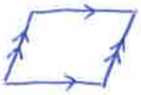
Geometry H
8.2 Properties of Parallelograms

Name: Key
Date: ____________ Period: ______

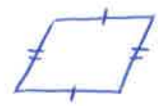
LEARNING TARGETS

- I can use properties of parallelograms to find side lengths and angle measures.
- I can apply my knowledge of parallelograms to solve problems on the coordinate plane.

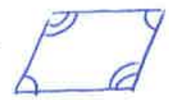
Properties of Parallelograms:



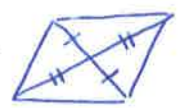
- **Definition**: If a quadrilateral is a parallelogram, then both pairs of opposite sides are parallel.



- If a quadrilateral is a parallelogram, then both pairs of opposite sides are congruent.



- If a quadrilateral is a parallelogram, then both pairs of opposite angles are congruent.
- If a quadrilateral is a parallelogram, then consecutive angles are supplementary.



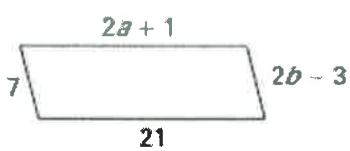
- If a quadrilateral is a parallelogram, then diagonals bisect each other.

<u>Example 1 – Use Properties of Parallelograms</u>

which property are you using?

Find the value of each variable in the parallelogram. Justify your answer.

1.

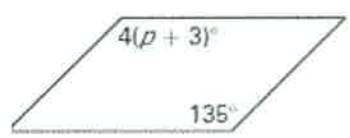


$2a+1 = 21$ opp. sides are ≅ $7 = 2b-3$

$2a = 20$ $10 = 2b$

$\boxed{a = 10}$ $\boxed{b = 5}$

2.



$4(p+3) = 135$ opp. angles are ≅

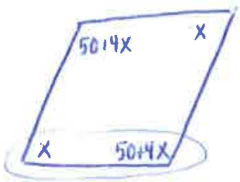
$4p + 12 = 135$

$4p = 123$

$\boxed{p = 30.75}$

Example 2 – Use Properties of Parallelogram

3. The measure of one interior angle of a parallelogram is 50 degrees more than 4 times the measure of another angle. Find the measure of each angle. Justify your answer.



$x+50+4x=180$ consec. angles are suppl.

$5x+50=180$

$5x=130$

$\boxed{x=26}$

Angles: 26°, 26°, 154°, 154°

OR $x+50+4x+x+50+4x=360$ sum of int. angles of a quad.

$10x+100=360$

$10x=260$

$\boxed{x=26}$

4. Find the indicated measure in ▱*ABCD*. Explain.

a. AD = 13 (opp. sides are ≅)

b. EC = 12 (Pythagorean Thm)

c. ED = 5 (diagonals bisect each other)

d. AC = 12+12 = 24

e. $m\angle BDA =$ 67° (alt. interior angles)

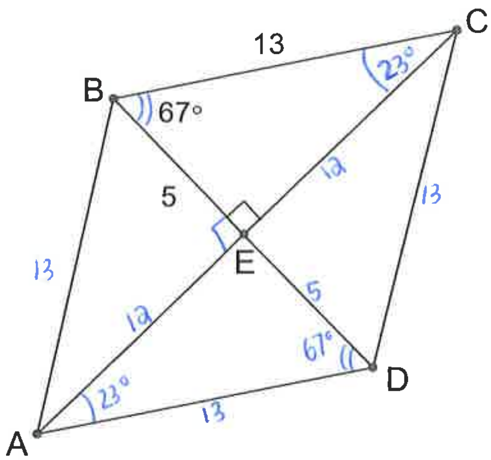
f. $\angle BEC =$ 90°

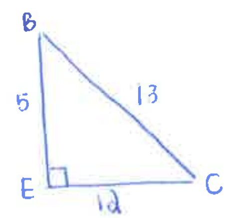
6. $\angle BCE =$ 23° (triangle sum)

h. $\angle DAE =$ 23° (alt. interior angles)

i. Perimeter of ▱*ABCD*.

13+13+13+13 = 52 units





$5^2+EC^2=13^2$

$25+EC^2=169$

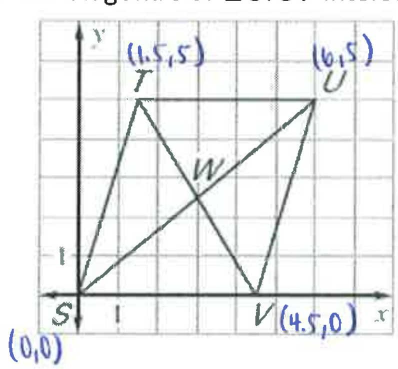
$EC^2=144$

$EC=12$

Example 3: Find the intersections of diagonals.

since the diagonals bisect each other, they meet at the midpoint $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

5. The diagonals of ▱*STUV* intersect at point W. Find the coordinates of W.



midpoint of $\overline{SU} = \left(\frac{0+6}{2}, \frac{0+5}{2}\right) = \left(\frac{6}{2}, \frac{5}{2}\right) = (3, 2.5)$

midpoint of $\overline{TV} = \left(\frac{1.5+4.5}{2}, \frac{5+0}{2}\right) = \left(\frac{6}{2}, \frac{5}{2}\right) = (3, 2.5)$

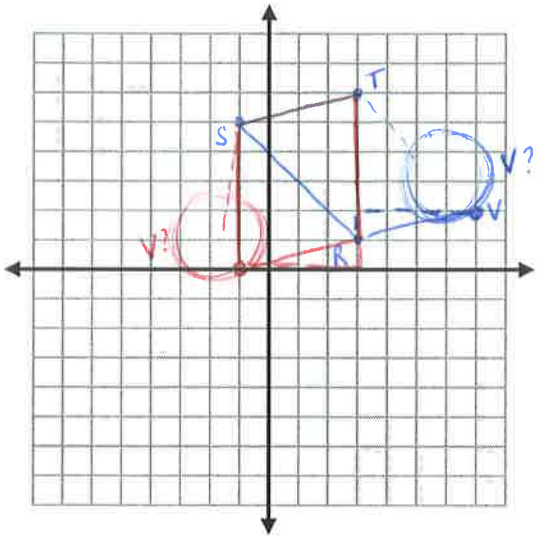
$\boxed{\text{The coordinates of W are } (3, 2.5)}$

Example 4: Find missing coordinate of parallelogram.

If you know the coordinates of three vertices of a parallelogram, you can use slope to find the coordinates of the fourth vertex.

both pairs of opp. sides are parallel

6. Three vertices of ▱*RSTV* are R(3, 1), S(-1, 5), and T(3, 6). Find the coordinates of V.



Find the slope $\left(\frac{\text{rise}}{\text{run}}\right)$ of one of the given segments ($\overline{RS}$ or $\overline{ST}$)

then count the same $\frac{\text{rise}}{\text{run}}$ on its opposite side

ST: slope $= \frac{\text{rise}}{\text{run}} = \frac{1}{4}$ so count $\frac{\text{rise}}{\text{run}}$ of $\frac{1}{4}$ from R

$\boxed{\text{So V has coordinates (7,2)}}$

$\boxed{\text{OR}}$

Count slope from T to S and repeat from R

TS: slope $= \frac{-1}{-4}$

$\boxed{\text{So V could have coordinates (-1,0)}}$