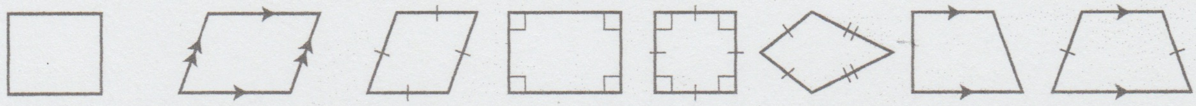
Name ______________________ Class ______________ Date ______________

Reteaching 6-1

OBJECTIVE: Classifying special types of quadrilaterals

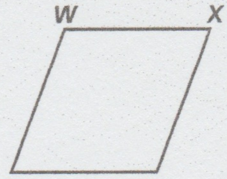
MATERIALS: Ruler, protractor



quadrilateral | parallelogram | rhombus | rectangle | square | kite | trapezoid | isosceles trapezoid

Example

Judging by appearance, name *WXYZ* in as many ways as possible.



It is a quadrilateral because it has four sides.

It is a parallelogram because both pairs of opposite sides are parallel.

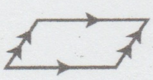
It is a rhombus because it has four congruent sides.

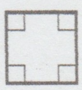
Exercises

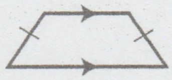
Use a protractor and a ruler to sketch an example of each quadrilateral. Then name it in as many ways as possible.

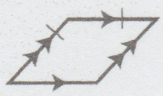
1. a quadrilateral with exactly one pair of parallel sides
2. a quadrilateral with opposite sides parallel
3. a quadrilateral with four right angles
4. a quadrilateral with four congruent sides

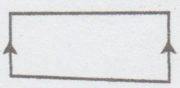
Classify each quadrilateral by its most precise name.

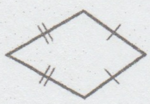
5. 

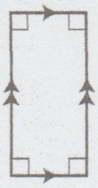
6. 

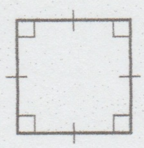
7. 

8. 

9. 

10. 

11. 

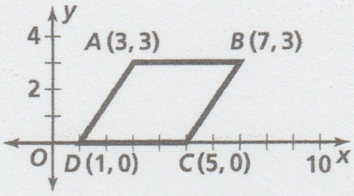
12. 

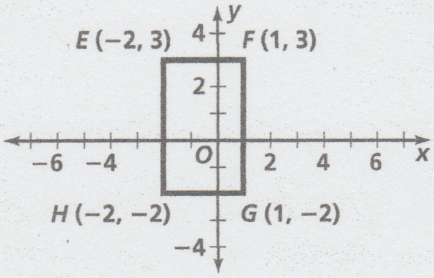
Name ______________________ Class ______________ Date ______________

Practice 6-1

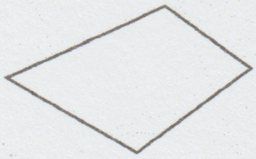
Classifying Quadrilaterals

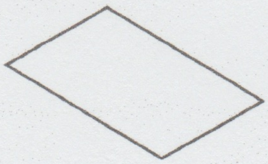
Determine the most precise name for each quadrilateral.

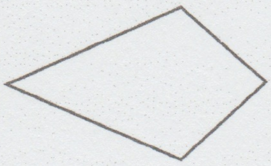
1. 

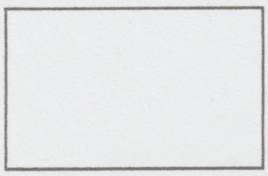
2. 

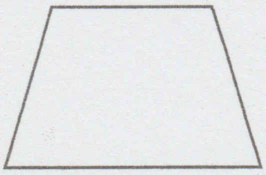
Judging by appearance, classify each quadrilateral in as many ways as possible.

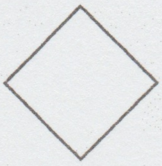
3. 

4. 

5. 

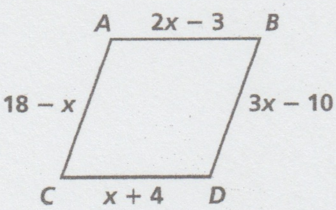
6. 

7. 

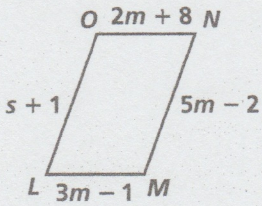
8. 

Algebra **Find the values of the variables. Then find the lengths of the sides of each quadrilateral.**

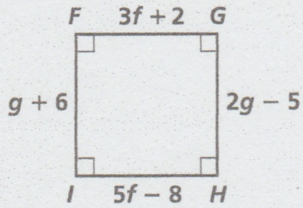
9. rhombus *ABDC*



10. parallelogram *LONM*



11. square *FGHI*



Determine the most precise name for each quadrilateral with the given vertices.

12. $A(1, 4)$, $B(3, 5)$, $C(6, 1)$, $D(4, 0)$

13. $W(0, 5)$, $X(3, 5)$, $Y(3, 1)$, $Z(0, 1)$

14. $A(-2, 4)$, $B(2, 6)$, $C(6, 4)$, $D(2, -3)$

15. $P(-1, 0)$, $Q(-1, 3)$, $R(2, 4)$, $S(2, 1)$

Name ____________________ Class ____________ Date ____________

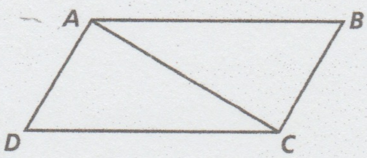
Reteaching 6-2

Properties of Parallelograms

OBJECTIVE: Finding relationships among angles, sides, and diagonals of parallelograms

MATERIALS: None

Example



Use a two-column proof to prove Theorem 6-2: Opposite angles of a parallelogram are congruent.

Given: parallelogram *ABCD*

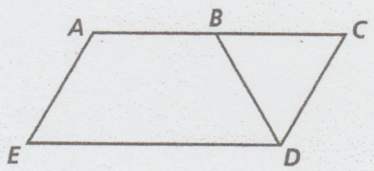
Prove: $\angle B \cong \angle D$

Statements	*Reasons*
1. parallelogram *ABCD*	**1.** Given
2. $\overline{AB} \cong \overline{CD}, \overline{BC} \cong \overline{DA}$	**2.** Opposite sides of a parallelogram are congruent.
3. $\overline{AC} \cong \overline{CA}$	**3.** Reflexive Property
4. $\triangle ABC \cong \triangle CDA$	**4.** SSS
5. $\angle B \cong \angle D$	**5.** CPCTC

Exercises

Use the figure to write a proof for each.

1. The proof in the example demonstrates that one pair of opposite angles is congruent. Prove that the other pair of opposite angles is congruent in parallelogram *ABCD* above.



2. Given: parallelogram *ACDE;* $\overline{CD} \cong \overline{BD}$

Prove: $\angle CBD \cong \angle E$

3. Given: parallelogram *ACDE;* $\overline{AE} \cong \overline{BD}$

Prove: $\angle CBD \cong \angle C$

4. Given: parallelogram *ACDE;* $\angle CBD \cong \angle E$

Prove: $\triangle BDC$ is isosceles.

5. Given: isosceles trapezoid *ABDE;* $\angle C \cong \angle E$

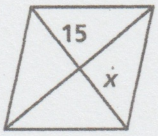
Prove: $\overline{AE} \cong \overline{CD}$

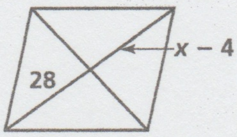
Name ____________________ Class ____________ Date ____________

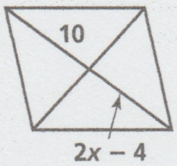
Practice 6-2

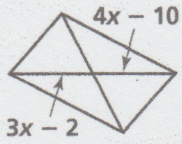
Properties of Parallelograms

Find the value of x in each parallelogram.

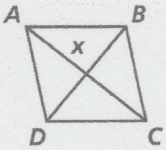
1. 

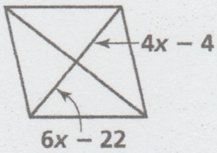
2. 

3. 

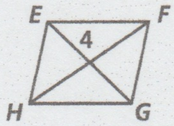
4. 

5. $AC = 24$

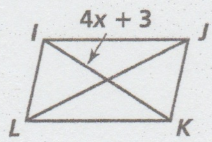


6. 

7. $x = EG$



8. $IK = 35$



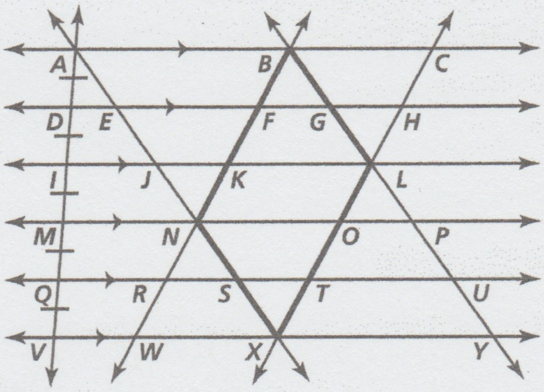
If $AE = 17$ and $BF = 18$, find the measures of the sides of parallelogram $BNXL$.

9. BN

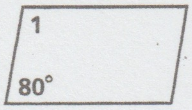
10. NX

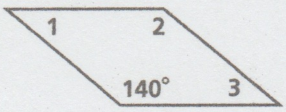
11. XL

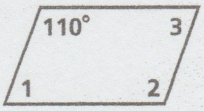
12. BL

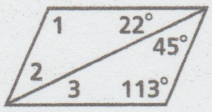


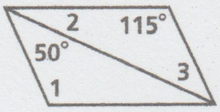
Find the measures of the numbered angles for each parallelogram.

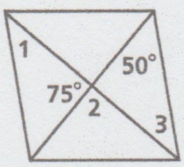
13. 

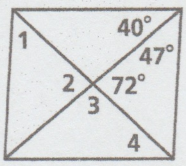
14. 

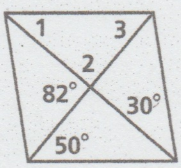
15. 

16. 

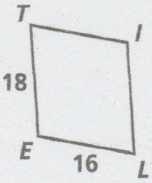
17. 

18. 

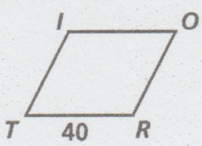
19. 

20. 

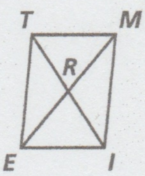
Find the length of $\overline{TI}$ in each parallelogram.

21. 

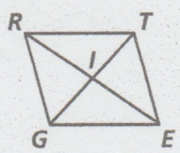
22. $OR = \frac{7}{8}IO$



23. $TR = 14$, $ME = 31$



24. $IE = 6$, $GT = 8$



Reteaching 6-3

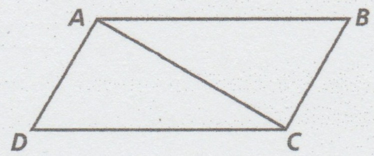
Proving That a Quadrilateral Is a Parallelogram

OBJECTIVE: Finding characteristics of quadrilaterals that indicate that the quadrilaterals are parallelograms

MATERIALS: None

Example

Use a two-column proof to prove Theorem 6-6: If one pair of opposite sides of a quadrilateral is both congruent and parallel, then the quadrilateral is a parallelogram.



Given: quadrilateral $ABCD$

$\overline{AB} \cong \overline{CD}$

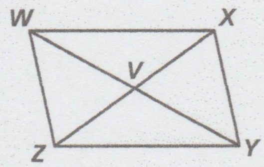
$\overline{AB} \parallel \overline{CD}$

Prove: $ABCD$ is a parallelogram.

Statements	***Reasons***
1. quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$	**1.** Given
2. $\angle BAC \cong \angle DCA$	**2.** Parallel lines form congruent alternate interior angles.
3. $\overline{AC} \cong \overline{CA}$	**3.** Reflexive Property
4. $\triangle ABC \cong \triangle CDA$	**4.** SAS
5. $\angle DAC \cong \angle BCA$	**5.** CPCTC
6. $\overline{AD} \parallel \overline{CB}$	**6.** If alternate interior angles are congruent, then lines are parallel.
7. $ABCD$ is a parallelogram.	**7.** Definition of parallelogram

Exercises

Determine whether the given information is sufficient to prove that quadrilateral *WXYZ* is a parallelogram.



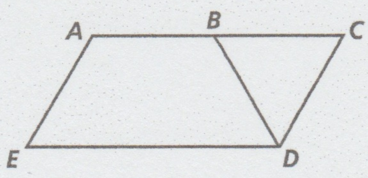
1. $\overline{WY}$ bisects $\overline{ZX}$

2. $\overline{WX} \parallel \overline{ZY}$; $\overline{WZ} \cong \overline{XY}$

3. $\overline{VZ} \cong \overline{VX}$; $\overline{WX} \cong \overline{ZY}$

4. $\angle VWZ \cong \angle VYX$; $\overline{WZ} \cong \overline{XY}$

Use the figure at the right to complete each proof.



5. Given: triangle with $\overline{BD} \cong \overline{CD}$, $\overline{AE} \cong \overline{BD}$, and $\overline{AE} \parallel \overline{CD}$

Prove: $ACDE$ is a parallelogram.

6. Given: $\angle CBD \cong \angle C$, $\overline{AE} \cong \overline{BD}$, and $\overline{AC} \cong \overline{ED}$

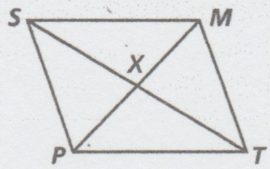
Prove: $ACDE$ is a parallelogram.

Name ______________________________ Class ______________ Date ______________

Practice 6-3

Proving That a Quadrilateral Is a Parallelogram

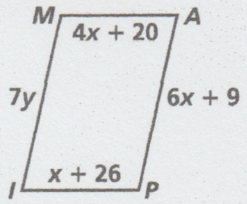
State whether the information given about quadrilateral *SMTP* is sufficient to determine that it is a parallelogram.



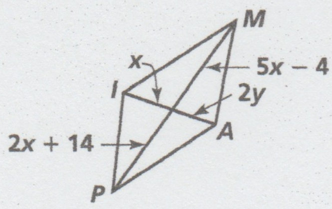
1. $\angle SPT \cong \angle SMT$
2. $\angle SPX \cong \angle TMX, \angle TPX \cong \angle SMX$
3. $\overline{SM} \cong \overline{PT}, \overline{SP} \cong \overline{MT}$
4. $\overline{SX} \cong \overline{XT}, \overline{SM} \cong \overline{PT}$
5. $\overline{PX} \cong \overline{MX}, \overline{SX} \cong \overline{TX}$
6. $\overline{SP} \cong \overline{MT}, \overline{SP} \parallel \overline{MT}$

Algebra **Find the values of *x* and *y* for which the figure must be a parallelogram.**

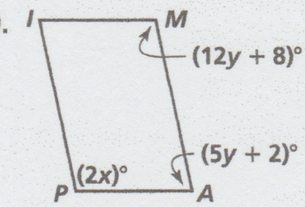
7.



8.

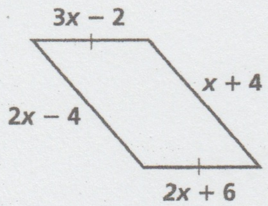


9.



Algebra **Find the value of *x*. Then tell whether the figure must be a parallelogram. Explain your answer.**

10.



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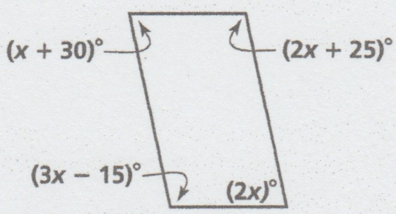

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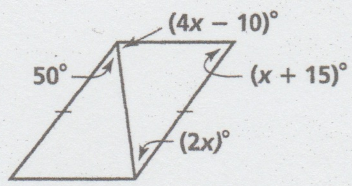
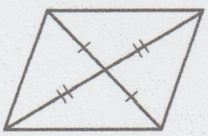


Decide whether the quadrilateral is a parallelogram. Explain your answer.

13.



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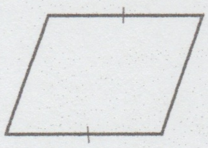

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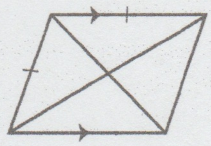
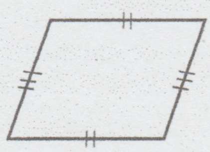


16.



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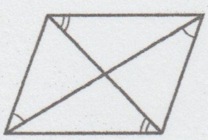

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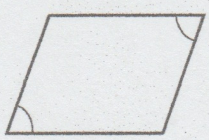

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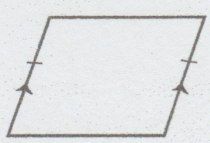

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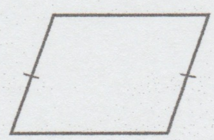


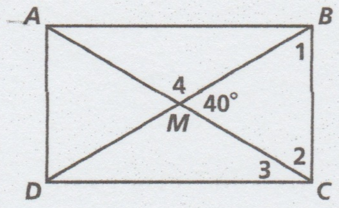
Reteaching 6-4

Special Parallelograms

OBJECTIVE: Finding properties of rectangles and rhombuses

MATERIALS: None

Example



Find the measures of the numbered angles in the rectangle.

Because $\angle 4$ and $\angle BMC$ are supplementary, $m\angle 4 = 140$.

Because the diagonals of a rectangle are congruent, $AC = BD$. And because the diagonals bisect each other, $BM = CM$. Therefore, $\triangle BMC$ is isosceles with $BM = CM$.

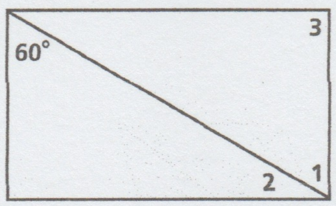
So, by the Isosceles Triangle Theorem, $m\angle 1 = m\angle 2$.

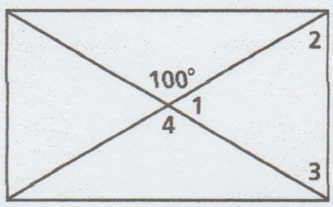
$$m\angle 1 + m\angle 2 + 40 = 180$$
$$m\angle 1 + m\angle 1 + 40 = 180$$
$$2m\angle 1 = 140$$
$$m\angle 1 = 70$$
$$m\angle 2 = 70$$

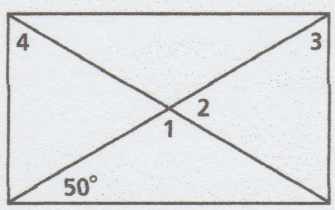
Finally, because $\angle 2$ and $\angle 3$ are complementary, $m\angle 3 = 20$.

Exercises

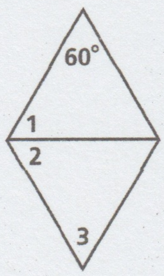
Find the measures of the numbered angles in each rectangle.

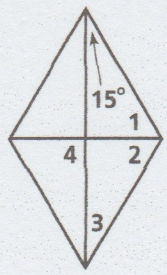
1. 

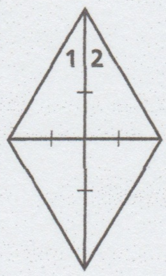
2. 

3. 

Find the measures of the numbered angles in each rhombus.

4. 

5. 

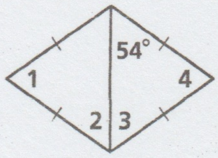
6. 

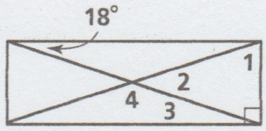
Name ______________________ Class ______________ Date ______________

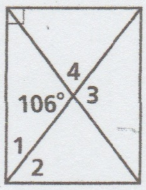
Practice 6-4

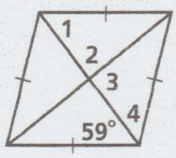
Special Parallelograms

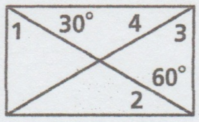
For each parallelogram, (a) choose the best name, and then (b) find the measures of the numbered angles.

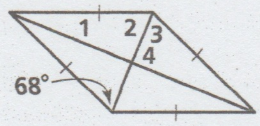
1. 

2. 

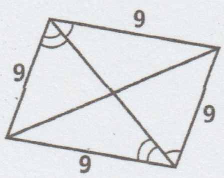
3. 

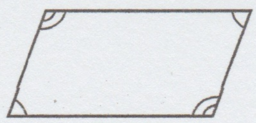
4. 

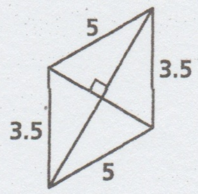
5. 

6. 

The parallelograms below are not drawn to scale. Can the parallelogram have the conditions marked? If not, write *impossible.* Explain your answer.

7. 

8. 

9. 

***HIJK* is a rectangle. Find the value of *x* and the length of each diagonal.**

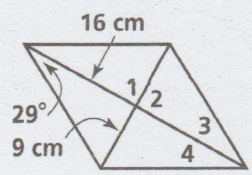
10. $HJ = x$ and $IK = 2x - 7$

11. $HJ = 3x + 5$ and $IK = 5x - 9$

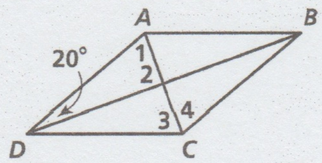
12. $HJ = 3x + 7$ and $IK = 6x - 11$

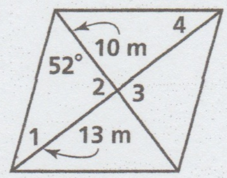
13. $HJ = 19 + 2x$ and $IK = 3x + 22$

For each rhombus, (a) find the measures of the numbered angles, and then (b) find the area.

14. 

15. $AC = 8$ in.
$BD = 22$ in.



16. 

Determine whether the quadrilateral can be a parallelogram. If not, write *impossible.* Explain your answer.

17. One pair of opposite sides is parallel, and the other pair is congruent.

18. Opposite angles are congruent and supplementary, but the quadrilateral is not a rectangle.

Name ______________________ Class ______________ Date ______________

Reteaching 6-5

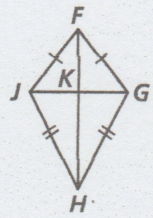
Trapezoids and Kites

OBJECTIVE: Using triangle congruence and two-column proofs to find angle measures in trapezoids and kites

MATERIALS: None

Example

Write a two-column proof to identify three pairs of congruent triangles in kite *FGHJ*.



Statements	*Reasons*
1. $m\angle FKG = m\angle GKH = m\angle HKJ = m\angle JKF = 90$	1. Theorem 6-17
2. $\overline{FG} \cong \overline{FJ}$	2. Given
3. $\overline{FK} \cong \overline{FK}$	3. Reflexive Property of Congruence
4. $\triangle FKG \cong \triangle FKJ$	4. HL Theorem
5. $\overline{JK} \cong \overline{KG}$	5. CPCTC
6. $\overline{KH} \cong \overline{KH}$	6. Reflexive Property of Congruence
7. $\triangle JKH \cong \triangle GKH$	7. SAS Postulate
8. $\overline{JH} \cong \overline{GH}$	8. Given
9. $\overline{FH} \cong \overline{FH}$	9. Reflexive Property of Congruence
10. $\triangle FJH \cong \triangle FGH$	10. SSS Postulate

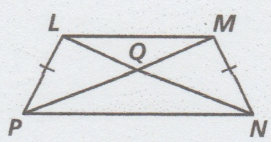
So $\triangle FKG \cong \triangle FKJ$, $\triangle JKH \cong \triangle GKH$, and $\triangle FJH \cong \triangle FGH$.

Exercises

In kite *FGHJ* in the example, $m\angle JFK = 38$ and $m\angle KGH = 63$. Find the following angle measures.

1. $m\angle FKJ$
2. $m\angle FJK$
3. $m\angle FKG$
4. $m\angle KFG$
5. $m\angle FGK$
6. $m\angle GKH$
7. $m\angle KHG$
8. $m\angle KJH$
9. $m\angle JHK$

10. Write a two-column proof to identify three pairs of congruent triangles in isosceles trapezoid *LMNP*.



In isosceles trapezoid *LMNP*, $m\angle LPQ = 45$, $m\angle QMN = 87$, and $m\angle PQN$ is 12 less than 6 times $m\angle QNP$. Find the following angle measures.

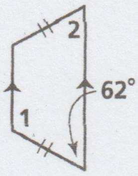
11. $m\angle PLQ$
12. $m\angle LQP$
13. $m\angle MNQ$
14. $m\angle MQN$
15. $m\angle QNP$
16. $m\angle QPN$
17. $m\angle PQN$
18. $m\angle LMQ$
19. $m\angle LQM$

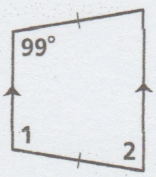
20. Use isosceles trapezoid *LMNP* to explain why in Chapter 4 you did not learn about an Angle-Angle-Angle Theorem to prove triangles congruent.

Practice 6-5

Trapezoids and Kites

Find the measures of the numbered angles in each isosceles trapezoid.

1.


2.


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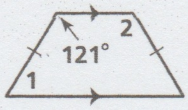

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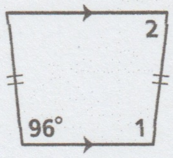

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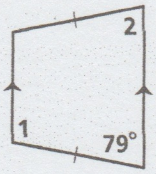

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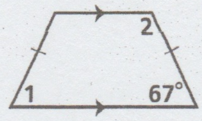
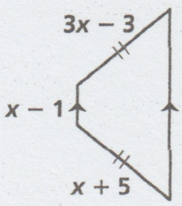


Algebra **Find the value(s) of the variable(s) in each isosceles trapezoid.**

7.


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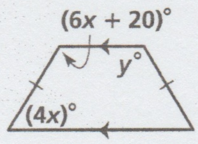

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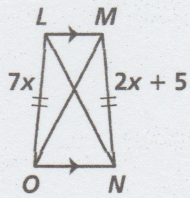
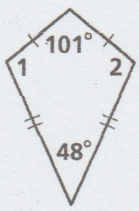


Find the measures of the numbered angles in each kite.

10.


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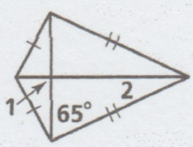

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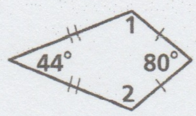

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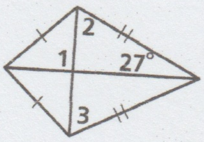

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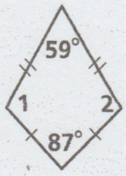

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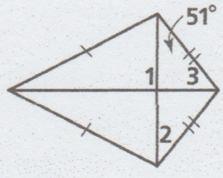
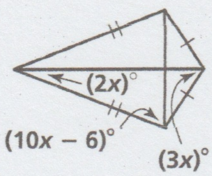
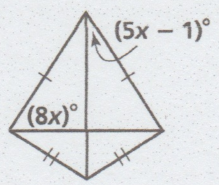


Algebra **Find the value(s) of the variable(s) in each kite.**

16.


17.


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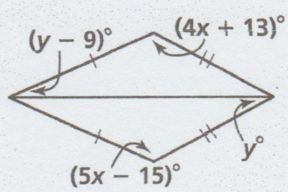


Name ______________ Class ______________ Date ______________

Reteaching 6-6

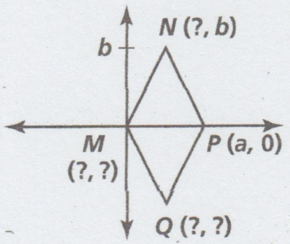
Placing Figures in the Coordinate Plane

OBJECTIVE: Choosing convenient placement of figures on coordinate axes

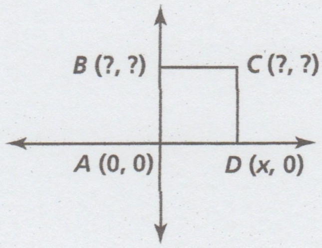
MATERIALS: None

Example

Use the properties of each figure to find the missing coordinates.



rhombus *MNPQ*



square *ABCD*

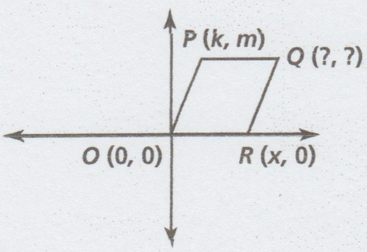
M is at the origin (0, 0). Because diagonals of a rhombus bisect each other, *N* has *x*-coordinate $\frac{a}{2}$. Because the *x*-axis is a horizontal line of symmetry for the rhombus, *Q* has coordinates $(\frac{a}{2}, -b)$.

Because all sides are congruent, *B* has coordinates $(0, x)$. Because all angles are right, *C* has coordinates (x, x).

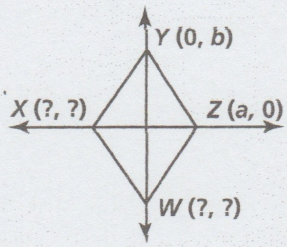
Exercises

Use the properties of each figure to find the missing coordinates.

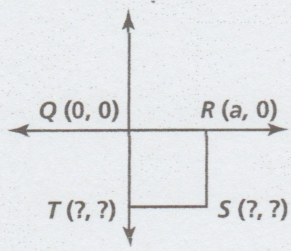
1. parallelogram *OPQR*



2. rhombus *XYZW*



3. square *QRST*



4. A quadrilateral has vertices at $(a, 0)$, $(-a, 0)$, $(0, a)$, and $(0, -a)$. Show that it is a square.

5. A quadrilateral has vertices at $(a, 0)$, $(0, a + 1)$, $(-a, 0)$ and $(0, -a - 1)$. Show that it is a rhombus.

6. Isosceles trapezoid *ABCD* has vertices $A(0, 0)$, $B(x, 0)$, and $D(k, m)$. Find the coordinates of *C* in terms of *x*, *k*, and *m*. Assume $\overline{AB} \parallel \overline{CD}$.

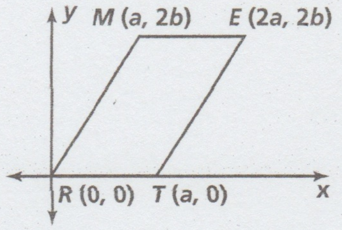
Name ______________________ Class ______________ Date ______________

Practice 6-6

Placing Figures in the Coordinate Plane

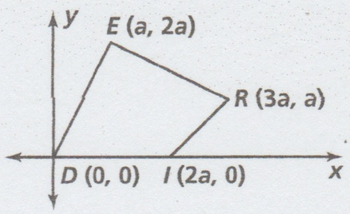
Find the coordinates of the midpoint of each segment and find the length of each segment.

1. $\overline{ME}$
2. $\overline{ET}$
3. $\overline{TR}$
4. $\overline{RM}$

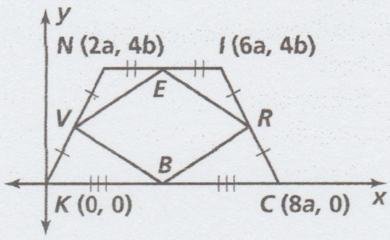


Find the slope of each segment.

5. $\overline{DI}$
6. $\overline{IR}$
7. $\overline{RE}$
8. $\overline{DE}$

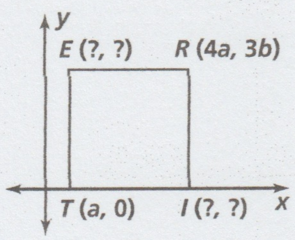


9. $\overline{VE}$
10. $\overline{ER}$
11. $\overline{RB}$
12. $\overline{VB}$

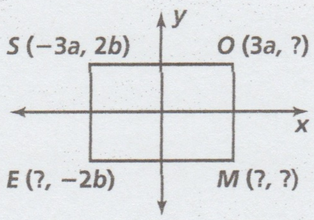


Use the properties of each figure to find the missing coordinates.

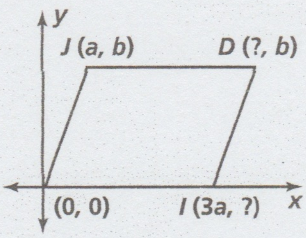
13. square



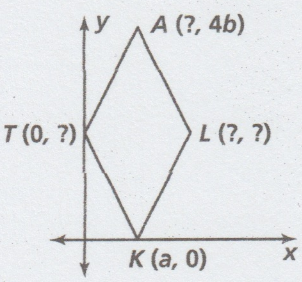
14. rectangle



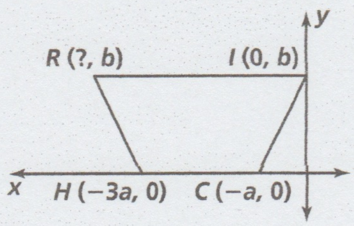
15. parallelogram



16. rhombus



17. isosceles trapezoid



18. kite