

Section 5

Geometric Perimeter

You can recognize a Geometric Perimeter problem because it uses the word “**perimeter**”. Once you identify a Geometric Perimeter problem, use the method taught in this section to set up and solve the problem.

Step 1

Read Through the Entire Problem

Use this opportunity to identify the **geometric shape** (for example, triangle or rectangle) in the problem and exactly **what question is being asked**. Get a sense of the problem, and look for Direct Translation Words.

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Step 2

Name The Expressions Using Direct Translation & Use A Variable For The Totally Unknown

In Perimeter Problems, you will be reading about the **length** and **width** and **sides** of geometric shapes. Use a variable for the Totally Unknown and focus on the Direct Translation Words to name all of the expressions.

For example, if the problem says “the length of a rectangle is 4 feet more than its width”, it is telling you that the **length** is *something* or **4 feet more than its width**.

You are getting some information about the length, but you are not getting any information about the width. This is how you know that the **width** is the **Totally Unknown**, so you will represent the **width** with a variable, such as x .

Step 3

Set Up An Equation By Substituting The Expressions Into The Appropriate Formula

The value for the perimeter is always given. So now that you can name the expressions for the sides of the shape, you have all the information that you need to substitute into the formula and set up the equation.

Geometric Shape	Perimeter Formula
Rectangle	$2L + 2W = P$

Triangle	$a + b + c = P$
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HELPFUL HINT

- If you can't recall the formula for finding the perimeter of a geometric shape, remember that "perimeter" means the distance around the outside of the shape. You can always set up your equation by adding together all of the sides of the shape and then setting it equal to the value of the perimeter.

Shape	Common Sense Formula To Use If You Can't Remember The Geometric Formula
Rectangle	Long Side + Long Side + Short Side + Short Side = Perimeter
Triangle	First Side + Second Side + Third Side = Perimeter

Step 4***Solve the Equation***

Using the method taught by your instructor, solve the equation for the variable.

Step 5***Make Sure to Answer the Question Being Asked***

As in Parts Problems in Section 4, when you solve the equation you will find the value for x , but that might not be the answer to the question. You need to reread the problem and make sure exactly what question is being asked.

It is possible that the value for the variable x may be your answer. But it may *not* be.

For example, the value for x may give you the *width* of a rectangle, while the problem may be asking for the *length* of the rectangle. You will have to substitute the value for x into the original expression for the length that you will set up in Step 2 in order to get the correct answer. Always be sure of exactly what the question is.

HELPFUL HINT

- Once you have the numerical value for each side, you can always check if your answer is correct by adding up all the sides of the shape. Your total amount should equal the perimeter given in the problem.

EXAMPLES

EXAMPLE 1 The length of a rectangle is 3 feet less than twice its width. If the perimeter of the rectangle is 30 feet, find its length.

SOLUTION*Step 1 Read The Problem*

- Seeing the word “perimeter” verifies that it is a Geometric Perimeter problem.
- The geometric shape is a rectangle.
- The answer that is wanted is the length of the rectangle.
- The problem contains Direct Translation Words [less than, twice, is].

Step 2 Name The Expressions

- You are given information about the length; the length is 3 feet less than twice the width.
- You are not given information about the width, so the width is the Totally Unknown.
- Use a variable to represent the Totally Unknown (in this example, the width).
- Use Direct Translation to name an expression for the length.

$$\begin{aligned}\text{Width } (W) &= x \\ \text{Length } (L) &= 2x - 3\end{aligned}$$

Step 3 Set Up The Equation

- Use the formula for a rectangle, $2L + 2W = P$.
- The perimeter is 30, so substitute the number 30 for P .
- Substitute the expressions you named in Step 2 for L and W into the formula.

$$2(2x - 3) + 2(x) = 30$$

Step 4 *Solve The Equation*

- The solution to the equation is

$$x = 6$$

Step 5 *Answer The Question Asked*

- You have the solution to the equation, but it is NOT the answer to the question.
- The value of x is the size of the width; the problem states “find its *length*”.
- You need to use the expression for the length that you named in Step 2.
- Get the answer by substituting the solution for x (which is 6) into the expression.

$$L = 2x - 3$$

$$L = 2(6) - 3$$

$$L = 9$$

Answer: The length of the rectangle is 9 feet.



EXAMPLE 2 On the show *Trading Places*, designer Vern Yip constructs a large triangular mirror for a living room. The length of the longest side is twice the length of the middle side. The shortest side is 4 feet shorter than the middle side. If the perimeter of the mirror is 24 feet, what is the length of the longest side?

SOLUTIONStep 1 *Read The Problem*

- Seeing the word “perimeter” verifies that it is a Geometric Perimeter problem.
- The geometric shape is a triangle.
- The answer that is wanted is the length of the longest side.
- The problem contains Direct Translation Words [twice, is, shorter than].

Step 2 *Name The Expressions*

- You have information about the longest side; it is twice the length of the middle side.
- You have information about the shortest side; it is 4 feet shorter than the middle side.
- You have no information about the middle side, so it is the Totally Unknown.
- Use a variable to represent the Totally Unknown (in this example, the middle side).
- Use Direct Translation to name the expression for the longest side and the shortest side.

Middle Side	$(a) = x$
Longest Side	$(b) = 2x$
Shortest Side	$(c) = x - 4$

Step 3 *Set Up The Equation*

- Use the formula for a triangle, $a + b + c = P$
- The perimeter is 24, so substitute the number 24 for P .
- Substitute the expressions you named in Step 2 for a , b , and c into the formula.

$x + 2x + x - 4 = 24$

Step 4 *Solve The Equation*

- The solution to the equation is

$$x = 7$$

Step 5 *Answer The Question Asked*

- You have the solution to the equation, but it is NOT the answer to the question.
- x is the size of the middle side; the question asks “what is the length of the longest side?”
- You need to use the expression for the longest side (b) that you named in Step 2.
- Get the answer by substituting the solution for x (which is 7) into the expression.

$$b = 2x$$

$$b = 2(7)$$

$$b = 14$$

Answer: The longest side of the triangle is 14 feet.



Geometric Perimeter: Exercise Set

1. The perimeter of a rectangle is 40 meters. The width is 4 meters less than the length. What is the length of the rectangle?
2. The length of a rectangle is 11 feet less than twice its width. Its perimeter is 26 feet. What is the length and width of the rectangle?
3. The length of a rectangle is 7 inches less than 3 times its width. The perimeter of the rectangle is 50 inches. Find the length of the rectangle.
4. The length of a rectangular parking lot is 10 meters less than twice its width, and the perimeter is 400 meters. Find the length of the parking lot.
5. The first side of a triangle is 3 centimeters longer than the second side. The third side of the triangle is 4 centimeters shorter than the second side. If the perimeter of the triangle is 32, how long is the first side?
6. In a triangle, the length of the second side is twice the length of the first side. The length of the third side is 8 less than 3 times the length of the first side. If the perimeter of this triangle is 34 inches, how long is each side?
7. The shortest side of a triangle is 5 yards shorter than the longest side. The middle side is 3 yards shorter than the longest side. If the perimeter of the triangle is 28 yards, find the length of the shortest side.
8. The third side of a triangle is one foot less than 4 times the length of the first side of the triangle. The second side is 6 feet more than the first side. If the perimeter of the triangle is 77 feet, what is the length of all three sides?
9. The width of a rectangle is 7 feet less than its length. If the perimeter of a rectangle is 58 feet, find the length and width of the rectangle.
10. The length of a rectangular yard is 12 feet more than twice its width. If the perimeter of the yard is 276 feet, find the width.
11. The largest known map is a relief map of Asia. It is rectangular in shape and its length is 25 times its width. The perimeter is 936 feet. What is the length of the map?
12. The length of a rectangle is 20 inches more than its width. If the perimeter is 176 inches, find the width of the rectangle.

13. The longest side of a triangle is 3 times the length of the shortest side. The middle side is 3 feet longer than the shortest side. If the perimeter of the triangle is 53 feet, what is the length of the middle side?
14. The middle side of a triangle is 7 inches longer than twice the shortest side. The longest side is 3 inches more than 5 times the shortest side. If the perimeter of the triangle is 82 inches, find the length of all three sides.
15. Sierra painted a ceramic triangle to hang on her bedroom wall. Two sides of the triangle are of equal length, and the third side is 6 inches longer than the length of one of the other sides. The perimeter of her ceramic triangle is 33 inches. What is the length of the third side? (Hint: If two sides are equal, use the same variable for each one.)
16. The shortest side of a triangle is 6 inches less than the middle side. The longest side is 11 inches less than 5 times the middle side. What is the length of the longest side of the triangle if the perimeter is 53 inches?
17. The length of a rectangle is 10 centimeters greater than its width. Find the length and width of the rectangle if its perimeter is 168 centimeters.
18. In the entranceway of the Sunrise Cinema, there is a large rectangular poster advertising the upcoming movie "Terminator III". If the poster's length is 3 feet less than twice its width, and its perimeter is 24 feet, what is the length of the poster?
19. The Chesterbrook Academy playground is rectangular in shape. Its length is 4 times its width. If the perimeter of the playground is 70 feet, what is its length and width?
20. Jarred's little league soccer team plays on a rectangular field with a perimeter of 78 yards. If the length of the field is 15 yards longer than its width, what are the dimensions of the soccer field?