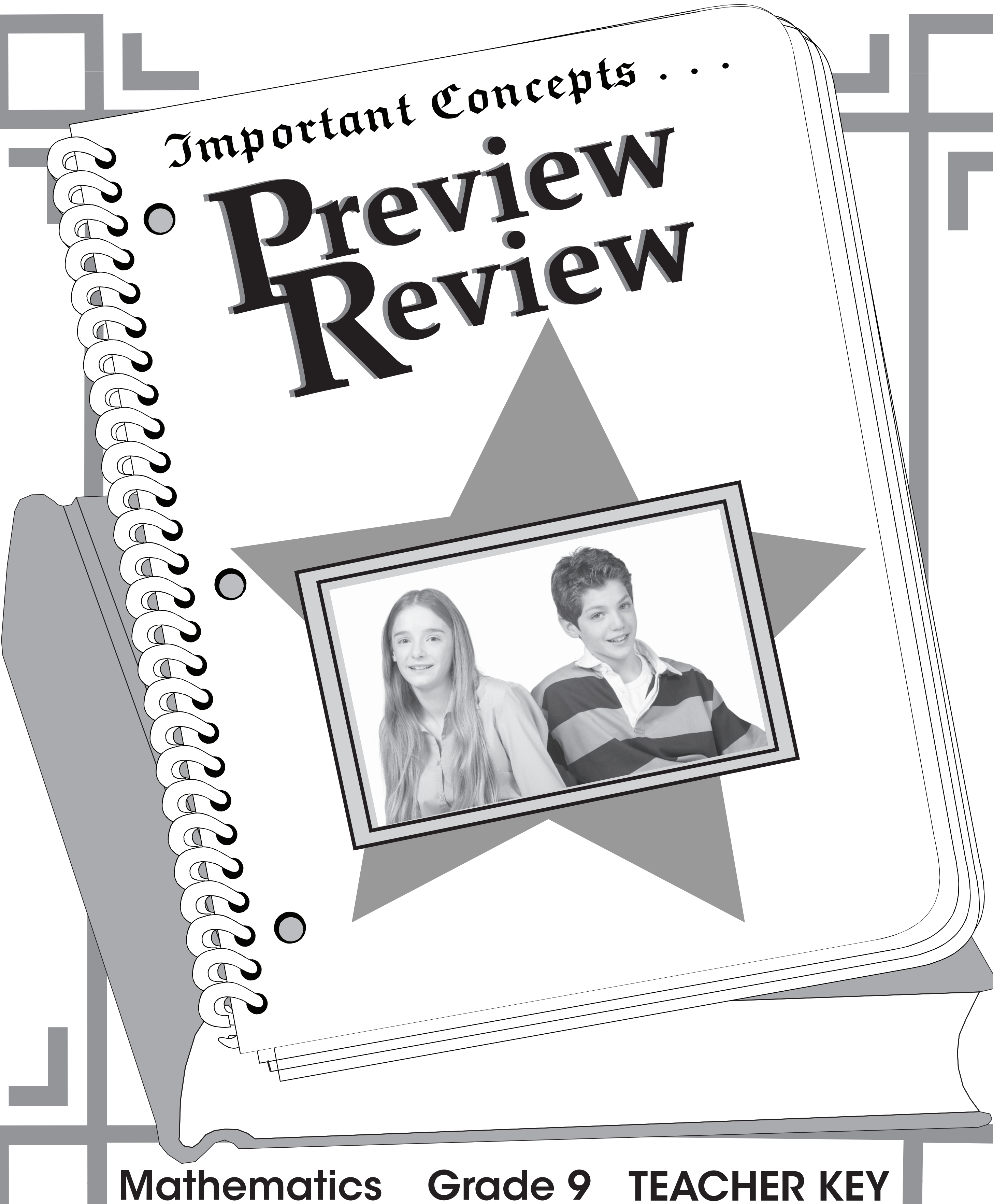

Mathematics Grade 9 TEACHER KEY

W3 - Review

Important Concepts of Grade 9 Mathematics

Materials Required

Pencil
Paper
Calculator
Tracing Paper
Grid Paper

No Textbook Required

This is a stand-alone course.

Mathematics Grade 9
Version 6
Preview/Review W3 - Review
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Preview/Review Concepts for Grade Nine Mathematics

Teacher Key

W3 – Review

W3 – Review

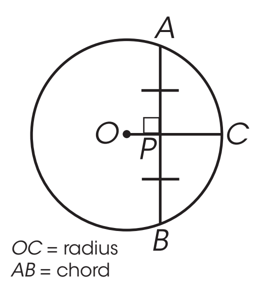
Materials required:

- Paper, Pencil, Calculator, Tracing Paper, Grid paper

Part 1: Properties of Circles

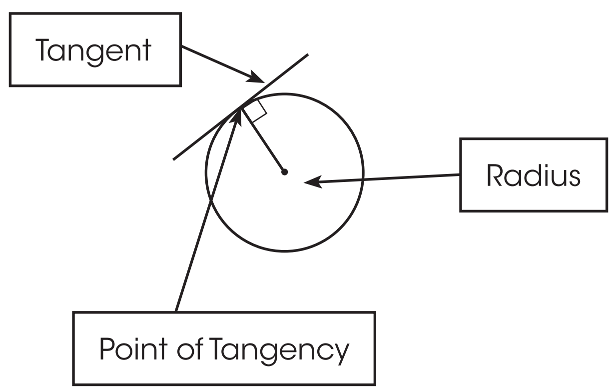
Properties related to angles in circles can be used to solve problems. To solve problems, properties of a circle need to be defined.

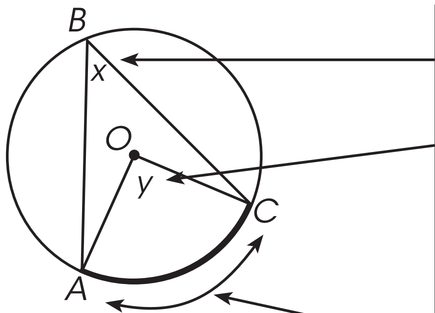
A **chord** is a line segment that joins two points of a circle.



The chord *AB* had end points that fall on the circle.

A **tangent** is a line intersecting only one point on the circle; it is perpendicular to the radius.



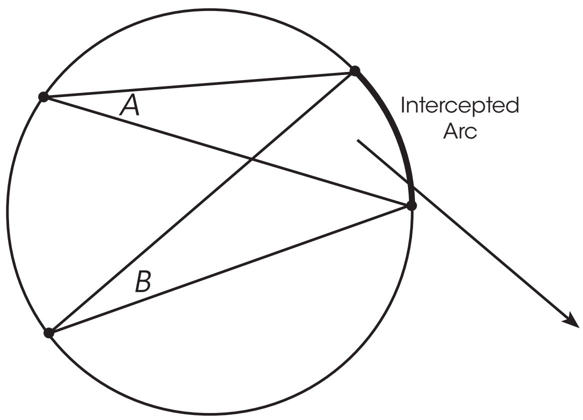


"*x*" is the inscribed angle. It is formed by the two chords *AB* and *BC*.

"*y*" is the central angle.

The central angle is twice the value of the inscribed angle.

Both angles are subtended by the same arc of the circle.



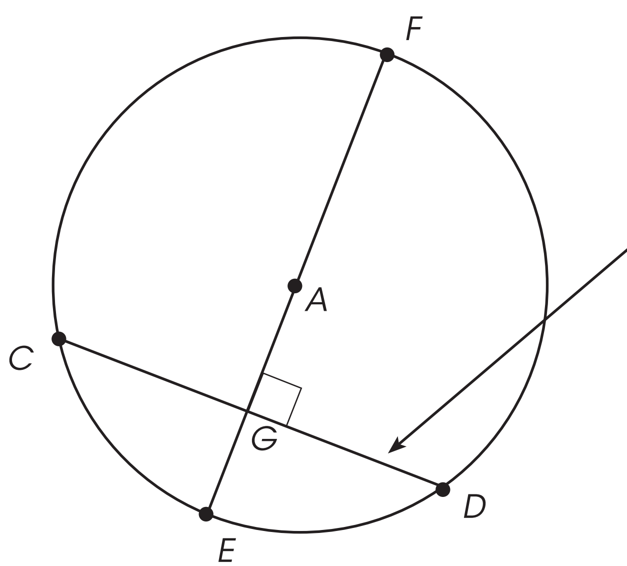
Angle *A* = Angle *B*

The inscribed angles *A* and *B* are congruent.

Angle *A* and Angle *B* are both 35°.

The measure of the central angle is twice the value of an inscribed angle subtended by the same arc. The central angle would be 70°.

The perpendicular bisector from the centre of a circle to a chord will bisect the cord.



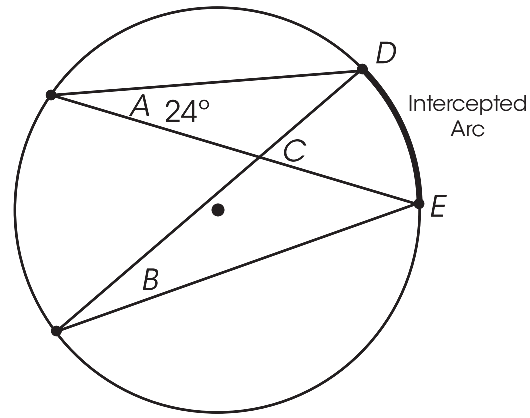
This is the chord. It is perpendicular because it forms a 90 degree angle with the line passing through the centre.

Example 1

Determine the measure of each angle.

a. $\angle B$
$= 24°$ since $\angle A = \angle B$

b. $\angle C$
$= 48°$ since the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc.

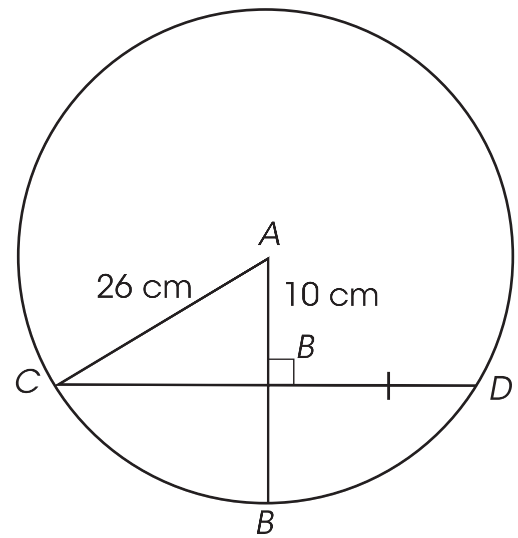


Angle *A* = Angle *B*

Example 2

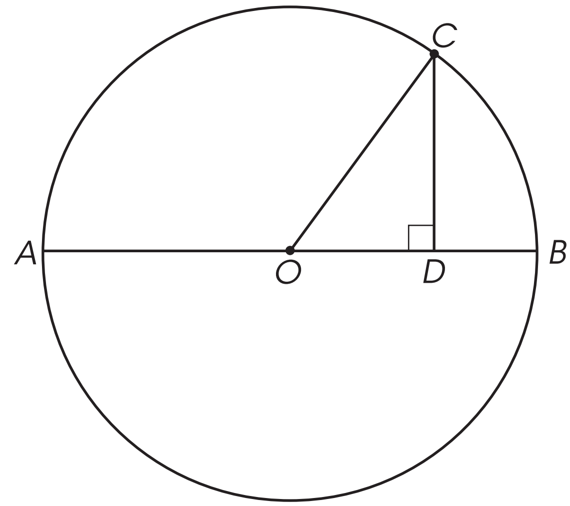
What is the length of chord *CD*?

To determine the length of *CD*, use the Pythagorean Theorem since triangle *ACB* is a right angled triangle.



$$a^2 + b^2 = c^2$$
$$10^2 + CB^2 = 26^2$$
$$CB^2 = 576$$
$$CB = \sqrt{576}$$
$$CB = 24$$
So $CD = 24 + 24 = 48$ cm

Example 3



The center of the circle is O.

$AO = 10$ cm

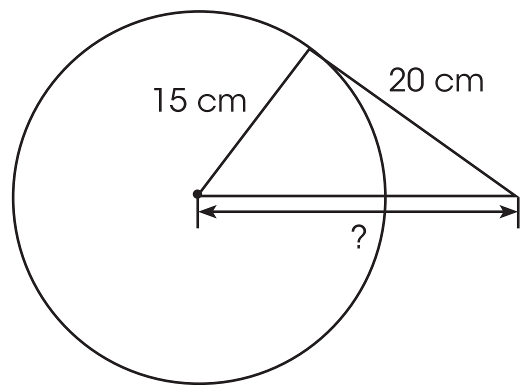
$DB = 4$ cm

a. What is the length of OC?
$AO = CO = 10$ cm

b. What is the length of OD?
$10 - 4 = 6$ cm

c. What is the length of CD?
$6^2 + a^2 = 10^2$
$a = 8$ cm

Example 4



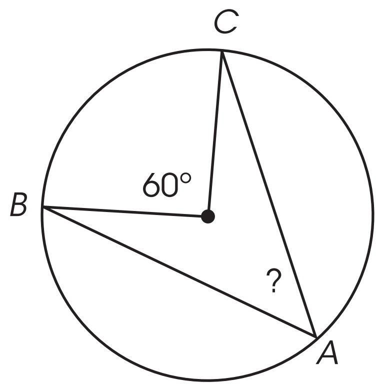
What is the measurement of the unknown length?

To solve, use the Pythagorean Theorem to find the unknown side.

$$a^2 + b^2 = c^2$$
$$15^2 + 20^2 = c^2$$
$$225 + 400 = c^2$$
$$625 = c^2$$
$$\sqrt{625} = c$$
$$c = 25 \text{ m}$$

Practice Questions

1. What is the measure of $\angle A$?

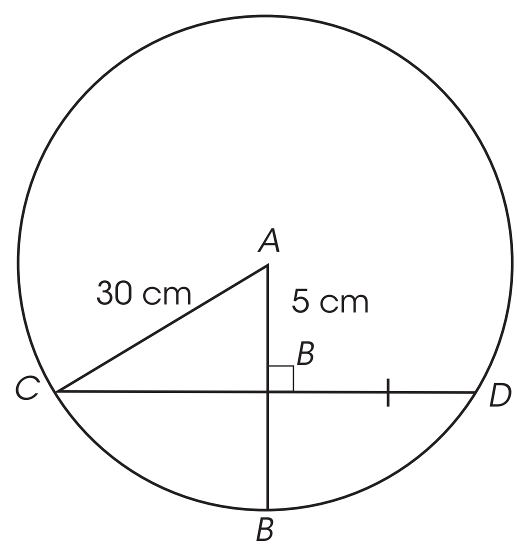


A is half the central angle, therefore A is 30°.

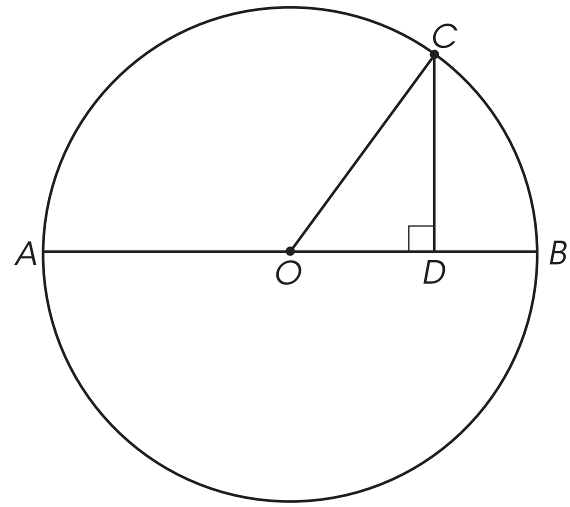
2. What is the length of chord *CD* rounded to the nearest decimal?

$$\boldsymbol{a^2 + b^2 = c^2}$$
$$\boldsymbol{5^2 + CB^2 = 30^2}$$
$$\boldsymbol{CB^2 = 875}$$
$$\boldsymbol{CB = \sqrt{875}}$$
$$\boldsymbol{CB = 29.6}$$

So CD = 29.6 + 29.6 = 53.2 cm



3. The center of the circle is O.



$AO = 25$ cm
$DB = 12$ cm

a. What is the length of OC?

AO = CO = 25 cm

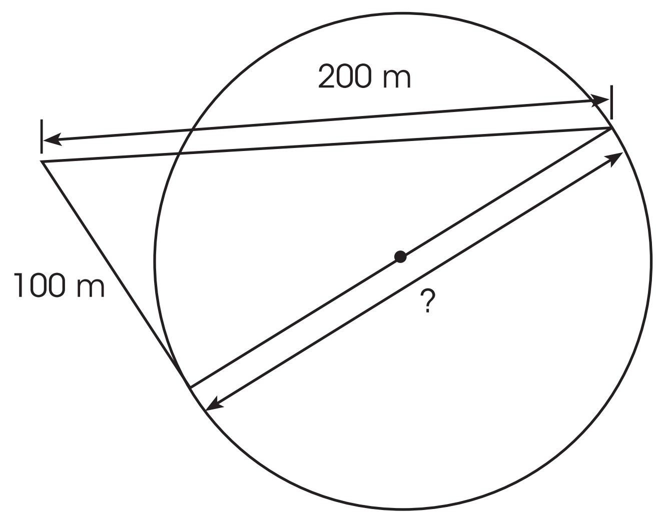
b. What is the length of OD?

25 – 12 = 13cm

c. What is the length of CD?

$\boldsymbol{13^2 + a^2 = 25^2, a = 21.35 \text{ cm}}$

4. Find the missing length.



Use Pythagorean Theorem to find the unknown side.

$$\begin{aligned} a^2 + b^2 &= c^2 \\ 100^2 + b^2 &= 200^2 \\ 10\,000 + b^2 &= 40\,000 \\ b^2 &= 30\,000 \\ \sqrt{30\,000} &= b \\ 173.2 &= b \end{aligned}$$

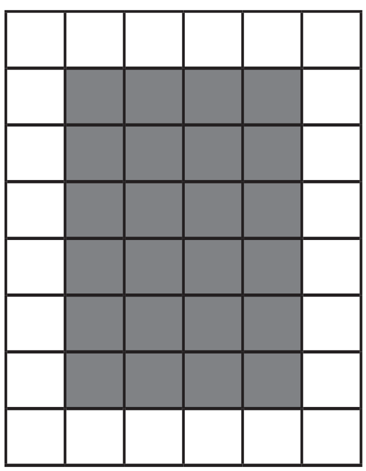
Part 2: Properties of Polygons

Similar polygons may be a different size or orientation, but they must be the same shape. To check if polygons are similar, see if they have corresponding sides and corresponding angles.

To solve for any unknown side in similar polygons, use scale factor or set up a proportion. If the scale factor is greater than 1, the image has been enlarged. If the scale factor is less than 1, the image has been reduced.

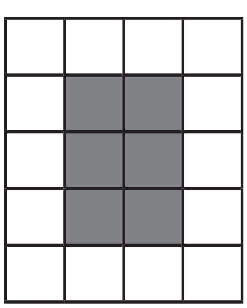
Example 1

Use grid paper to draw the design with a scale factor of 0.5.



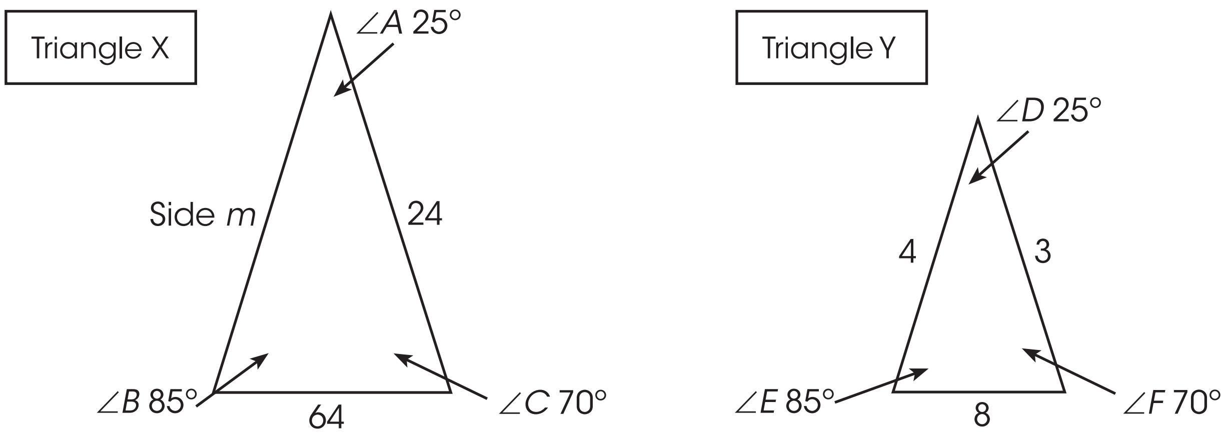
$L = 4 \times 0.5 = 2$
$W = 6 \times 0.5 = 3$

The reduced image should have new dimensions of 2×3. The scale factor is 0.5 units. This is a reduction.



Example 2

The following triangles below are similar. Determine the length of the missing side m.



To find the missing side, compare the corresponding sides to determine the scale factor. Once the scale factor is known, solve for the missing side.

$$\frac{AB}{DE} = \frac{m}{4} \qquad \frac{BC}{EF} = \frac{64}{8} = 8 \qquad \frac{AC}{DF} = \frac{24}{3} = 8$$

The scale factor is 8. This is an enlargement.

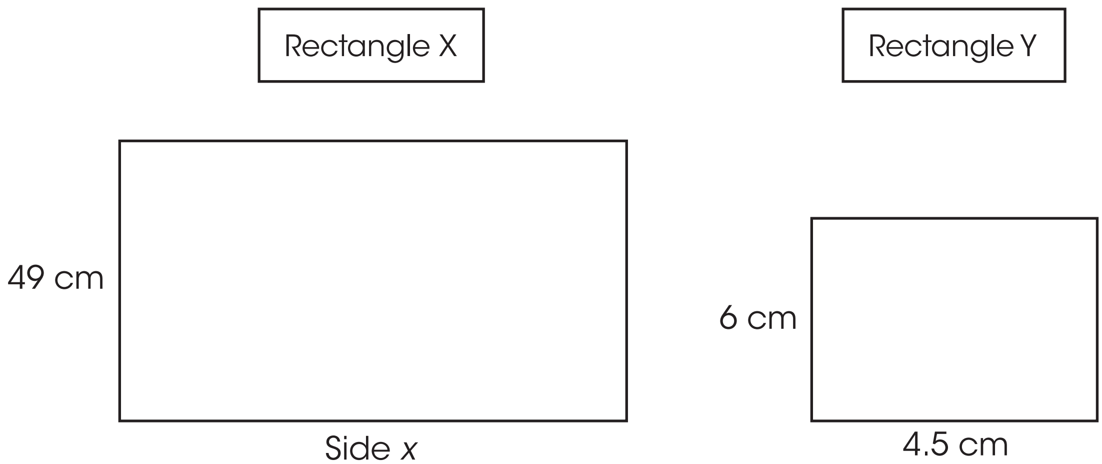
Using algebra, $\frac{m}{4} = 8$

$$\frac{m}{4} \square 4 = 8 \square 4$$

$$m = 32^\circ$$

Example 3

The following rectangles below are similar. Determine the length of the missing side x.



Since the rectangles are similar, the side lengths will be proportional. Set up a proportion to solve for the unknown side.

$$\frac{6}{49} = \frac{4.5}{x}$$
$$6x = 220.5$$
$$\frac{6x}{6} = \frac{220.5}{6}$$
$$x = 36.75 \text{ cm}$$

The missing side length on rectangle x is 36.75 cm.

Practice Questions

1. Solve the following proportions. Round to the nearest tenth.

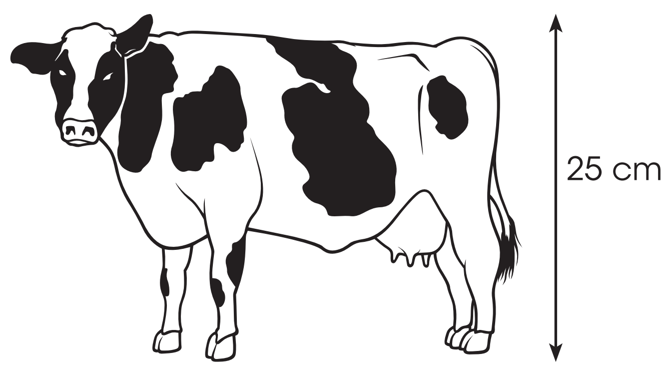
a. $\frac{5}{6} = \frac{x}{450}$ b. $\frac{2}{20} = \frac{3.5}{x}$ c. $\frac{1}{x} = \frac{4}{320}$

***x* = 375** ***x* = 35** ***x* = 80**

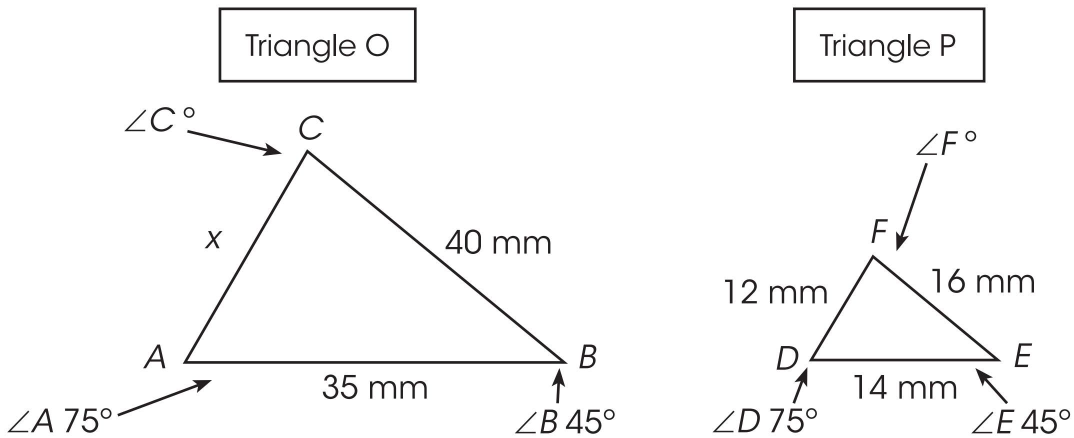
2. The average height of a Holstein cow is 175 cm. What was the scale factor used to create this image of the cow?

$$\boldsymbol{\frac{1}{25} = \frac{x}{175}}$$

***x* = 7 cm**



3. The following triangles are similar. Find the missing side and angles.



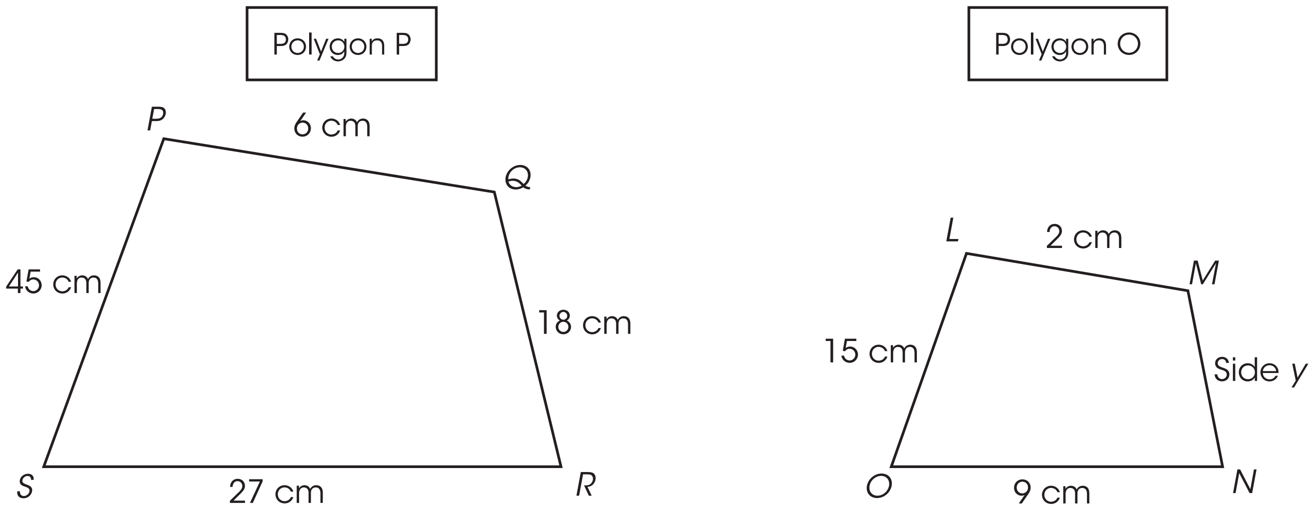
$75^\circ + 45^\circ + {<}F = 180^\circ$
$\angle F = 60^\circ$ and $\angle C = 60^\circ$ because the triangles are similar.

$\frac{CB}{FE} = \frac{40}{16} = 2.5$ and $\frac{BA}{ED} = \frac{35}{14} = 2.5$, so the scale factor is 2.5.

Using the scale factor, $\frac{x}{12} = 2.5$

$x = 30$ mm

4. The following polygons are similar. Find the length of the missing side y.



To find the missing side, set up a proportion.

$$\frac{PQ}{QR} = \frac{LM}{MN}$$

$$\frac{6}{18} = \frac{2}{MN} \qquad \textit{Cross multiply}$$

$$6mn = 36$$

$$mn = 6 \text{ cm, therefore Side } y \text{ is } 6 \text{ cm.}$$

Part 3: Rotational Symmetry

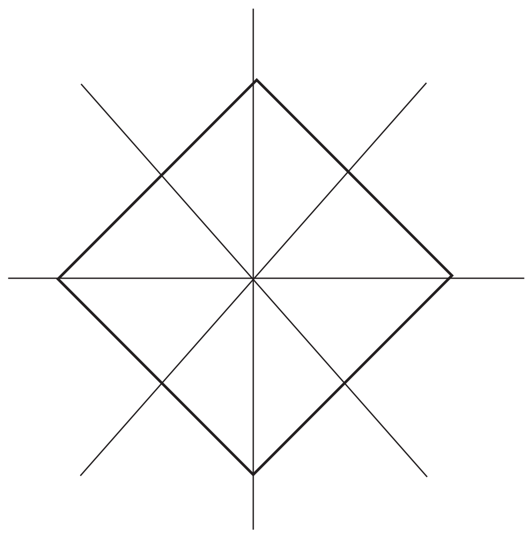
Rotational symmetry occurs when an image can be turned about its centre of rotation so that it fits onto its shape more than once in a complete 360 degree turn.

Polygons, images and designs can have rotational symmetry and line symmetry.

Lines of symmetry occur when a shape or image can be divided into identical halves. These identical halves are mirror images of each other and were created by the line of symmetry.

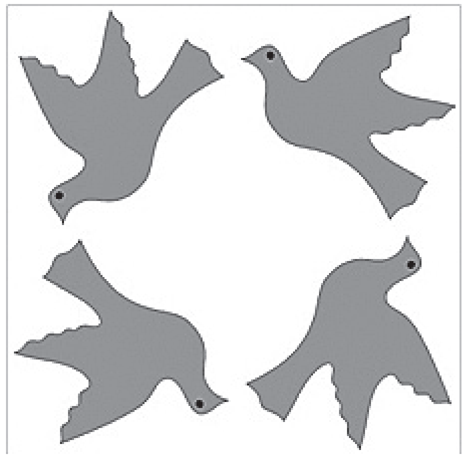
Example 1

How many lines of symmetry does the image have?



This shape has 4 lines of symmetry.

Example 2



a. What is the order of rotation? ***4***

b. What is the angle of rotation? $\boldsymbol{\frac{360^o}{4} = 90^o}$

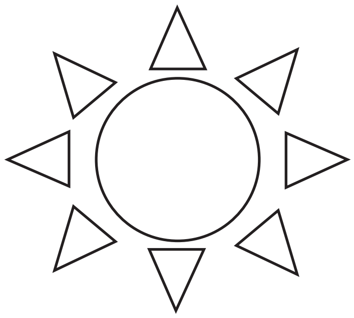
c. Where is the centre of rotation? ***The centre of the shape.***

d. How many lines of symmetry does the shape have? ***0***

Practice Questions

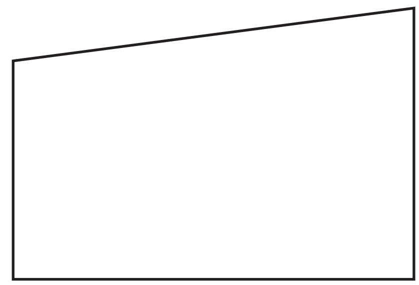
1. How many lines of symmetry does each of the following shapes have?

a.



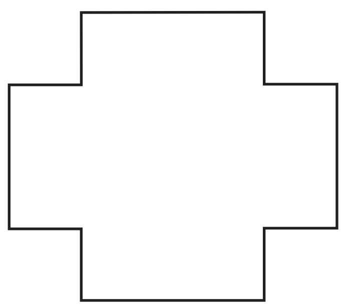
4 lines of symmetry

b.



no lines of symmetry

2. Consider the following shape.



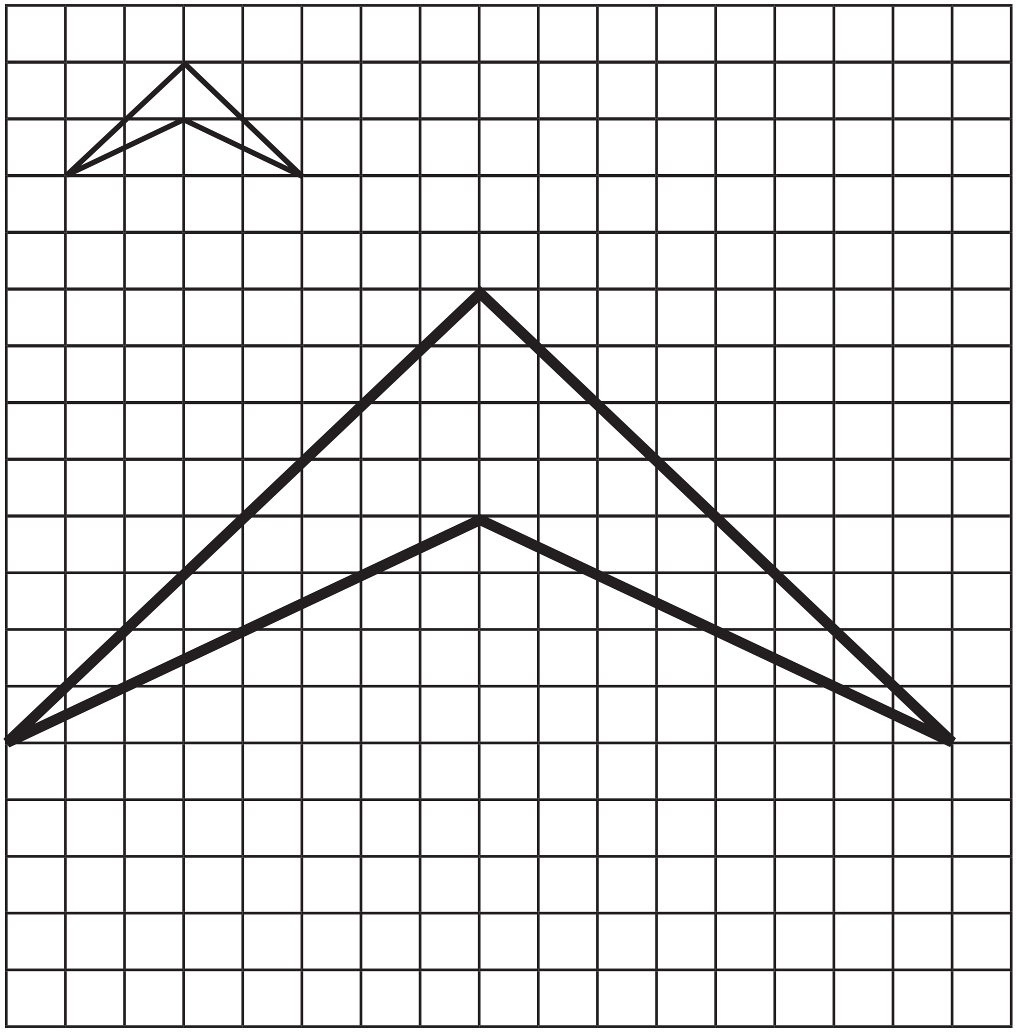
a. What is the order of rotation? ***4***

b. What is the angle of rotation? $\boldsymbol{\frac{360^\circ}{4} = 90^\circ}$

c. Where is the centre of rotation? ***The centre of the shape.***

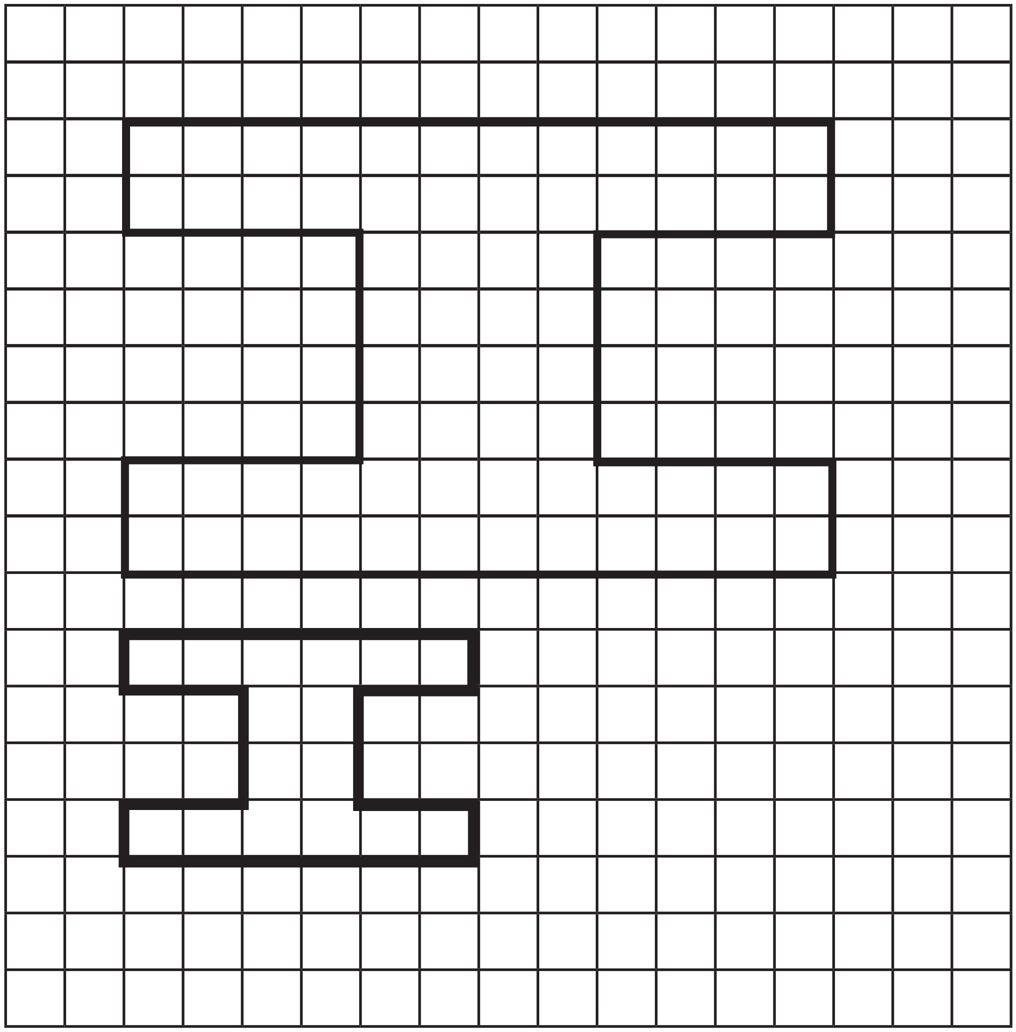
d. How many lines of symmetry does the shape have? ***4***

3. a. Draw the image with a scale factor of 4.



b. Is it an enlargement or a reduction? ***Enlargement***

4. a. Draw the image with a scale factor of 0.5.



b. Is it an enlargement or a reduction? ***Reduction***

Part 4: Data Analysis

Survey questions should be worded so that they are free from any influencing factors that may impact the survey positively or negatively. Factors that can influence a survey include:

Bias	Cultural Sensitivity	Use of Language
Ethics	Time	Timing
Cost	Privacy	

Example 1

The first 40 people to enter a Home and Garden Trade Show were asked if they would support an increase to the entrance fee for the show, from $5.00 to $6.00.

Here, the influencing factor is the wording of the question. The words increasing the entrance fee could negatively influence people. No one wants to pay more money.

Populations and Samples

To conduct a survey, either a ***population*** or a ***sample*** can participate. A ***population*** refers to the whole group of individuals being studied. However, sometimes this method of data collection is not always practical or cost effective. If the population is too large, using this method is not practical.

Ensure that the sample is random. This means that everyone in the population has an equal chance of being chosen. A biased sample will influence the survey. A bias will impact results by favouring one outcome.

Example 2

A survey is planned to find out what Albertan Grade 12 students plan to do after high school. It would be impossible to survey all grade 12 students, so a sample can be used instead. A **sample** is any part of the population.

Using Data to Draw Conclusions

Conclusions can be drawn from theoretical and experimental probability. Probability can also be very helpful when making a decision.

Example 3

A researcher wishes to determine the most common eye colour for teenagers in the area. 2302 students from three local high schools were asked to identify their eye colour.

Eye Color	Total
Brown	1656
Blue	483
Hazel	115
Green	22
Other	26

Using these results, predict how many students out of 5000 would have blue eyes. Round the answer to the nearest percent.

$$\begin{aligned} \frac{483}{2302} &= 20.98\% \\ &= 21 \end{aligned}$$

$$\begin{aligned} &21\% \text{ of } 5000 \\ &= 0.21 \times 5000 \\ &= 1050 \end{aligned}$$

Based on the results of the survey, we can predict that 1050 students out of 5000 would have blue eyes.

Practice Questions

1. For each situation, decide if a survey should be conducted using the population or a sample.

   a. A survey of teachers, parents, students and administrators to see whether the library in the school needs to be updated.

   Population

   b. A survey of customers to determine most popular soda flavour.

   Sample

2. Ask 10 people selected at random in a parking lot if they like to drive cars. What are the influencing factors?

   Bias: usually people in a parking lot will drive a car.

3. 2302 students were asked to identify their eye colour to determine the most common eye colour in high schools.

Eye Color	Total
Brown	1656
Blue	483
Hazel	115
Green	22
Other	26

   a. Based on the above results, predict how many people out of 7500 would have brown eyes.

$$\frac{1656}{2302} = 72\%$$

$$0.72 \times 7500 = 5400$$

   b. What assumptions are made?

   All people have an equal chance of being selected for the survey; all people surveyed have two eyes that are the same colour.

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