Important Concepts of Grade 6 Mathematics

W1 - Lesson 1 ............................................................. Basic Facts, Basic Operations, and Integers
W1 - Lesson 2 .......................................................... Place Value, Whole Numbers, Decimals, and Common Fractions
W1 - Lesson 3 ............................................................ Improper Fractions and Mixed Numbers
W1 - Lesson 4 ............................................................. Ratios and Percents
W1 - Lesson 5 ............................................................. Number Operations with Decimals
W1 - Quiz
W2 - Lesson 1 ............................................................. Factors, Multiples, and Prime Factorizations
W2 - Lesson 2 ............................................................. Metric Measurement
W2 - Lesson 3 ............................................................. Perimeter and Area
W2 - Lesson 4 ............................................................. Surface Area and Volume
W2 - Lesson 5 ............................................................. Working with Angles and Drawing Objects and Shapes
W2 - Quiz
W3 - Lesson 1 ............................................................. Transformations
W3 - Lesson 2 ............................................................. Bar Graphs, Line Graphs, and Circle Graphs
W3 - Lesson 3 ............................................................. Collecting and Analyzing Data
W3 - Lesson 4 ............................................................. Number Patterns, Magic Squares, and Problem Solving
W3 - Lesson 5 ............................................................. Probability and Outcomes
W3 - Quiz

Materials Required: A textbook is not needed. This is a stand-alone course.

Mathematics Grade 6
Version 5
Preview/Review W2 - Lesson 5

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Preview/Review Concepts for Grade Six Mathematics

W2 - Lesson 5: Working with Angles and Drawing Objects and Shapes
OBJECTIVES

By the end of this lesson, you should

- use a protractor
- draw and measure various angles
- name various types of angles
- construct various figures

GLOSSARY

acute angle - angle less than 90°
angle - formed by two rays sharing an endpoint
degree - the unit of measurement used to measure the size of angles
equilateral triangle - triangle with three equal sides and angles
isosceles triangle - triangle with two equal sides and two equal angles
obtuse angle - angle greater than 90° but less than 180°
obtuse triangle - triangle with one angle greater than 90°
parallelogram - a four-sided closed figure with two pairs of equal angles and sides
pentagon - a five-sided closed figure
protractor - a semi-circular tool used to measure the size of angles
quadrilateral - any closed figure of four sides
ray - a line that starts at an endpoint and continues in one direction
reflex angle - an angle greater than 180°
right angle - angle of 90°
right-angle triangle - triangle with one angle of 90°
scalene triangle - triangle with all sides and angles different
straight line or straight angle - angle of 180°
vertex - the end point of the rays that join to make an angle
W2 - Lesson 5: Working with Angles and Drawing Objects and Shapes

Welcome to W2 - Lesson 5! This lesson is about surface area and volume. You will use your skills in metric measurement to find volumes and total areas. The lesson has three topics:

- Drawing and Measuring Angles
- Types of Triangles
- Drawing Polygons and Measuring Angles

Have you seen any interesting figures lately?

Drawing and Measuring Angles

For this lesson, you need a protractor to measure the size of angles.

The unit of measurement used to measure the size of an angle is a degree. The symbol for degree is °. A twenty degree angle is written 20°.

A ray is a line that starts at an endpoint and continues on in one direction.

![Ray diagram]

An angle is formed by two rays that share an endpoint. The endpoint is called the vertex. In the drawing below, B is the vertex. An angle is named by labeling three points on the rays: one on each ray and one on the vertex. Capital letters are used when naming angles. The letter for the vertex must be the middle letter. The symbol used to represent an angle is ∠.

Below is ∠ABC. This angle can also be named ∠B.

![Angle diagram]
The Names of Different Angles

A **right angle** is an angle that forms a square corner. It is exactly 90°. The small square connecting the rays is a symbol for a right angle.

An **acute angle** is less than 90°. An acute angle is between 0° and 90°.

An **obtuse angle** is more than 90° but less than a straight line. An obtuse angle is between 90° and 180°.

A **straight line** is an angle that is exactly 180°.

A **reflex angle** is an angle that is greater than a straight line. A reflex angle is between 180° and 360°.

Drawing Angles

Place the protractor on the ray so the centre of the protractor is on the vertex and the base line is on the ray. For a 70° angle, place the protractor on the ray, find the band of numbers that start at 0°, and move to 70°. Make a mark at 70°. Remove the protractor and draw a straight line from the vertex to your mark.

On this protractor use the inside band of numbers when the ray points to the right. Use the outside numbers when the ray points to the left.
Questions

1. Use a protractor to measure the following angles. Your answer should be within 1° of the correct answer. Also, name the type of angle in each drawing: right $\angle$, acute $\angle$, obtuse $\angle$, reflex $\angle$, or straight line. Write your measurement inside the angle.

Example:

\[
\begin{array}{c}
\text{A} \\
\text{40°} \\
\text{acute}
\end{array}
\]

a. Type of Angle: ______________________

b. Type of Angle: ______________________

c. Type of Angle: ______________________
d. Type of Angle: ______________________

e. Type of Angle: ______________________

f. Type of Angle: ______________________

g. Type of Angle: ______________________
2. Use the rays that are provided and draw angles as instructed. Your answers should be within 1° of the correct measurement. Write your measurement inside the angle.

Example:

\[
\text{Draw } \angle \text{Example} = 40^\circ
\]

a. Draw \( \angle A = 45^\circ \)

b. Draw \( \angle B = 72^\circ \)
c. Draw $\angle C = 115^\circ$

d. Draw $\angle D = 148^\circ$

e. Draw $\angle E = 200^\circ$
Types of Triangles

A triangle is a three-sided polygon. The sum of three angles of a triangle is always 180°. The symbol for a triangle is Δ.

Types of Triangles

Equilateral triangle has three sides that are the same length. This triangle also has three angles that are equal. Each angle is 60°.

Isosceles triangle has two sides that are the same length. This triangle has two angles that are equal in size.

Scalene triangle has no sides the same length. Also, none of the angles of this triangle are equal.

Right-angle triangle is a triangle with one angle that is 90°.

Acute triangle is a triangle with all 3 angles less than 90°.

Obtuse triangle is a triangle that has one angle greater than 90°.
**Identifying Triangles**

Each triangle can be identified two ways. It is one of the following three types: equilateral, isosceles, or scalene. It is also one of the following three types: right-angle, acute, or obtuse.

ΔABC is an equilateral triangle and an acute triangle.
\[ \angle A = 60^\circ, \angle B = 60^\circ, \text{ and } \angle C = 60^\circ \]
The sum of the three angles is 180°.

ΔDEF is a scalene triangle and an obtuse triangle.
\[ \angle D = 42^\circ, \angle E = 123^\circ \text{ and } \angle F = 15^\circ \]
The sum of the three angles is 180°.

**Questions**

1. Identify each of the following triangles two ways. Pick one name from each category. Category I (equilateral, isosceles, or scalene). Category II (acute, obtuse, or right-angle). Measure each angle and record the number of degrees in the space provided. Find the total number of degrees of each triangle.

   a. \[ \angle H = \quad \text{Category I: } \quad \]

   \[ \angle I = \quad \text{Category II: } \quad \]

   \[ \angle J = \quad \]

   Total = \[ \]
b. $\angle K = \underline{\hspace{2cm}}$ Category I: $\underline{\hspace{2cm}}$

$\angle L = \underline{\hspace{2cm}}$ Category II: $\underline{\hspace{2cm}}$

$\angle M = \underline{\hspace{2cm}}$

Total = $\underline{\hspace{2cm}}$

c. $\angle N = \underline{\hspace{2cm}}$ Category I: $\underline{\hspace{2cm}}$

$\angle O = \underline{\hspace{2cm}}$ Category II: $\underline{\hspace{2cm}}$

$\angle P = \underline{\hspace{2cm}}$

Total = $\underline{\hspace{2cm}}$

d. $\angle Q = \underline{\hspace{2cm}}$ Category I: $\underline{\hspace{2cm}}$

$\angle R = \underline{\hspace{2cm}}$ Category II: $\underline{\hspace{2cm}}$

$\angle S = \underline{\hspace{2cm}}$

Total = $\underline{\hspace{2cm}}$
e. \( \angle T = \underline{\phantom{0}} \) Category I: \( \underline{\phantom{0}} \)
\( \angle U = \underline{\phantom{0}} \) Category II: \( \underline{\phantom{0}} \)
\( \angle V = \underline{\phantom{0}} \)
Total = \( \underline{\phantom{0}} \)

f. \( \angle W = \underline{\phantom{0}} \) Category I: \( \underline{\phantom{0}} \)
\( \angle X = \underline{\phantom{0}} \) Category II: \( \underline{\phantom{0}} \)
\( \angle Y = \underline{\phantom{0}} \)
Total = \( \underline{\phantom{0}} \)
2. Use a ruler and protractor to draw triangles to fit the descriptions given below. For each question a named line segment is given. You must add to the line segment to make a triangle.

a. Draw a right-angle triangle (ΔABC). \( \angle A = 90^\circ \) and \( \angle B = 35^\circ \)
   
   Is this triangle equilateral, isosceles, or scalene? ______________
   
   How large is \( \angle C \)? ______________

b. Draw an acute triangle (ΔDEF). \( \angle D = 65^\circ \) and \( \angle E = 45^\circ \)
   
   Is this triangle equilateral, isosceles, or scalene? ______________
   
   How large is \( \angle F \)? ______________
c. Draw an obtuse triangle (ΔGHI). \( \angle G = 120^\circ \) and \( \angle H = 25^\circ \)
   Is this triangle equilateral, isosceles, or scalene? _______________
   How large is \( \angle I \)? _______________

   __________________________________________________________________
   G                             H

d. Draw an acute triangle (ΔJKL). \( \angle J = 55^\circ \) and \( \angle K = 55^\circ \)
   Is this triangle equilateral, isosceles, or scalene? _______________
   How large is \( \angle L \)? _______________

   __________________________________________________________________
   J                             K
### Drawing Polygons and Measuring Angles

A **quadrilateral** is a four-sided figure. The most common quadrilaterals are squares, rectangles, and parallelograms. The sum of the four angles in a quadrilateral is 360°.

A **pentagon** is a five-sided figure. The sum of the five angles is 540°.

The numbers of degrees in various figures are in the chart below.

<table>
<thead>
<tr>
<th>Polygon</th>
<th>Number of Sides</th>
<th>Number of Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>3</td>
<td>180°</td>
</tr>
<tr>
<td>Square</td>
<td>4</td>
<td>360°</td>
</tr>
<tr>
<td>Rectangle</td>
<td>4</td>
<td>360°</td>
</tr>
<tr>
<td>Parallelogram</td>
<td>4</td>
<td>360°</td>
</tr>
<tr>
<td>Pentagon</td>
<td>5</td>
<td>540°</td>
</tr>
</tbody>
</table>

The angles in squares and rectangles are all right angles.

In a **parallelogram**, opposite sides and opposite angles are equal. In parallelogram ABCD, the following sides and angles are equal.

\[ AB = DC \text{ and } AD = BC \]
\[ \angle A = \angle C \text{ and } \angle B = \angle D \]

In a parallelogram, the top two angles (\( \angle A \) and \( \angle B \)) and the bottom two angles (\( \angle D \) and \( \angle C \)) equal 180°.

For example, in parallelogram ABCD

\[ \angle D = 60°. \text{ Therefore, } \angle C \text{ is } 120° \text{ because } 180° - 60° = 120°. \]
\[ \angle B = 60°. \text{ Therefore, } \angle A \text{ is } 120° \text{ because } 180° - 60° = 120°. \]
Questions

1. Use a protractor to measure all the angles in the figures below. Record the number of degrees in the space provided. Calculate the sum of all the angles in each figure.

a. $\angle A = \underline{\quad}$
   $\angle B = \underline{\quad}$
   $\angle C = \underline{\quad}$
   $\angle D = \underline{\quad}$
   Total = $\underline{\quad}$

b. $\angle E = \underline{\quad}$
   $\angle F = \underline{\quad}$
   $\angle G = \underline{\quad}$
   $\angle H = \underline{\quad}$
   Total = $\underline{\quad}$

c. $\angle I = \underline{\quad}$
   $\angle J = \underline{\quad}$
   $\angle K = \underline{\quad}$
   $\angle L = \underline{\quad}$
   Total = $\underline{\quad}$
d. \( \angle M = \) \\
\( \angle N = \) \\
\( \angle O = \) \\
\( \angle P = \) \\
Total = 

\[ MNOP \]

\[ \text{Total} = \]

e. \( \angle Q = \) \\
\( \angle R = \) \\
\( \angle S = \) \\
\( \angle T = \) \\
\( \angle U = \) \\
Total = 

\[ QURST \]

\[ \text{Total} = \]

f. \( \angle W = \) \\
\( \angle X = \) \\
\( \angle Y = \) \\
\( \angle Z = \) \\
\( \angle A = \) \\
Total = 

\[ WZXYA \]
2. Use a ruler and a protractor to draw figures to fit the description given below. Use capital letters to name the points. Hint: Draw the item that is in **bold** letters first.

a. Draw a parallelogram named ABCD.

   \[ \text{DC} = 6 \text{ cm}, \text{DA} = 4 \text{ cm and } \angle D = 45^\circ \]

b. Draw a parallelogram named FGHI.

   \[ \text{IH} = 4.5 \text{ cm}, \text{all sides} = 4.5 \text{ cm and } \angle I = 30^\circ \]
c. Draw a quadrilateral named JKLM.

**ML = 9 cm, ∠M = 60°, ∠L = 60°, and LK = MJ = 5 cm**

What is the length of side JK? __________

d. Draw a pentagon named PQRST.

**SR = 6 cm, ∠S = ∠R = 120°, ST = RQ = 4 cm, ∠T = 90° and TP = 5 cm**

What is the length of side PQ? __________
Homework Assignment

1. Draw an Acute Triangle (\( \triangle ABC \)).  
   \( AB = 4.5 \text{ cm}, \quad \angle A = 60^\circ \) You can choose the size of the other two angles and the other two sides.

2. Draw a parallelogram named DEFG.  
   \( DE = FG = 7 \text{ cm}, \quad DG = EF = 3 \text{ cm}, \quad \angle G = 80^\circ \)

3. Draw a pentagon named LMNOP.  
   \( ON = 5 \text{ cm}, \quad OP = NM = 4 \text{ cm}, \quad \angle O = 75^\circ, \quad \angle N = 115^\circ \)  
   You can choose the size of the other two angles and the other two sides.
Self-Evaluation

Ask yourself some important questions. Write your answers in sentences for your teacher.

1. In this lesson, what part of your work was **excellent**?

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

2. In this lesson, what part of your work **needs improvement**?

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

3. If you want help for some of the work in this lesson, ask your teacher in this space.

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________