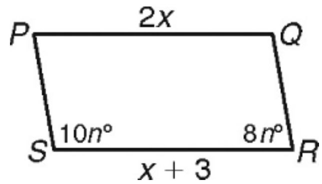
Name ______________________________ Date ______________ Class______________

LESSON 9-1

Properties of Parallelograms

Practice and Problem Solving: A/B

***PQRS* is a parallelogram. Find each measure.**

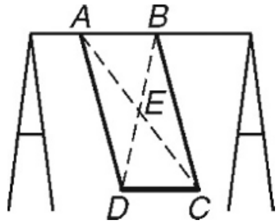


1. *RS* __________

2. m∠*S* __________

3. m∠*R* __________

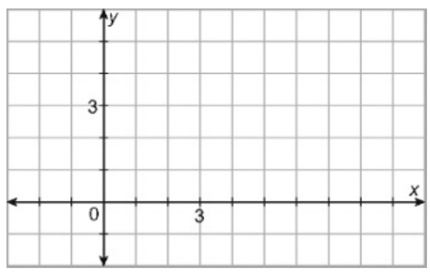
The figure shows a swing blown to one side by a breeze. As long as the seat of the swing is parallel to the top bar, the swing makes a parallelogram. In ▱ *ABCD*, *DC* = 2 ft, *BE* = $4\frac{1}{2}$ ft, and m∠*BAD* = 75°.



Find each measure.

4. *AB* __________
5. *ED* __________
6. *BD* __________
7. m∠*ABC* __________
8. m∠*BCD* __________
9. m∠*ADC* __________

Three vertices of ▱ *GHIJ* are *G*(0, 0), *H*(2, 3), and *J*(6, 1). Use the grid to the right to complete Problems 10–16.



10. Plot vertices *G*, *H*, and *J* on the coordinate plane.

11. Find the rise (difference in the *y*-coordinates) from

    G to *H*. ______________

12. Find the run (difference in the *x*-coordinates) from

    G to *H*. ______________

13. Using your answers from Problems 11 and 12, add the rise to the *y*-coordinate of vertex *J* and add the run to the *x*-coordinate of vertex *J*.

    The coordinates of vertex *I* are (______________, ______________).

14. Plot vertex *I*. Connect the points to draw ▱ *GHIJ*.

15. Check your answer by finding the slopes of $\overline{IH}$ and $\overline{JG}$.

    slope of $\overline{IH}$ = ______________ slope of $\overline{JG}$ = ______________

16. What do the slopes tell you about $\overline{IH}$ and $\overline{JG}$? ______________________________

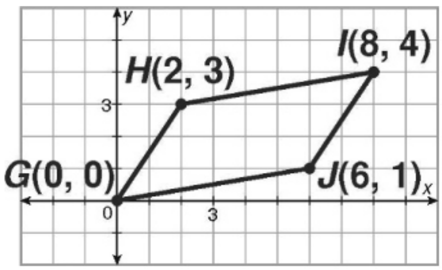
    ____

UNIT 3 Quadrilaterals and Coordinate Proof

MODULE 9 Properties of Quadrilaterals

LESSON 9-1

Practice and Problem Solving: A/B

1. 6
2. 100°
3. 80°
4. 2 ft
5. $4\frac{1}{2}$ ft
6. 9 ft
7. 105°
8. 75°
9. 105°
10. 

11. 3
12. 2
13. 8; 4
14. See graph.
15. $\frac{1}{6}$; $\frac{1}{6}$
16. If two lines have the same slope they are parallel. $\overline{IH}$ and $\overline{JG}$ have the same slope so they are parallel.

Practice and Problem Solving: C

1. $m\angle C = 135°$; $m\angle D = 45°$
2. 15 in.
3. 4.5 ft
4. $9 < \ell < 15$
5. $x < \ell < 3x$
6. $0 < \ell < 2x$
7. Possible answer: The height of *ABCD* is 2*b* and the length of the base is 2*c*, so the area of *ABCD* is 4*bc*. Because *ABCD* is a parallelogram, $AB = DC$ and $BC = AD$, and $\angle A$ is congruent to $\angle C$ and $\angle B$ is congruent to $\angle D$. Furthermore, because *E*, *F*, *G*, and *H* are midpoints, $AE = BE = CG = DG$, and $BF = CF = AH = DH$. So by SAS, $\triangle AEH$ is congruent to $\triangle CGF$, and $\triangle BEF$ is congruent to $\triangle DGH$. Now find the coordinates of the midpoints: $E(a, b)$, $F(c + 2a, 2b)$, $G(2c + a, b)$, $H(c, 0)$. The height of $\triangle AEH$ is *b* and the length of the base is *c*, so its area is $\frac{1}{2}bc$. The areas of congruent triangles are equal, so the area of $\triangle CGF$ is also $\frac{1}{2}bc$. The height of $\triangle DGH$ is *b* and the length of the base is *c*, so its area is $\frac{1}{2}bc$. The area of $\triangle BEF$ is also $\frac{1}{2}bc$. The area of all four triangles is thus 2*bc*. The area of *EFGH* is the area of *ABCD* minus the area of the triangles, or $4bc - 2bc = 2bc$. And the area of *EFGH* is $2bc = \frac{1}{2}(4bc) = \frac{1}{2}$(area of *ABCD*).
8. Possible answer: Use the slope formula to find the slope of each side: slope of $\overline{EF} = \frac{b}{a+c}$, slope of $\overline{GH} = \frac{b}{a+c}$, slope of $\overline{FG} = \frac{b}{a-c}$, slope of $\overline{EH} = \frac{b}{a-c}$. Segments with equal slopes are parallel, so $\overline{EF}$ is parallel to $\overline{GH}$, and $\overline{FG}$ is parallel to $\overline{EH}$. Therefore, *EFGH* is a parallelogram.

Practice and Problem Solving: Modified

1. supplementary
2. parallel or congruent
3. bisect
4. congruent