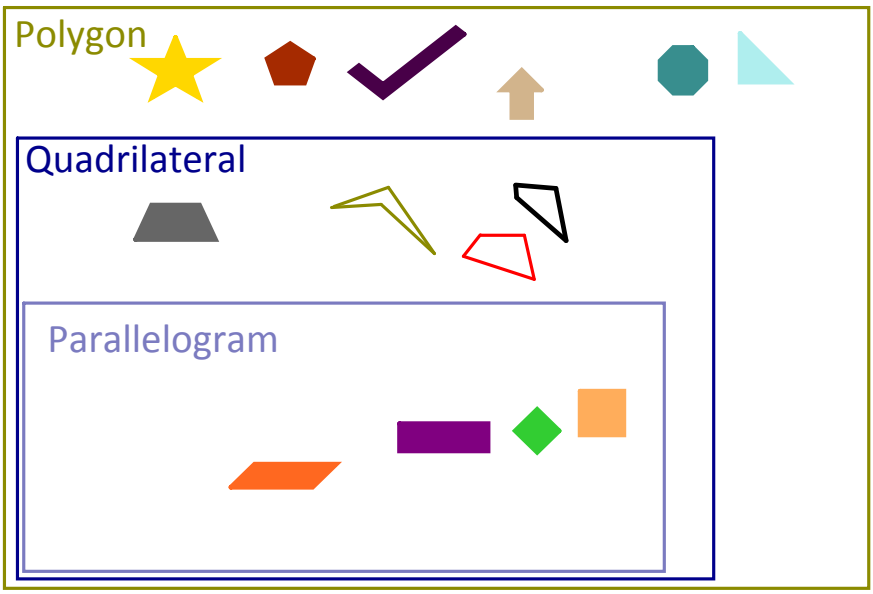
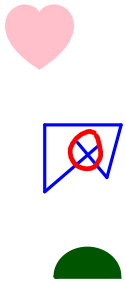
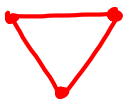




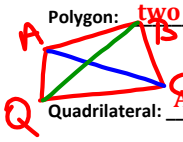
8.2 Use Properties of Parallelograms



Goal: Find angle and side measures of parallelograms.

Vocabulary

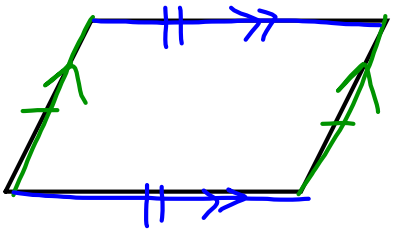
Polygon: A closed plane figure with 3 or more sides. Each side intersects exactly two other sides at each endpoint.



Quadrilateral: A polygon with four sides whose interior angles sum to 360^0.

Diagonal: A segment that joins two non-consecutive vertices of a polygon.

Parallelogram: A quadrilateral with both pairs of opposite sides both parallel and congruent.



Quadrilateral: A polygon with four sides whose interior angles sum to 360°.

Example 1 *Find an unknown interior angle measure*

Find the value of x in the diagram shown.

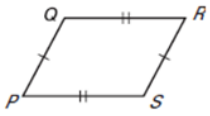
$135+112+71=318°$

$360-318=42°$

THEOREM 8.3

If a quadrilateral is a parallelogram, then its opposite sides are congruent.

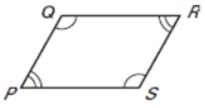
If $PQRS$ is a parallelogram, then $\overline{QP} \cong \overline{RS}$ and $\overline{QR} \cong \overline{PS}$.



THEOREM 8.4

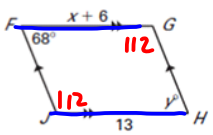
If a quadrilateral is a parallelogram, then its opposite angles are congruent.

If $PQRS$ is a parallelogram, then $\angle P \cong \angle R$ and $\angle Q \cong \angle S$.



Example 2 *Use properties of parallelograms*

Find the values of x and y.



$y=68$

$x+6=13$

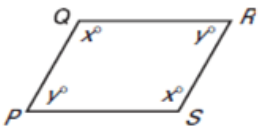
$x=7$

$F+H=68+60=136$

$360-136=224°=J+G$

THEOREM 8.5

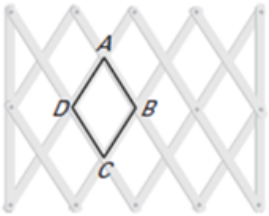
If a quadrilateral is a parallelogram, then its consecutive angles are Supplementary.

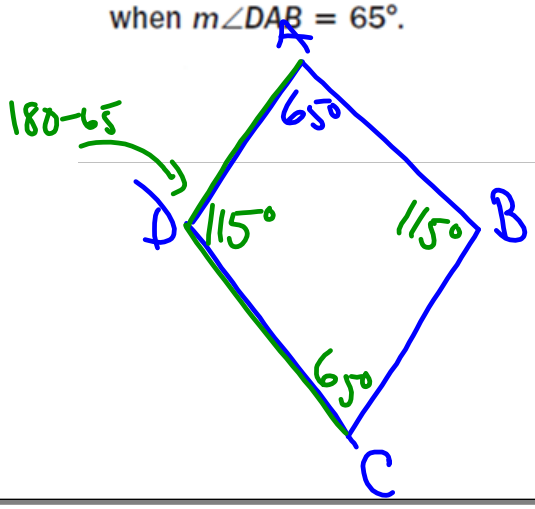


If *PQRS* is a parallelogram, then $x° + y° =$ 180°.

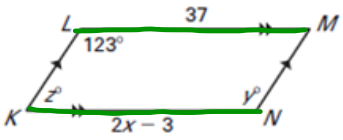
Example 3 *Use properties of a parallelogram*

Gates As shown, a gate contains several parallelograms. Find $m\angle ADC$ when $m\angle DAB = 65°$.





Checkpoint Find the indicated measure in □*KLMN* shown at the right.



$y = 123$

$z = 57$ $(180 - 123 = 57)$

$2x - 3 = 37$

$+3 \quad +3$

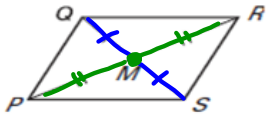
$\frac{2x}{2} = \frac{40}{2}$

$x = 20$

Diagonal: A segment that joins two non-consecutive vertices of a polygon.

THEOREM 8.6

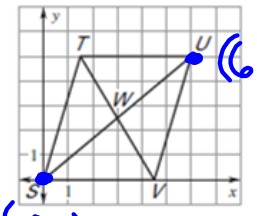
If a quadrilateral is a parallelogram, then its diagonals bisect each other.



$\overline{QM} \cong \overline{MS}$ and $\overline{PM} \cong \overline{MR}$

Example 4 *Use properties of a parallelogram*

The diagonals of $\square STUV$ intersect at point W. Find the coordinates of W.



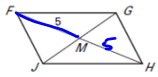
(6,5)

(0,0)

$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ ← AVERAGE

$\left(\frac{0+6}{2}, \frac{0+5}{2}\right) = \left(3, \frac{5}{2}\right)$

5. Given that $\square FGHJ$ is a parallelogram, find MH and FH.

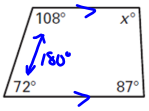


MH = 5

FH = 10

Find the value of x.

6.

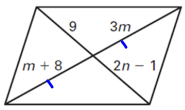


108+72+87=267

x=360-267=93°

Find the values of m and n.

7.



m+8=3m

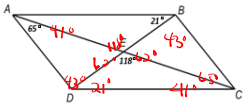
8=2m

4=m

2n-1=9

2n=10

n=5



118 + 21 = 139

65 + 62 = 127

Find the indicated measure in $\square ABCD$.

7. $m\angle AEB$ 118°
8. $m\angle AED$ 62°
9. $m\angle BAD$ 106°
10. $m\angle ADC$ 64°
11. $m\angle BAE$ 41°
12. $m\angle ECB$ 65°
13. $m\angle DCE$ 41°
14. $m\angle DCB$ 106°

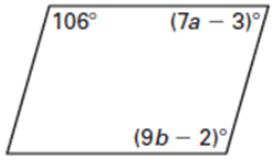
LESSON 8.2

Practice C

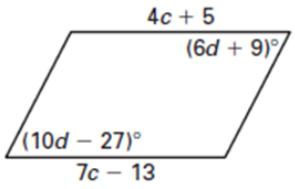
For use with pages 514–521

Find the value of each variable in the parallelogram.

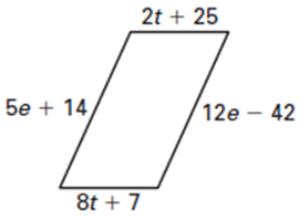
1.



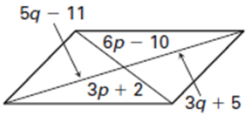
2.



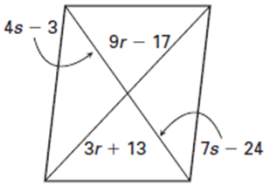
3.



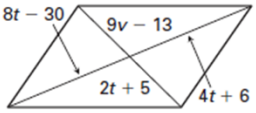
4.



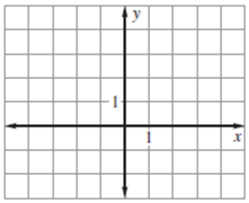
5.



6.



7. The coordinates for $\square ABCD$ are $A(-1, 3)$, $B(4, 2)$, $C(2, -1)$, and $D(-3, 0)$. Plot the points and draw $\square ABCD$ on the coordinate plane. Then draw the diagonals $\overline{AC}$ and $\overline{BD}$. Label the intersection of the diagonals as point E. What are the coordinates of point E?



8. In $\square WXYZ$, $m\angle W$ is 50 degrees more than $m\angle X$. Sketch $\square WXYZ$. Find the measure of each interior angle. Then label each angle with its measure.

9. In $\square EFGH$, $m\angle G$ is 25 degrees less than $m\angle H$. Sketch $\square EFGH$. Find the measure of each interior angle. Then label each angle with its measure.

Find the indicated measure in $\square ABCD$.

10. $m\angle AEB$

11. $m\angle BAE$

12. $m\angle AED$

13. $m\angle ECB$

14. $m\angle BAD$

15. $m\angle DCE$

16. $m\angle ADC$

17. $m\angle DCB$