W2 - Lesson 3: Perimeter and Area
Important Concepts of Grade 6 Mathematics

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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
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W3 - Quiz

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

Mathematics Grade 6
Version 5
Preview/Review W2 - Lesson 3 TEACHER KEY

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Preview/Review Concepts for Grade Six Mathematics

W2 - Lesson 3: Perimeter and Area
OBJECTIVES

By the end of this lesson, you should

- understand the perimeter as the distance around a figure
- understand area as the size of a surface
- use metric units of measure to determine perimeter and area

GLOSSARY

**area** - the amount of surface a figure covers

**parallelogram** - a variation of a rectangle, but opposite angles are equal

**perimeter** - distance around any shape

**polygon** - a straight-sided figure with three or more sides

**quadrilateral** - a straight-sided figure with four sides

**rectangle** - a variation of a square, but opposite sides are equal

**square** - a figure with four equal sides and angles
W2 - Lesson 3: Perimeter and Area

Welcome to W2 - Lesson 3! This lesson is about perimeter and area. You will use your skills in metric measurement to find lengths and areas. The lesson has three topics:

- Perimeter
- Area
- Areas of Irregular Shapes

Have fun with shapes and sizes!

Perimeter

The distance around any shape is its perimeter. Perimeter is found by adding the lengths of all sides of the figure. Perimeter is usually measured in kilometres, metres, centimetres, or millimetres.

All straight-sided figures with three or more sides are called polygons. The names of some common polygons are given in this chart.

<table>
<thead>
<tr>
<th>Number of Sides</th>
<th>Name of Polygon</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-sided figure</td>
<td>triangle</td>
</tr>
<tr>
<td>4-sided figure</td>
<td>quadrilateral</td>
</tr>
<tr>
<td>5-sided figure</td>
<td>pentagon</td>
</tr>
<tr>
<td>6-sided figure</td>
<td>hexagon</td>
</tr>
<tr>
<td>7-sided figure</td>
<td>heptagon</td>
</tr>
<tr>
<td>8-sided figure</td>
<td>octagon</td>
</tr>
</tbody>
</table>

Special quadrilaterals that you can see frequently include the following:

- **Square** - All four sides and angles (corners) are equal.
- **Rectangle** - Opposite sides are equal, and all angles are equal.
- **Parallelogram** - Opposite sides are parallel and equal, but pairs of opposite angles are equal.
Questions

1. Find the perimeter of the following polygons. Write the formula (such as \(8 + 4 + 4 = 16\)) each time and always write the units of measurement in your answer. (km, m, cm, or mm)

   a.
   \[
   6 \text{ cm} \enspace 6 \text{ cm} \\
   4 \text{ cm}
   \]
   \[
   6 + 6 + 4 = 16 \text{ cm}
   \]

   b.
   \[
   12 \text{ mm}
   \]
   \[
   12 + 12 + 12 + 12 = 48 \text{ mm}
   \]

   c.
   \[
   10 \text{ km} \enspace 14 \text{ km}
   \]
   \[
   10 + 10 + 14 + 14 = 48 \text{ km}
   \]

   d.
   \[
   40 \text{ mm} \enspace 55 \text{ mm}
   \]
   \[
   40 + 40 + 55 + 55 = 190 \text{ mm}
   \]
e. \[6 + 8 + 6 + 4 = 24 \text{ mm}\]

f. \[11 + 22 + 22 + 11 + 22 + 22 + = 110 \text{ cm}\]

g. \[6 + 24 + 6 + 24 = 60 \text{ m}\]

h. \[50 + 85 + 70 = 205 \text{ mm}\]
2. Use a ruler to measure the sides of the following polygons, and write the lengths on the figure. Then, find the perimeter of each. Write your answers in centimetres.

a. \[4 \text{ cm} \quad 2 \text{ cm}\]
   \[P = 12 \text{ cm}\]

b. \[6.7 \text{ cm} \quad 6.7 \text{ cm}\]
   \[6 \text{ cm}\]
   \[P = 19.4 \text{ cm}\]

c. \[4 \text{ cm}\]
   \[2.5 \text{ cm}\]
   \[P = 13 \text{ cm}\]

d. \[2.8 \text{ cm}\]
   \[P = 11.2 \text{ cm}\]

e. \[3.7 \text{ cm}\]
   \[1 \text{ cm}\]
   \[2.5 \text{ cm}\]
   \[P = 20.4 \text{ cm}\]

f. \[2 \text{ cm}\]
   \[2 \text{ cm}\]
   \[2 \text{ cm}\]
   \[P = 12 \text{ cm}\]
3. Calculate the perimeter for each polygon. Use the space below to do your calculations.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Type of Polygon</th>
<th>Length of Sides</th>
<th>Perimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>triangle</td>
<td>13.1 m, 17.8 m, 14.4 m</td>
<td>45.3 m</td>
</tr>
<tr>
<td>B</td>
<td>square</td>
<td>55 mm</td>
<td>220 mm</td>
</tr>
<tr>
<td>C</td>
<td>rectangle</td>
<td>4.7 cm, 7.6 cm</td>
<td>24.6 cm</td>
</tr>
<tr>
<td>D</td>
<td>parallelogram</td>
<td>63 cm, 24 cm</td>
<td>174 cm</td>
</tr>
<tr>
<td>E</td>
<td>regular octagon*</td>
<td>16 m</td>
<td>128 m</td>
</tr>
<tr>
<td>F</td>
<td>hexagon</td>
<td>1.5 m, 4.0 m, 3.6 m, 5.2 m, 5.8 m, 2.8 m</td>
<td>22.9 m</td>
</tr>
</tbody>
</table>

* A regular octagon has eight equal sides.
4. Calculate the perimeter for each polygon. Note carefully the units of measurement. Write all the answers in centimetres. Use the space below to do your calculations.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Type of Polygon</th>
<th>Length of Sides</th>
<th>Perimeter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>triangle</td>
<td>3.1 m, 178 cm, 144 cm</td>
<td>310 cm + 178 cm + 144 cm = 632 cm</td>
</tr>
<tr>
<td>B</td>
<td>quadrilateral</td>
<td>65 mm, 123 mm, 15 cm, 18.5 cm</td>
<td>6.5 cm + 12.3 cm + 15 cm + 18.5 cm = 52.3 cm</td>
</tr>
<tr>
<td>C</td>
<td>pentagon</td>
<td>67 cm, 7.6 cm, 67 cm, 54 cm, 54 cm</td>
<td>67 cm + 7.6 cm + 67 cm + 54 cm + 54 cm = 249.6 cm</td>
</tr>
<tr>
<td>D</td>
<td>hexagon</td>
<td>63 cm, 24 cm, 122 mm, 134 mm, 51 cm, 33 cm</td>
<td>63 cm + 24 cm + 12.2 cm + 13.4 cm + 51 cm + 33 cm = 196.6 cm</td>
</tr>
<tr>
<td>E</td>
<td>octagon</td>
<td>16 m, 9 m, 18 m, 7 m, 234 cm, 543 cm, 430 cm, 742 cm</td>
<td>1600 cm + 900 cm + 1800 cm + 700 cm + 234 cm + 543 cm + 430 cm + 742 cm = 6949 cm</td>
</tr>
</tbody>
</table>
Area

Area is the amount of surface a figure covers. Square units are used to measure area.

- $\text{mm}^2 = \text{square millimetres}$
- $\text{cm}^2 = \text{square centimetres}$
- $\text{m}^2 = \text{square metres}$
- $\text{km}^2 = \text{square kilometres}$

**Formula for Area of Quadrilaterals**

Because quadrilaterals are regular figures, formulas are useful to calculate area.

**Rectangle:**
Area = base $\times$ height

\[ A = b \times h \] (abbreviated form)

\[ A = 5 \times 3 = 15 \text{ cm}^2 \]
(Count the squares.)

**Parallelogram:**
Remember: Height means the vertical height - the distance up and down.

\[ A = b \times h \]
\[ A = 5 \times 2 = 10 \text{ km}^2 \]

**Triangle:**
A triangle is one half a rectangle.

\[ \text{Area} = \frac{1}{2} \text{ base} \times \text{height} \]

\[ A = \frac{1}{2} b \times h \]

\[ A = \frac{1}{2} (2.5 \times 4) = \frac{1}{2} (10) = 5 \text{ cm}^2 \]
A = \frac{1}{2} b \times h

A = \frac{1}{2} (5 \times 6) = \frac{1}{2} (30) = 15 \text{ km}^2

Note: The height is the vertical height.

A = \frac{1}{2} b \times h

A = \frac{1}{2} (25 \times 40)

A = \frac{1}{2} (1000)

A = 500 \text{ mm}^2

\textbf{Remember: The height is the vertical height.}
Questions

1. Use the correct formula to calculate the area of each of the following polygons. Write your answer in square units (mm², cm², m², or km²).

   a. \[ A = b \times h \]
      \[ = 8 \text{ km} \times 6 \text{ km} \]
      \[ = 48 \text{ km}^2 \]

   b. \[ A = b \times h \]
      \[ = 18 \text{ mm} \times 30 \text{ mm} \]
      \[ = 540 \text{ mm}^2 \]

   c. \[ A = b \times h \]
      \[ = 4 \text{ cm} \times 4 \text{ cm} \]
      \[ = 16 \text{ cm}^2 \]

   d. \[ A = b \times h \]
      \[ = 12 \text{ km} \times 5 \text{ km} \]
      \[ = 60 \text{ km}^2 \]


\[ A = b \times h \]
\[ = 61\text{ mm} \times 42\text{ mm} \]
\[ = 2562\text{ mm}^2 \]

\[ A = \frac{1}{2} (b \times h) \]
\[ A = \frac{1}{2} (10\text{ km} \times 18\text{ km}) \]
\[ A = \frac{1}{2} (180\text{ km}^2) \]
\[ A = 90\text{ km}^2 \]

\[ A = \frac{1}{2} (b \times h) \]
\[ A = \frac{1}{2} (36\text{ mm} \times 47\text{ mm}) \]
\[ A = \frac{1}{2} (1692\text{ mm}^2) \]
\[ A = 846\text{ mm}^2 \]

\[ A = \frac{1}{2} (5\text{ km} \times 3.5\text{ km}) \]
\[ A = \frac{1}{2} (17.5\text{ km}^2) \]
\[ A = 8.75\text{ km}^2 \]
2. Calculate the area of each polygon. Write your answer in square units (mm², cm², m², or km²). Use the space below to do your calculations.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Type of Polygon</th>
<th>Base</th>
<th>Height</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>triangle</td>
<td>22 mm</td>
<td>12 mm</td>
<td>132 mm²</td>
</tr>
<tr>
<td>B</td>
<td>square</td>
<td>17 cm</td>
<td></td>
<td>289 cm²</td>
</tr>
<tr>
<td>C</td>
<td>rectangle</td>
<td>23 m</td>
<td>11 m</td>
<td>253 m²</td>
</tr>
<tr>
<td>D</td>
<td>parallelogram</td>
<td>18 km</td>
<td>25 km</td>
<td>450 km²</td>
</tr>
<tr>
<td>E</td>
<td>triangle</td>
<td>30 m</td>
<td>22 m</td>
<td>330 m²</td>
</tr>
<tr>
<td>F</td>
<td>rectangle</td>
<td>112 mm</td>
<td>200 mm</td>
<td>22 400 mm²</td>
</tr>
<tr>
<td>G</td>
<td>parallelogram</td>
<td>33 cm</td>
<td>44 cm</td>
<td>1 452 cm²</td>
</tr>
</tbody>
</table>
3. Determine the area of each polygon. Note carefully the units of measurement. Write your answer in square centimetres (cm$^2$). Hint: You should convert all measurements to cm before completing the calculations.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Type of Polygon</th>
<th>Base</th>
<th>Height</th>
<th>Area (cm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>triangle</td>
<td>80 mm</td>
<td>12 cm</td>
<td>48 cm$^2$</td>
</tr>
<tr>
<td>B</td>
<td>square</td>
<td>0.4 m</td>
<td>0.4 m</td>
<td>1600 cm$^2$</td>
</tr>
<tr>
<td>C</td>
<td>rectangle</td>
<td>0.35 m</td>
<td>55 m</td>
<td>192.5 m$^2$</td>
</tr>
<tr>
<td>D</td>
<td>parallelogram</td>
<td>24 mm</td>
<td>4 dm</td>
<td>96 cm$^2$</td>
</tr>
<tr>
<td>E</td>
<td>triangle</td>
<td>1.0 m</td>
<td>2.2 cm</td>
<td>110 cm$^2$</td>
</tr>
<tr>
<td>F</td>
<td>rectangle</td>
<td>92 mm</td>
<td>32 cm</td>
<td>294.4 cm$^2$</td>
</tr>
<tr>
<td>G</td>
<td>parallelogram</td>
<td>43 cm</td>
<td>14 cm</td>
<td>602 cm$^2$</td>
</tr>
</tbody>
</table>
4. Use a ruler to measure the base and height of each of the following polygons and then calculate the area. Your measurements should be within 2 mm of the correct answer. Measure carefully!

<table>
<thead>
<tr>
<th>PERIMETER</th>
<th>AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12.5 cm (approx)</strong></td>
<td>[ \frac{1}{2} \times 3.5 \times 4 ] = ( 7 \text{ cm}^2 )</td>
</tr>
<tr>
<td><strong>20 cm</strong></td>
<td>( 5 \times 5 = 25 \text{ cm}^2 )</td>
</tr>
<tr>
<td><strong>18 cm</strong></td>
<td>( 2.5 \times 5 = 12.5 \text{ cm}^2 )</td>
</tr>
<tr>
<td><strong>24 cm</strong></td>
<td>( 3 \times 9 = 27 \text{ cm}^2 )</td>
</tr>
</tbody>
</table>
Areas of Irregular Shapes

Finding the areas of figures that are not triangles, rectangles, or parallelograms is a challenge for you. You likely see that this figure below is actually two rectangles—one larger than the other.

Figure ABCDEFG is not a regular polygon but it can be viewed as two rectangles. Then, the areas can be added to find the total.

Area of rectangle ABFG = \( b \times h = 4 \times 3 = 12 \text{ cm}^2 \)
Area of rectangle CDEF = \( b \times h = 3 \times 2 = 6 \text{ cm}^2 \)
Total area = \( 18 \text{ cm}^2 \)
Questions

1. Find the perimeter and area of each of the figures below.

   a. 
   \[ A = (b \times h) + (b \times h) \]
   \[ A = (12 \times 7) + (7 \times 3) \]
   \[ A = 84 + 21 \]
   \[ A = 105 \text{ cm}^2 \]
   Perimeter = 52 cm

   b. 
   \[ A = (b \times h) + \frac{1}{2}(b \times h) \]
   \[ A = (4.5 \text{ cm} \times 3 \text{ cm}) + \frac{1}{2}(3 \text{ cm} \times 2 \text{ cm}) \]
   \[ A = 13.5 \text{ cm}^2 + 3 \text{ cm}^2 \]
   \[ A = 16.5 \text{ cm}^2 \]
   Perimeter = 17 cm

   c. 
   \[ A = (b \times h) + (b \times h) \]
   \[ A = (6 \text{ cm} \times 1 \text{ cm}) + (4 \text{ cm} \times 1.5 \text{ cm}) \]
   \[ A = 6 \text{ cm}^2 + 6 \text{ cm}^2 \]
   \[ A = 12 \text{ cm}^2 \]
   Perimeter = 19.5 cm
2. Draw a polygon with the following characteristics.

a. rectangle with a perimeter of 12 cm and an area of 8 cm²

   **Exact measurement of 2 cm by 4 cm rectangle.**

   \[ P = 4 \text{ cm} + 4 \text{ cm} + 2 \text{ cm} + 2 \text{ cm} = 12 \text{ cm}. \]

   \[ A = b \times h \]
   \[ = 4 \text{ cm} \times 2 \text{ cm} \]
   \[ = 8 \text{ cm}^2 \]

b. square with a perimeter of 24 cm and an area of 36 cm²

   **Exact measurement of 6 cm on each side.**

   \[ P = 6 + 6 + 6 + 6 \]
   \[ P = 24 \text{ cm} \]
Homework Assignment

1. Find the perimeter and area of the following figures.

a. 10 mm
   \[ P = 200 \text{ mm} \]
   \[ A = 40 \text{ mm} \times 40 \text{ mm} = 1600 \text{ mm}^2 \]
   \[ = 20 \text{ mm} \times 10 \text{ mm} = 200 \text{ mm}^2 \]
   \[ = 20 \text{ mm} \times 10 \text{ mm} = 200 \text{ mm}^2 \]
   \[ A = 2000 \text{ mm}^2 \]

b. 7 km
   \[ A = (7 \text{ km} \times 9.5 \text{ km}) + \frac{1}{2}(4 \text{ km} \times 15 \text{ km}) \]
   \[ A = 66.5 \text{ km}^2 + 30 \text{ cm}^2 \]
   \[ A = 96.5 \text{ km}^2 \]

Perimeter = 54 km
c. \[ A = (b \times h) + \frac{1}{2}(b \times h) \]
\[ A = (25 \text{ mm} \times 46 \text{ mm}) + \frac{1}{2}(90 \text{ mm} \times 45 \text{ mm}) \]
\[ A = 1150 \text{ mm}^2 + 2025 \text{ mm}^2 \]
\[ A = 3175 \text{ mm}^2 \]

**Perimeter** = **283 mm**

d. \[ A = (b \times h) + (b \times h) + (b \times h) \]
\[ A = (55 \text{ cm} \times 13 \text{ cm}) + (55 \text{ cm} \times 22 \text{ cm}) + (55 \text{ cm} \times 15 \text{ cm}) \]
\[ A = 715 \text{ cm}^2 + 1210 \text{ cm}^2 + 825 \text{ cm}^2 \]
\[ A = 2750 \text{ cm}^2 \]

**Perimeter** = **250 cm**
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.

   _____________________________________________________________

   _____________________________________________________________

   _____________________________________________________________