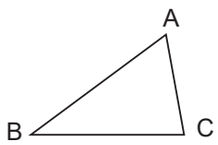
1 Quadrilateral FGHJ that is 2 times larger than quadrilateral ABCD.



2 Triangle FGH that is 2 times larger than triangle ABC.

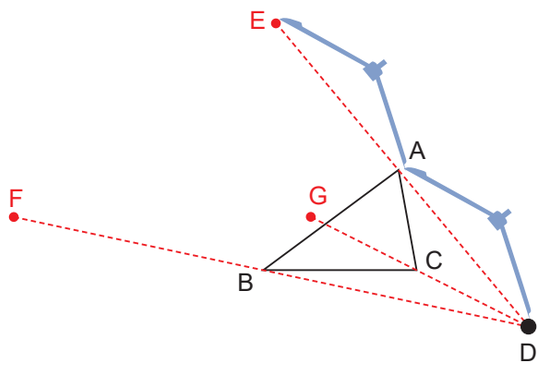


Example 2 Using point D, draw triangle EFG that is 2 times quadrilateral ABC.

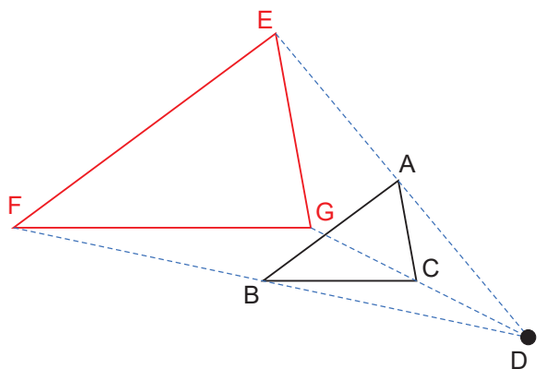


Compared to Example 1, the point is outside of the figure.

1. Measure the length from point E and each point. Then, draw point G, H and J at twice the length.

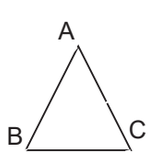


2. Connect these points.



2 Using point O as the centre point, draw the following enlarged figures.

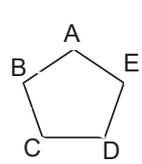
1 Triangle EFG that is 2 times larger than triangle ABC.



O•

2 Pentagon FGHIJ that is 2 times larger than quadrilateral ABCDE.

O•



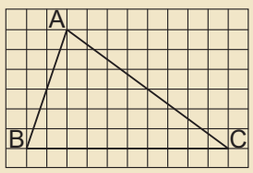
3 Using point O as the centre point, draw the following figure 2 times larger than the enlarged figure.

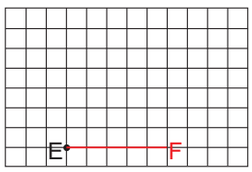
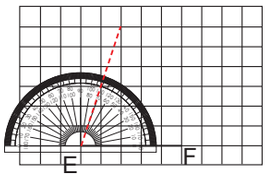
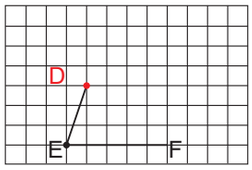
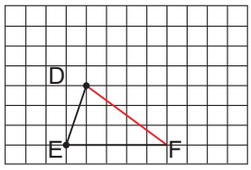
O•

11 – 5 Enlarged and Reduced Drawings

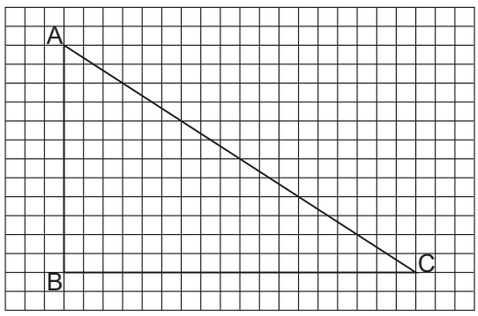
How to Draw Reduced Drawings (1)

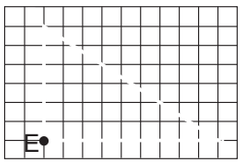
Example 1 Draw reduced triangle DEF which is half of triangle ABC. Point E, corresponding to point B, is already located on the grid paper below.



1. Draw point F at half the length of side BC and connect point E and F. 	2. Measure the size of the angle B and make the same size of the angle at point E. 
3. Draw point D at half the length of side AB and connect point D and E. 	4. Connect point D and F. 

1 Draw enlarged triangle DEF which is half of triangle ABC. Point E, corresponding to point B is already located on the grid paper below.





Example 2 Draw a $\frac{1}{2}$ reduced drawing of triangle ABC and answer the following questions.

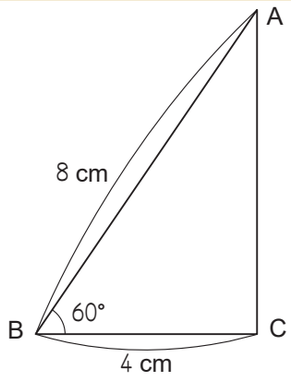
1 Find the length of the corresponding sides AB and BC.

Corresponding Side AB: 4 cm

Corresponding Side BC: 2 cm

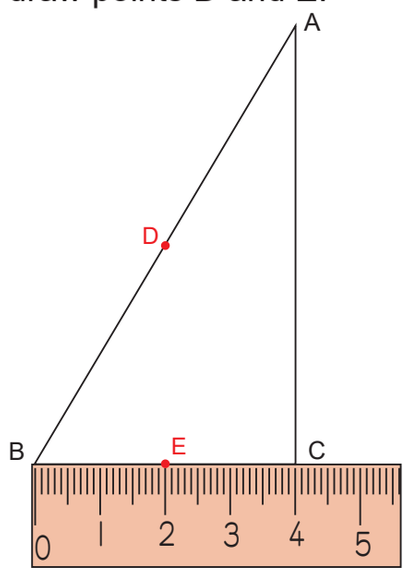
2 Find the size of the corresponding angle B.

Corresponding Angle B | 60°

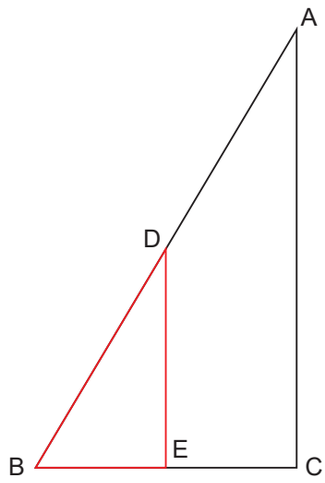


3 Draw the reduced triangle DBE.

1. Measure the length from point B and draw points D and E.



2. Connect point D and E.

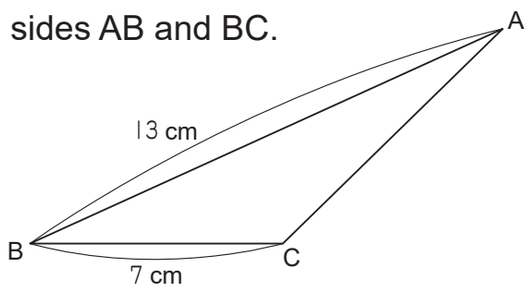


1 When you draw a $\frac{1}{2}$ reduced drawing of triangle ABC, answer the following questions.

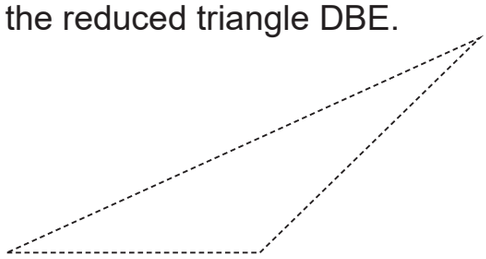
1 Find the length of the corresponding sides AB and BC.

Corresponding Side AB |

Corresponding Side BC |



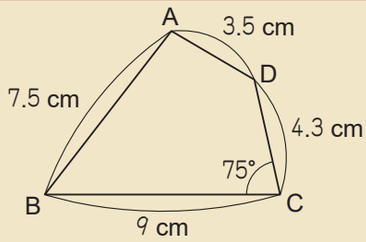
2 Using point B as a centre point, draw the reduced triangle DBE.



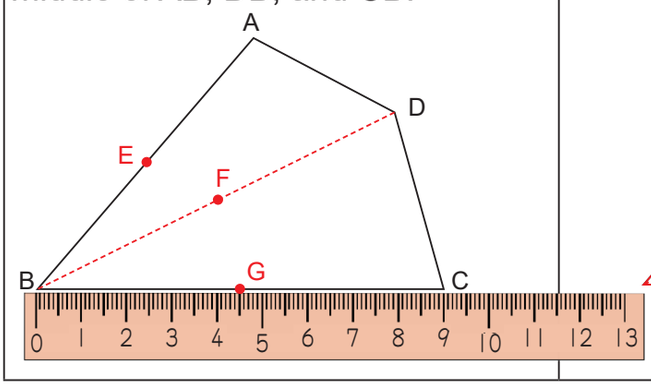
11 – 6 Enlarged and Reduced Drawings

How to Draw Reduced Drawings (2)

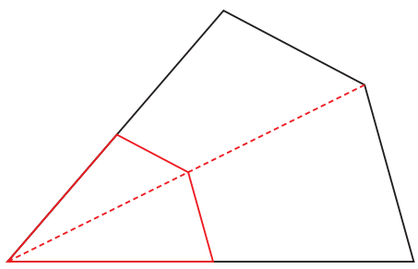
Example 1 Using point B as a centre point, draw a $\frac{1}{2}$ reduced drawing of quadrilateral ABCD.



1. Measure the length from point B and draw points, E, F and G in the middle of AB, DB, and CB.

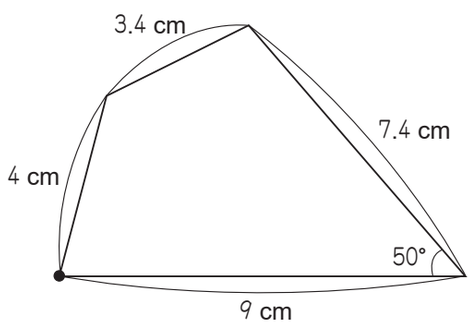


2. Connect point E, F and G.

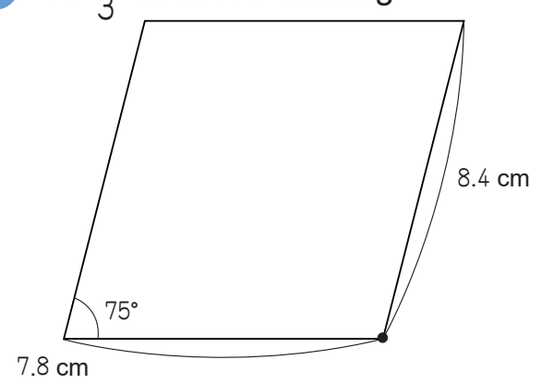


1 Using the point as a centre point, draw the following reduced drawings.

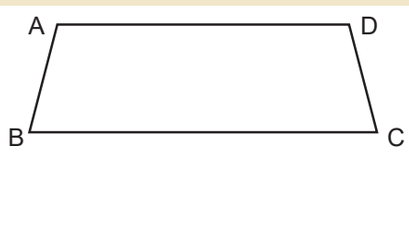
1 A $\frac{1}{2}$ reduced drawing

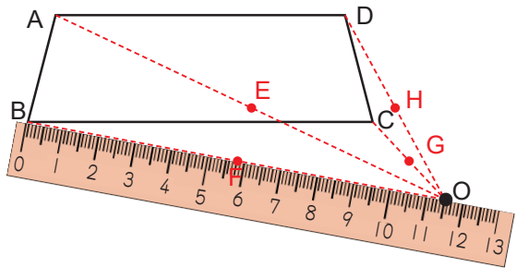
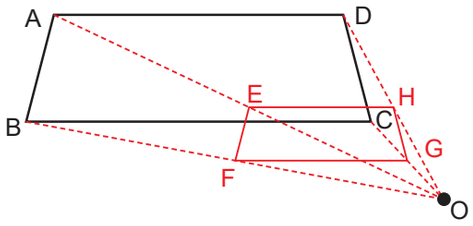


2 A $\frac{1}{3}$ reduced drawing



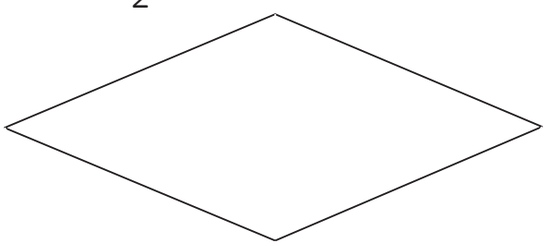
Example 2 Using point O as a centre point, draw a reduced quadrilaterals that is 2 times as small as the quadrilateral.



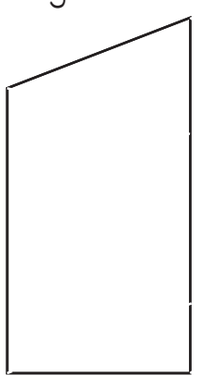
1. Draw lines from point O to each point. Then, take point E, F, G and H at $\frac{1}{2}$ of the length.	2. Connect these points.
	

2 Using point O as a centre point, draw the following triangles.

1 A $\frac{1}{2}$ reduced drawing



2 A $\frac{1}{3}$ reduced drawing

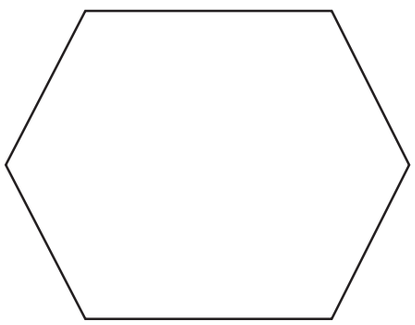


● O

● O

3 A $\frac{1}{3}$ reduced drawing

● O



11 – 7 Enlarged and Reduced Drawings

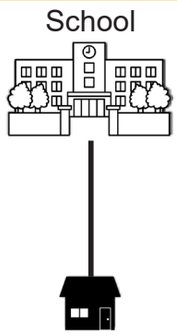
Application of Reduced Drawings (1)

Instruction Reduced scale.

The figure on the right is a reduced drawing from school to a student's house. The actual distance between the school and the house is 300 m. It is shown as 3 cm on the reduced drawing.

Express the rate of reduction using a fraction. Also express the rate as a ratio.

Since the actual distance is 300 m and it is shown as 3 cm on the drawing,



$$\frac{3}{30000} = \frac{1}{10000}$$

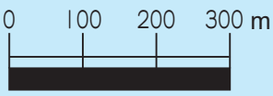
Also, expressing the rate as a ratio,

$3 : 30000 = 1 : 10000$

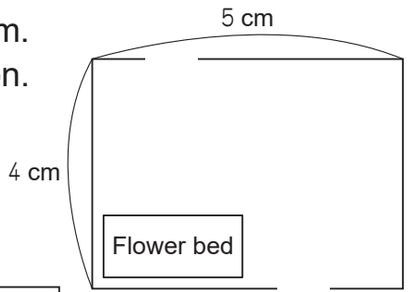
m			cm	
				3
3	0	0	0	0

1 m = 100 cm.

- The ratio that represents how many it is reduced by from the actual distance is called the reduced scale.
- There are 3 ways to show a reduced scale:

A $\frac{1}{10000}$ B $1 : 10000$ C 

Example 1 The figure on the right is a reduced drawing of a park. Answer the following questions.



1 The actual lateral length of the park is 20 m. Express the rate of reduction using a fraction.

m			cm	
				5
	2	0	0	0

$$\frac{5}{2000} = \frac{1}{400}$$

Reduced scale = $\frac{1}{400}$

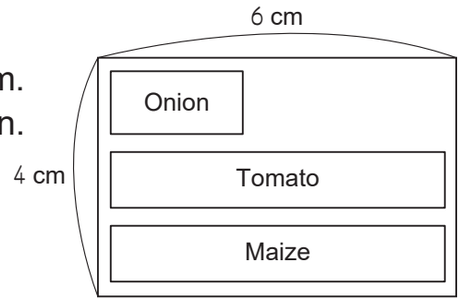
2 Find the actual width of the park.

Math sentence $4 \times 400 = 1600$

Answer 16 m

$4 : \frac{1}{400} = x : 1$ (× 400 on both sides)

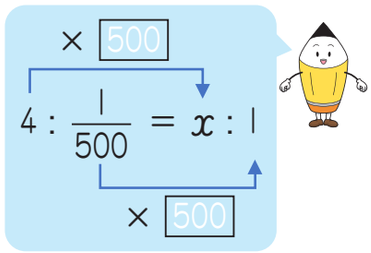
1 The figure on the right is a reduced drawing of a field. Answer the following questions.



1 The actual lateral length of the park is 30 m. Express the rate of reduction using a fraction.

m		cm		

Reduced scale = ☐



2 Find the actual width of the field.

Math sentence

Answer _____

3 The size of a maize field is 5 cm in length and 1 cm in width. Find the actual size of the maize field. Also find the area of the field.

Length: ☐ Width: ☐

Area:

Math sentence

Answer _____

2 There is a map of a school that is drawn to $\frac{1}{400}$ reduced scale. In the reduced drawing, the assembly hall has a rectangular shape with a length that is 6 cm long and a width that is 3.2 cm long. How many meters is the actual length and width of the hall?

Length:

Math sentence

Answer _____

Width:

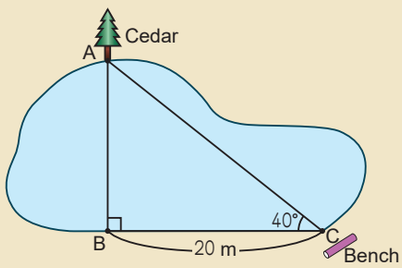
Math sentence

Answer _____

11 – 8 Enlarged and Reduced Drawings

Application of Reduced Drawings (2)

Example A girl walked from point C to point B as shown on the right. What should we do to find the distance from point B to point A? Point A is a cedar tree at the opposite side of the pond.

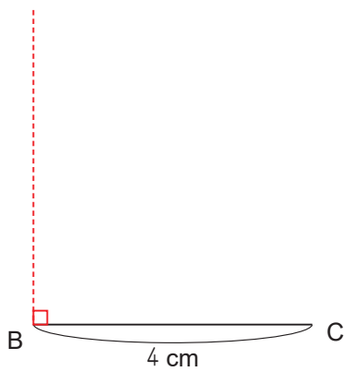
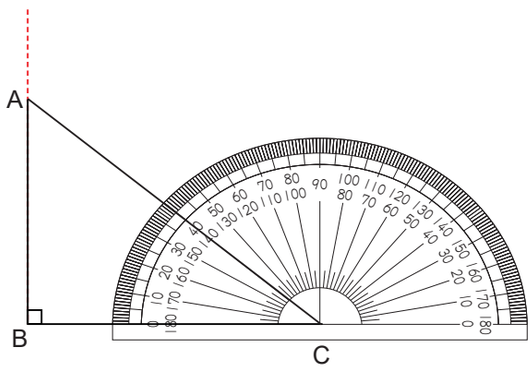


Draw a $\frac{1}{500}$ reduced drawing of the right triangle ABC.

Step 1

Calculate the length of corresponding Side BC:

$20 \times \frac{1}{500} = 0.04$ 4 cm

Step 2. Draw 4 cm as the corresponding side BC and draw a perpendicular line to the drawn line.	Step 3. Measure angle C at 40° and place point A. Then, connect point A and point C.
	

Step 4

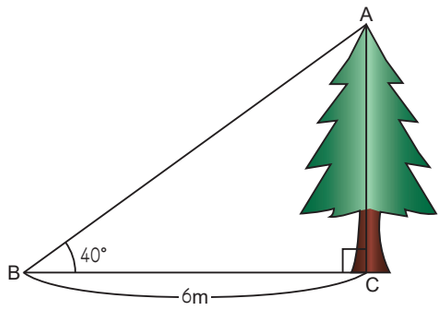
Measure the length of side AB on the reduced drawing and find the distance between point A and point B.

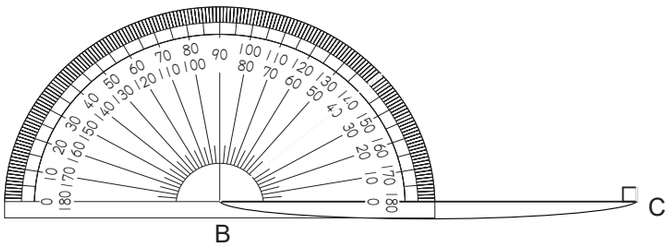
Given that the length of side AB on the reduced drawing is 3.2 cm, what is the actual distance?

Math sentence $3.2 \times 500 = 1600$ Answer 16 m

1 In the figure shown on the right, how many meters is the actual height of the tree? Find the answer by drawing a reduced triangle in $\frac{1}{100}$ reduced scale.

Calculate the length of the corresponding Side BC:





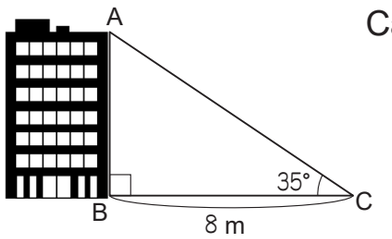
Math sentence

Answer _____

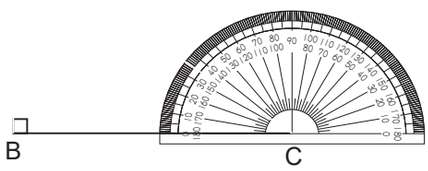
2 Find the actual height of the building shown below.

1 Draw a reduced triangle in $\frac{1}{200}$ reduced scale.

Calculate the length of the corresponding Side BC:



2 Find the height of the building.



Math sentence

Answer _____

3 When you draw a reduced triangle in $\frac{1}{400}$ reduced scale, find the height of the building.

Math sentence

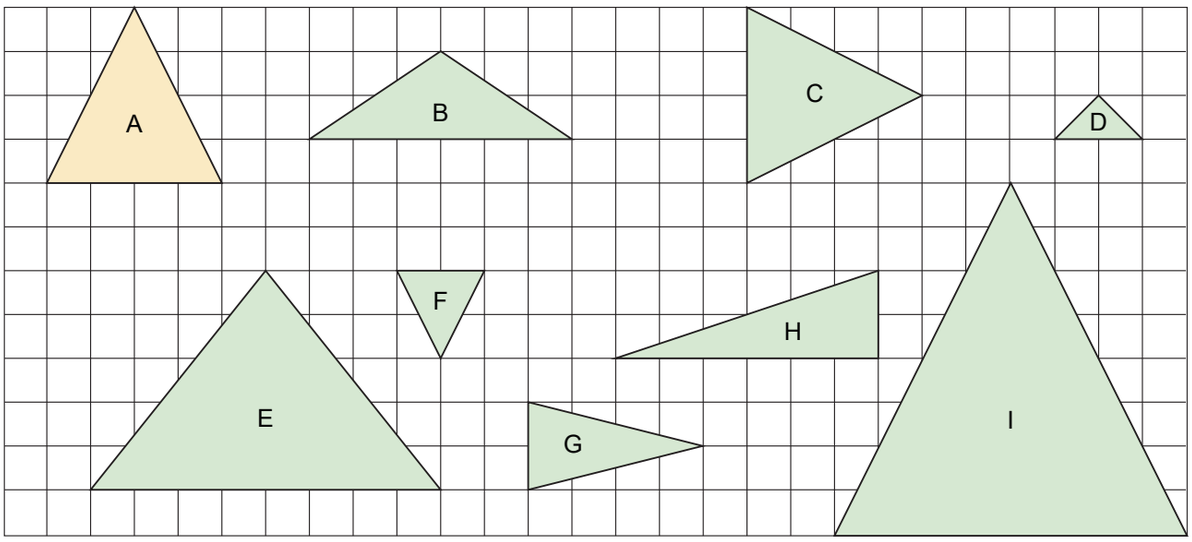
Answer _____

Do you have any findings when you change reduced scale?

11 – 9 Enlarged and Reduced Drawings

Review

1 Look at the figures below and answer the following questions.



1 Which of the following figures is congruent to Figure A?

Congruent ☐

2 Which of the following figures is an enlarged drawing of Figure A? Also, how many times is it enlarged?

Enlarged drawing ☐ How many times ☐

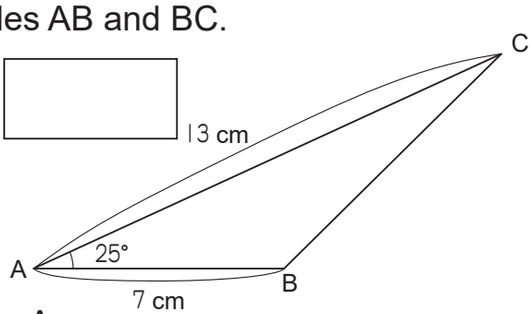
3 Which of the following figures is a reduced drawing of Figure A? Also, how much is it reduced?

Reduced drawing ☐ How much reduced ☐

2 Draw an enlarged triangle DEF 3 times larger than triangle ABC. Answer the following questions.

1 Find the length of the corresponding sides AB and BC.

Corresponding Side AB ☐ Corresponding Side AC ☐



2 Find the size of the corresponding angle A.

Corresponding Angle A ☐

3 Answer about a $\frac{1}{2000}$ reduced scale.

1 Using the scale, how many m is the actual length of 4 cm and 6.5 cm?

In the case of 4 cm:

Math sentence

Answer _____

In the case of 6.5 cm:

Math sentence

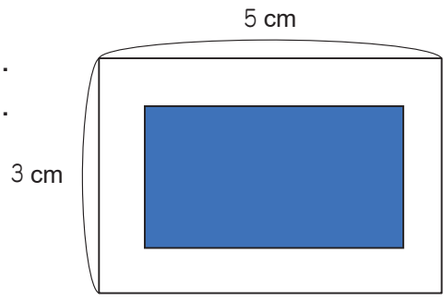
Answer _____

2 60 m are represented by how many cm using the scale?

Math sentence

Answer _____

4 The figure on the right is a reduced drawing of a swimming pool. Answer the following questions.



1 The actual lateral length of the pool is 30 m. Express the rate of reduction using a fraction.

m			cm	

Reduced scale = ☐

2 Find the actual width of the field.

Math sentence

Answer _____

3 The size of a maize field is 4 cm in length and 1.5 cm in width. Find the actual size of the maize field. Also find the area of the field.

Length: ☐ Width: ☐

Area:

Math sentence

Answer _____