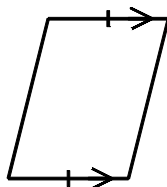
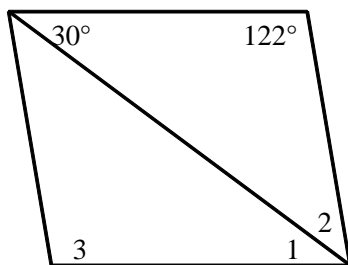


P.I. G.G.38: Investigate, justify, and apply theorems about parallelograms involving their angles, sides, and diagonals

1. Based on the markings, determine if the figure is a parallelogram. If so, justify your answer.



2. Find the measures of the numbered angles in the parallelogram.



- [A] $m\angle 1 = 28$; $m\angle 2 = 30$; $m\angle 3 = 122$
 [B] $m\angle 1 = 30$; $m\angle 2 = 28$; $m\angle 3 = 122$
 [C] $m\angle 1 = 15$; $m\angle 2 = 61$; $m\angle 3 = 150$
 [D] $m\angle 1 = 30$; $m\angle 2 = 15$; $m\angle 3 = 150$

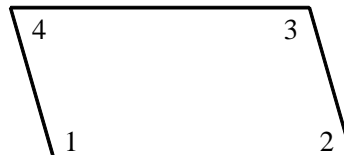
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3. If $m\angle 1 = m\angle 3 = 11x$, $m\angle 2 = 3x - 30$, and $m\angle 4 = x$, find the value of x .

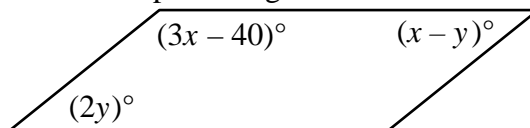


- [A] 15 [B] 75 [C] 30 [D] 150

4. If $m\angle 1 = m\angle 3 = 5x$, $m\angle 2 = 3x - 60$, and $m\angle 4 = x$, find the value of x .

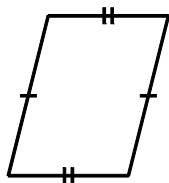


5. Determine the values of x and y for which $ABCD$ is a parallelogram.

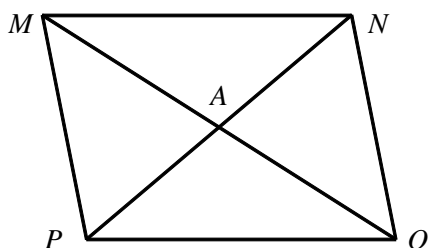


- [A] $x = 140$, $y = 40$ [B] $x = 60$, $y = 20$
 [C] $x = 20$, $y = 20$ [D] $x = 20$, $y = 60$
 [E] none of the above

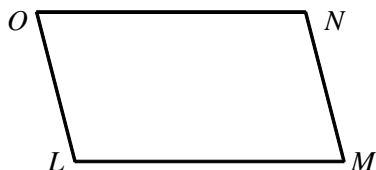
6. Based on the markings, determine if the figure is a parallelogram. If so, justify your answer.



7. Find AM in the parallelogram if $PN = 7$ and $AO = 3$.



8. If $ON = 8x - 2$, $LM = 7x + 7$, $NM = x - 4$, and $OL = 2y + 3$, find the values of x and y for which $LMNO$ must be a parallelogram.



- [A] $x = 9$; $y = 1$ [B] $x = -\frac{1}{5}$; $y = -1$
 [C] $x = 9$; $y = -1$ [D] $x = 5$; $y = -1$

9. If $ON = 7x - 5$, $LM = 6x + 4$, $NM = x + 6$, and $OL = 8y + 3$, find the values of x and y for which $LMNO$ must be a parallelogram.



10. Compare the quantity in Column A with the quantity in Column B.

Given: $AC > BC$ in parallelogram $ABCD$.

Column A Column B

$m\angle A$ $m\angle B$

[A] The quantity in Column A is greater.

[B] The quantity in Column B is greater.

[C] The two quantities are equal.

[D] The relationship cannot be determined on the basis of the information supplied.

11. Graph the points $A(-1, 2)$, $B(1, 8)$, and $C(5, 2)$. Find all possible coordinates of the point D so that $ABCD$ is a parallelogram.

12. Points $A(2, 3)$, $B(7, 3)$, and $C(4, -1)$ are three vertices of a parallelogram. Theorem 9-3 states that the diagonals of a parallelogram bisect each other. Use this to find the coordinates of the fourth vertex of the parallelogram $ABCD$.

- [1] yes; a pair of opposite sides are congruent and parallel _____
- [2] B _____
- [3] A _____
- [4] 30 _____
- [5] B _____
- [6] yes; both pairs of opposite sides are congruent _____
- [7] 3 _____
- [8] A _____
- [9] $x = 9; y = \frac{3}{2}$ _____
- [10] D _____
- [11] $(3, -4), (7, 8), \text{ and } (-5, 8)$ _____
- Since the diagonals of a parallelogram bisect each other, D has to be a point (x, y) so that $(3, 1)$, the midpoint of \overline{AC} , is also the midpoint of \overline{BD} . Using the midpoint formula, D is the point $(-1, -1)$.
- [12] _____