

Name

Key

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# Chapter 1 Notes

## Geometry

### Objectives

*To know the definitions of basic geometric figures.*

*To understand relationships between basic geometric figures.*

*To incorporate your algebra skills to solve basic geometric problems.*

*Points, lines and planes page 2*

*Segments page 4*

*Angles page 6*

*Angle Pairs page 8*

*Midpoint and Distance Formulas page 10*

*Basic Area Formulas page 12*

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### Naming Points, Lines and Planes

**Note:** Line  $r$  pierces the plane at  $X$ . It is not coplanar with  $V$ .

What are two ways to name  $\overleftrightarrow{QX}$ ?

$\overleftrightarrow{QR}$ , line  $s$

What are two other ways to name plane  $V$ ?

plane  $ZRQ$

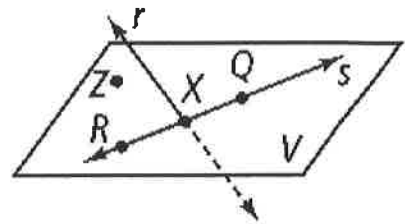
plane  $XRZ$

Name three collinear points.

$R, X, Q$

Name four coplanar points.

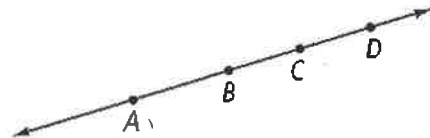
$Z, R, X, Q$



### Naming Segments and Rays

Name six segments in the figure.

$\overline{AB}, \overline{AC}, \overline{AD}, \overline{BC}, \overline{CD}, \overline{BD}$



Name the rays in the figure.

$\overrightarrow{AB}, \overrightarrow{BC}, \overrightarrow{CD}, \overrightarrow{DC}, \overrightarrow{CB}, \overrightarrow{BA}$

Name the pairs of opposite rays with endpoint  $C$ .

$\overrightarrow{CA}$  and  $\overrightarrow{CB}$

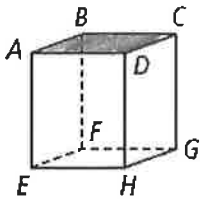
Name another pair of opposite rays.

$\overrightarrow{BA}$  and  $\overrightarrow{BC}$

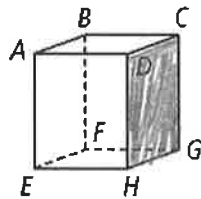
**Recognizing Planes**

Shade the plane that contains the given points.

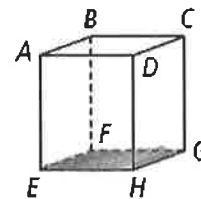
A, B, C



C, D, H



E, H, G



Give the plane that contains the first three points listed. Then determine whether the fourth point is in that plane. Write *coplanar* or *noncoplanar* to describe the points.

P, T, R, N

Plane PTR

coplanar

T, R, N, U

Plane TRN

noncoplanar

P, O, S, N

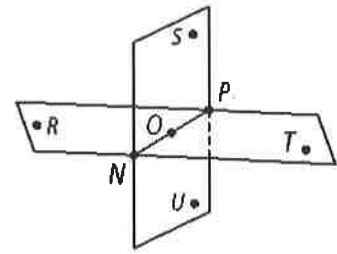
Plane POS

coplanar

P, O, R, S

Plane POR

noncoplanar



**Finding the Intersection of two Planes**

Name the intersection of each pair of planes.

Planes DCG and EFG

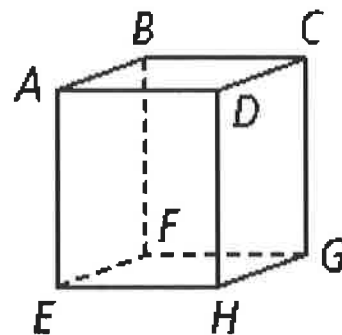
$\overline{HG}$

Planes BCG and ABF

$\overline{BF}$

Planes EFG and ADH

$\overline{EH}$



Name two planes that intersect at the given line.

$\overline{CD}$

Planes ABC  
and CDH

$\overline{DH}$

Planes ADE  
and CDG

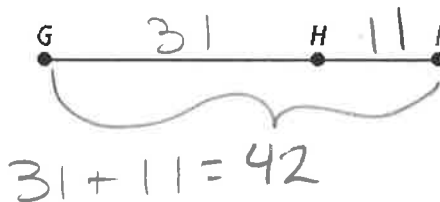
$\overline{EF}$

Planes  
EHG and ABF

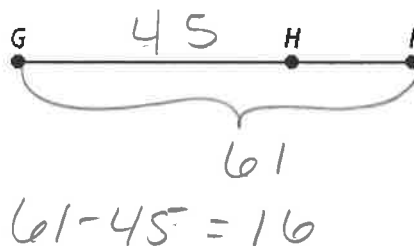
**VERY IMPORTANT RULE:** When values are given for figures  
you must label the diagram.

### Using the Segment Addition Postulate

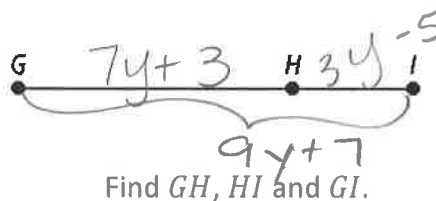
If  $GH = 31$  and  $HI = 11$ , then  $GI = \underline{42}$ .



If  $GH = 45$  and  $GI = 61$ , then  $HI = \underline{16}$ .



$GH = 7y + 3$ ,  $HI = 3y - 5$ , and  $GI = 9y + 7$ .



What is the value of  $y$ ?

$$(7y+3) + (3y-5) = 9y+7$$

$$10y - 2 = 9y + 7$$

$$y - 2 = 7$$

$$y = 9$$

$$GH = 7(9) + 3 = 66$$

$$HI = 3(9) - 5 = 22$$

$$GI = 9(9) + 7 = 88$$

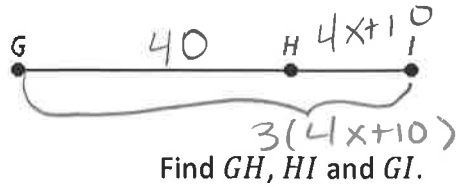
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$HI = 4x + 10$ ,  $GI = 3HI$ , and  $GH = 40$

$4x + 10$

What is the value of  $x$ ?



$$(40) + (4x + 10) = 3(4x + 10)$$

$$4x + 50 = 12x + 30$$

$$50 = 8x + 30$$

$$20 = 8x$$

$$x = 2.5$$

$$GH = 40$$

$$HI = 4(2.5) + 10 = 20$$

$$GI = 3(20) = 60$$

**Using the Midpoint**

If  $NO = 17$  and  $NP = 5x - 6$ , find the value of  $x$ . Then find  $NP$  and  $OP$ .

$$17 + 17 = 5x - 6$$

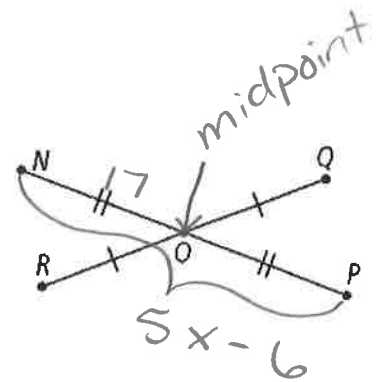
$$34 = 5x - 6$$

$$40 = 5x$$

$$x = 8$$

$$NP = 5(8) - 6 = 34$$

$$OP = 17$$



If  $RO = 6 + x$  and  $OQ = 2x + 1$  find the value of  $x$ . Then find  $RO$ ,  $OQ$  and  $RQ$ .

$$6 + x = 2x + 1$$

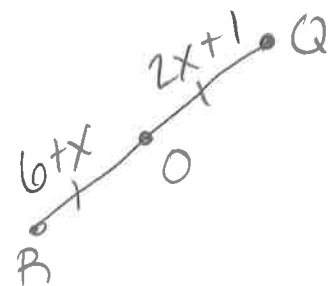
$$6 = x + 1$$

$$x = 5$$

$$RO = 6 + 5 = 11$$

$$OQ = 2(5) + 1 = 11$$

$$RQ = 11(2) = 22$$

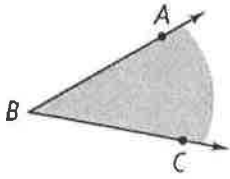


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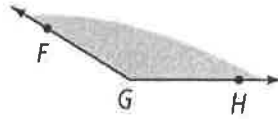
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### Naming Angles

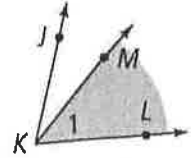
Name each shaded angle in three different ways.



$\angle B$ ,  $\angle ABC$ ,  $\angle CBA$



$\angle G$ ,  $\angle FGH$ ,  $\angle HGF$



$\angle I$   
 $\angle MKL$   
 $\angle LKM$

### Measuring and Classifying Angles

Use the diagram to find the measure of each angle. Also, classify each angle as *right*, *acute*, *obtuse* or *straight*.

$\angle AFB$

$m\angle AFB = 50^\circ$

Acute

$\angle CFD$

$m\angle CFD = 65^\circ$

Acute

$\angle AFE$

$m\angle AFE = 180^\circ$

Straight

$\angle AFD$

$m\angle AFD = 140^\circ$

Obtuse

$\angle BFD$

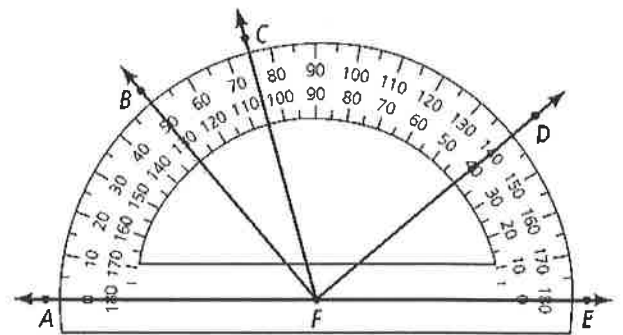
$m\angle BFD = 90^\circ$

Right

$\angle BFE$

$m\angle BFE = 130^\circ$

obtuse



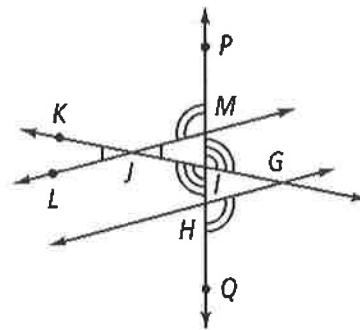
### Using Congruent Angles

$\angle MIG \cong \angle JIH$

$\angle PMJ \cong \angle LKQ$

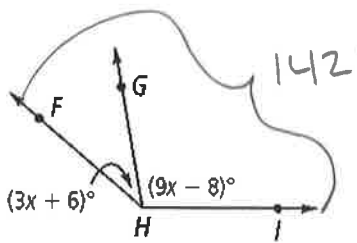
If  $m\angle KJL = 30$ , then  $m\angle MJI = 30$

If  $m\angle LMP = 100$ , then  $m\angle QHG = m\angle GHQ$



**Using the Angle Addition Postulate**

If  $m\angle FHI = 142$ , what are  $m\angle FHG$  and  $m\angle GHI$ ?



$$(3x + 6) + (9x - 8) = 142$$

$$12x - 2 = 142$$

$$12x = 144$$

$$x = 12$$

$$m\angle FHG = 3(12) + 6 = 42 \quad m\angle GHI = 9(12) - 8 = 100$$

$$m\angle CGD = 4x + 2, m\angle DGE = 3x - 5, m\angle EGF = 2x + 10$$

Find  $x$ . \*Note  $\angle DGE \cong \angle EGF$

$$3x - 5 = 2x + 10$$

$$x + 5 = 10$$

$$x = 5$$

$$m\angle CGD = 2x - 2, m\angle EGF = 37, m\angle CGF = 7x + 2$$

Find  $x$ .

$$(2x - 2) + 37 + 37 = 7x + 2$$

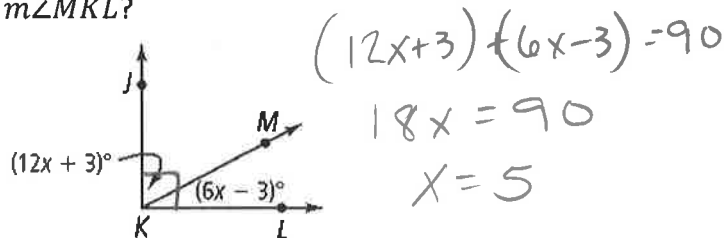
$$2x + 72 = 7x + 2$$

$$72 = 5x + 2$$

$$70 = 5x$$

$$x = 14$$

$\angle JKL$  is a right angle. What are  $m\angle JKM$  and  $m\angle MKL$ ?



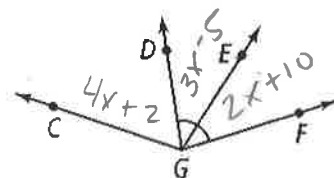
$$(12x + 3) + (6x - 3) = 90$$

$$18x = 90$$

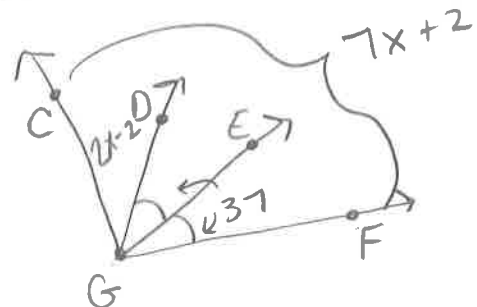
$$x = 5$$

$$m\angle JKM = 12(5) + 3 = 63$$

$$m\angle MKL = 6(5) - 3 = 27$$



\*Best to redraw picture

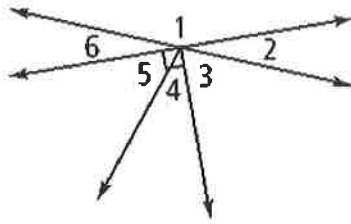


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### Identifying Angle Pairs

Is each statement true? Explain.



$\angle 5$  and  $\angle 4$  are supplementary.

False, they form a right angle therefore they are complimentary.

$\angle 6$  and  $\angle 5$  are adjacent.

True, they have a common vertex and side but do not overlap.

$\angle 1$  and  $\angle 2$  are a linear pair.

True, they form a straight line.

Name a pair of vertical angles.

$\angle QPR$  and  $\angle TPU$

Name an angle supplementary to  $\angle RPS$ .

$\angle SPU$

Name a linear pair.

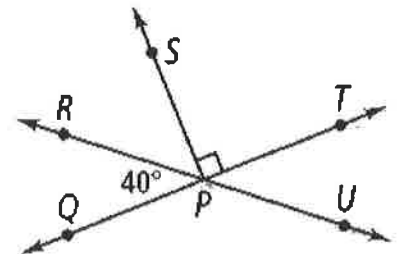
$\angle QPS$  and  $\angle SPT$

Name a pair of complementary angles.

$\angle QRP$  and  $\angle RPS$

Name an angle adjacent to  $\angle TPU$ .

$\angle UPQ$





**Using an Angle Bisectors and Linear Pairs to find Angle Measures**

In the diagram,  $XY$  bisects  $\angle WXZ$ . Solve for  $x$  and find  $m\angle WXY$ ,  $m\angle YXZ$  and  $m\angle WXZ$ .

$$7x - 7 = 5x + 3$$

$$2x - 7 = 3$$

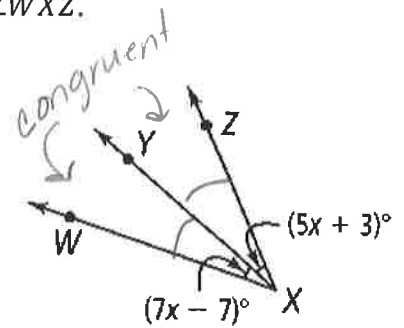
$$2x = 10$$

$$x = 5$$

$$m\angle WXY = 7(5) - 7 = 28$$

$$m\angle YXZ = 28$$

$$m\angle WXZ = 56$$



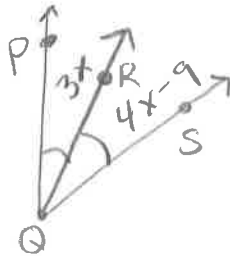
$\overline{QR}$  bisects  $\angle PQS$ . Solve for  $x$  and find  $m\angle PQS$ .

$$m\angle PQR = 3x, m\angle RQS = 4x - 9$$

$$3x = 4x - 9$$

$$0 = x - 9$$

$$x = 9$$



$$m\angle PQS = 4x - 6, m\angle PQR = x + 11$$

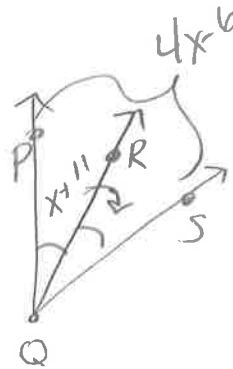
$$(x + 11) + (x + 11) = 4x - 6$$

$$2x + 22 = 4x - 6$$

$$22 = 2x - 6$$

$$28 = 2x$$

$$x = 7$$



$$m\angle PQS = 2(3(9)) = 54$$

$$m\angle PQS = 4(7) - 6 = 22$$

$\angle ABD$  and  $\angle DBC$  are a linear pair. Solve for  $x$  and find  $m\angle ABD$  and  $m\angle DBC$ .

$$m\angle ABD = 10x \text{ and } m\angle DBC = 8x$$

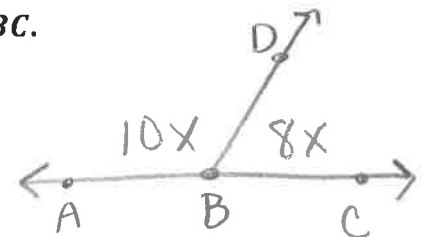
$$10x + 8x = 180$$

$$18x = 180$$

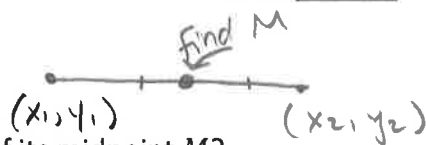
$$x = 10$$

$$m\angle ABD = 10(10) = 100$$

$$m\angle DBC = 8(10) = 80$$



**Finding the Midpoint**



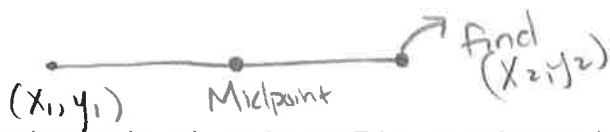
$\overline{GH}$  has endpoints  $(6, 5)$  and  $(10, 14)$ . What are the coordinates of its midpoint  $M$ ?

$$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) = \left( \frac{6 + 10}{2}, \frac{5 + 14}{2} \right) = (8, 9.5)$$

$\overline{QR}$  has endpoints  $(-20, -3)$  and  $(-1, 0)$ . What are the coordinates of its midpoint  $M$ ?

$$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) = \left( \frac{-20 + (-1)}{2}, \frac{-3 + 0}{2} \right) = (-10.5, -1.5)$$

**Finding an Endpoint**



The midpoint of  $\overline{EF}$  has coordinates  $(4, -9)$ . Endpoint  $E$  has coordinates  $(-3, -5)$ . What are the coordinates of  $F$ ?

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

$$\underbrace{(4)}_x, \underbrace{(-9)}_y = \left( \underbrace{\frac{-3 + x}{2}}_x, \underbrace{\frac{-5 + y}{2}}_y \right)$$

Write + Solve 2 equations

$$\begin{cases} (2) 4 = \frac{-3 + x}{2} \\ (2) -9 = \frac{-5 + y}{2} \end{cases} \Rightarrow \begin{cases} 8 = -3 + x \\ x = 11 \\ -18 = -5 + y \\ -13 = y \end{cases}$$

$$(11, -13)$$

The midpoint of  $\overline{TU}$  has coordinates  $(-2, -6)$ . Endpoint  $T$  has coordinates  $(12, -8)$ . What are the coordinates of  $U$ ?

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

$$(-2, -6) = \left( \frac{12 + x}{2}, \frac{-8 + y}{2} \right)$$

$$\begin{cases} (2) -2 = \frac{12 + x}{2} \\ (2) -6 = \frac{-8 + y}{2} \end{cases} \Rightarrow \begin{cases} -4 = 12 + x \\ x = -16 \\ -12 = -8 + y \\ -4 = y \end{cases}$$

$$(-16, -4)$$

**Finding Distance**

$\overline{JK}$  has endpoints  $J(x_1, y_1)$  and  $K(x_2, y_2)$ . What is  $JK$  to the nearest tenth?

$$\begin{aligned} d &= \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2} \\ &= \sqrt{(4 - (-12))^2 + (3 - 5)^2} \\ &= \sqrt{(16)^2 + (-2)^2} \\ &= \sqrt{256 + 4} \\ &= \sqrt{260} \\ &\approx 16.1 \end{aligned}$$

$\overline{PQ}$  has endpoints  $P(x_1, y_1)$  and  $Q(x_2, y_2)$ . What is  $PQ$  to the nearest tenth?

$$\begin{aligned} d &= \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2} \\ &= \sqrt{(10 - 8)^2 + (-11 - 0)^2} \\ &= \sqrt{(2)^2 + (-11)^2} \\ &= \sqrt{4 + 121} \\ &= \sqrt{125} \\ &\approx 11.2 \end{aligned}$$

**Finding Perimeter in the Coordinate Plane**

Find the perimeter of  $QRST$ . *→ add all sides*

$Q(-1, 0)$ ,  $R(2, 3)$ ,  $S(3, -3)$ ,  $T(-1, 3)$

→ Quadrilateral means 4 sides.

$$d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$

QR

$$\begin{array}{cc} (-1, 0) & (2, 3) \\ x_1, y_1 & x_2, y_2 \end{array}$$

$$\begin{aligned} d &= \sqrt{(2 - (-1))^2 + (3 - 0)^2} \\ &= \sqrt{(3)^2 + (3)^2} \\ &= \sqrt{18} \end{aligned}$$

RS

$$\begin{array}{cc} (2, 3) & (3, -3) \\ x_1, y_1 & x_2, y_2 \end{array}$$

$$\begin{aligned} d &= \sqrt{(3 - 2)^2 + (-3 - 3)^2} \\ &= \sqrt{(1)^2 + (-6)^2} \\ &= \sqrt{37} \end{aligned}$$

ST

$$\begin{array}{cc} (3, -3) & (-1, 3) \\ x_1, y_1 & x_2, y_2 \end{array}$$

$$\begin{aligned} d &= \sqrt{(3 - (-3))^2 + (-1 - 3)^2} \\ &= \sqrt{(6)^2 + (-4)^2} \\ &= \sqrt{52} \end{aligned}$$

TQ

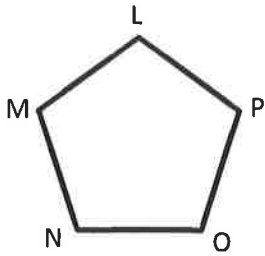
$$\begin{array}{cc} (-1, 3) & (-1, 0) \\ x_1, y_1 & x_2, y_2 \end{array}$$

$$\begin{aligned} d &= \sqrt{(0 - 3)^2 + (-1 - (-1))^2} \\ &= \sqrt{(-3)^2 + (0)^2} \\ &= \sqrt{9} \\ &= 3 \end{aligned}$$

Perimeter

$$\sqrt{18} + \sqrt{37} + \sqrt{52} + 3 \approx 20.5$$

Name the polygon, then identify its sides and angles.



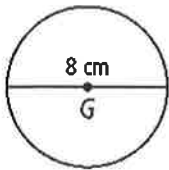
Name 2 ways:  $MLPON$ ,  $ONMLP$

Sides:  $\overline{ML}$ ,  $\overline{LP}$ ,  $\overline{PO}$ ,  $\overline{ON}$ ,  $\overline{NM}$

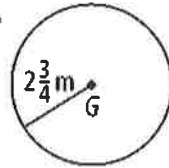
Angles:  $\angle M$ ,  $\angle L$ ,  $\angle P$ ,  $\angle O$ ,  $\angle N$

**Finding Circumference**

Find the circumference and area of circle  $G$  in terms of  $\pi$ .



$C = 2\pi r = 2\pi(8) = 16\pi \text{ cm}$   
 $A = \pi r^2 = \pi(8)^2 = 64\pi \text{ cm}^2$



$r = \frac{11}{4}$

$C = 2\pi r = 2\pi\left(\frac{11}{4}\right) = \frac{22}{2}\pi = 11\pi \text{ m}$

$A = \pi r^2 = \pi\left(\frac{11}{4}\right)^2 = \frac{121\pi}{16} \text{ m}^2$

**Finding Area**

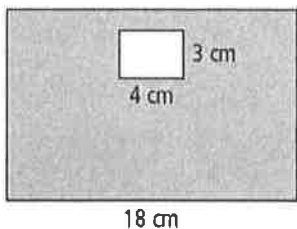
Find the area of each rectangle with the given base and height.

→ dimensions must be the same units

3 ft., 8 in.  
 $\downarrow$   
 36 in.  
 $A = bh = 8(36) = 288 \text{ in}^2$   
 $288 \div 144 = 2 \text{ ft}^2$

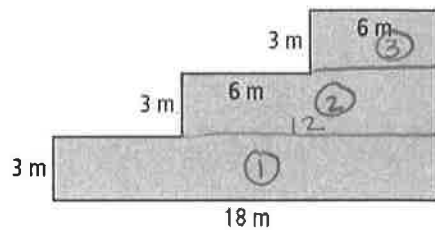
8 ft. 6 in., 2 ft.  
 $\downarrow$   
 8.5 ft.  
 $A = bh = 8.5(2) = 17 \text{ ft}^2$

Find the area of the shaded region. All angles are right angles.



Large Rectangle  
 $A = bh = 12(18) = 216$   
Small Rectangle  
 $A = bh = 4(3) = 12$

Shaded Area  
 $216 - 12 = 204 \text{ cm}^2$



$R_1: A = bh = 3(18) = 54$   
 $R_2: A = bh = 3(12) = 36$   
 $R_3: A = 3(6) = 18$   
Total Area  
 $54 + 36 + 18 = 108 \text{ m}^2$