

## Geometry Problem Solving Drill – 13: Parallelograms

### Question No. 1 of 10

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

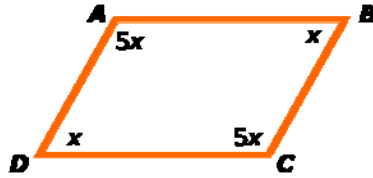
<b>Question #01</b>	<p>Question 1. Mr. Smith's garden has 4 equal sides. It has 2 pairs of parallel sides. There are no right angles. Choose the most precise name for the shape of Mr. Smith's garden.</p> <p>(A) trapezoid (B) square (C) parallelogram (D) rhombus</p>
<b>Feedback on Each Answer Choice</b>	<p>A. Incorrect! Trapezoids have 4 sides but they only have one pair of parallel sides.</p> <p>B. Incorrect! Squares have two pairs of parallel lines and four equal sides but squares always have four right angles.</p> <p>C. Incorrect! Mr. Smith's garden is a parallelogram but since it does not have any right angles, the classification of parallelogram is not precise enough.</p> <p>D. Correct! A rhombus is a special parallelogram. A rhombus is more precise than a parallelogram because it has four equal sides. Mr. Smith's garden fits all the properties of a rhombus.</p>
<b>Solution</b>	<p>The answer can easily be found by remembering the quadrilateral diagram. The term <i>quadrilateral</i> is the most general way to describe a 4-sided figure. The diagram goes from general to specific as you continue to read. Quadrilaterals break down into figures that have 2 pair of parallel sides, parallelograms. Parallelograms break down into figures that have 4 right angles (rectangles) and 4 equal sided (rhombuses). The square is even more specific because it has 4 right angles and 4 equal sides. Mr. Smith has a garden in the shape of a rhombus because it fits all the characteristics of a rhombus.</p>

**Question No. 2 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #02**

Question 2. Determine the value of the variable. Also tell whether  $ABCD$  is a parallelogram.



- (A)  $x = 30$ ,  $ABCD$  is a parallelogram
- (B)  $x = 6$ ,  $ABCD$  is not a parallelogram
- (C)  $x = 30$ ,  $ABCD$  is not a parallelogram
- (D)  $x = 15$ ,  $ABCD$  is a parallelogram

**Feedback on Each Answer Choice**

A. Correct!  
 $ABCD$  is a parallelogram because the opposite angles are congruent.

B. Incorrect!  
 $ABCD$  is a parallelogram and  $x$  is not 6.

C. Incorrect!  
The value of the variable is 30, but  $ABCD$  is a parallelogram.

D. Incorrect!  
 $ABCD$  is a parallelogram but  $x$  is not 15.

**Solution**

$ABCD$  is a parallelogram because opposite angles are congruent. Since it **is** a parallelogram consecutive angles are supplementary. The variable can be found by setting up an equation:

$$x + 5x = 180$$

$$\frac{6x}{6} = \frac{180}{6} \quad \begin{array}{l} \text{combine like terms} \\ \text{divide both sides by 6} \end{array}$$

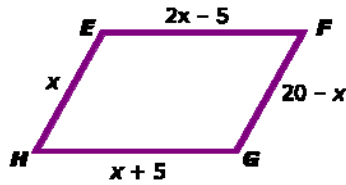
$$x = 30$$

**Question No. 3 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #03**

Question 3. Determine the value of  $x$  for which  $EFGH$  is a parallelogram.



- (A) 60
- (B) 5
- (C) 15
- (D) 10

**Feedback on Each Answer Choice**

A. Incorrect!

If you substitute 60 for the variable the opposite sides will not be equal and  $EFGH$  will not be a parallelogram.

B. Incorrect!

If you substitute 5 for the variable the opposite sides will not be equal and  $EFGH$  will not be a parallelogram.

C. Incorrect!

If you substitute 15 for the variable the opposite sides will not be equal and  $EFGH$  will not be a parallelogram.

D. Correct!

Opposite sides of a parallelogram are congruent. When  $x = 10$ , the opposite side lengths are equal.

**Solution**

Remember the property: Opposite sides of a parallelogram are congruent. Set up an equation and solve. (Choose a pair of opposite sides and set one side equal to the other)

$$\begin{array}{r} x = 20 - x \\ \underline{+x} \quad \underline{+x} \end{array} \qquad \text{add } x \text{ to both sides}$$

$$\frac{2x}{2} = \frac{20}{2} \qquad \text{divide both sides by 2}$$

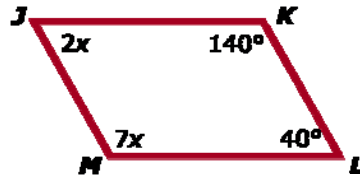
$$x = 10$$

**Question No. 4 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #04**

Question 4. Figure  $JKLM$  is a parallelogram. Find  $m\angle J$ .



- (A)  $140^\circ$
- (B)  $100^\circ$
- (C)  $20^\circ$
- (D)  $40^\circ$

**Feedback on Each Answer Choice**

A. Incorrect!  
Remember that opposite angles of parallelograms are congruent.

B. Incorrect!  
Remember that opposite angles of parallelograms are congruent.

C. Incorrect!  
Remember that opposite angles of parallelograms are congruent.

D. Correct!  
Since opposite angles of parallelograms are congruent,  $m\angle J = m\angle L = 40^\circ$ .

**Solution**

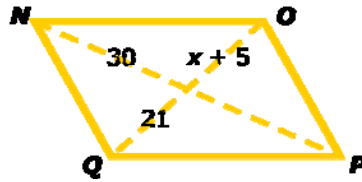
The answer is  $40^\circ$  because opposite angles of parallelograms are congruent. There is no need to solve since the opposite angle ( $40^\circ$ ) is given.

**Question No. 5 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #05**

Question 5.  $NOPQ$  is a parallelogram. Find the value of  $x$ .



- (A) 51
- (B) 26
- (C) 16
- (D) 21

**Feedback on Each Answer Choice**

- A. Incorrect!  
Remember that diagonals of parallelograms bisect each other.
- B. Incorrect!  
Remember that diagonals of parallelograms bisect each other.
- C. Correct!  
Set up the equation  $21 = x + 5$  and solved.
- D. Incorrect!  
Remember that diagonals of parallelograms bisect each other.

**Solution**

Remember: Diagonals of parallelograms bisect each other. Only one diagonal has enough information to set up an equation.

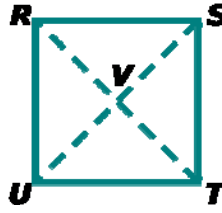
$$\begin{array}{r} 21 = x + 5 \\ \underline{-5} \quad \underline{-5} \\ 16 = x \end{array}$$

**Question No. 6 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #06**

Question 6.  $RSTU$  is a square. The diagonals intersect at  $V$ . Find  $m\angle SRV$  and justify your answer.



- (A)  $90^\circ$  because all angles of a square are  $90^\circ$
- (B)  $90^\circ$  because diagonals of a square are perpendicular
- (C)  $45^\circ$  because diagonals of a square bisect the angles
- (D)  $180^\circ$  because consecutive angles are supplementary

**Feedback on Each Answer Choice**

A. Incorrect!  
 $\angle SRV$  is not a right angle. It is an acute angle.

B. Incorrect!  
 $\angle SRV$  is not formed by the diagonals.

C. Correct!  
 $\angle SRV$  is formed by the diagonals. The  $90^\circ$  angles of the square are bisected by the diagonals.

D. Incorrect!  
 $\angle SRV$  is not one of the angles of the square so this property does not apply.

**Solution**

Step 1: Locate the angle and highlight it.

Step 2: Think about the properties of parallelograms, rectangles, and rhombuses (a square fits in all these classifications). Remember that squares have 4 right angles. Remember, the diagonals of a rhombus bisect two angles.

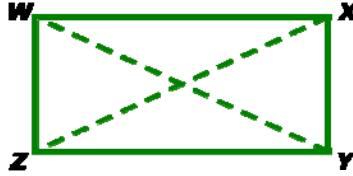
Divide 90 by 2. The answer is  $45^\circ$

**Question No. 7 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #07**

Question 7.  $WXYZ$  is a rectangle.  $\overline{WY}$  measures 30.  $\overline{ZX}$  measures  $2x + 4$ . Find the value of  $x$ .



- (A) 15
- (B) 17
- (C) 13
- (D) 30

**Feedback on Each Answer Choice**

A. Incorrect!  
Check your arithmetic and try again.

B. Incorrect!  
Check your arithmetic and try again.

C. Correct!  
Recognizing that the diagonals are congruent, you solved the equation  $30 = 2x + 4$ .

D. Incorrect!  
Remember that the diagonals of rectangles are congruent. Set up an equation and solve.

**Solution**

Step 1: Remember that the diagonals of a rectangle are congruent.

Step 2: Set up an equation using the lengths of each diagonal.

$$\text{Step 3: } 30 = 2x + 4$$

Step 4: Solve the equation.

$$\begin{array}{r} 30 = 2x + 4 \\ -4 \quad -4 \\ \hline \end{array} \quad \text{subtract 4 from both sides}$$

$$\frac{26}{2} = \frac{2x}{2} \quad \text{divide by 2}$$

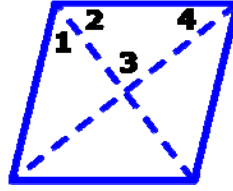
$$13 = x$$

**Question No. 8 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #08**

Question 8. The figure is a rhombus. The measures of  $\angle 1$  and  $\angle 2$  are  $50^\circ$  each.  $\angle 3$  is a right angle. Find  $m\angle 4$ .



- (A)  $40^\circ$
- (B)  $50^\circ$
- (C)  $90^\circ$
- (D)  $140^\circ$

**Feedback on Each Answer Choice**

A. Correct!

The three angles of any triangle add up to  $180^\circ$ . Therefore,  $m\angle 4 = 40^\circ$ .

B. Incorrect!

Remember that the three angles of a triangle add up to  $180^\circ$ .

C. Incorrect!

$m\angle 3 = 90^\circ$ . You can use it to figure out  $m\angle 4$ . Remember that the three angles of a triangle add up to  $180^\circ$ .

D. Incorrect!

$140^\circ$  is too big.  $\angle 4$  is an acute angle.

**Solution**

Focus on the upper triangle within the rhombus.  $\angle 2 = 50^\circ$  and  $m\angle 3 = 90^\circ$ .  $m\angle 2$ ,  $m\angle 3$  and  $m\angle 4$  must have a sum of  $180^\circ$ . Write an equation and solve:

$$50 + 90 + m\angle 4 = 180$$

$$140 + m\angle 4 = 180$$

$$m\angle 4 = 40$$

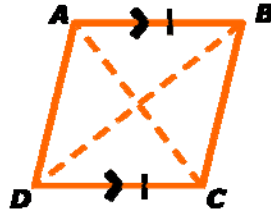


**Question No. 9 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #09**

Question 9. Which statement could be used to prove that this figure is a parallelogram?



- (A) If the diagonals of a parallelogram are congruent then it is a parallelogram.
- (B) If one diagonal of a parallelogram bisects two angles of the parallelogram then it is a parallelogram.
- (C) If the diagonals of a quadrilateral bisect each other, it is a parallelogram.
- (D) If one pair of opposite sides of a quadrilateral are both congruent and parallel, it is a parallelogram.

**Feedback on Each Answer Choice**

- A. Incorrect!  
This theorem is used to prove a rectangle.
- B. Incorrect!  
This theorem is used to prove a rhombus and the diagram does not indicate that the angles are congruent.
- C. Incorrect!  
The diagram does not indicate that both sides of the diagonal are congruent.
- D. Correct!  
The markings on this figure show that the upper and lower sides are both congruent and parallel; this proves that the figure is a parallelogram.

**Solution**

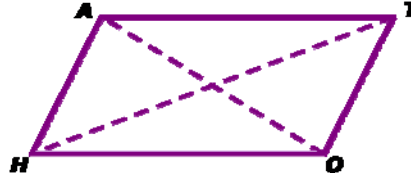
The markings on the figure are the only facts you can use to prove that this figure is a parallelogram. Some of the theorems given are not even true theorems. The only true theorem that deals with one pair of opposite sides is choice D.

**Question No. 10 of 10**

**Instruction:** (1) Read the problem statement and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.

**Question #10**

Question 10.  $\triangle HAT \cong \triangle TOH$ . If you were writing a two-column proof to prove that this quadrilateral was a parallelogram, which reasons would you write in the "Reasons" column?



- (A) CPCTC and If both pair of opposite angles of a quadrilateral are congruent, then it is a parallelogram.
- (B) CPCTC and If both pairs of opposite sides of a quadrilateral are congruent, then it is a parallelogram.
- (C) CPCTC and If the diagonals of a quadrilateral bisect each other, then it is a parallelogram.
- (D) CPCTC and If one pair of opposite sides of a quadrilateral are both congruent and parallel, then it is a parallelogram.

**Feedback on Each Answer Choice**

A. Incorrect!  
Revise the second reason and try again.

B. Correct!  
CPCTC would be used to show that the opposite sides are congruent which means the figure must be a parallelogram.

C. Incorrect!  
Revise the second reason and try again.

D. Incorrect!  
Revise the second reason and try again.

**Solution**

Step by step complete solution (the long version). This can be any format, whatever you can type in Word.

Statements	Reasons
$\triangle HOT \cong \triangle HAT$	<i>Given</i>
$HA \cong TO$	<i>CPCTC</i>
$AT \cong OH$	<i>CPCTC</i>
<b>ATOH is a parallelogram</b>	<b><i>If both pairs of opp. sides of a quad are <math>\cong</math>, then the quad is a parallelogram</i></b>