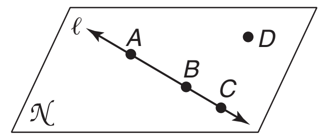
NAME ______________________________ DATE ____________ PERIOD _____

1-1 Study Guide and Intervention

Points, Lines, and Planes

Name Points, Lines, and Planes In geometry, a **point** is a location, a **line** contains points, and a **plane** is a flat surface that contains points and lines. If points are on the same line, they are **collinear**. If points on are the same plane, they are **coplanar**.

Example **Use the figure to name each of the following.**



a. a line containing point *A*

The line can be named as ℓ. Also, any two of the three points on the line can be used to name it.

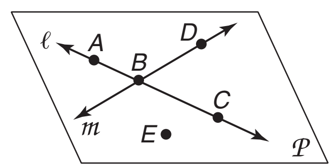
$\overleftrightarrow{AB}$, $\overleftrightarrow{AC}$, or $\overleftrightarrow{BC}$

b. a plane containing point *D*

The plane can be named as plane $\mathcal{N}$ or can be named using three noncollinear points in the plane, such as plane *ABD,* plane *ACD,* and so on.

Exercises

Refer to the figure.



1. Name a line that contains point *A*.

2. What is another name for line m?

3. Name a point not on $\overleftrightarrow{AC}$.

4. Name the intersection of $\overleftrightarrow{AC}$ and $\overleftrightarrow{DB}$.

5. Name a point not on line ℓ or line m.

Draw and label a plane *Q* for each relationship.

6. $\overleftrightarrow{AB}$ is in plane *Q*.

7. $\overleftrightarrow{ST}$ intersects $\overleftrightarrow{AB}$ at *P*.

8. Point *X* is collinear with points *A* and *P*.

9. Point *Y* is not collinear with points *T* and *P*.

10. Line ℓ contains points *X* and *Y*.

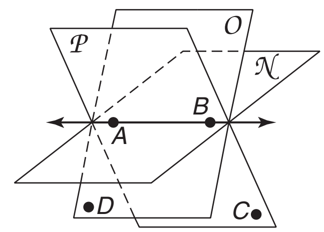
NAME ________________________________ DATE ____________ PERIOD _____

1-1 Study Guide and Intervention *(continued)*

Points, Lines, and Planes

Points, Lines, and Planes in Space **Space** is a boundless, three-dimensional set of all points. It contains lines and planes.

Example



a. How many planes appear in the figure?

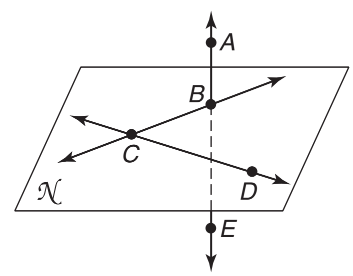
There are three planes: plane $\mathcal{N}$, plane $\mathcal{O}$, and plane $\mathcal{P}$.

b. Are points *A*, *B*, and *D* coplanar?

Yes. They are contained in plane $\mathcal{O}$.

Exercises

Refer to the figure.

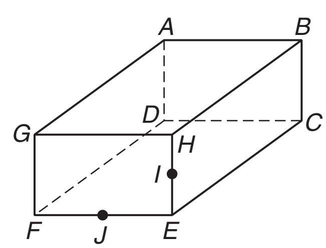


1. Name a line that is not contained in plane $\mathcal{N}$.

2. Name a plane that contains point *B*.

3. Name three collinear points.

Refer to the figure.



4. How many planes are shown in the figure?

5. Are points *B, E, G,* and *H* coplanar? Explain.

6. Name a point coplanar with *D*, *C,* and *E*.

Draw and label a figure for each relationship.

7. Planes $\mathcal{M}$ and $\mathcal{N}$ intersect in $\overleftrightarrow{HJ}$.

8. Line *r* is in plane $\mathcal{N}$, line *s* is in plane $\mathcal{M}$, and lines *r* and *s* intersect at point *J*.

9. Line *t* contains point *H* and line *t* does not lie in plane $\mathcal{M}$ or plane $\mathcal{N}$.

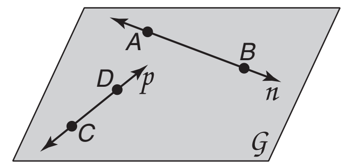
NAME ______________________________ DATE __________ PERIOD ____

1-1 Skills Practice

Points, Lines, and Planes

Lesson 1-1

Refer to the figure.



1. Name a line that contains point D.

2. Name a point contained in line n.

3. What is another name for line p?

4. Name the plane containing lines n and p.

Draw and label a figure for each relationship.

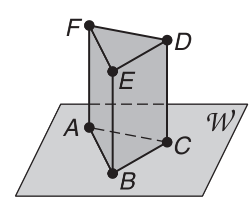
5. Point K lies on $\overleftrightarrow{RT}$.

6. Plane $\mathcal{J}$ contains line s.

7. $\overleftrightarrow{YP}$ lies in plane $\mathcal{B}$ and contains point C, but does not contain point H.

8. Lines q and f intersect at point Z in plane $\mathcal{U}$.

Refer to the figure.



9. How many planes are shown in the figure?

10. How many of the planes contain points F and E?

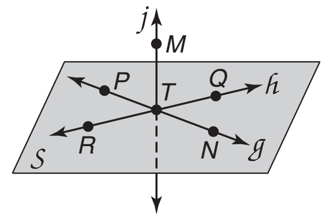
11. Name four points that are coplanar.

12. Are points A, B, and C coplanar? Explain.

1-1 Practice

Points, Lines, and Planes

Refer to the figure.



1. Name a line that contains points T and P.

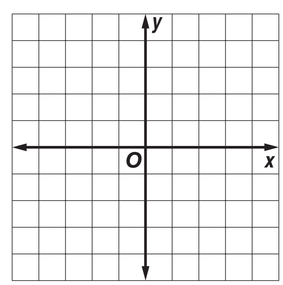
2. Name a line that intersects the plane containing points Q, N, and P.

3. Name the plane that contains $\overleftrightarrow{TN}$ and $\overleftrightarrow{QR}$.

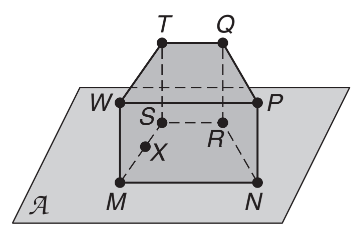
Draw and label a figure for each relationship.

4. $\overleftrightarrow{AK}$ and $\overleftrightarrow{CG}$ intersect at point M in plane $\mathcal{T}$.

5. A line contains $L(-4, -4)$ and $M(2, 3)$. Line q is in the same coordinate plane but does not intersect $\overleftrightarrow{LM}$. Line q contains point N.



Refer to the figure.



6. How many planes are shown in the figure?

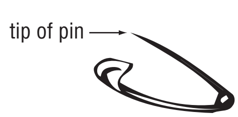
7. Name three collinear points.

8. Are points N, R, S, and W coplanar? Explain.

VISUALIZATION Name the geometric term(s) modeled by each object.

9.

10.



11.

12. a car antenna

13. a library card

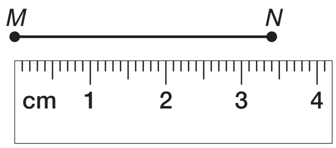
NAME ______________________________ DATE __________ PERIOD _____

1-2 Study Guide and Intervention

Linear Measure and Precision

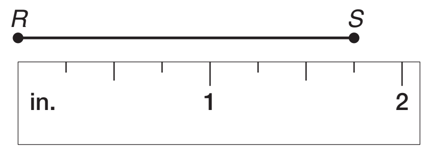
Measure Line Segments A part of a line between two endpoints is called a **line segment**. The lengths of $\overline{MN}$ and $\overline{RS}$ are written as MN and RS. When you measure a segment, the precision of the measurement is half of the smallest unit on the ruler.

Example 1 **Find the length of $\overline{MN}$.**



The long marks are centimeters, and the shorter marks are millimeters. The length of $\overline{MN}$ is 3.4 centimeters. The measurement is accurate to within 0.5 millimeter, so $\overline{MN}$ is between 3.35 centimeters and 3.45 centimeters long.

Example 2 **Find the length of $\overline{RS}$.**

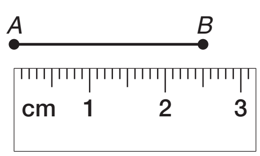


The long marks are inches and the short marks are quarter inches. The length of $\overline{RS}$ is about $1\frac{3}{4}$ inches. The measurement is accurate to within one half of a quarter inch, or $\frac{1}{8}$ inch, so $\overline{RS}$ is between $1\frac{5}{8}$ inches and $1\frac{7}{8}$ inches long.

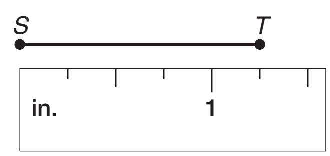
Exercises

Find the length of each line segment or object.

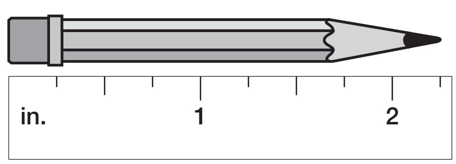
1.



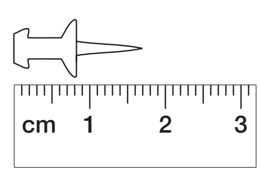
2.



3.



4.



Find the precision for each measurement.

5. 10 in.

6. 32 mm

7. 44 cm

8. 2 ft

9. 3.5 mm

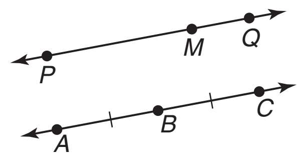
10. $2\frac{1}{2}$ yd

NAME ______________________________ DATE ____________ PERIOD _____

1-2 Study Guide and Intervention *(continued)*

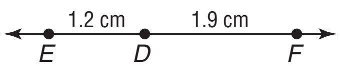
Linear Measure and Precision

Calculate Measures On $\overleftrightarrow{PQ}$, to say that point M is between points P and Q means P, Q, and M are collinear and $PM + MQ = PQ$.



On $\overleftrightarrow{AC}$, $AB = BC = 3$ cm. We can say that the segments are **congruent**, or $\overline{AB} \cong \overline{BC}$. Slashes on the figure indicate which segments are congruent.

Example 1 **Find *EF*.**



Calculate EF by adding ED and DF.

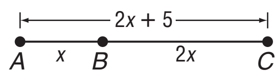
$ED + DF = EF$

$1.2 + 1.9 = EF$

$3.1 = EF$

Therefore, $\overline{EF}$ is 3.1 centimeters long.

Example 2 **Find *x* and *AC*.**



B is between A and C.

$AB + BC = AC$

$x + 2x = 2x + 5$

$3x = 2x + 5$

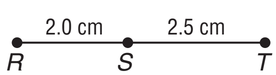
$x = 5$

$AC = 2x + 5 = 2(5) + 5 = 15$

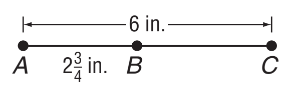
Exercises

Find the measurement of each segment. Assume that the art is not drawn to scale.

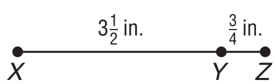
1. $\overline{RT}$



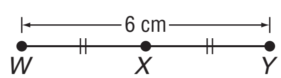
2. $\overline{BC}$



3. $\overline{XZ}$



4. $\overline{WX}$



Find *x* and *RS* if *S* is between *R* and *T*.

5. $RS = 5x$, $ST = 3x$, and $RT = 48$.

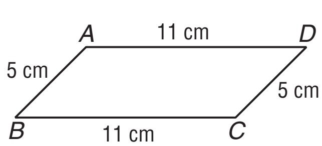
6. $RS = 2x$, $ST = 5x + 4$, and $RT = 32$.

7. $RS = 6x$, $ST = 12$, and $RT = 72$.

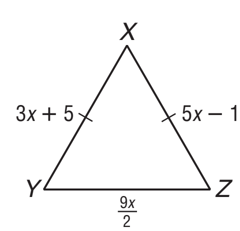
8. $RS = 4x$, $\overline{RS} \cong \overline{ST}$, and $RT = 24$.

Use the figures to determine whether each pair of segments is congruent.

9. $\overline{AB}$ and $\overline{CD}$



10. $\overline{XY}$ and $\overline{YZ}$

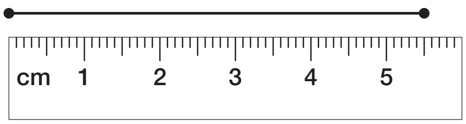


1-2 Skills Practice

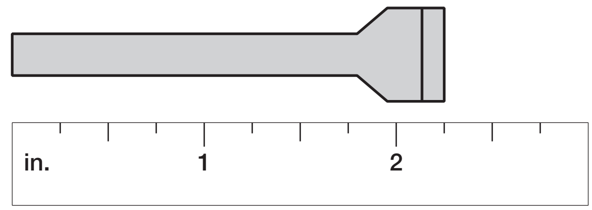
Linear Measure and Precision

Find the length of each line segment or object.

1.



2.



Find the precision for each measurement.

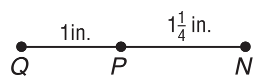
3. 40 feet

4. 12 centimeters

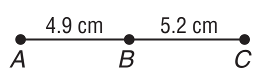
5. $9\frac{1}{2}$ inches

Find the measurement of each segment.

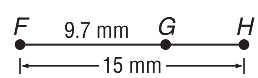
6. $\overline{NQ}$



7. $\overline{AC}$



8. $\overline{GH}$



Find the value of the variable and *YZ* if *Y* is between *X* and *Z*.

9. $XY = 5p$, $YZ = p$, and $XY = 25$

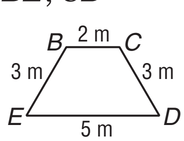
10. $XY = 12$, $YZ = 2g$, and $XZ = 28$

11. $XY = 4m$, $YZ = 3m$, and $XZ = 42$

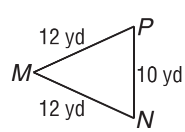
12. $XY = 2c + 1$, $YZ = 6c$, and $XZ = 81$

Use the figures to determine whether each pair of segments is congruent.

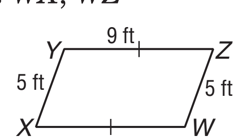
13. $\overline{BE}$, $\overline{CD}$



14. $\overline{MP}$, $\overline{NP}$



15. $\overline{WX}$, $\overline{WZ}$

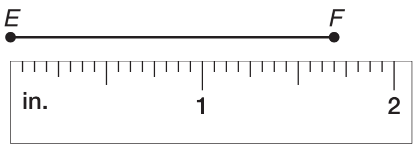


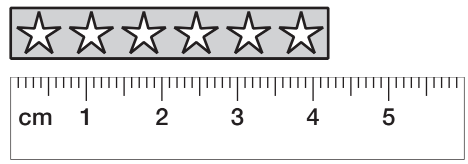
NAME ______________________________ DATE __________ PERIOD _____

1-2 Practice

Linear Measure and Precision

Find the length of each line segment or object.

1. 

2. 

Find the precision for each measurement.

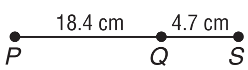
3. 120 meters

4. $7\frac{1}{4}$ inches

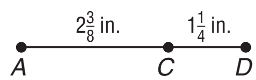
5. 30.0 millimeters

Find the measurement of each segment.

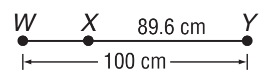
6. $\overline{PS}$



7. $\overline{AD}$



8. $\overline{WX}$



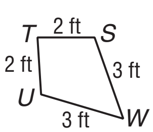
Find the value of the variable and *KL* if *K* is between *J* and *L*.

9. $JK = 6r$, $KL = 3r$, and $JL = 27$

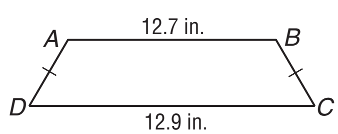
10. $JK = 2s$, $KL = s + 2$, and $JL = 5s - 10$

Use the figures to determine whether each pair of segments is congruent.

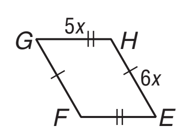
11. $\overline{TU}$, $\overline{SW}$



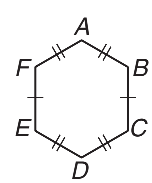
12. $\overline{AD}$, $\overline{BC}$



13. $\overline{GF}$, $\overline{FE}$



14. CARPENTRY Jorge used the figure at the right to make a pattern for a mosaic he plans to inlay on a tabletop. Name all of the congruent segments in the figure.

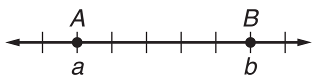
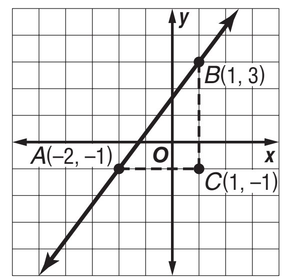


NAME ______________________________ DATE ____________ PERIOD _____

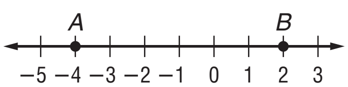
1-3 Study Guide and Intervention

Distance and Midpoints

Distance Between Two Points

Distance on a Number Line	Distance in the Coordinate Plane
 $AB = \lvert b - a \rvert$ or $\lvert a - b \rvert$	Pythagorean Theorem: $a^2 + b^2 = c^2$ Distance Formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ 

Example 1 **Find *AB*.**



$$\begin{aligned} AB &= \lvert(-4) - 2\rvert \\ &= \lvert -6\rvert \\ &= 6 \end{aligned}$$

Example 2 **Find the distance between *A*(−2, −1) and *B*(1, 3).**

Pythagorean Theorem

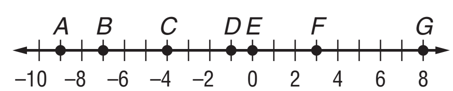
$$\begin{aligned} (AB)^2 &= (AC)^2 + (BC)^2 \\ (AB)^2 &= (3)^2 + (4)^2 \\ (AB)^2 &= 25 \\ AB &= \sqrt{25} \\ &= 5 \end{aligned}$$

Distance Formula

$$\begin{aligned} d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ AB &= \sqrt{(1 - (-2))^2 + (3 - (-1))^2} \\ AB &= \sqrt{(3)^2 + (4)^2} \\ &= \sqrt{25} \\ &= 5 \end{aligned}$$

Exercises

Use the number line to find each measure.



1. *BD*

2. *DG*

3. *AF*

4. *EF*

5. *BG*

6. *AG*

7. *BE*

8. *DE*

Use the Pythagorean Theorem to find the distance between each pair of points.

9. $A(0, 0), B(6, 8)$

10. $R(-2, 3), S(3, 15)$

11. $M(1, -2), N(9, 13)$

12. $E(-12, 2), F(-9, 6)$

Use the Distance Formula to find the distance between each pair of points.

13. $A(0, 0), B(15, 20)$

14. $O(-12, 0), P(-8, 3)$

15. $C(11, -12), D(6, 2)$

16. $E(-2, 10), F(-4, 3)$

NAME ____ DATE ____________ PERIOD _____

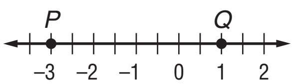
1-3 Study Guide and Intervention *(continued)*

Distance and Midpoints

Midpoint of a Segment

Midpoint on a Number Line	If the coordinates of the endpoints of a segment are a and b, then the coordinate of the midpoint of the segment is $\frac{a+b}{2}$.
Midpoint on a Coordinate Plane	If a segment has endpoints with coordinates (x_1, y_1) and (x_2, y_2), then the coordinates of the midpoint of the segment are $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$.

Example 1 **Find the coordinate of the midpoint of $\overline{PQ}$.**



The coordinates of P and Q are -3 and 1.

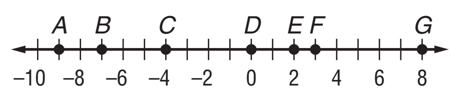
If M is the midpoint of $\overline{PQ}$, then the coordinate of M is $\frac{-3+1}{2} = \frac{-2}{2}$ or -1.

Example 2 **M is the midpoint of $\overline{PQ}$ for $P(-2, 4)$ and $Q(4, 1)$. Find the coordinates of M.**

$M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{-2+4}{2}, \frac{4+1}{2}\right)$ or $(1, 2.5)$

Exercises

Use the number line to find the coordinate of the midpoint of each segment.



1. $\overline{CE}$ **2.** $\overline{DG}$

3. $\overline{AF}$ **4.** $\overline{EG}$

5. $\overline{AB}$ **6.** $\overline{BG}$

7. $\overline{BD}$ **8.** $\overline{DE}$

Find the coordinates of the midpoint of a segment having the given endpoints.

9. $A(0, 0)$, $B(12, 8)$ **10.** $R(-12, 8)$, $S(6, 12)$

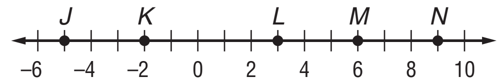
11. $M(11, -2)$, $N(-9, 13)$ **12.** $E(-2, 6)$, $F(-9, 3)$

13. $S(10, -22)$, $T(9, 10)$ **14.** $M(-11, 2)$, $N(-19, 6)$

1-3 Skills Practice

Distance and Midpoints

Use the number line to find each measure.

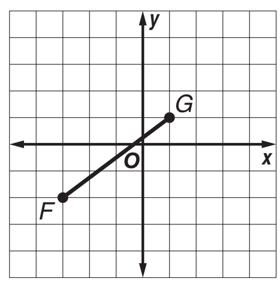


1. *LN* **2.** *JL*

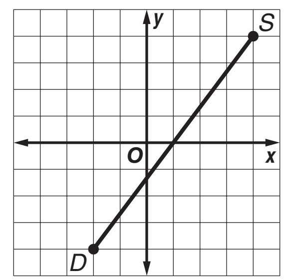
3. *KN* **4.** *MN*

Use the Pythagorean Theorem to find the distance between each pair of points.

5.



6.



7. $K(2, 3)$, $F(4, 4)$ **8.** $C(-3, -1)$, $Q(-2, 3)$

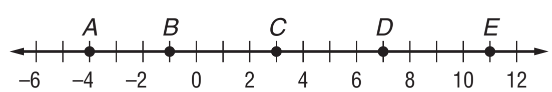
Use the Distance Formula to find the distance between each pair of points.

9. $Y(2, 0)$, $P(2, 6)$ **10.** $W(-2, 2)$, $R(5, 2)$

11. $A(-7, -3)$, $B(5, 2)$ **12.** $C(-3, 1)$, $Q(2, 6)$

Lesson 1-3

Use the number line to find the coordinate of the midpoint of each segment.



13. $\overline{DE}$ **14.** $\overline{BC}$

15. $\overline{BD}$ **16.** $\overline{AD}$

Find the coordinates of the midpoint of a segment having the given endpoints.

17. $T(3, 1)$, $U(5, 3)$ **18.** $J(-4, 2)$, $F(5, -2)$

Find the coordinates of the missing endpoint given that P is the midpoint of $\overline{NQ}$.

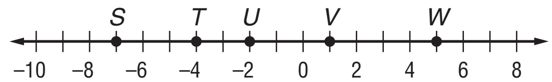
19. $N(2, 0)$, $P(5, 2)$ **20.** $N(5, 4)$, $P(6, 3)$ **21.** $Q(3, 9)$, $P(-1, 5)$

NAME ______________________________________ DATE ___________ PERIOD _____

1-3 Practice

Distance and Midpoints

Use the number line to find each measure.

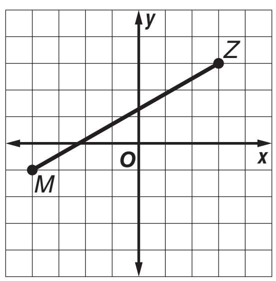


1. VW **2.** TV

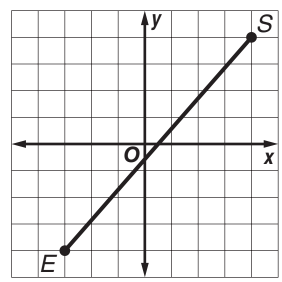
3. ST **4.** SV

Use the Pythagorean Theorem to find the distance between each pair of points.

5.



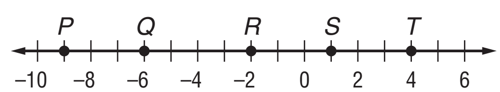
6.



Use the Distance Formula to find the distance between each pair of points.

7. $L(-7, 0)$, $Y(5, 9)$ **8.** $U(1, 3)$, $B(4, 6)$

Use the number line to find the coordinate of the midpoint of each segment.



9. $\overline{RT}$ **10.** $\overline{QR}$

11. $\overline{ST}$ **12.** $\overline{PR}$

Find the coordinates of the midpoint of a segment having the given endpoints.

13. $K(-9, 3)$, $H(5, 7)$ **14.** $W(-12, -7)$, $T(-8, -4)$

Find the coordinates of the missing endpoint given that E is the midpoint of $\overline{DF}$.

15. $F(5, 8)$, $E(4, 3)$ **16.** $F(2, 9)$, $E(-1, 6)$ **17.** $D(-3, -8)$, $E(1, -2)$

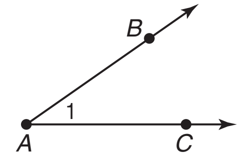
18. PERIMETER The coordinates of the vertices of a quadrilateral are $R(-1, 3)$, $S(3, 3)$, $T(5, -1)$, and $U(-2, -1)$. Find the perimeter of the quadrilateral. Round to the nearest tenth.

NAME ____ DATE ____________ PERIOD _____

1-4 Study Guide and Intervention

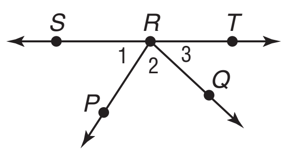
Angle Measure

Measure Angles If two noncollinear **rays** have a common endpoint, they form an **angle**. The rays are the **sides** of the angle. The common endpoint is the **vertex**. The angle at the right can be named as $\angle A$, $\angle BAC$, $\angle CAB$, or $\angle 1$.



A **right angle** is an angle whose measure is 90. An **acute angle** has measure less than 90. An **obtuse angle** has measure greater than 90 but less than 180.

Example 1



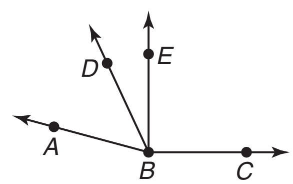
a. Name all angles that have *R* as a vertex.

Three angles are $\angle 1$, $\angle 2$, and $\angle 3$. For other angles, use three letters to name them: $\angle SRQ$, $\angle PRT$, and $\angle SRT$.

b. Name the sides of $\angle 1$.

$\overrightarrow{RS}$, $\overrightarrow{RP}$

Example 2 **Measure each angle and classify it as *right*, *acute*, or *obtuse.***



a. $\angle ABD$

Using a protractor, $m\angle ABD = 50$.

$50 < 90$, so $\angle ABD$ is an acute angle.

b. $\angle DBC$

Using a protractor, $m\angle DBC = 115$.

$180 > 115 > 90$, so $\angle DBC$ is an obtuse angle.

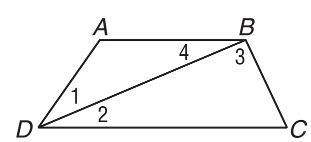
c. $\angle EBC$

Using a protractor, $m\angle EBC = 90$.

$\angle EBC$ is a right angle.

Exercises

Refer to the figure.

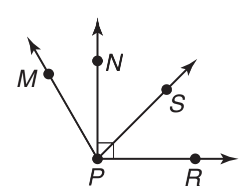


1. Name the vertex of $\angle 4$.

2. Name the sides of $\angle BDC$.

3. Write another name for $\angle DBC$.

Measure each angle in the figure and classify it as *right*, *acute*, or *obtuse.*



4. $\angle MPR$

5. $\angle RPN$

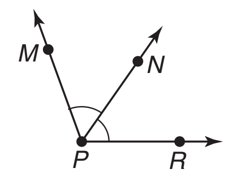
6. $\angle NPS$

NAME ____ DATE ____________ PERIOD _____

1-4 Study Guide and Intervention *(continued)*

Angle Measure

Congruent Angles Angles that have the same measure are **congruent angles**. A ray that divides an angle into two congruent angles is called an **angle bisector**. In the figure, $\overrightarrow{PN}$ is the angle bisector of $\angle MPR$. Point N lies in the interior of $\angle MPR$ and $\angle MPN \cong \angle NPR$.



Example **Refer to the figure above. If $m\angle MPN = 2x + 14$ and $m\angle NPR = x + 34$, find x and find $m\angle MPR$.**

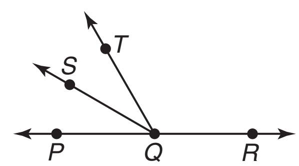
Since $\overrightarrow{PN}$ bisects $\angle MPR$, $\angle MPN \cong \angle NPR$, or $m\angle MPN = m\angle NPR$.

$$\begin{aligned} 2x + 14 &= x + 34 \\ 2x + 14 - x &= x + 34 - x \\ x + 14 &= 34 \\ x + 14 - 14 &= 34 - 14 \\ x &= 20 \end{aligned}$$

$$\begin{aligned} m\angle NPR &= (2x + 14) + (x + 34) \\ &= 54 + 54 \\ &= 108 \end{aligned}$$

Exercises

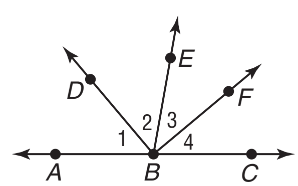
$\overrightarrow{QS}$ bisects $\angle PQT$, and $\overrightarrow{QP}$ and $\overrightarrow{QR}$ are opposite rays.



1. If $m\angle PQT = 60$ and $m\angle PQS = 4x + 14$, find the value of x.

2. If $m\angle PQS = 3x + 13$ and $m\angle SQT = 6x - 2$, find $m\angle PQT$.

$\overrightarrow{BA}$ and $\overrightarrow{BC}$ are opposite rays, $\overrightarrow{BF}$ bisects $\angle CBE$, and $\overrightarrow{BD}$ bisects $\angle ABE$.



3. If $m\angle EBF = 6x + 4$ and $m\angle CBF = 7x - 2$, find $m\angle EBC$.

4. If $m\angle 1 = 4x + 10$ and $m\angle 2 = 5x$, find $m\angle 2$.

5. If $m\angle 2 = 6y + 2$ and $m\angle 1 = 8y - 14$, find $m\angle ABE$.

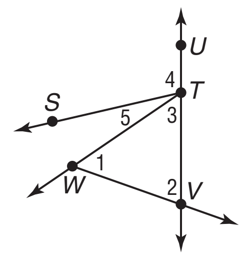
6. Is $\angle DBF$ a right angle? Explain.

NAME ____ DATE ____________ PERIOD _____

1-4 Skills Practice

Angle Measure

For Exercises 1–12, use the figure at the right.



Name the vertex of each angle.

1. $\angle 4$

2. $\angle 1$

3. $\angle 2$

4. $\angle 5$

Name the sides of each angle.

5. $\angle 4$

6. $\angle 5$

7. $\angle STV$

8. $\angle 1$

Write another name for each angle.

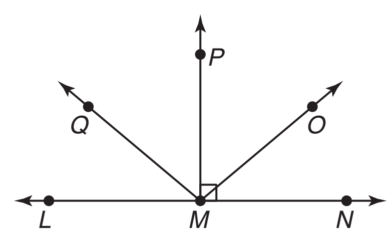
9. $\angle 3$

10. $\angle 4$

11. $\angle WTS$

12. $\angle 2$

Measure each angle and classify it as *right*, *acute*, or *obtuse*.



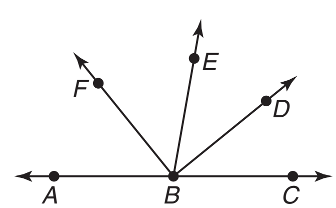
13. $\angle NMP$

14. $\angle OMN$

15. $\angle QMN$

16. $\angle QMO$

ALGEBRA In the figure, $\overrightarrow{BA}$ and $\overrightarrow{BC}$ are opposite rays, $\overrightarrow{BD}$ bisects $\angle EBC$, and $\overrightarrow{BF}$ bisects $\angle ABE$.



17. If $m\angle EBD = 4x + 16$ and $m\angle DBC = 6x + 4$, find $m\angle EBD$.

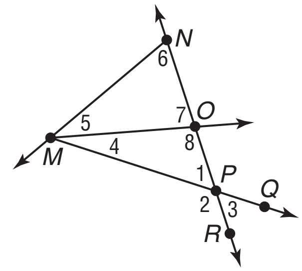
18. If $m\angle ABF = 7x - 8$ and $m\angle EBF = 5x + 10$, find $m\angle EBF$.

NAME ______________________________ DATE __________ PERIOD _____

1-4 Practice

Angle Measure

For Exercises 1–10, use the figure at the right.



Name the vertex of each angle.

1. $\angle 5$

2. $\angle 3$

3. $\angle 8$

4. $\angle NMP$

Name the sides of each angle.

5. $\angle 6$

6. $\angle 2$

7. $\angle MOP$

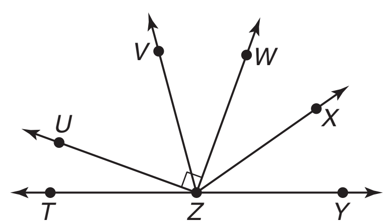
8. $\angle OMN$

Write another name for each angle.

9. $\angle QPR$

10. $\angle 1$

Measure each angle and classify it as *right*, *acute*, or *obtuse*.



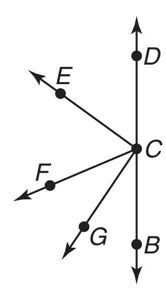
11. $\angle UZW$

12. $\angle YZW$

13. $\angle TZW$

14. $\angle UZT$

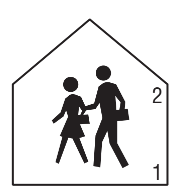
ALGEBRA In the figure, $\overrightarrow{CB}$ and $\overrightarrow{CD}$ are opposite rays, $\overrightarrow{CE}$ bisects $\angle DCF$, and $\overrightarrow{CG}$ bisects $\angle FCB$.



15. If $m\angle DCE = 4x + 15$ and $m\angle ECF = 6x - 5$, find $m\angle DCE$.

16. If $m\angle FCG = 9x + 3$ and $m\angle GCB = 13x - 9$, find $m\angle GCB$.

17. TRAFFIC SIGNS The diagram shows a sign used to warn drivers of a school zone or crossing. Measure and classify each numbered angle.



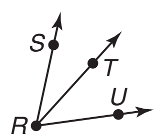
1-5 Study Guide and Intervention

Angle Relationships

Pairs of Angles **Adjacent angles** are angles in the same plane that have a common vertex and a common side, but no common interior points. **Vertical angles** are two nonadjacent angles formed by two intersecting lines. A pair of adjacent angles whose noncommon sides are opposite rays is called a **linear pair**.

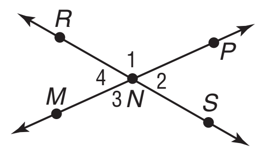
Example **Identify each pair of angles as *adjacent angles*, *vertical angles*, and/or as a *linear pair*.**

a.



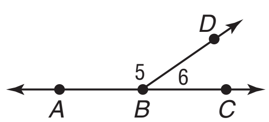
$\angle SRT$ and $\angle TRU$ have a common vertex and a common side, but no common interior points. They are adjacent angles.

b.



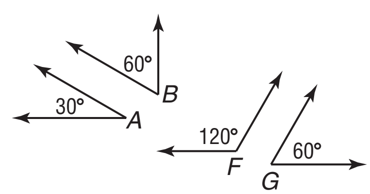
$\angle 1$ and $\angle 3$ are nonadjacent angles formed by two intersecting lines. They are vertical angles. $\angle 2$ and $\angle 4$ are also vertical angles.

c.



$\angle 6$ and $\angle 5$ are adjacent angles whose noncommon sides are opposite rays. The angles form a linear pair.

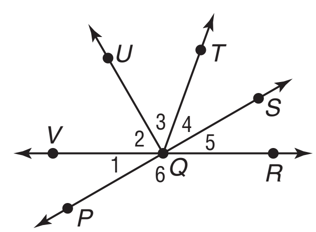
d.



$\angle A$ and $\angle B$ are two angles whose measures have a sum of 90. They are complementary. $\angle F$ and $\angle G$ are two angles whose measures have a sum of 180. They are supplementary.

Exercises

Identify each pair of angles as *adjacent*, *vertical*, and/or as a *linear pair*.



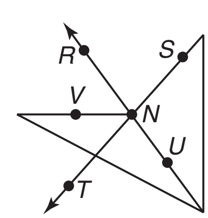
1. $\angle 1$ and $\angle 2$

2. $\angle 1$ and $\angle 6$

3. $\angle 1$ and $\angle 5$

4. $\angle 3$ and $\angle 2$

For Exercises 5–7, refer to the figure at the right.



5. Identify two obtuse vertical angles.

6. Identify two acute adjacent angles.

7. Identify an angle supplementary to $\angle TNU$.

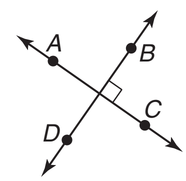
8. Find the measures of two complementary angles if the difference in their measures is 18.

Lesson 1-5

1-5 Study Guide and Intervention *(continued)*

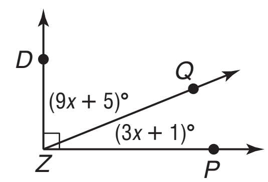
Angle Relationships

Perpendicular Lines Lines, rays, and segments that form four right angles are **perpendicular**. The right angle symbol indicates that the lines are perpendicular. In the figure at the right, $\overleftrightarrow{AC}$ is perpendicular to $\overleftrightarrow{BD}$, or $\overleftrightarrow{AC} \perp \overleftrightarrow{BD}$.



Example **Find x so that $\overline{DZ} \perp \overline{PZ}$.**

If $\overline{DZ} \perp \overline{PZ}$, then $m\angle DZP = 90$.

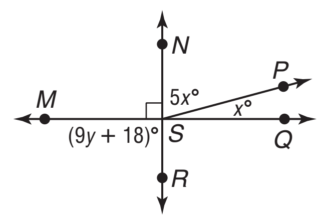


$m\angle DZQ + m\angle QZP = m\angle DZP$	Sum of parts = whole
$(9x + 5) + (3x + 1) = 90$	Substitution
$12x + 6 = 90$	Simplify.
$12x = 84$	Subtract 6 from each side.
$x = 7$	Divide each side by 12.

Exercises

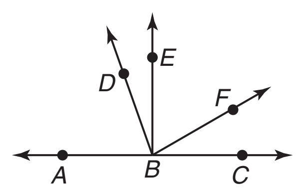
1. Find x and y so that $\overleftrightarrow{NR} \perp \overleftrightarrow{MQ}$.

2. Find $m\angle MSN$.

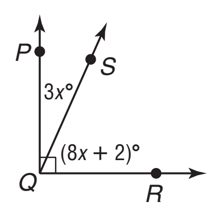


3. $m\angle EBF = 3x + 10$, $m\angle DBE = x$, and $\overrightarrow{BD} \perp \overrightarrow{BF}$. Find x.

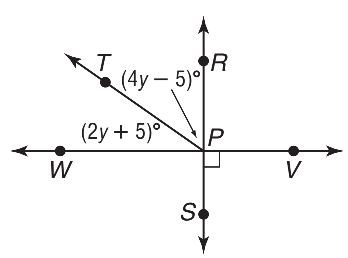
4. If $m\angle EBF = 7y - 3$ and $m\angle FBC = 3y + 3$, find y so that $\overrightarrow{EB} \perp \overrightarrow{BC}$.



5. Find x, $m\angle PQS$, and $m\angle SQR$.



6. Find y, $m\angle RPT$, and $m\angle TPW$.

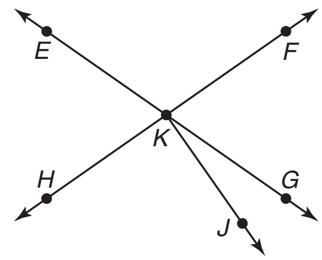


NAME ______________________________ DATE ____________ PERIOD _____

1-5 Skills Practice

Angle Relationships

For Exercises 1–6, use the figure at the right and a protractor.



1. Name two acute vertical angles.

2. Name two obtuse vertical angles.

3. Name a linear pair.

4. Name two acute adjacent angles.

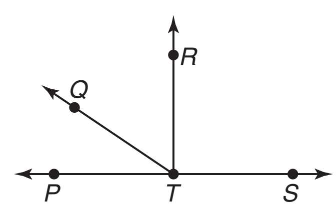
5. Name an angle complementary to $\angle EKH$.

6. Name an angle supplementary to $\angle FKG$.

7. Find the measures of an angle and its complement if one angle measures 18 degrees more than the other.

8. The measure of the supplement of an angle is 36 less than the measure of the angle. Find the measures of the angles.

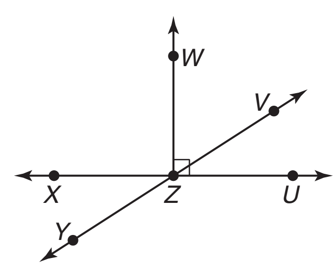
ALGEBRA For Exercises 9–10, use the figure at the right.



9. If $m\angle RTS = 8x + 18$, find x so that $\overrightarrow{TR} \perp \overrightarrow{TS}$.

10. If $m\angle PTQ = 3y - 10$ and $m\angle QTR = y$, find y so that $\angle PTR$ is a right angle.

Determine whether each statement can be assumed from the figure. Explain.



11. $\angle WZU$ is a right angle.

12. $\angle YZU$ and $\angle UZV$ are supplementary.

13. $\angle VZU$ is adjacent to $\angle YZX$.

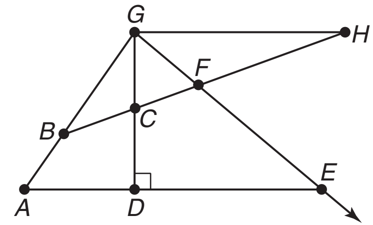
Lesson 1-5

NAME ______________________________ DATE __________ PERIOD _____

1-5 Practice

Angle Relationships

For Exercises 1–4, use the figure at the right and a protractor.



1. Name two obtuse vertical angles.

2. Name a linear pair whose vertex is B.

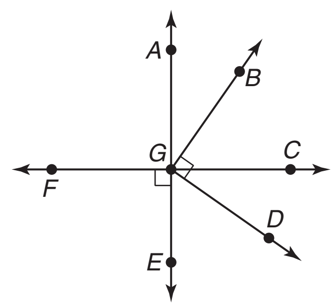
3. Name an angle not adjacent to but complementary to $\angle FGC$.

4. Name an angle adjacent and supplementary to $\angle DCB$.

5. Two angles are complementary. The measure of one angle is 21 more than twice the measure of the other angle. Find the measures of the angles.

6. If a supplement of an angle has a measure 78 less than the measure of the angle, what are the measures of the angles?

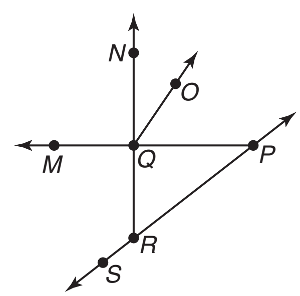
ALGEBRA For Exercises 7–8, use the figure at the right.



7. If $m\angle FGE = 5x + 10$, find x so that $\overleftrightarrow{FC} \perp \overleftrightarrow{AE}$.

8. If $m\angle BGC = 16x - 4$ and $m\angle CGD = 2x + 13$, find x so that $\angle BGD$ is a right angle.

Determine whether each statement can be assumed from the figure. Explain.

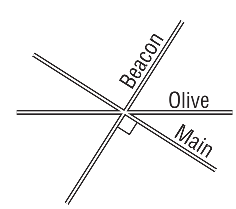


9. $\angle NQO$ and $\angle OQP$ are complementary.

10. $\angle SRQ$ and $\angle QRP$ is a linear pair.

11. $\angle MQN$ and $\angle MQR$ are vertical angles.

12. STREET MAPS Darren sketched a map of the cross streets nearest to his home for his friend Miguel. Describe two different angle relationships between the streets.



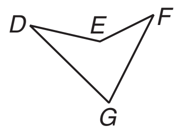
1-6 Study Guide and Intervention

Polygons

Polygons A **polygon** is a closed figure formed by a finite number of coplanar line segments. The sides that have a common endpoint must be noncollinear and each side intersects exactly two other sides at their endpoints. A polygon is named according to its number of sides. A **regular polygon** has congruent sides and congruent angles. A polygon can be **concave** or **convex**.

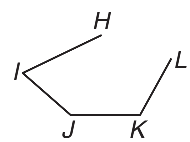
Example **Name each polygon by its number of sides. Then classify it as *concave* or *convex* and *regular* or *irregular*.**

a.



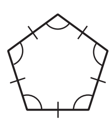
The polygon has 4 sides, so it is a quadrilateral. It is concave because part of $\overline{DE}$ or $\overline{EF}$ lies in the interior of the figure. Because it is concave, it cannot have all its angles congruent and so it is irregular.

b.



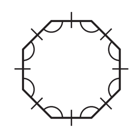
The figure is not closed, so it is not a polygon.

c.



The polygon has 5 sides, so it is a pentagon. It is convex. All sides are congruent and all angles are congruent, so it is a regular pentagon.

d.

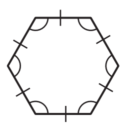


The figure has 8 congruent sides and 8 congruent angles. It is convex and is a regular octagon.

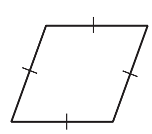
Exercises

Name each polygon by its number of sides. Then classify it as *concave* or *convex* and *regular* or *irregular*.

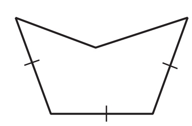
1.



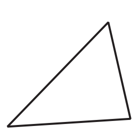
2.



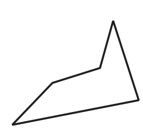
3.



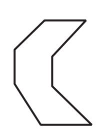
4.



5.



6.



NAME ____ DATE ____________ PERIOD _____

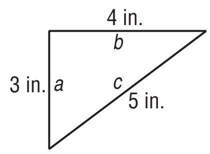
1-6 Study Guide and Intervention *(continued)*

Polygons

Perimeter The **perimeter** of a polygon is the sum of the lengths of all the sides of the polygon. There are special formulas for the perimeter of a square or a rectangle.

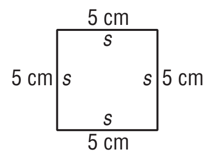
Example **Write an expression or formula for the perimeter of each polygon. Find the perimeter.**

a.



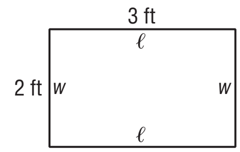
$P = a + b + c$
$= 3 + 4 + 5$
$= 12$ in.

b.



$P = 4s$
$= 4(5)$
$= 20$ cm

c.

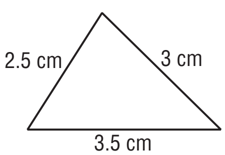


$P = 2\ell + 2w$
$= 2(3) + 2(2)$
$= 10$ ft

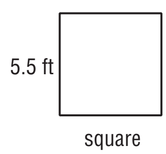
Exercises

Find the perimeter of each figure.

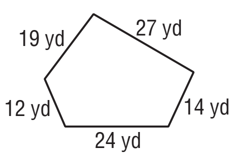
1.



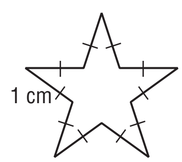
2.



3.

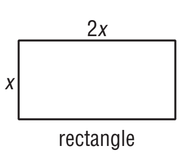


4.

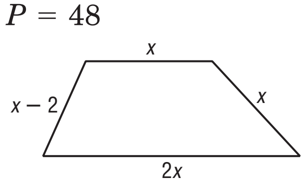


Find the length of each side of the polygon for the given perimeter.

5. $P = 96$



6. $P = 48$

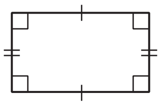


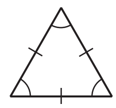
NAME ______________________________ DATE ____________ PERIOD _____

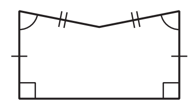
1-6 Skills Practice

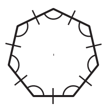
Polygons

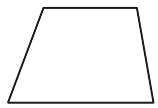
Name each polygon by its number of sides and then classify it as *convex* or *concave* and *regular* or *irregular*.

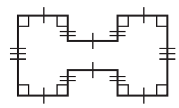
1. 

2. 

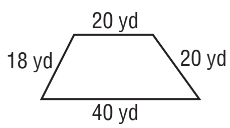
3. 

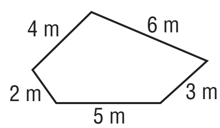
4. 

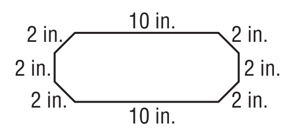
5. 

6. 

Find the perimeter of each figure.

7. 

8. 

9. 

COORDINATE GEOMETRY Find the perimeter of each polygon.

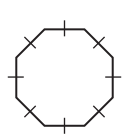
10. triangle ABC with vertices $A(3, 5)$, $B(3, 1)$, and $C(0, 1)$

11. quadrilateral $QRST$ with vertices $Q(-3, 2)$, $R(1, 2)$, $S(1, -4)$, and $T(-3, -4)$

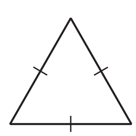
12. quadrilateral $LMNO$ with vertices $L(-1, 4)$, $M(3, 4)$, $N(2, 1)$, and $O(-2, 1)$

ALGEBRA Find the length of each side of the polygon for the given perimeter.

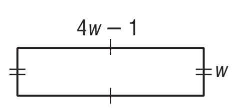
13. $P = 104$ millimeters



14. $P = 84$ kilometers



15. $P = 88$ feet

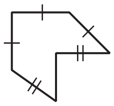


NAME ____ DATE ____________ PERIOD _____

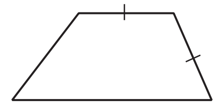
1-6 Practice

Polygons

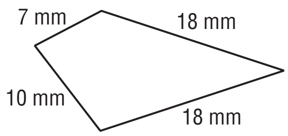
Name each polygon by its number of sides and then classify it as *convex* or *concave* and *regular* or *irregular*.

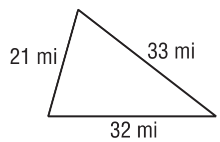
1. 

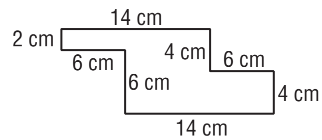
2. 

3. 

Find the perimeter of each figure.

4. 

5. 

6. 

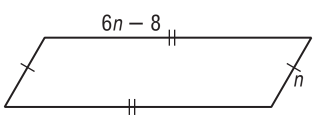
COORDINATE GEOMETRY Find the perimeter of each polygon.

7. quadrilateral $OPQR$ with vertices $O(-3, 2)$, $P(1, 5)$, $Q(6, 4)$, and $R(5, -2)$

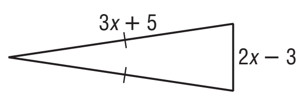
8. pentagon $STUVW$ with vertices $S(0, 0)$, $T(3, -2)$, $U(2, -5)$, $V(-2, -5)$, and $W(-3, -2)$

ALGEBRA Find the length of each side of the polygon for the given perimeter.

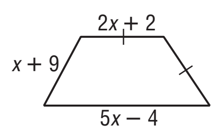
9. $P = 26$ inches



10. $P = 39$ centimeters

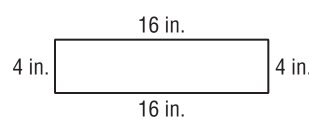


11. $P = 89$ feet



SEWING For Exercises 12–13, use the following information.

Jasmine plans to sew fringe around the scarf shown in the diagram.



12. How many inches of fringe does she need to purchase?

13. If Jasmine doubles the width of the scarf, how many inches of fringe will she need?