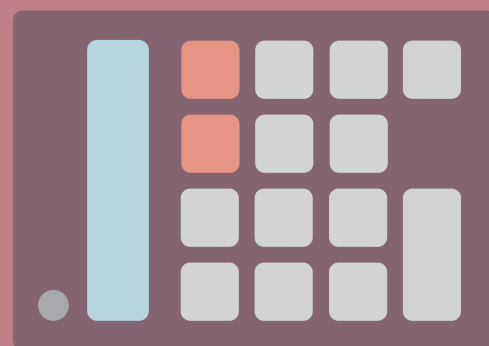




MATH

Student Book



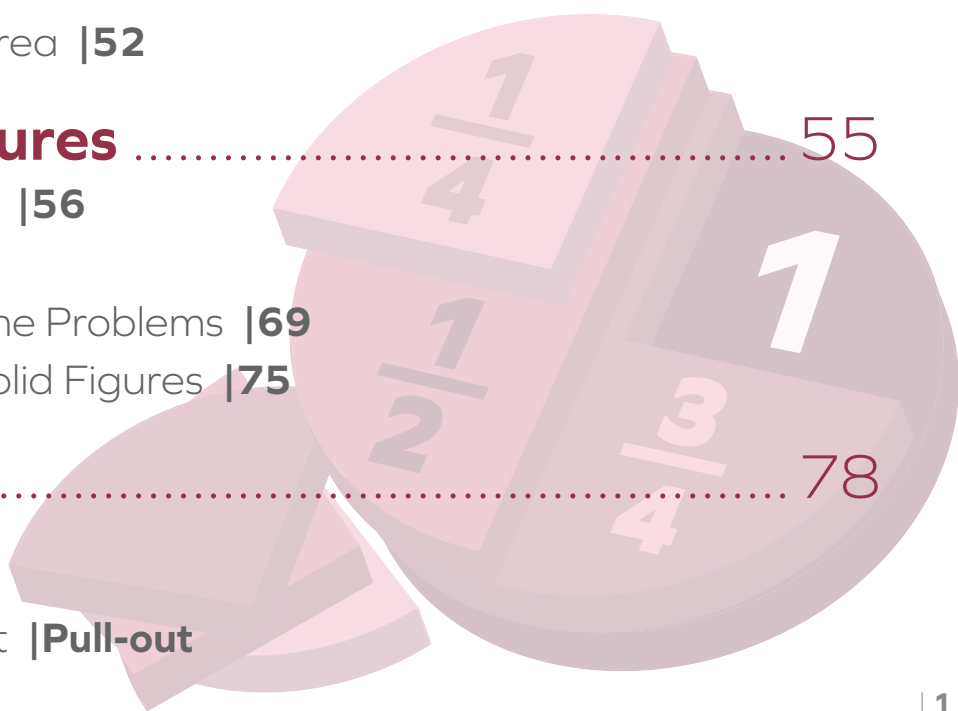
► **5th Grade | Unit 10**

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MATH 510

PERIMETER, AREA, AND VOLUME

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PERIMETER, AREA, AND VOLUME

In this unit, you will learn different ways to measure plane and solid figures. You will find the perimeter of polygons, rectangles, and circles (circumference). You will find the area of rectangles, parallelograms, triangles, and figures made up of those shapes. For solid figures, you will find the surface area and volume of rectangular prisms. You will learn that perimeter is a length of measurement, but area is measured in square units, while volume is measured in cubic units. You will also learn several useful formulas: for rectangles: $2l + 2w = p$, $lw = A$; for parallelograms: $bh = A$; for triangles: $\frac{bh}{2} = A$; for rectangular prisms: $l \times w \times h = V$; and for circles: $C = \pi d$. All of these measurements, and more, will be used as you learn more about geometry.

Objectives

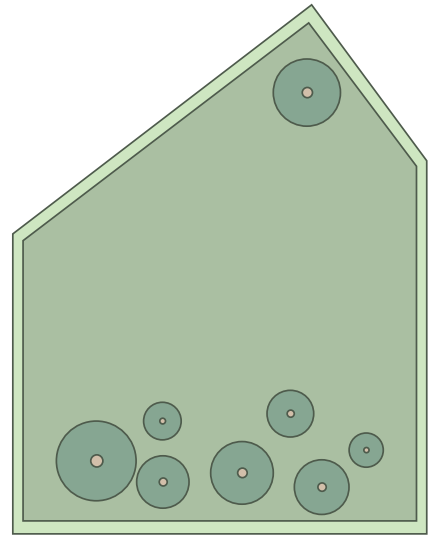
Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAAC. When you have finished this LIFEPAAC, you should be able to:

- Find the perimeter of polygons, including regular polygons and rectangles.
- Find the approximate circumference of a circle, given the diameter.
- Find the area of plane figures, including rectangles, parallelograms, triangles, and composite figures.
- Find the surface area and volume of rectangular prisms.

1. PERIMETER

At the neighborhood park, there is a path that goes all the way around the edge. People use it to run, or to walk their dog. If you walked around the edge of the park, how far would you have walked?

In geometry, the distance around the edge of a figure is called the perimeter. What is the perimeter of the park? In this lesson, we will learn about perimeter and find the perimeter of polygons.



Objectives

Read these objectives. When you have completed this section, you should be able to:

- Find the perimeter of polygons.
- Find the perimeter of regular polygons.
- Find the perimeter of rectangles.
- Find the approximate circumference of a circle, given the diameter.

Vocabulary

Study these new words. Learning the meanings of these words is a good study habit and will improve your understanding of this LIFEPAK.

approximation. A number that is close to the exact value.

perimeter. The distance around the outside of a plane figure.

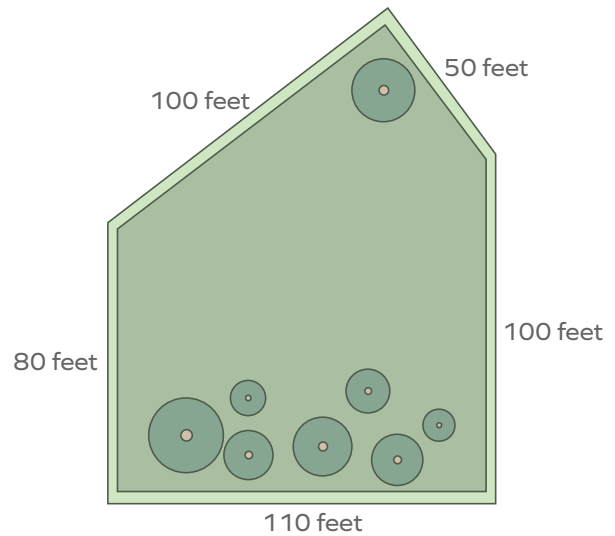
Note: All vocabulary words in this LIFEPAK appear in **boldface** print the first time they are used. If you are unsure of the meaning when you are reading, study the definitions given.

Polygons

Since the **perimeter** is the distance around the edge of a figure, we can find the perimeter of a polygon by adding the lengths of the sides:

The park is a pentagon, so we can add the lengths of the 5 sides to find the perimeter:

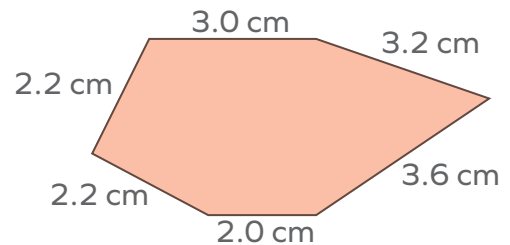
$$\begin{array}{r}
 110 \text{ feet} \\
 80 \text{ feet} \\
 100 \text{ feet} \\
 50 \text{ feet} \\
 + 100 \text{ feet} \\
 \hline
 440 \text{ feet}
 \end{array}$$



So, the length of the path around the edge of the park is 440 feet.

Example:

What is the perimeter of the polygon shown here?



Solution:

To find the perimeter, we will add the lengths of the sides.

The figure is a hexagon so there are 6 lengths to add:

$$\begin{array}{r}
 2.0 \text{ cm} \\
 2.2 \text{ cm} \\
 2.2 \text{ cm} \\
 3.0 \text{ cm} \\
 3.2 \text{ cm} \\
 + 3.6 \text{ cm} \\
 \hline
 16.2 \text{ cm}
 \end{array}$$

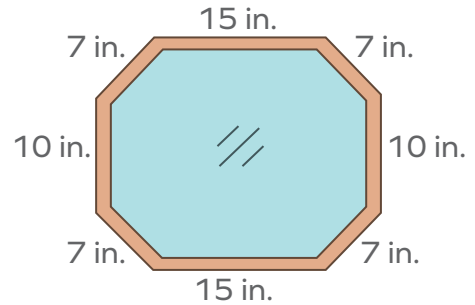
The perimeter of the hexagon is 16.2 cm.

This might help!

The word perimeter has the word *rim* in it (*perimeter*). The rim of something is its edge, so this might help you remember that perimeter is the length around the edge of a plane figure.

Example:

Sarah is making a frame for a mirror. The frame will be a strip of copper, 1 inch wide, around the edge of the mirror. The copper will be expensive, so Sarah needs to find the right length of 1-inch copper to buy. What length of copper should she buy?



Solution:

To find the length needed, we will add the lengths of the sides of the mirror. Because some of the sides are the same length, we can multiply to shorten the calculation:

$$4 \text{ sides are } 7 \text{ inches:} \quad 4 \times 7 \text{ in.} = 28 \text{ in.}$$

$$2 \text{ sides are } 10 \text{ inches:} \quad 2 \times 10 \text{ in.} = 20 \text{ in.}$$

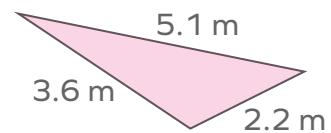
$$2 \text{ sides are } 15 \text{ inches:} \quad 2 \times 15 \text{ in.} = 30 \text{ in.}$$

$$28 \text{ in.} + 20 \text{ in.} + 30 \text{ in.} = 78 \text{ inches}$$

So, Sarah needs 78 inches of 1-inch-wide copper.

Example:

What is the perimeter of this scalene triangle?



Solution:

To find the perimeter, we will add the lengths of the sides.

$$\begin{array}{r} 5.1 \text{ m} \\ 2.2 \text{ m} \\ + 3.6 \text{ m} \\ \hline 10.9 \text{ m} \end{array}$$

So, the perimeter of the triangle is 10.9 meters.

If the perimeter of a figure is known, but one of the side lengths is missing, we can solve for the missing side.

Example:

If we know that the perimeter of the pentagon is 20 millimeters, what is the length of the bottom side?

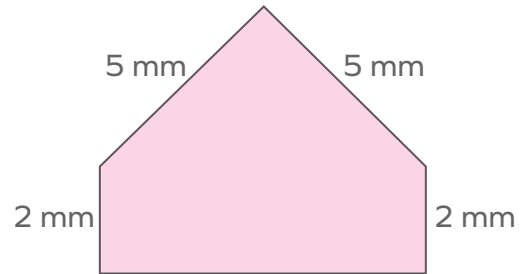
Solution:

First, we will add the lengths of the sides shown and see how much is needed for a perimeter of 20 millimeters.

$$2 \text{ mm} + 5 \text{ mm} + 5 \text{ mm} + 2 \text{ mm} = 14 \text{ mm}$$

We have 14 millimeters of length, but we need a total of 20 millimeters. We would add 6 to 14 to get 20, so the missing length must be 6 millimeters.

$$2 \text{ mm} + 5 \text{ mm} + 5 \text{ mm} + 2 \text{ mm} + 6 \text{ mm} = 20 \text{ mm}$$



Example:

Bob has 12 meters of fencing and he would like to enclose a small garden. Because of the shape of his yard, two sides of the garden will be 3 meters and 4 meters. How long will the third side be?

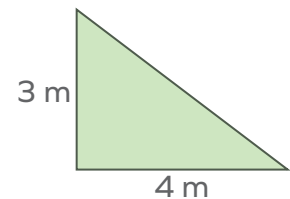
Solution:

First, we'll add the lengths of the sides shown and see how much is needed for a perimeter of 12 meters.

$$3 \text{ m} + 4 \text{ m} = 7 \text{ m}$$

We have 7 meters of length, but we need a total of 12 meters. We would add 5 to 7 to get 12, so the missing length must be 5 meters.

$$3 \text{ m} + 4 \text{ m} + 5 \text{ m} = 12 \text{ m}$$



Let's Review!

Before going on to the practice problems, make sure you understand the main points of this lesson.

- ✓ Perimeter is the distance around the outside of a plane figure.
- ✓ To find the perimeter of a polygon, add the lengths of the sides.



Fill in the blank.

1.1

The distance around the edge of a figure is its _____.



Circle each correct letter and answer.

1.2

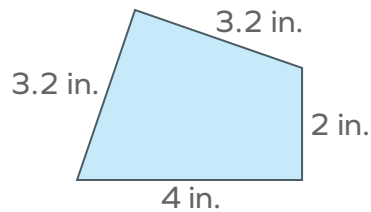
What is the perimeter of a triangle with side lengths of 5 cm, 8 cm, and 9 cm?

- a. 9 cm b. 13 cm c. 22 cm d. 30 cm

1.3

What is the perimeter of this quadrilateral?

- a. 4 inches
b. 8 inches
c. 12 inches
d. 12.4 inches



1.4

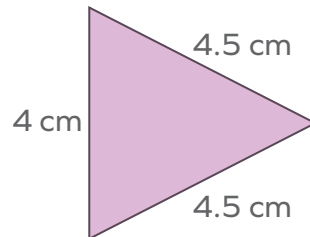
Which quadrilateral with side lengths shown will have a perimeter of 18 meters?

- a. 4 m, 4 m, 4 m, 4 m b. 3 m, 5 m, 4 m, 6 m
c. 5 m, 2 m, 5 m, 2 m d. 4 m, 7 m, 2 m, 6 m

1.5

What is the perimeter of this isosceles triangle?

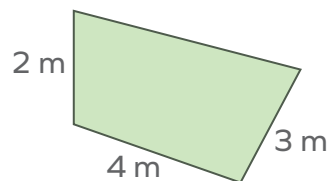
- a. 4 cm
b. 13 cm
c. 13.5 cm
d. 14 cm



1.6

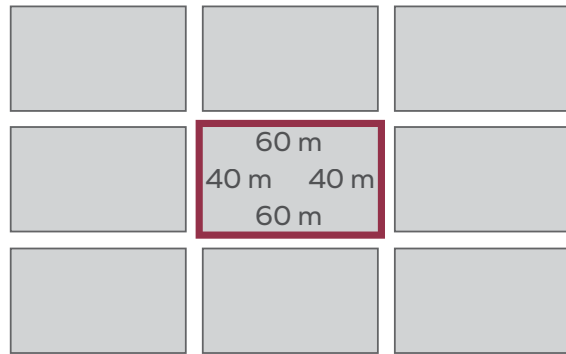
The perimeter of this quadrilateral is 14 meters. What is the length of the unlabeled side?

- a. 5 m
b. 6 m
c. 7 m
d. 9 m



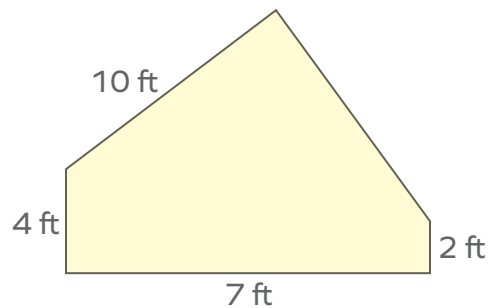
1.7 Scott takes a walk around the block. How far does he walk?

- a. 100 m
- b. 120 m
- c. 200 m
- d. 240 m



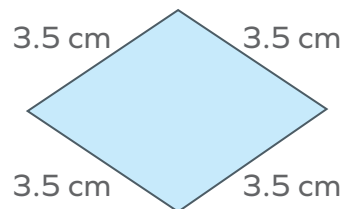
1.8 The perimeter of this pentagon is 28 feet. What is the length of the unlabeled side?

- a. 4 ft.
- b. 5 ft.
- c. 6 ft.
- d. 23 ft.



1.9 What is the perimeter of this rhombus?

- a. 3.5 cm
- b. 7 cm
- c. 13.5 cm
- d. 14 cm



Complete this activity.

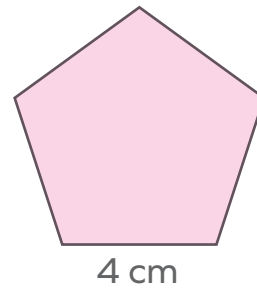
1.10 Match each set of measurements with the perimeter of a polygon having those measurements.

- | | |
|--|---------|
| a. _____ pentagon: 3 m, 5 m, 3 m, 4 m, 7 m | 1. 22 m |
| b. _____ triangle: 5 m, 6 m, 8 m | 2. 18 m |
| c. _____ quadrilateral: 3 m, 2 m, 8 m, 8 m | 3. 19 m |
| d. _____ quadrilateral: 5 m, 4 m, 5 m, 4 m | 4. 24 m |
| e. _____ triangle: 8 m, 8 m, 8 m | 5. 21 m |

Regular Polygons

You know how to find the perimeter of a polygon. What is the perimeter of this regular pentagon? Only one side is labeled, but you know that all sides are the same length.

Is there a shorter way to find the perimeter than adding all of the sides? In this lesson, we will explore methods for finding the perimeter of regular polygons and rectangles.



Finding the Perimeter of Regular Polygons

To find the perimeter of the regular pentagon, we could add the lengths of all of the sides. We know each side is 4 centimeters

$$4 \text{ cm} + 4 \text{ cm} + 4 \text{ cm} + 4 \text{ cm} + 4 \text{ cm} = 20 \text{ cm}$$

However, since all the sides are the same length, we can multiply the side length by 5:

$$4 \text{ cm} \times 5 = 20 \text{ cm}$$

For any regular polygon, we can multiply the number of sides by the side length, since all the sides are the same length.

Example:

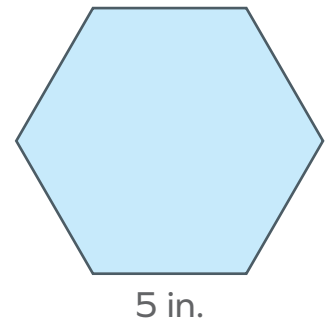
What is the perimeter of this regular hexagon?

Solution:

Because it is a hexagon, we know it has six sides. Because it is a regular polygon, we know each side is 5 inches. So, we will multiply the number of sides by the side length:

$$6 \times 5 \text{ in.} = 30 \text{ in.}$$

The perimeter of the regular hexagon is 30 inches.



Example:

A stop sign needs its border re-taped with reflective tape to make sure it is seen at night. If the stop sign is 6 inches on each side, how many inches of reflective tape are needed?

Solution:

There are 8 sides of the same length (6 inches), so we'll multiply the number of sides by their length:

$$8 \times 6 \text{ in.} = 48 \text{ in.}$$

So, 48 inches of reflective tape is needed.



If we know the perimeter of a regular polygon, we can solve to find the length of the sides.

Example:

The perimeter of the square is 32 meters. How long is each side?

Solution:

The square has four congruent sides. We know that the length of the side of the square multiplied by 4 is 32 meters. If we let s be the side length, we can write an equation to solve:

$$4 \times s = 32 \text{ m}$$

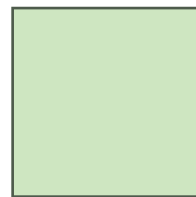
or

$$4s = 32$$

What number multiplied by 4 is 32?

$$4 \times 8 = 32$$

So, each side of the square is 8 meters.



perimeter = 32 m

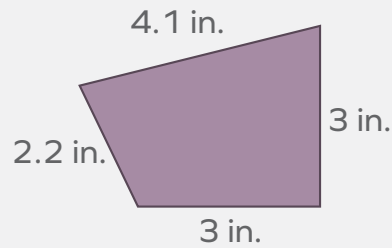
SELF TEST 1: PERIMETER

Each numbered question = 6 points

Circle the correct letter and answer.

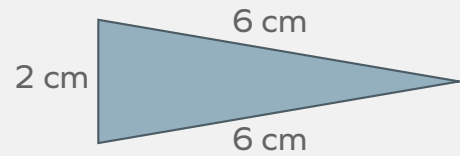
- 1.01** What is the perimeter of a triangle with side lengths of 8 cm, 8 cm, and 3 cm?
a. 16 cm b. 17 cm c. 18 cm d. 19 cm

- 1.02** What is the perimeter of this quadrilateral?
a. 12 inches
b. 12.3 inches
c. 13 inches
d. 13.2 inches

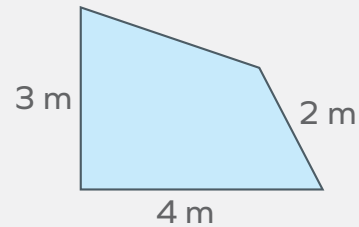


- 1.03** Which quadrilateral with side lengths shown will have a perimeter of 25 meters?
a. 5 m, 8 m, 4 m, 7 m b. 7 m, 7 m, 4 m, 6 m
c. 6 m, 6 m, 6 m, 6 m d. 8 m, 5 m, 6 m, 6 m

- 1.04** What is the perimeter of this isosceles triangle?
a. 12 cm
b. 13 cm
c. 14 cm
d. 15 cm



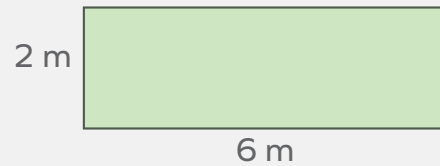
- 1.05** The perimeter of this quadrilateral is 12 meters. What is the length of the unlabeled side?
a. 2 m
b. 3 m
c. 4 m
d. 5 cm



- 1.06** What is the perimeter of a square with a side length of 8.5 cm?
a. 17 cm b. 32 cm c. 33 cm d. 34 cm

1.07 What is the perimeter of this rectangle?

- a. 12 m
- b. 14 m
- c. 16 m
- d. 18 m

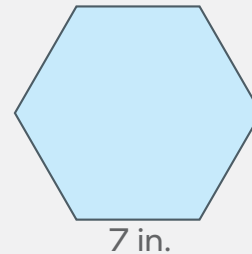


1.08 The perimeter of a regular heptagon is 21 m. How long is each side?

- a. 2 m
- b. 3 m
- c. 4 m
- d. 5 m

1.09 What is the perimeter of this regular hexagon?

- a. 7 in.
- b. 35 in.
- c. 42 in.
- d. 49 in.



1.010 A rectangle is 4 feet long and 5 feet wide. What is its perimeter?

- a. 9 ft.
- b. 15 ft.
- c. 18 ft.
- d. 20 ft.

1.011 What is the circumference of a circle with a diameter of 12 feet? (use 3.14 for π)

- a. 36 ft.
- b. 36.26 ft.
- c. 37.68 ft.
- d. 38 ft.

1.012 What is the circumference of a circle with a diameter of 9 inches? (use $\frac{22}{7}$ for π)

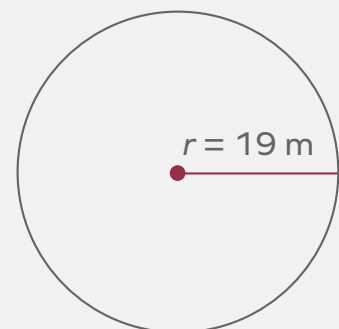
- a. 27 in.
- b. $24\frac{4}{7}$ in.
- c. $28\frac{2}{7}$ in.
- d. 30 in.

1.013 If pi is rounded to a whole number, what is a reasonable estimate for the circumference of a circle with a diameter of 18 cm?

- a. 50 cm
- b. 54 cm
- c. 56 cm
- d. 57 cm

1.014 What is the circumference of this circle? (use 3.14 for π)

- a. 29.83 m
- b. 59.66 m
- c. 119.32 m
- d. 238.62 m



1.015 Sam needs to find the circumference of a circle with a diameter of 24 inches. He uses a calculator to find the circumference. Which answer is reasonable?

- a. 72.013678 in.
- b. 75.398223 in.
- c. 80.332161 in.
- d. 85.335372 in.

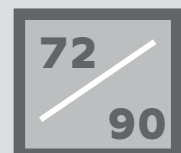


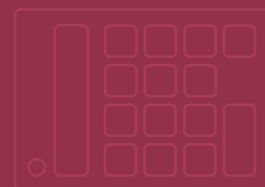
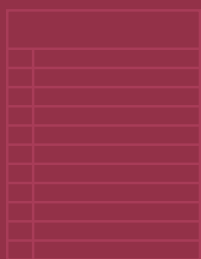
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Score _____

Initials _____

Date _____





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