

Parallelograms

Parallelograms are special kinds of **quadrilaterals** (4-sided figures) that follow these rules:

RULE #1: The opposite sides of a parallelogram are parallel.

RULE #2: The opposite parts of a parallelogram are congruent (opposite sides, opposite angles, opposite parts of the diagonals, opposite triangles, etc.)

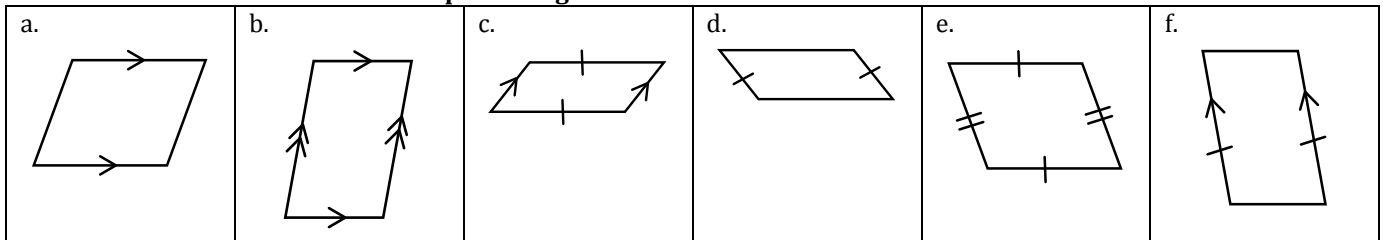
RULE #3: Each angle is supplementary to the angles that are next to it.

The three ways to know that a **Quadrilateral** is a **Parallelogram** (assuming you're not told it is one) are...

- You know that **TWO SETS** of opposite sides are **parallel**,
- You know that **ONE SET** of opposite sides is **both parallel and congruent**
- You know that **TWO SETS** of opposite sides are **congruent**.

1. Of the six **quadrilaterals** shown below, there are only three that you can **know** are **parallelograms**.

Circle the ones that **must be parallelograms**.

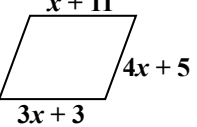
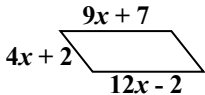
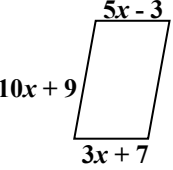
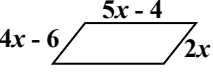
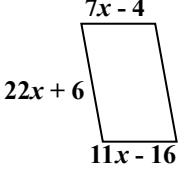
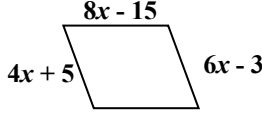


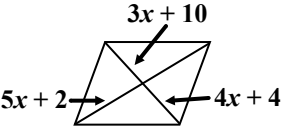
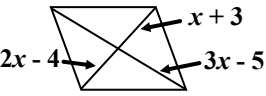
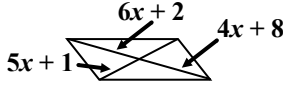
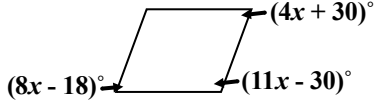
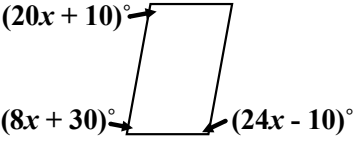
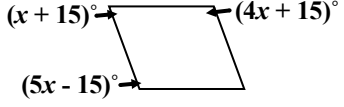
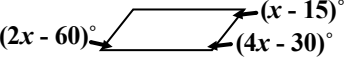
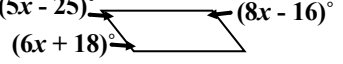
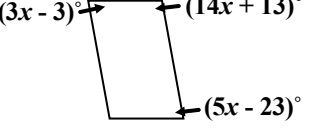
Solving for Parts of a Parallelogram...

Since opposite parts are always congruent, you can simply set **opposite** measures equal and solve.

Beware of extra information! You will not always be able to use everything you're given.

Determine the measure of x . Assume each figure is a parallelogram.

<p>EXAMPLE</p>  <p>The opposite sides are: $x + 11$ & $3x + 3$. Ignore $4x + 5$.</p> $x + 11 = 3x + 3$ $11 = 2x + 3$ $8 = 2x$ $4 = x$ $x = \boxed{4}$	<p>2.</p> 	<p>3.</p> 
<p>EXAMPLE</p>  <p>The opposite sides are: $4x - 6$ & $2x$. Ignore $5x - 4$.</p> $4x - 6 = 2x$ $-6 = -2x$ $3 = x$ $x = \boxed{3}$	<p>4.</p> 	<p>5.</p> 

<p>EXAMPLE</p>  <p>The opposite parts are: $3x + 10$ (top left) & $4x + 4$ (bottom right). Ignore $5x + 2$.</p> $3x + 10 = 4x + 4$ $10 = x + 4$ $6 = x$ $x = \boxed{6}$	<p>6.</p> 	<p>7.</p> 
<p>EXAMPLE</p>  <p>There are two options here: opposite parts are congruent, so...</p> $8x - 18 = 4x + 30$ $4x - 18 = 30$ $4x = 48$ $x = \boxed{12}$ <p>OR... angles that are next to each other are supplementary so...</p> $(4x + 30) + (11x - 30) = 180$ $15x = 180$ $x = \boxed{12}$ <p>The answer is the same, either way.</p>	<p>8.</p> 	<p>9.</p> 
<p>EXAMPLE</p>  <p>Again, there are two options: opposite parts are congruent...</p> $2x - 60 = x - 15$ $x - 60 = -15$ $x = \boxed{45}$ <p>OR... angles that are next to each other are supplementary...</p> $(2x - 60) + (4x - 30) = 180$ $6x - 90 = 180$ $6x = 270$ $x = \boxed{45}$	<p>10.</p> 	<p>11.</p> 

Fun Fact: Every **polygon** can be broken up into triangles. To figure out the *smallest number of possible triangles* created from a polygon, simply subtract the number of sides by 2.

EXAMPLE: A parallelogram has 4 sides, and $4 - 2 = 2$. So, the minimum number of triangles in a parallelogram is $\boxed{2}$

Determine the minimum number of triangles in a figure with the given number of sides.

12. 5-sided	13. 8-sided	14. 20-sided	15. 36-sided	16. 9-sided	17. 18-sided
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