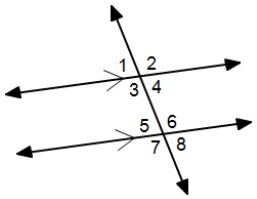
Name: _____

SM2 9.1: Prove Parallelogram Theorems

Problems: Use the figure below for problems 1–2.



1) Identify the pairs of angles that fit each category.

Linear Pairs	Vertical Angles	Corresponding Angles
$\angle 1 \text{ and } \angle 2$ $\angle 5 \text{ and } \angle 6$ $\angle 2 \text{ and } \angle 4$ $\angle 6 \text{ and } \angle 8$ $\angle 4 \text{ and } \angle 3$ $\angle 8 \text{ and } \angle 7$ $\angle 3 \text{ and } \angle 1$ $\angle 7 \text{ and } \angle 5$	$\angle 1 \text{ and } \angle 4$ $\angle 2 \text{ and } \angle 3$ $\angle 5 \text{ and } \angle 8$ $\angle 6 \text{ and } \angle 7$	$\angle 1 \text{ and } \angle 5$ $\angle 2 \text{ and } \angle 6$ $\angle 3 \text{ and } \angle 7$ $\angle 4 \text{ and } \angle 8$
Alternate Interior Angles	**Alternate Exterior Angles**	**Same Side Interior**
$\angle 3 \text{ and } \angle 6$ $\angle 4 \text{ and } \angle 5$	$\angle 1 \text{ and } \angle 8$ $\angle 2 \text{ and } \angle 7$	$\angle 3 \text{ and } \angle 5$ $\angle 4 \text{ and } \angle 6$

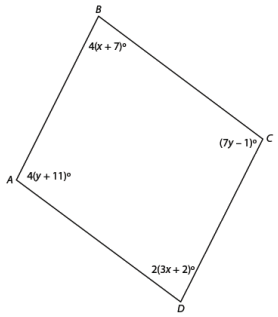
2) Given $m\angle 1 = 72°$, find the measure of the remaining angles

$m\angle 2 = 180° - 72° = 108°$ $m\angle 3 = m\angle 2 = 108°$ $m\angle 4 = m\angle 1 = 72°$ $m\angle 5 = m\angle 1 = 72°$

$m\angle 6 = m\angle 3 = m\angle 2 = 108°$ $m\angle 7 = m\angle 2 = 108°$ $m\angle 8 = m\angle 1 = 72°$

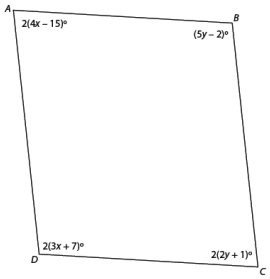
Problems: Find the value(s) of the variable(s) in each parallelogram.

3)



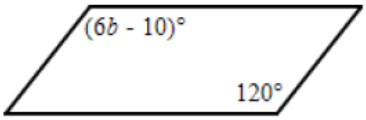
$x = 12, y = 15$

4)



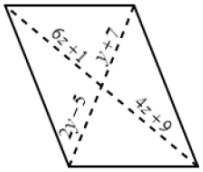
$x = 14, y = 20$

5)



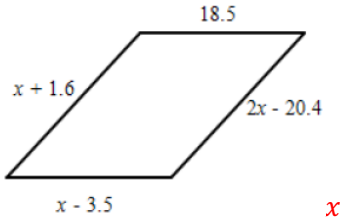
$b = \frac{65}{3}$ *or* 21.67

6)



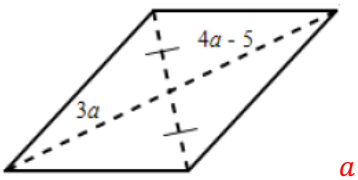
$y = 12, z = 4$

7)



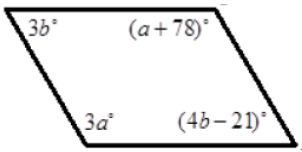
$x = 22$

8)



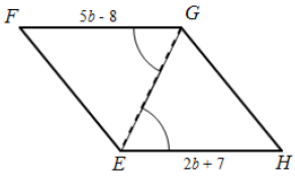
$a = 5$

9)



$a = 39, b = 21$

10)

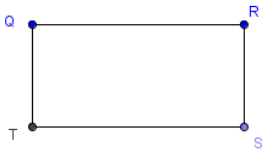


$b = 5$

QRST is a rectangle. Find the value of x and the length of each diagonal.

11) $QS = x \ \ and \ \ RT = 2x - 4$

$x = 4$ $\quad$ $QS = RT = 4$



12) $QS = 7x - 2 \ \ and \ \ RT = 4x + 3$

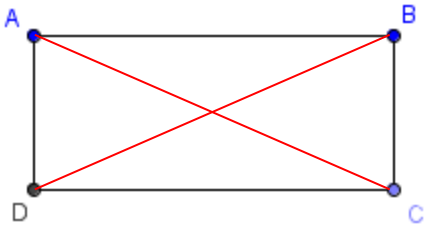
$x = \frac{5}{3}$ $\quad$ $QS = RT = \frac{29}{3}$

13) $QS = 5x - 8 \ and \ \ RT = 2x + 1$

$x = 3$ $\quad$ $QS = RT = 7$

Construct a proof for the following problems.

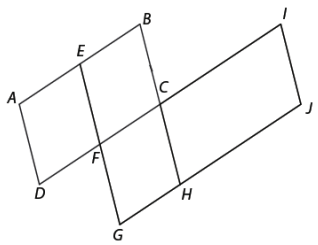
14) If a parallelogram is a rectangle, then its diagonals are congruent.



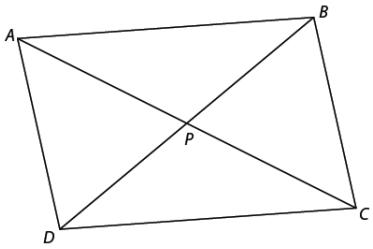
$ABCD$ is a rectangle.	Given
$\overline{AD} \cong \overline{BC}$, and $\overline{AB} \cong \overline{DC}$	Opp. Sides of a parallelogram are ≅.
$m\angle A = m\angle B = m\angle C = m\angle D = 90°$	Definition of a rectangle
$\Delta ABD \cong \Delta CDB \cong \Delta DCA \cong \Delta BAC$	SAS Triangle Congruence
$\overline{AC} \cong \overline{BD}$	CPCTC

15) Given that $\square ABCD, \square EBHG, and \ \square FIJG$ are parallelograms, prove that $\angle D \cong \angle I$

$\square ABCD, \square EBHG, and \ \square FIJG$	Given
$\angle D \cong \angle B$	Opp. angles of parallelogram are ≅.
$\angle B \cong \angle G$	Opp. angles of parallelogram are ≅.
$\angle G \cong \angle I$	Opp. angles of parallelogram are ≅.
$\angle D \cong \angle I$	Substitution

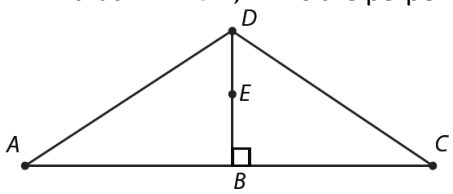


16) Given that $\square ABCD$ is a parallelogram, prove that $\triangle DPA \cong \triangle BPC$



$\square ABCD$ is a parallelogram	Given
$\overline{AD} \cong \overline{BC}$	Opp. sides of a parallelogram are ≅.
$\overline{DP} \cong \overline{PB}$ and $\overline{AP} \cong \overline{PC}$	Diagonals of a parallelogram bisect each other.
$\Delta DPA \cong \Delta BPC$	SSS Triangle Congruence

17) Prove that a point on a perpendicular bisector is equidistant from the endpoints of the segment it bisects given that in $\triangle ACD$, $\overline{BD}$ is the perpendicular bisector of $\overline{AC}$ and point *E* is on $\overline{BD}$. Write your answer in a proof.



Given:

$\overline{DB}$ is the perpendicular bisector of $\overline{AC}$.

E is a point on $\overline{DB}$.

Prove:

EA = EC

$\overline{DB}$ is the perpendicular bisector of $\overline{AC}$.	Given
Draw segment $\overline{EA}$ and $\overline{EC}$	
$AB = BC$	Definition of a Bisector
$EB = EB$	Reflexive Property
$m\angle EBA = 90° = m\angle EBC$	Definition of Perpendicular
$\Delta EBA \cong \Delta EBC$	SAS Triangle Congruence
$EA = EC$	CPCTC