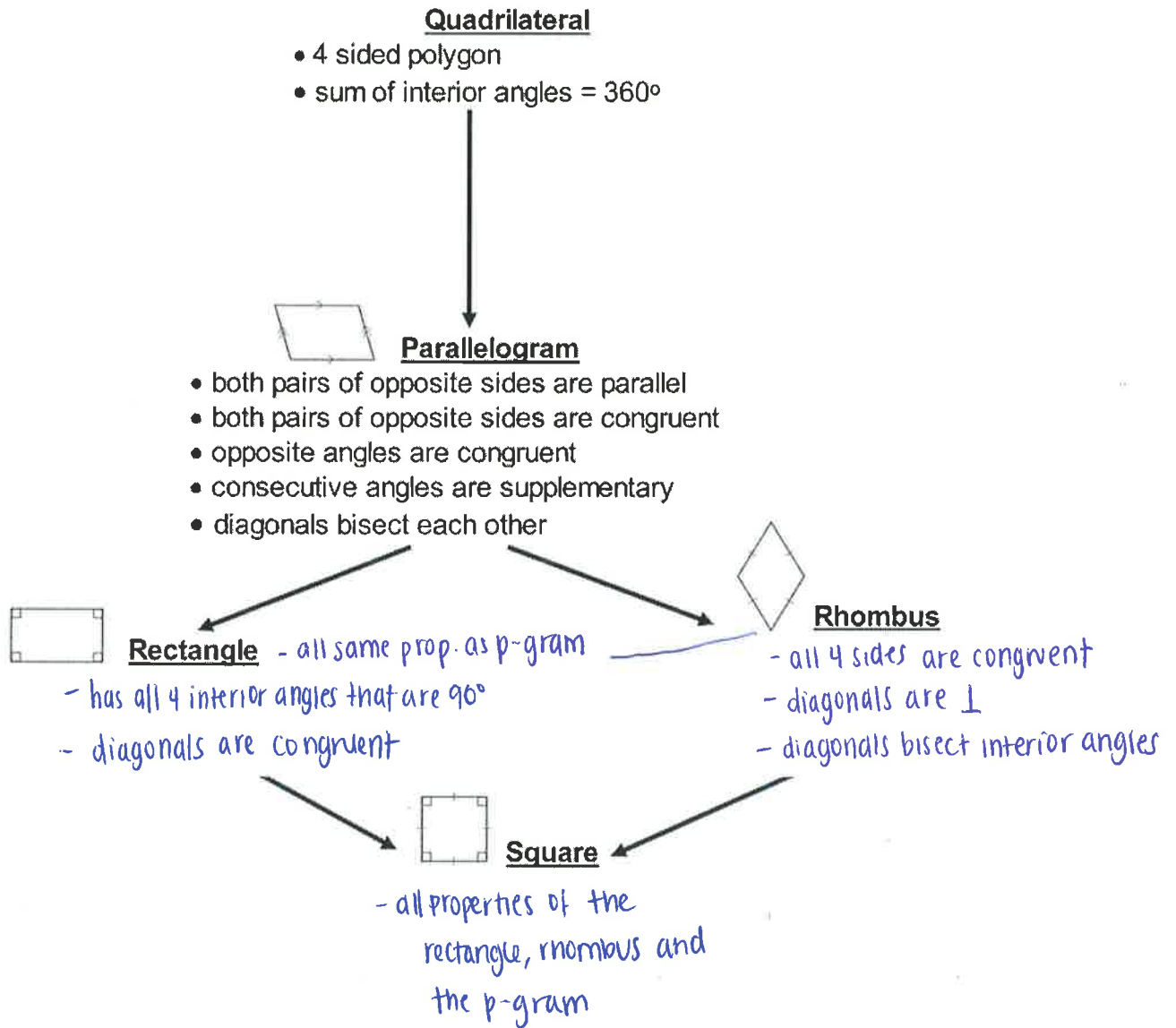



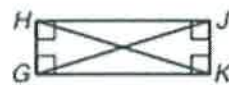


- I can use properties of rhombuses, rectangles, and squares.

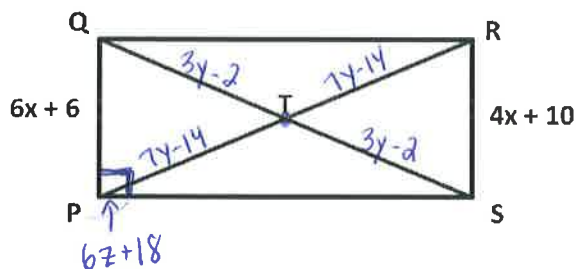
In the last section, we looked at properties of parallelograms. When we add extra characteristics to some angle measures or side lengths in parallelograms, we create some special parallelograms – the rectangle, rhombus, and square.



## Rectangles

Properties of Rectangles	
<p>A <b>rectangle</b> is a parallelogram with at least one right angle (all right angles!).</p> 	<p>If a parallelogram is a rectangle, then its diagonals are congruent.</p> 

Example 1: In rectangle PQRS, if  $PQ = 6x + 6$ ,  $RS = 4x + 10$ ,  $QT = 3y - 2$  and  $PT = 7y - 14$ , and  $m\angle P = (6z + 18)^\circ$  solve for  $x$ ,  $y$  and  $z$ .



$$6x + 6 = 4x + 10$$

$$2x + 6 = 10$$

$$2x = 4$$

$$\boxed{x = 2}$$

opp sides are  $\cong$

$$\overline{PR} \cong \overline{QS}$$

$$7y - 14 + 7y - 14 = 3y - 2 + 3y - 2$$

$$14y - 28 = 6y - 4$$

$$8y - 24 = -4$$

$$8y = 24$$

$$\boxed{y = 3}$$

diagonals are  $\cong$

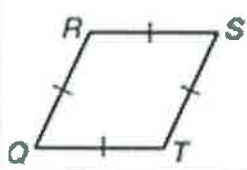
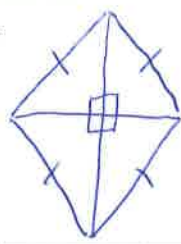
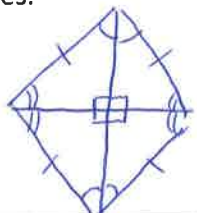
$$6z + 18 = 90$$

$$6z = 72$$

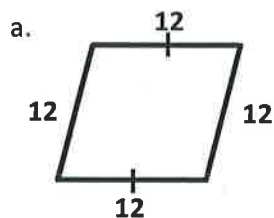
$$\boxed{z = 12}$$

all angles are  $90^\circ$

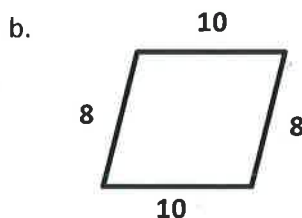
## Rhombus

Properties of Rhombuses		
<p>A <b>rhombus</b> is a parallelogram with at least 2 consecutive sides congruent (all sides congruent!).</p> 	<p>If a parallelogram is a rhombus, then its diagonals are perpendicular.</p> 	<p>If a parallelogram is a rhombus, then each diagonal bisects a pair of opposite angles.</p> 

Example 2: Is the following a rhombus?



Yes, because all sides are  $\cong$

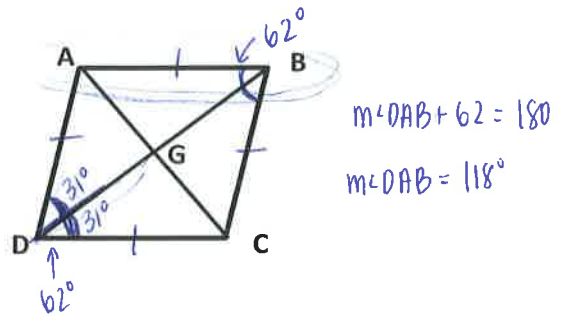


No, all sides are not  $\cong$

Example 3: Quadrilateral ABCD is a rhombus.

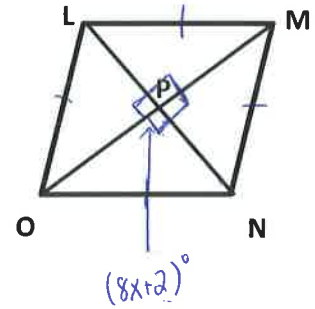
If  $m \angle ABC = 62^\circ$ , please find:

- a.  $m \angle ADG = \underline{31^\circ}$   
 b.  $m \angle DAB = \underline{118^\circ}$



Example 4: Quadrilateral LMNO is a rhombus and its diagonals intersect at point P. If  $m \angle OPN = (8x + 2)^\circ$ , find the value of x.

$8x + 2 = 90$   
 $8x = 88$   
 $x = 11$   
 diagonals are  $\perp$



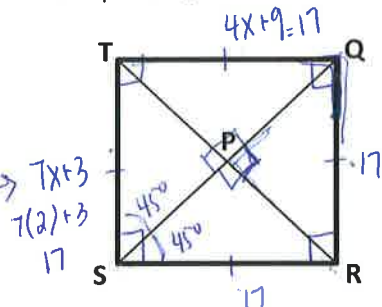
**Square**

Properties of Squares	
<p>A <b>square</b> is a parallelogram that is both equilateral and equiangular.                      A square has all of the properties of the rectangle and rhombus.</p>	

Example 5: Quadrilateral TQRS is a square and its diagonals intersect at point P.

- a. Find  $m \angle TQR = \underline{90^\circ}$ .  
 b. Find  $m \angle RSP = \underline{45^\circ}$ .  
 c. Find  $m \angle RPQ = \underline{90^\circ}$ .

d. If  $ST = 7x + 3$  and  $TQ = 4x + 9$ , solve for x and find the perimeter of  $\square TQRS$ .



$7x + 3 = 4x + 9$   
 $3x + 3 = 9$   
 $3x = 6$   
 $x = 2$

$4x + 9 = 17$   
 $Perimeter = 17 + 17 + 17 + 17$   
 $P = 68 \text{ units}$

Try these!

Use rectangle ABCD and the given information to solve problems #1 -3.

1. If  $AC = 4x - 60$  and  $BD = 30 - x$ , find BD.

$$4x - 60 = 30 - x$$

$$5x = 90 \Rightarrow x = 18$$

$$BD = 30 - 18$$

$$BD = 12$$

2. If  $m\angle BAC = (4x + 5)^\circ$  and  $m\angle CAD = (5x - 14)^\circ$ , find  $m\angle CAD$ .

$$4x + 5 + 5x - 14 = 90$$

$$9x - 9 = 90$$

$$9x = 99$$

$$x = 11$$

$$m\angle CAD = 5(11) - 14$$

$$m\angle CAD = 41^\circ$$

3. If  $AB = 3x + 5$  and  $CD = 40 - 2x$ , find the lengths of both segments.

$$3x + 5 = 40 - 2x$$

$$5x + 5 = 40$$

$$5x = 35$$

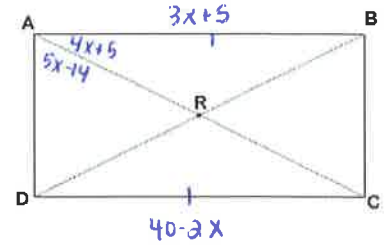
$$x = 7$$

$$AB = 3(7) + 5$$

$$AB = 26$$

$$CD = 40 - 2(7)$$

$$CD = 26$$



Use square ABCD and the given information to find each value in problems #4 - 6.

4. If  $AC = 2x + 4$  and  $CD = 3x - 5$ , find the perimeter of square ABCD.

$$2x + 4 = 3x - 5$$

$$x = 9$$

$$P = 2a + 2a + 2a + 2a$$

$$P = 88 \text{ units}$$

5. If  $m\angle BAC = 9x^\circ$ , please solve for x.

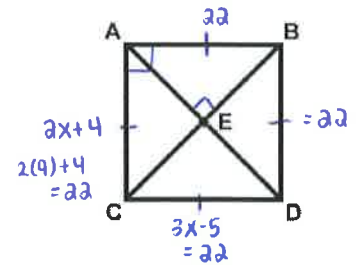
$$9x = 90$$

$$x = 10$$

6. If  $m\angle AEB = 3x^\circ$ , please solve for x.

$$3x = 90$$

$$x = 30$$



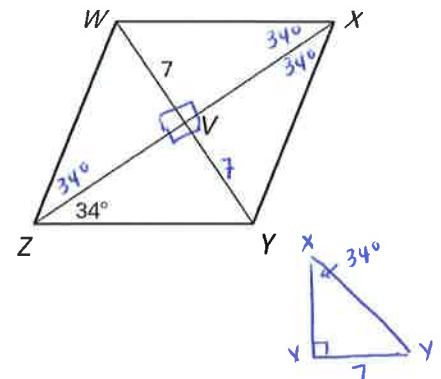
The diagonals of rhombus WXYZ intersect at V. Given that  $m\angle XZY = 34^\circ$  and  $WV = 7$ , find the indicated measure in problems #7 - 10.

7.  $m\angle WZV = 34^\circ$

8.  $m\angle XYZ = 180 - 68 = 112^\circ$

9.  $WY = 7 + 7 = 14$

10.  $XY = 12.5$



**Answer Key:** 1.  $BD = 12$     2.  $41^\circ$     3.  $AB = 26, CD = 26$     4. Perimeter = 88 units    5.  $x = 10$   
6.  $x = 30$     7.  $34^\circ$     8.  $112^\circ$     9. 14    10. ~~12~~ 12.5

$$\sin 34 = \frac{7}{x}$$

$$7 = x \sin 34$$

$$x = \frac{7}{\sin 34}$$

$$x = 12.5$$