CHAPTER 6

Study Guide and Review

Study Guide

KeyConcepts

Angles of Polygons (Lesson 6-1)

- The sum of the measures of the interior angles of a polygon is given by the formula $S = (n - 2)180$.
- The sum of the measures of the exterior angles of a convex polygon is 360.

Properties of Parallelograms (Lessons 6-2 and 6-3)

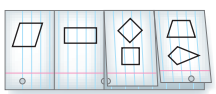
- Opposite sides are congruent and parallel.
- Opposite angles are congruent.
- Consecutive angles are supplementary.
- If a parallelogram has one right angle, it has four right angles.
- Diagonals bisect each other.

Properties of Rectangles, Rhombi, Squares, and Trapezoids (Lesson 6-4 through 6-6)

- A rectangle has all the properties of a parallelogram. Diagonals are congruent and bisect each other. All four angles are right angles.
- A rhombus has all the properties of a parallelogram. All sides are congruent. Diagonals are perpendicular. Each diagonal bisects a pair of opposite angles.
- A square has all the properties of a parallelogram, a rectangle, and a rhombus.
- In an isosceles trapezoid, both pairs of base angles are congruent and the diagonals are congruent.

FOLDABLES StudyOrganizer

Be sure the Key Concepts are noted in your Foldable.



KeyVocabulary

base (p. 439)

base angle (p. 439)

diagonal (p. 393)

isosceles trapezoid (p. 439)

kite (p. 442)

legs (p. 439)

midsegment of a trapezoid (p. 441)

parallelogram (p. 403)

rectangle (p. 423)

rhombus (p. 430)

square (p. 431)

trapezoid (p. 439)

VocabularyCheck

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or phrase to make a true sentence.

1. No angles in an isosceles trapezoid are congruent.
2. If a parallelogram is a rectangle, then the diagonals are congruent.
3. A midsegment of a trapezoid is a segment that connects any two nonconsecutive vertices.
4. The base of a trapezoid is one of the parallel sides.
5. The diagonals of a rhombus are perpendicular.
6. The diagonal of a trapezoid is the segment that connects the midpoints of the legs.
7. A rectangle is not always a parallelogram.
8. A quadrilateral with only one set of parallel sides is a parallelogram.
9. A rectangle that is also a rhombus is a square.
10. The leg of a trapezoid is one of the parallel sides.

Lesson-by-Lesson Review

6-1 Angles of Polygons

Find the sum of the measures of the interior angles of each convex polygon.

11. decagon

12. 15-gon

13. **SNOWFLAKES** The snowflake decoration at the right suggests a regular hexagon. Find the sum of the measures of the interior angles of the hexagon.

The measure of an interior angle of a regular polygon is given. Find the number of sides in the polygon.

14. 135

15. ≈166.15

Example 1

Find the sum of the measures of the interior angles of a convex 22-gon.

$m = (n - 2)180$ Write an equation.
$= (22 - 2)180$ Substitution
$= 20 \cdot 180$ Subtract.
$= 3600$ Multiply.

Example 2

The measure of an interior angle of a regular polygon is 157.5. Find the number of sides in the polygon.

$157.5n = (n - 2)180$ Write an equation.
$157.5n = 180n - 360$ Distributive Property
$-22.5n = -360$ Subtract.
$n = 16$ Divide.

The polygon has 16 sides.

6-2 Parallelograms

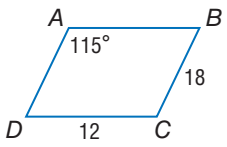
Use $\square ABCD$ to find each measure.

16. $m\angle ADC$

17. AD

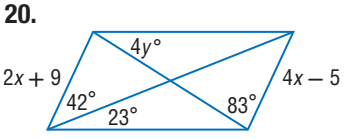
18. AB

19. $m\angle BCD$

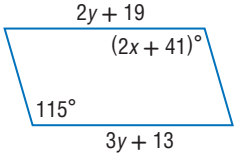


ALGEBRA Find the value of each variable in each parallelogram.

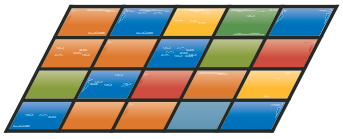
20.



21.

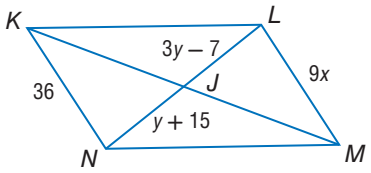


22. **DESIGN** What type of information is needed to determine whether the shapes that make up the stained glass window below are parallelograms?



Example 3

ALGEBRA If $KLMN$ is a parallelogram, find the value of the indicated variable.



a. x

$\overline{KN} \cong \overline{LM}$ Opp. sides of a $\square$ are $\cong$.
$KN = LM$ Definition of congruence
$36 = 9x$ Substitution
$4 = x$ Divide.

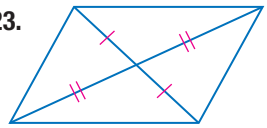
b. y

$\overline{NJ} \cong \overline{JL}$ Diag. of a $\square$ bisect each other.
$NJ = JL$ Definition of congruence
$y + 15 = 3y - 7$ Substitution
$-2y = -22$ Subtract.
$y = 11$ Divide.

6-3 Tests for Parallelograms

Determine whether each quadrilateral is a parallelogram. Justify your answer.

23.



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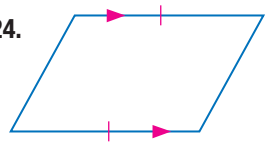
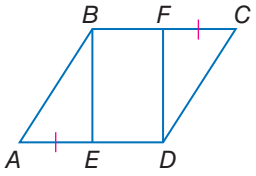


25. PROOF Write a two-column proof.

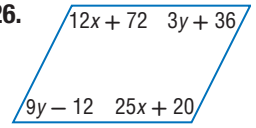
Given: $\square ABCD$, $\overline{AE} \cong \overline{CF}$

Prove: Quadrilateral $EBFD$ is a parallelogram.

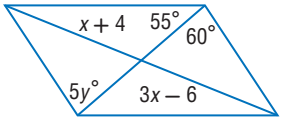


ALGEBRA Find x and y so that the quadrilateral is a parallelogram.

26.

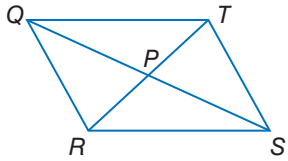


27.



Example 4

If $TP = 4x + 2$, $QP = 2y - 6$, $PS = 5y - 12$, and $PR = 6x - 4$, find x and y so that the quadrilateral is a parallelogram.



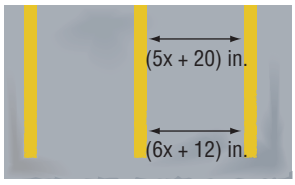
Find x such that $\overline{TP} \cong \overline{PR}$ and y such that $\overline{QP} \cong \overline{PS}$.

$TP = PR$	Definition of $\cong$
$4x + 2 = 6x - 4$	Substitution
$-2x = -6$	Subtract.
$x = 3$	Divide.

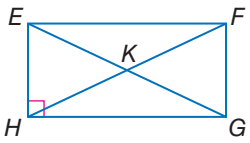
$QP = PS$	Definition of $\cong$
$2y - 6 = 5y - 12$	Substitution
$-3y = -6$	Subtract.
$y = 2$	Divide.

6-4 Rectangles

28. PARKING The lines of the parking space shown below are parallel. How wide is the space (in inches)?



ALGEBRA Quadrilateral $EFGH$ is a rectangle.



29. If $m\angle FEG = 57$, find $m\angle GEH$.

30. If $m\angle HGE = 13$, find $m\angle FGE$.

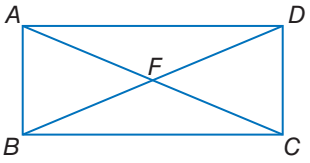
31. If $FK = 32$ feet, find EG.

32. Find $m\angle HEF + m\angle EFG$.

33. If $EF = 4x - 6$ and $HG = x + 3$, find EF.

Example 5

ALGEBRA Quadrilateral $ABCD$ is a rectangle. If $m\angle ADB = 4x + 8$ and $m\angle DBA = 6x + 12$, find x.



$ABCD$ is a rectangle, so $m\angle ABC = 90$. Since the opposite sides of a rectangle are parallel, and the alternate interior angles of parallel lines are congruent, $\angle DBC \cong \angle ADB$ and $m\angle DBC = m\angle ADB$.

$m\angle DBC + m\angle DBA = 90$	Angle Addition
$m\angle ADB + m\angle DBA = 90$	Substitution
$4x + 8 + 6x + 12 = 90$	Substitution
$10x + 20 = 90$	Add.
$10x = 70$	Subtract.
$x = 7$	Divide.

6-5 Rhombi and Squares

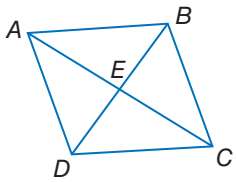
ALGEBRA $ABCD$ is a rhombus. If $EB = 9$, $AB = 12$ and $m\angle ABD = 55$, find each measure.

34. AE

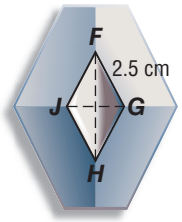
35. $m\angle BDA$

36. CE

37. $m\angle ACB$



38. LOGOS A car company uses the symbol shown at the right for their logo. If the inside space of the logo is a rhombus, what is the length of FJ?



COORDINATE GEOMETRY Given each set of vertices, determine whether $\square QRST$ is a *rhombus*, a *rectangle*, or a *square*. List all that apply. Explain.

39. $Q(12, 0)$, $R(6, -6)$, $S(0, 0)$, $T(6, 6)$

40. $Q(-2, 4)$, $R(5, 6)$, $S(12, 4)$, $T(5, 2)$

Example 6

The diagonals of rhombus $QRST$ intersect at P. Use the information to find each measure or value.

a. ALGEBRA If QT = x + 7 and TS = 2x − 9, find x.

$\overline{QT} \cong \overline{TS}$	Def. of rhombus
$QT = TS$	Def. of congruence
$x + 7 = 2x - 9$	Substitution
$-x = -16$	Subtract.
$x = 16$	Divide.

b. If $m\angle QTS = 76$, find $m\angle TSP$.

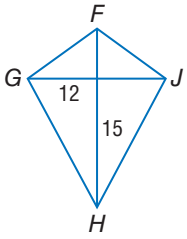
$\overline{TR}$ bisects $\angle QTS$. Therefore, $m\angle PTS = \frac{1}{2}m\angle QTS$. So $m\angle PTS = \frac{1}{2}(76)$ or 38. Since the diagonals of a rhombus are perpendicular, $m\angle TPS = 90$.

$m\angle PTS + m\angle TPS + m\angle TSP = 180$	△ Sum Thm.
$38 + 90 + m\angle TSP = 180$	Substitution
$128 + m\angle TSP = 180$	Add.
$m\angle TSP = 52$	Subtract.

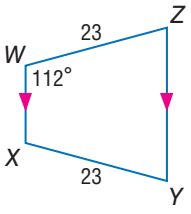
6-6 Trapezoids and Kites

Find each measure.

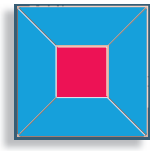
41. GH



42. $m\angle Z$



43. DESIGN Renee designed the square tile as an art project.



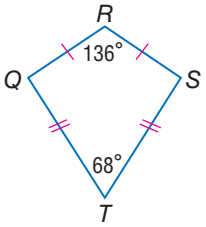
a. Describe a way to determine if the trapezoids in the design are isosceles.

b. If the perimeter of the tile is 48 inches and the perimeter of the red square is 16 inches, what is the perimeter of one of the trapezoids?

Example 7

If $QRST$ is a kite, find $m\angle RST$.

Since $\angle Q \cong \angle S$, $m\angle Q = m\angle S$. Write and solve an equation to find $m\angle S$.



$m\angle Q + m\angle R + m\angle S + m\angle T = 360$	Polygon Int. Δs Sum Thm
$m\angle Q + 136 + m\angle S + 68 = 360$	Substitution
$2m\angle S + 204 = 360$	Simplify.
$2m\angle S = 156$	Subtract.
$m\angle S = 78$	Divide.

CHAPTER 6

Practice Test

Find the sum of the measures of the interior angles of each convex polygon.

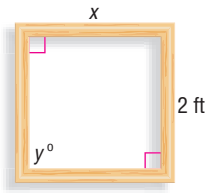
1. hexagon

2. 16-gon

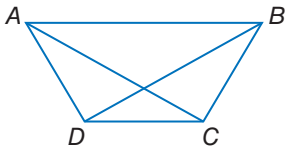
3. **ART** Jen is making a frame to stretch a canvas over for a painting. She nailed four pieces of wood together at what she believes will be the four vertices of a square.

a. How can she be sure that the canvas will be a square?

b. If the canvas has the dimensions shown below, what are the missing measures?



Quadrilateral *ABCD* is an isosceles trapezoid.



4. Which angle is congruent to $\angle C$?

5. Which side is parallel to $\overline{AB}$?

6. Which segment is congruent to $\overline{AC}$?

The measure of the interior angles of a regular polygon is given. Find the number of sides in the polygon.

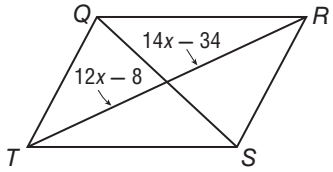
7. 900

8. 1980

9. 2880

10. 5400

11. **MULTIPLE CHOICE** If *QRST* is a parallelogram, what is the value of *x*?



A 11

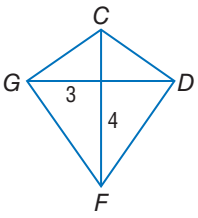
B 12

C 13

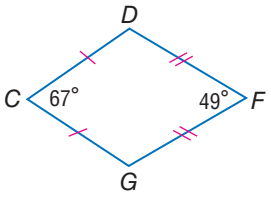
D 14

If *CDFG* is a kite, find each measure.

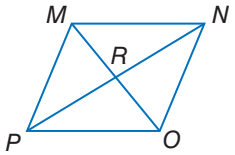
12. *GF*



13. $m\angle D$



ALGEBRA **Quadrilateral *MNOP* is a rhombus. Find each value or measure.**



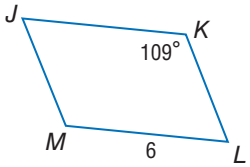
14. $m\angle MRN$

15. If $PR = 12$, find RN.

16. If $m\angle PON = 124$, find $m\angle POM$.

17. **CONSTRUCTION** The Smiths are building an addition to their house. Mrs. Smith is cutting an opening for a new window. If she measures to see that the opposite sides are congruent and that the diagonal measures are congruent, can Mrs. Smith be sure that the window opening is rectangular? Explain.

Use $\square JKLM$ to find each measure.

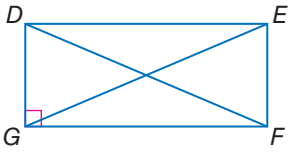


18. $m\angle JML$

19. JK

20. $m\angle KLM$

ALGEBRA **Quadrilateral *DEFG* is a rectangle.**



21. If $DF = 2(x + 5) - 7$ and $EG = 3(x - 2)$, find EG.

22. If $m\angle EDF = 5x - 3$ and $m\angle DFG = 3x + 7$, find $m\angle EDF$.

23. If $DE = 14 + 2x$ and $GF = 4(x - 3) + 6$, find GF.

Determine whether each quadrilateral is a parallelogram. Justify your answer.

24.

25.