PERIMETER & AREA NOTES: POLYGONS AND REGULAR POLYGONS (FOR 4th AND 5th GRADES)

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(Remember: A polygon is a 2-dimensional, closed shape with straight sides. This lesson will focus on perimeter and area of polygons only. We will move on to explore perimeter and area of circles and 3-dimensional objects soon!)

VOCAB: A regular polygon: All sides are the same length. All angles are equal is size. (Ex: Square, Equilateral triangle, regular hexagon)

An irregular polygon: All sides are NOT the same length. All angles are NOT equal in size.

PERIMETER:

Definition: Perimeter is the total distance around the outside of an object or shape, including all its edges and boundaries.

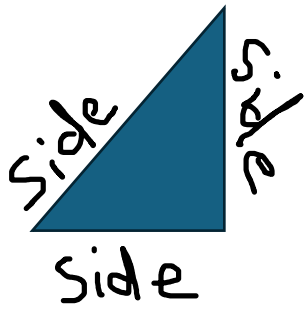
One way to think about perimeter to visualize a garden enclosed by a fence. The fence is marking the perimeter of the garden. Perimeter is measured in length.

Calculating Perimeter:

- **Perimeter= SUM of ALL Sides**

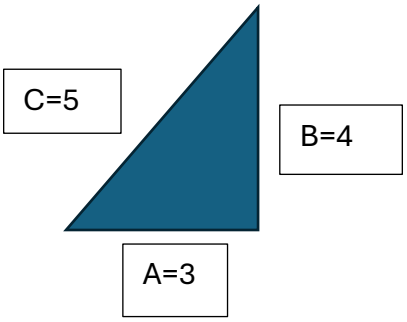
  Add together the lengths of all sides.

- **Example 1, Triangle:** This triangle has 3 sides. To find the perimeter, we add the triangle's 3 side lengths together.



We can label the 3 sides to help us keep track.

We will label them sides A, B, & C.



Perimeter= The Sum of All Sides

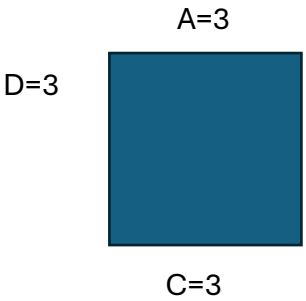
P= A + B + C

P= 3 + 4 + 5

P= 12

When we add all 3 sides of the above triangle together, we find the perimeter equals 12!

- **Example 2, Square:** This square has 4 sides. To find the perimeter of a square, we have to add all four side lengths together. We know that one characteristic of a square is the *all 4 sides are equal length*. So we can use a shortcut to find the perimeter of a square.



P= A + B + C + D

P= 3+3+3+3

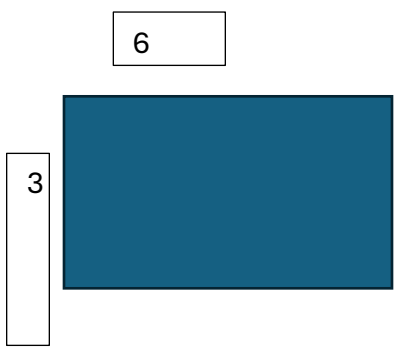
P= 12

Shortcut: We know that one characteristic of a square is that *all 4 sides are equal length*. This means the perimeter is 4 times the length of one side. So, we can use a shortcut to find the perimeter of a square. P= 4 x side

P= 4 x 3

P= 12

- **Example 3, Rectangle:** Just like with every polygon, we add all the sides of a rectangle together to find the total perimeter. Perimeter is always the sum of the object's side lengths. With rectangles, we know that we will have two pairs of identical side lengths. So we can create a shortcut formula and say the perimeter of a rectangle is equal to twice the length plus twice the width, or P= 2L + 2W, also written as P= 2(L+W).



P= 6 + 6 + 3 + 3

P= 2(6) + 2(3)

P= 12 + 3

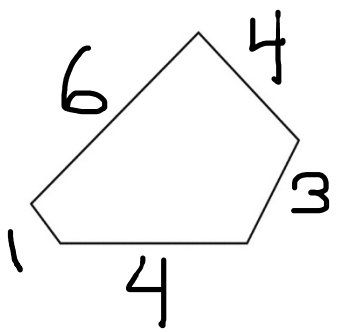
P = 15

- **Example 4, Irregular Polygon:** An irregular polygon still has straight sides, but their adjacent sides and angles are **not** equal. Irregular polygons do not have sides and

angles that are *all* equal to each other. Look at the irregular polygon below. We still use the same method to find its perimeter! We add together all of its side lengths!

To find the **perimeter** of the irregular polygon below: P= 6 + 4 + 3 + 4 + 1

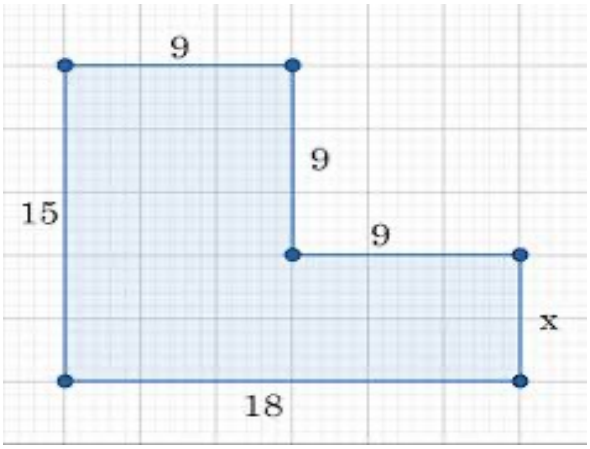
P= 18



As we demonstrated, to find the perimeter of any polygon, we find the sum of all of its sides!

P = Sum of all sides!

- **Example 5, Find the Missing Side:** Sometimes we have irregular polygons with many sides of different lengths. If we are not given all of the length, we will need to do some math to find the missing lengths. Look at this example:



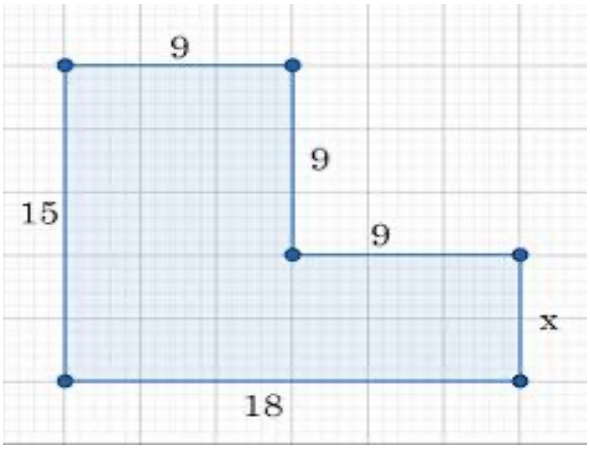
Looking at this irregular polygon, we see that all the side lengths are given except for one. We can find the missing length called x by doing some mathematical detective work.

Step 1: We can look across the image to the left from x at the side parallel. The left - hand vertical side of this shape has a length of 15.

Step 2: We must add together all the vertical sides on the right. They should equal 15.

Step 3: This leaves us with an equation: 15 = 9 + x. We need to figure out what number added to 9 equals 15. (Or what number is left when we subtract 9 from 15... 15-9=?)

Step 4: We find the answer is 6! So the missing side length is 6.



$x = 15 - 9$

$x = 6$

AREA

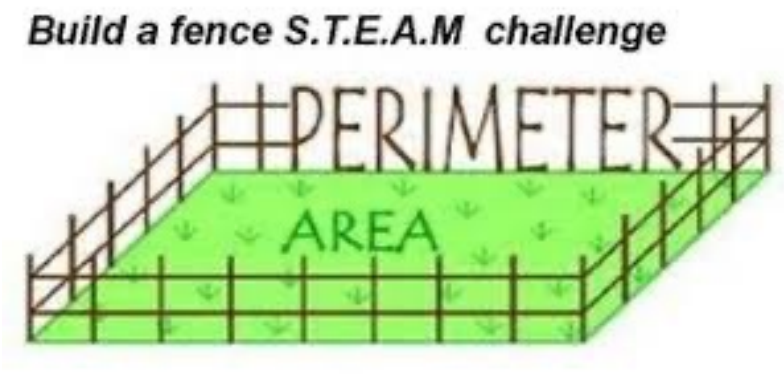
Definition: Area is the amount of space inside a shape.

We measure area in square units liken square inches or square feet.

**Remember: The perimeter is the measurement in length of the outside of a shape. The area is the measurement of how much space fills the inside of a shape.*

We said we can think use the analogy of a fence around the garden to talk about perimeter.

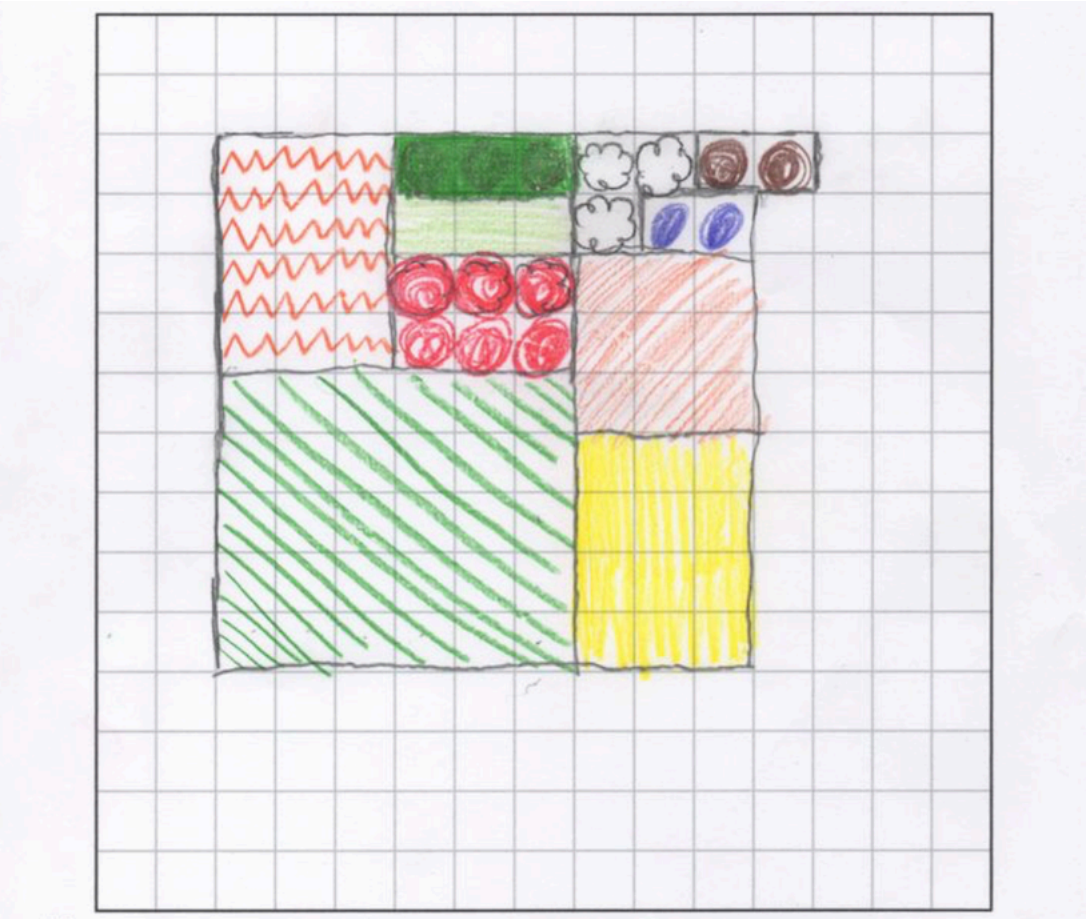
If the fence around a garden is the perimeter, the garden inside the fence is the area!



Today, we will focus on the area of quadrilaterals.

(We will look at triangles next time!)

- In the example below, there is a drawing of a garden. All of the colored in squares represent different parts of the garden. If you add all of the colored squares together, that is the **area** of this garden!



How many total squares are colored in to make up the entire garden? This question is the same as asking: What is the **area** of this garden?

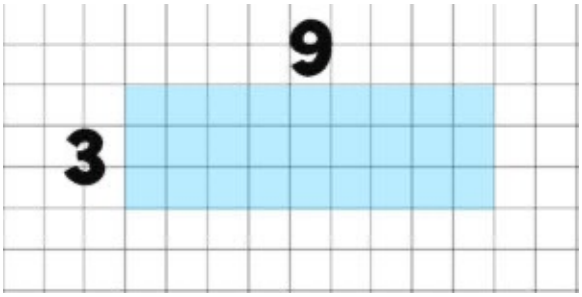
Regular Polygons

- An easy way to find the area of a regular polygon is to multiply the length of the polygon by the width.

  Area = L x W

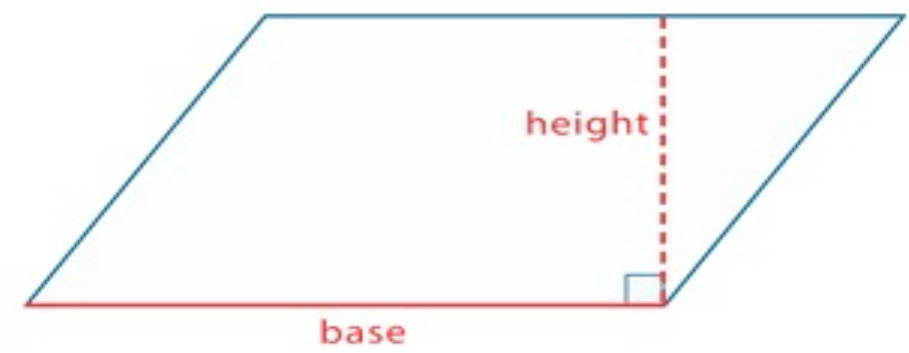
- Example 1, Rectangle: The rectangle below has a length of 9 and a width of 3. Instead of counting each square unit inside the rectangle, we can look at it as an array and multiply the length times the width to find the area.

  For this rectangle, A= 9 x 3 A = 9 x 3 A = 27

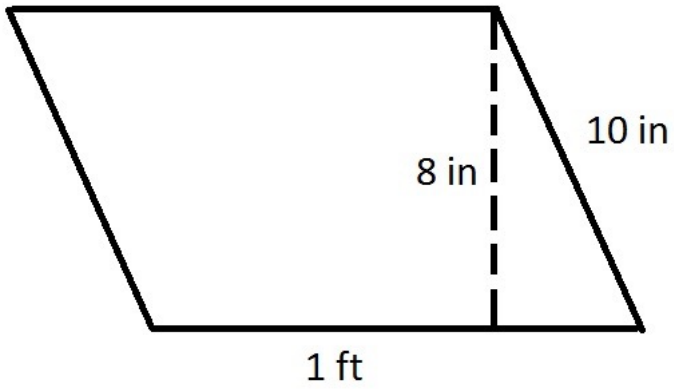


- We can use the same formula to find the area of a square. A = L x W
- If we have a rectangle with a length of 12 inches and a width of 4 inches, we find the area by multiplying 12 x 4. A = 12x4. or A = 48 square inches.

Parallelograms: For parallelograms, it will be different. The formula for parallelograms is **Area = Base x Height**



- Example, Parallelogram: Let's look at the parallelogram below.
- Because the shape is slanted, we use a different formula. For the example below, we will need to multiply the base times its height.
- Using the formula for area of a parallelogram: Area = Base x Height

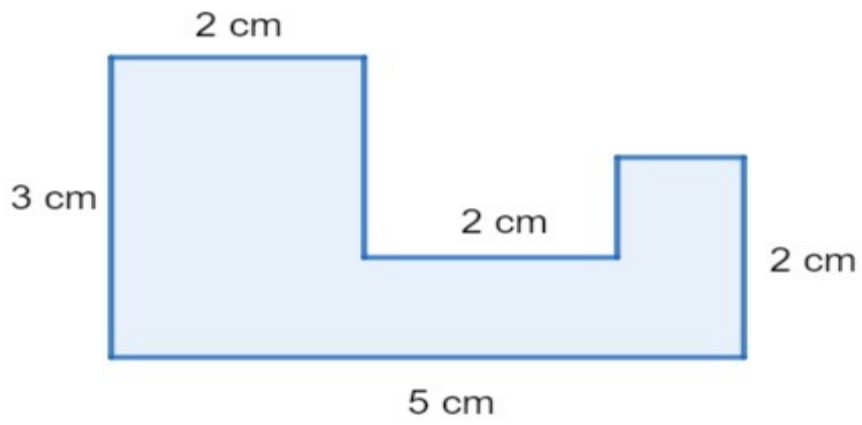


- For the above parallelogram, we have A= 1 x 8. So the Area = 8!
  Remember: Parallelograms are treated differently than rectangles when it comes to area! Perimeter is still adding the sum of all sides. However, area is multiplying the base by the height (which is different from the side length as you see above!)

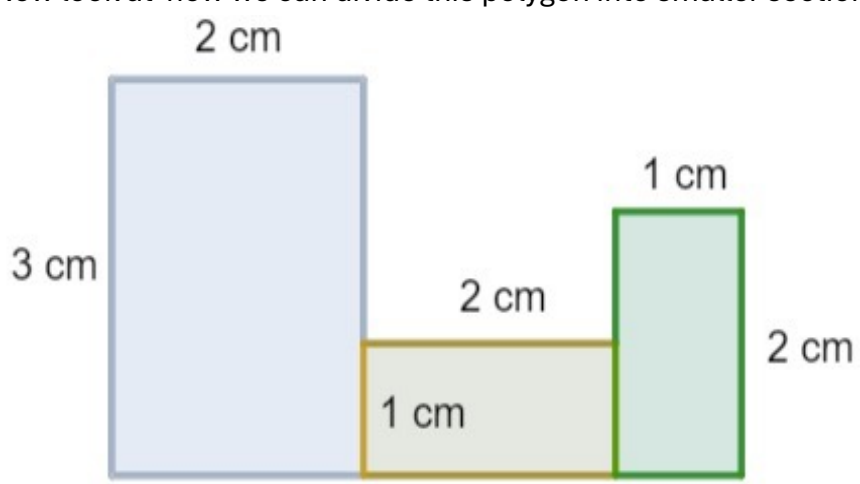
Finding the Area of Irregular Polygons

- We will need to know how to find the area within irregular polygons. To do this, we will need to break them down into shapes that are easier to visualize. Then, once we have smaller shapes withing the larger irregular polygon, we can add all their areas together. Let's try one.

- **Example :** This irregular polygon has many side lengths. We can divide this shape into smaller rectangles or squares to make it easier to find the total area.



Now look at how we can divide this polygon into smaller sections.



- We have broken our irregular polygon into 3 regular polygons, rectangles.

  We already know that the area of a rectangle is: A= L x W.

  So we can multiply the length by the width of each rectangle, and add each rectangles area together.

- Step 1: The blue rectangle has a length of 3 cm and a width of 2 cm.

  The area for the blue rectangle is: A = 3cm x 2 cm. A = 6 square cm.

- Step 2: The yellow rectangle has a length of 1cm and a width of 2cm.

  The area for the yellow rectangle is A = 1cm x 2cm. A= 2 sq cm.

- Step 3: The length of the green rectangle is 2cm and the width is 1cm.

  The area of the green rectangle is: A = 2cm x 1 cm. A = 2 sq cm.

- Step 4: Now we know the areas of 3 small rectangles within our original shape.

  We have to find the TOTAL area of our original shape.

  To do this, we add all 3 areas together!

  Area = Area Blue Rectangle + Area Yellow Rectangle + Area Green Rectangle.

  A= 6 + 2 + 2. A = 10.

  The total area of our irregular polygon above is 10 square centimeters!

  Now head over to some activities!