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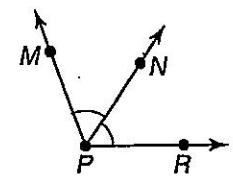
1-4 Study Guide and Intervention *(continued)*

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 $m\angle MPR$.**

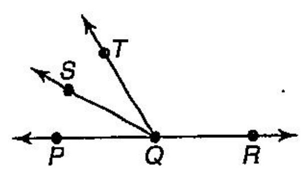
Since $\overrightarrow{PN}$ bisects $\angle MPR$, $\angle MPN \cong \angle NPR$, or $m\angle MPN = m\angle NPR$.

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

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

Exercises

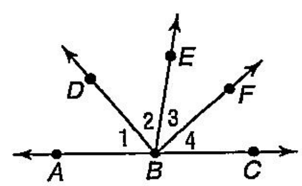
$\overrightarrow{QS}$ bisects $\angle PQT$, and $\overrightarrow{QP}$ and $\overrightarrow{QR}$ are opposite rays.



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.

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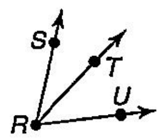
1-5 Study Guide and Intervention

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.**

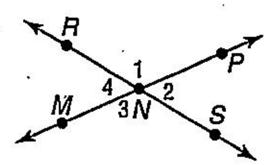
Example **Identify each pair of angles as *adjacent angles, vertical angles,* and/or as a *linear pair.***

a.



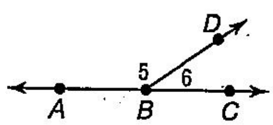
$\angle SRT$ and $\angle TRU$ have a common vertex and a common side, but no common interior points. They are adjacent angles.

b.



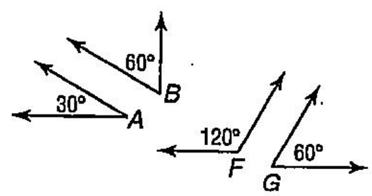
$\angle 1$ and $\angle 3$ are nonadjacent angles formed by two intersecting lines. They are vertical angles. $\angle 2$ and $\angle 4$ are also vertical angles. $\angle 1$ and $\angle 4$, $\angle 4$ and $\angle 3$, $\angle 3$ and $\angle 2$, $\angle 2$ and $\angle 1$ are all linear pairs.

c.



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

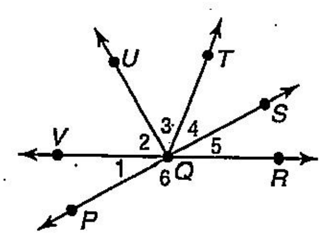
d.



$\angle A$ 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.*



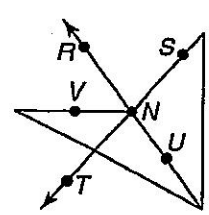
1. $\angle 1$ and $\angle 2$

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 $\angle TNU$.

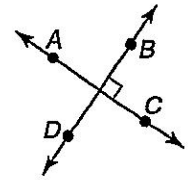
8. Find the measures of two complementary angles if the difference in their measures is 18.

Lesson 1-5

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

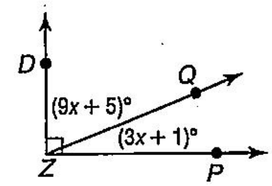
Angle Relationships

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 $m\angle DZP = 90$.

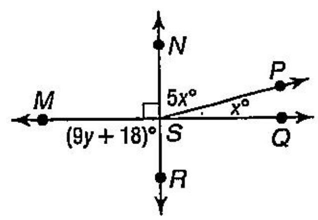


$m\angle DZQ + m\angle QZP = m\angle DZP$	Sum of parts = whole
$(9x + 5) + (3x + 1) = 90$	Substitution
$12x + 6 = 90$	Simplify.
$12x = 84$	Subtract 6 from each side.
$x = 7$	Divide each side by 12.

Exercises

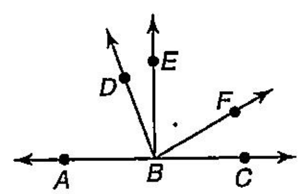
1. Find x and y so that $\overleftrightarrow{NR} \perp \overleftrightarrow{MQ}$.

2. Find $m\angle MSN$.

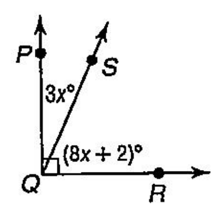


3. $m\angle EBF = 3x + 10$, $m\angle DBE = x$, and $\overrightarrow{BD} \perp \overrightarrow{BF}$. Find x.

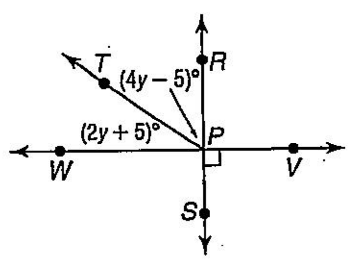
4. If $m\angle EBF = 7y - 3$ and $m\angle FBC = 3y + 3$, find y so that $\overrightarrow{EB} \perp \overrightarrow{BC}$.



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



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



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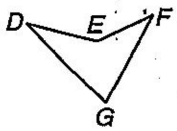
1-6 Study Guide and Intervention

Two-Dimensional Figures

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**.

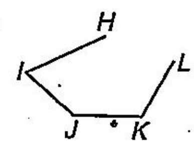
Example **Name each polygon by its number of sides. Then classify it as *concave* or *convex* and *regular* or *irregular*.**

a.



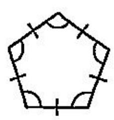
The polygon has 4 sides, so it is a quadrilateral. It is concave because part of $\overline{DE}$ or $\overline{EF}$ lies in the interior of the figure. Because it is concave, it cannot have all its angles congruent and so it is irregular.

b.



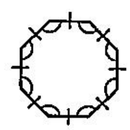
The figure is not closed, so it is not a polygon.

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.

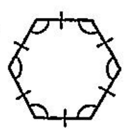


The figure has 8 congruent sides and 8 congruent angles. It is convex and is a regular octagon.

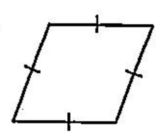
Exercises

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

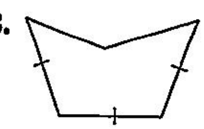
1.



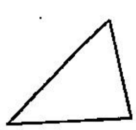
2.



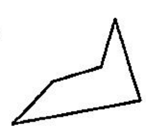
3.



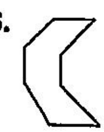
4.



5.



6.



Lesson 1-6

NAME ______________________ DATE __________ PERIOD _____

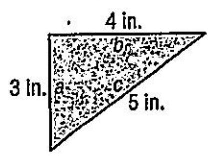
1-6 Study Guide and Intervention *(continued)*

Two-Dimensional Figures

Perimeter, Circumference, and Area The **perimeter** of a polygon is the sum of the lengths of all the sides of the polygon. The **circumference** of a circle is the distance around the circle. The **area** is the number of square units needed to cover a surface.

Example **Write an expression or formula for the perimeter and area of each. Find the perimeter and area to the nearest tenth.**

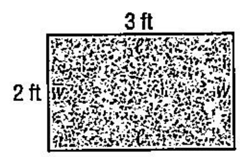
a.



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

$A = \frac{1}{2}bh$
$= \frac{1}{2}(4)(3)$
$= 6 \text{ in}^2$

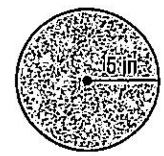
b.



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

$A = lw$
$= (3)(2)$
$= 6 \text{ ft}^2$

c.



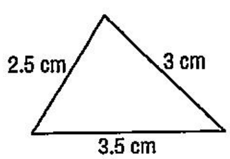
$C = 2\pi r$
$= 2\pi(5)$
$= 10\pi$ or about 31.4 in.

$A = \pi r^2$
$= \pi(5)^2$
$= 25\pi$ or about 78.5 in^2

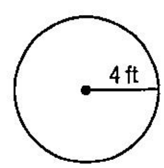
Exercises

Find the perimeter or circumference of each figure to the nearest tenth.

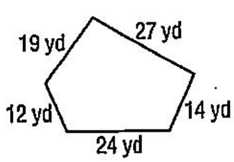
1.



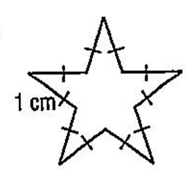
2.



3.

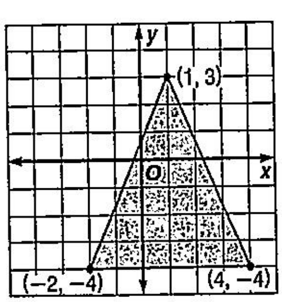


4.

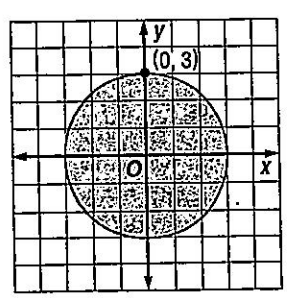


Find the area of each figure on the coordinate plane to the nearest tenth.

5.



6.



1-7 Study Guide and Intervention

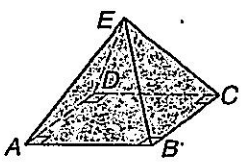
Three-Dimensional Figures

Identify Three-Dimensional Figures A **polyhedron** is a solid with all flat surfaces. Each surface of a polyhedron is called a **face**, and each line segment where faces intersect is called an **edge**. Two special kinds of polyhedra are **prisms**, for which two faces are congruent, parallel **bases**, and **pyramids**, for which one face is a base and all the other faces meet at a point called the **vertex**. Prisms and pyramids are named for the shape of their bases, and a regular polyhedron has a **regular** polygon as its base.

Other solids are a **cylinder**, which has congruent circular bases in parallel planes, a **cone**, which has one circular base and a vertex, and a **sphere**.

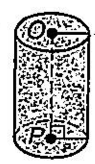
Example **Identify each solid. Name the bases, faces, edges, and vertices.**

a.



The figure is a rectangular pyramid. The base is rectangle $ABCD$, and the four faces $\triangle ABE$, $\triangle BCE$, $\triangle CDE$, and $\triangle ADE$ meet at vertex E. The edges are $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, $\overline{AD}$, $\overline{AE}$, $\overline{BE}$, $\overline{CE}$, and $\overline{DE}$. The vertices are A, B, C, D, and E.

b.

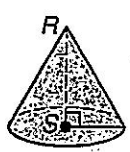


This solid is a cylinder. The two bases are $\odot O$ and $\odot P$.

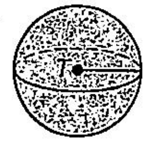
Exercises

Identify each solid. Name the bases, faces, edges, and vertices.

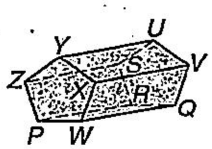
1.



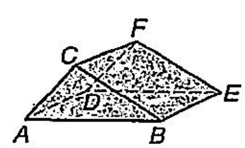
2.



3.



4.



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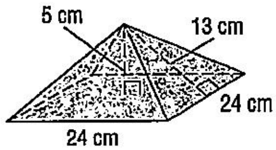
1-7 Study Guide and Intervention *(continued)*

Three-Dimensional Figures

SURFACE AREA AND VOLUME Surface area is the sum of the areas of each face of a solid. Volume is the measure of the amount of space the solid encloses.

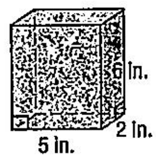
Example **Write an expression or formula for the surface area and volume of each solid. Find the surface area and volume. Round to the nearest tenth.**

a.



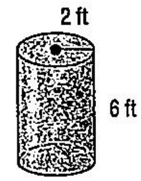
$$T = \frac{1}{2}Pl + B$$
$$= \frac{1}{2}(13)(96) + 576$$
$$= 1200 \text{ cm}^2$$
$$V = \frac{1}{3}Bh$$
$$= \frac{1}{3}(576)(5)$$
$$= 960 \text{ cm}^3$$

b.



$$T = Ph + 2B$$
$$= (14)(6) + 2(10)$$
$$= 104 \text{ in}^2$$
$$V = Bh$$
$$= (10)(6)$$
$$= 60 \text{ in}^3$$

c.

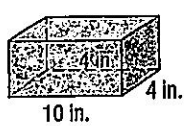


$$T = 2\pi rh + 2\pi r^2$$
$$= 2\pi(2)(6) + 2\pi(2)^2$$
$$= 32\pi \text{ or about } 100.5 \text{ ft}^2$$
$$V = \pi r^2 h$$
$$= \pi(2)^2(6)$$
$$= 24\pi \text{ or about } 75.4 \text{ ft}^3$$

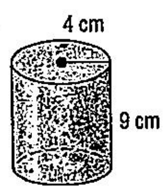
Exercises

Find the surface area of each solid. Round to the nearest tenth.

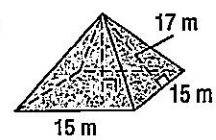
1.



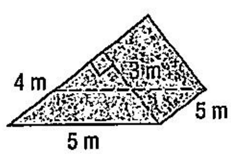
2.



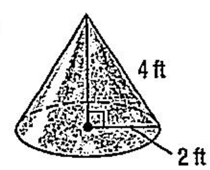
3.



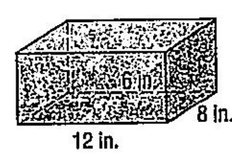
4.



5.

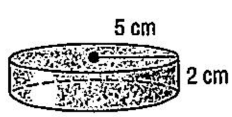


6.

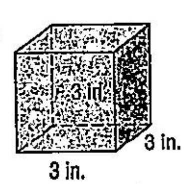


Find the volume of each solid. Round to the nearest tenth.

7.



8.



9.