

# 1-3 Measuring and Constructing Angles

## Warm Up

1.  $2x + 3 + x - 4 + 3x - 5 = 180$       31

4

2.  $5x + 2 = 8x - 10$

There is no Bellwork for today.

Please have your notebook out, learning journal out, and your assignment ready to check.

## Bellwork – Block 3

- 1) Suppose S is between R and T. Use the Segment Addition postulate to solve for x.

$$RS = 2x + 6, \quad ST = 4x - 3, \quad RT = 5x + 12$$

- 2) B is the midpoint of segment AC,  $AB = 5x$ ,  $BC = 3x + 4$ . Find AB, BC, and AC.

## *Objectives*

Name and classify angles.

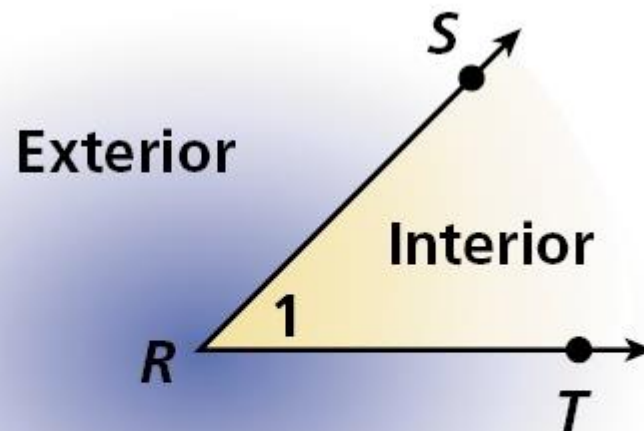
Measure and construct angles and angle bisectors.

## 1-3 Measuring and Constructing Angles

An **angle** is a figure formed by two rays, or sides, with a common endpoint called the **vertex** (plural: *vertices*).

### Angle Name

$\angle R$ ,  $\angle SRT$ ,  $\angle TRS$ , or  $\angle 1$



**1-3****Measuring and Constructing Angles****Example 1: Naming Angles**

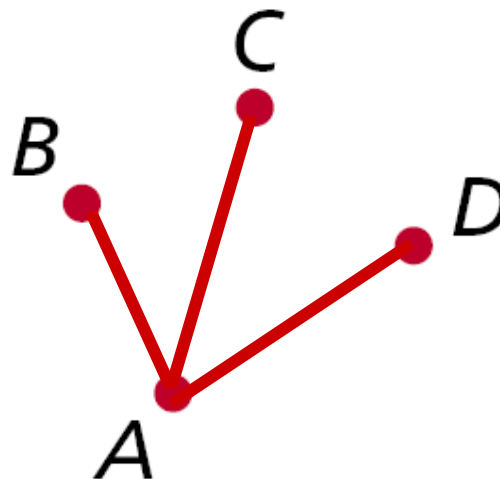
**A surveyor recorded the angles formed by a transit (point  $A$ ) and three distant points,  $B$ ,  $C$ , and  $D$ . Name three of the angles.**

Possible answer:

$\angle BAC$

$\angle CAD$

$\angle BAD$

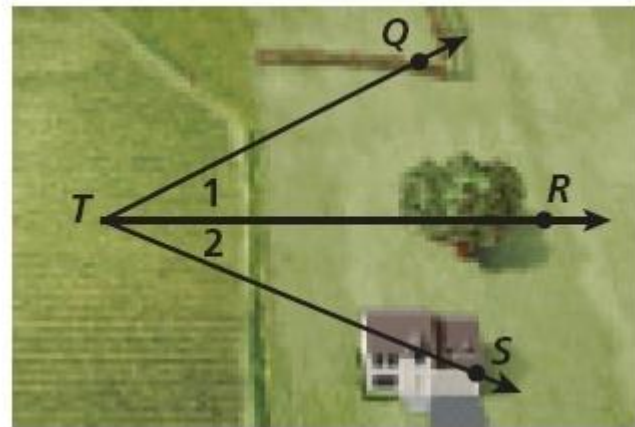


# 1-3 Measuring and Constructing Angles

## Check It Out! Example 1

Write the different ways you can name the angles in the diagram.

$\angle RTQ$ ,  $\angle T$ ,  $\angle STR$ ,  $\angle 1$ ,  $\angle 2$



**1-3****Measuring and Constructing Angles**

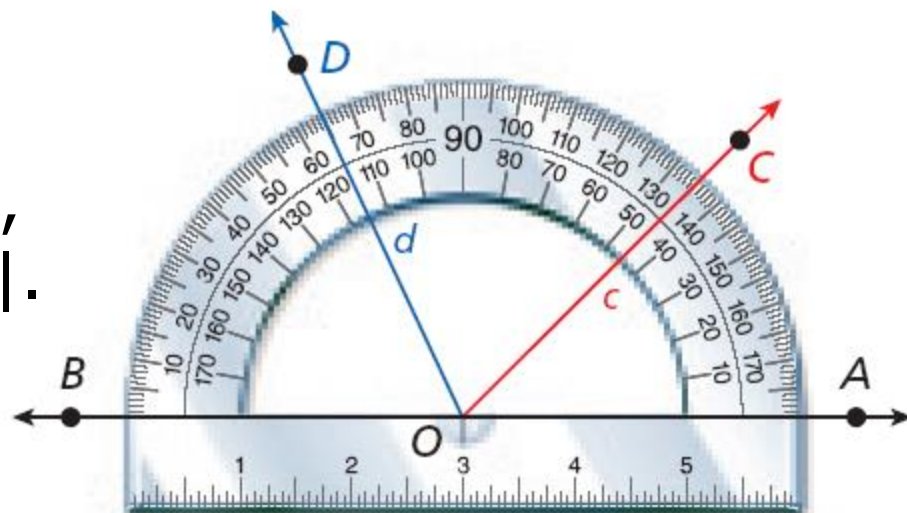
The **measure** of an angle is how wide it opens. It is measured in degrees.

Since there are  $360^\circ$  in a circle, one **degree** is  $\frac{1}{360}$  of a circle.



# 1-3 Measuring and Constructing Angles

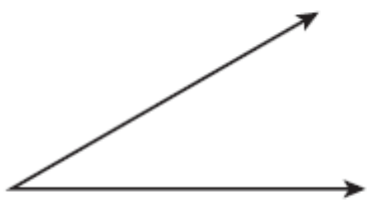
If  $\overrightarrow{OC}$  corresponds with  $c$   
and  $\overrightarrow{OD}$  corresponds with  $d$ ,  
 $m\angle DOC = |d - c|$  or  $|c - d|$ .



# 1-3 Measuring and Constructing Angles

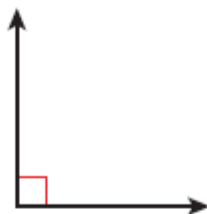
## Types of Angles

Acute Angle



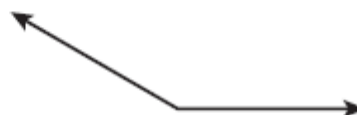
Measures greater than  $0^\circ$  and less than  $90^\circ$

Right Angle



Measures  $90^\circ$

Obtuse Angle



Measures greater than  $90^\circ$  and less than  $180^\circ$

Straight Angle



Formed by two opposite rays and measures  $180^\circ$

**1-3****Measuring and Constructing Angles****Example 2: Measuring and Classifying Angles**

**Find the measure of each angle. Then classify each as acute, right, or obtuse.**

**A.**  $\angle WXV$

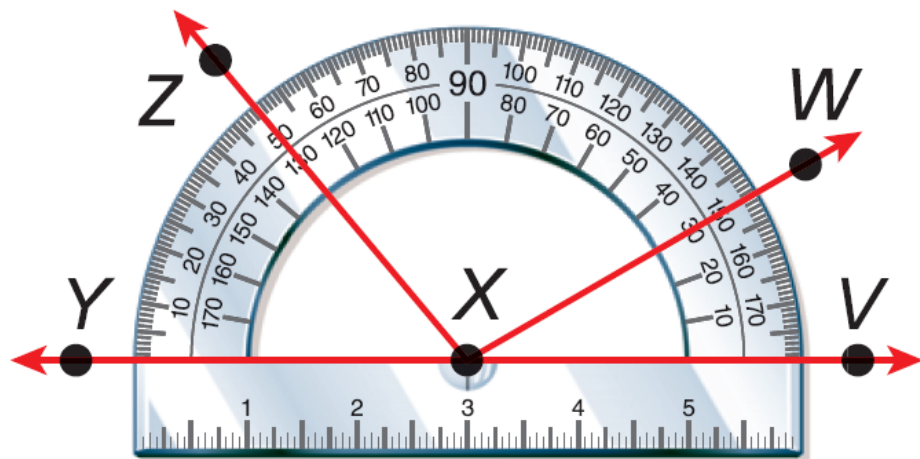
$$m\angle WXV = 30^\circ$$

$\angle WXV$  is acute.

**B.**  $\angle ZXW$

$$m\angle ZXW = |130^\circ - 30^\circ| = 100^\circ$$

$\angle ZXW$  is obtuse.



**1-3****Measuring and Constructing Angles****Check It Out! Example 2**

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

a.  $\angle BOA$

$$m\angle BOA = 40^\circ$$

$\angle BOA$  is acute.

b.  $\angle DOB$

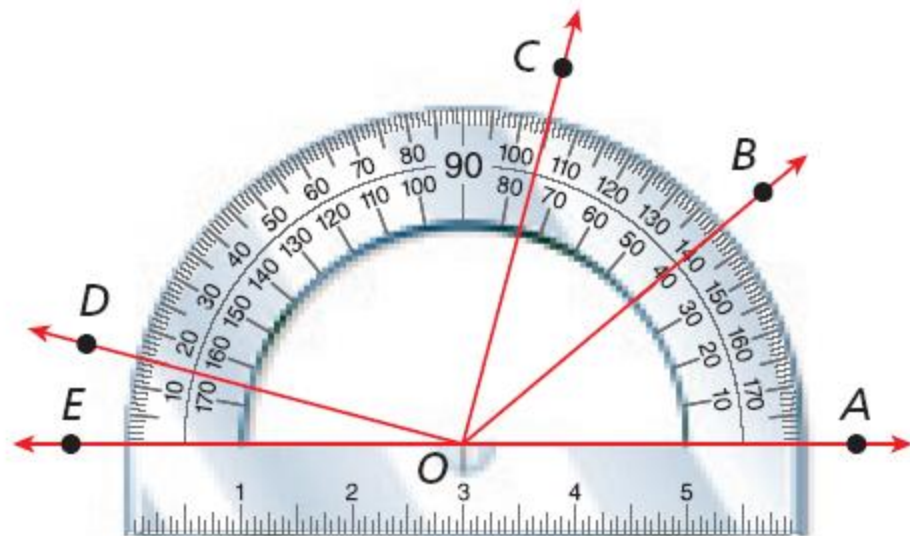
$$m\angle DOB = 125^\circ$$

$\angle DOB$  is obtuse.

c.  $\angle EOC$

$$m\angle EOC = 105^\circ$$

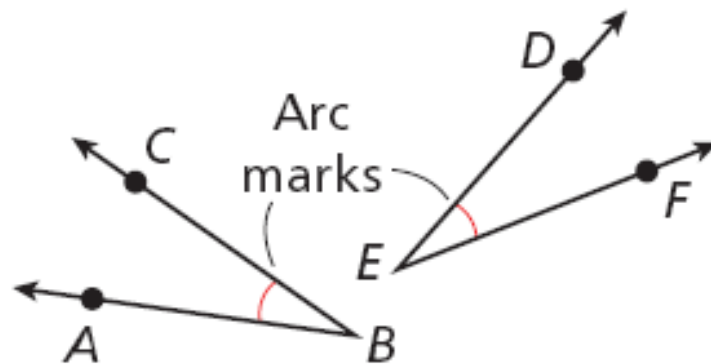
$\angle EOC$  is obtuse.



# 1-3 Measuring and Constructing Angles

**Congruent angles** are angles that have the same measure.

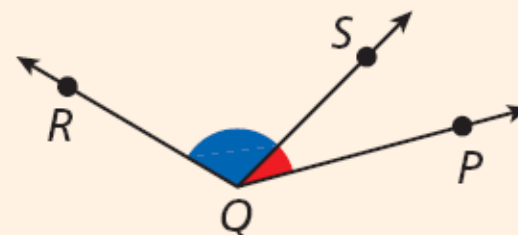
In the diagram,  $m\angle ABC = m\angle DEF$ , so you can write  $\angle ABC \cong \angle DEF$ . This is read as "angle ABC is congruent to angle DEF." *Arc marks* are used to show that the two angles are congruent.



# 1-3 Measuring and Constructing Angles

## Postulate 1-3-2 Angle Addition Postulate

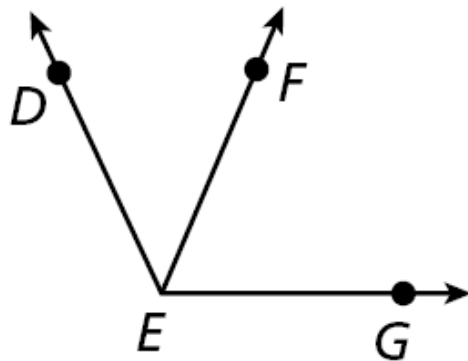
If  $S$  is in the interior of  $\angle PQR$ , then  
 $m\angle PQS + m\angle SQR = m\angle PQR$ .  
( $\angle$  Add. Post.)



# 1-3 Measuring and Constructing Angles

## Example 3: Using the Angle Addition Postulate

$m\angle DEG = 115^\circ$ , and  $m\angle DEF = 48^\circ$ . Find  $m\angle FEG$



$$m\angle DEG = m\angle DEF + m\angle FEG \quad \angle \text{Add. Post.}$$

$$115^\circ = 48^\circ + m\angle FEG$$

*Substitute the given values.*

$$\underline{-48^\circ} \quad \underline{-48^\circ}$$

*Subtract 48 from both sides.*

$$67^\circ = m\angle FEG$$

*Simplify.*



**1-3****Measuring and Constructing Angles****Check It Out! Example 3**

**Y is in the interior of angle XWZ.**

**$m\angle XWZ = 121^\circ$  and  $m\angle XWY = 59^\circ$ . Find  $m\angle YWZ$ .**

$$m\angle YWZ = m\angle XWZ - m\angle XWY \quad \angle \text{Add. Post.}$$

$$m\angle YWZ = 121^\circ - 59^\circ \quad \text{Substitute the given values.}$$

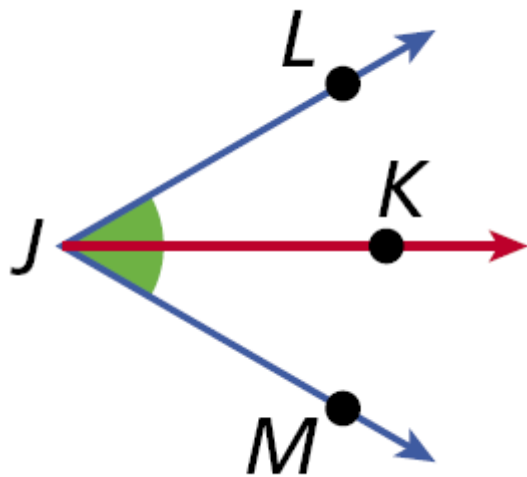
$$m\angle YWZ = 62^\circ \quad \text{Subtract.}$$



# 1-3 Measuring and Constructing Angles

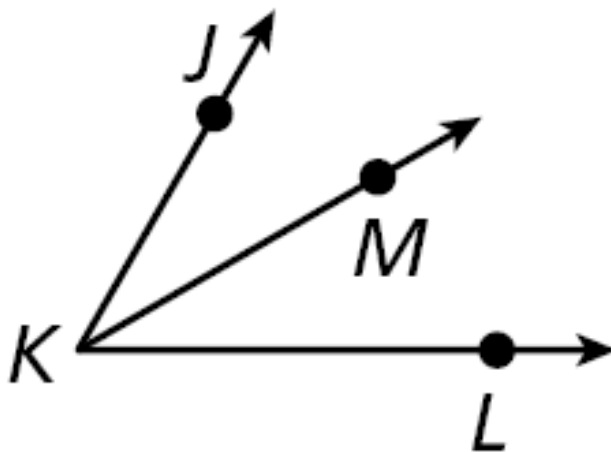
An **angle bisector** is a ray that divides an angle into two congruent angles.

$\overrightarrow{JK}$  bisects  $\angle LJM$ ; thus  $\angle LJK \cong \angle KJM$ .



**1-3****Measuring and Constructing Angles****Example 4: Finding the Measure of an Angle**

$\overrightarrow{KM}$  bisects  $\angle JKL$ ,  $m\angle JKM = (4x + 6)^\circ$ , and  $m\angle MKL = (7x - 12)^\circ$ . Find  $m\angle JKM$ .



**1-3****Measuring and Constructing Angles****Example 4 Continued****Step 1** Find  $x$ .

$$m\angle JKM = m\angle MKL$$

$$(4x + 6)^\circ = (7x - 12)^\circ$$

$$\begin{array}{r} +12 \\ \hline 4x + 6 \end{array} = \begin{array}{r} +12 \\ \hline 7x - 12 \end{array}$$

$$4x + 18 = 7x$$

$$\begin{array}{r} -4x \\ \hline 4x + 18 \end{array} = \begin{array}{r} -4x \\ \hline 7x \end{array}$$

$$18 = 3x$$

$$6 = x$$

*Def. of  $\angle$  bisector**Substitute the given values.**Add 12 to both sides.**Simplify.**Subtract  $4x$  from both sides.**Divide both sides by 3.**Simplify.*

## Example 4 Continued

**Step 2** Find  $m\angle JKM$ .

$$m\angle JKM = 4x + 6$$

$$= 4(6) + 6$$

*Substitute 6 for  $x$ .*

$$= 30^\circ$$

*Simplify.*

**1-3****Measuring and Constructing Angles****Check It Out! Example 4a**

Find the measure of each angle.

$\overrightarrow{QS}$  bisects  $\angle PQR$ ,  $m\angle PQS = (5y - 1)^\circ$ , and  $m\angle PQR = (8y + 12)^\circ$ . Find  $m\angle PQS$ .

**Step 1** Find  $y$ .

$$\angle PQS = \frac{1}{2}\angle PQR \quad \text{Def. of } \angle \text{ bisector}$$

$$(5y - 1)^\circ = \frac{1}{2}(8y + 12)^\circ \quad \text{Substitute the given values.}$$

$$5y - 1 = 4y + 6 \quad \text{Simplify.}$$

$$y - 1 = 6 \quad \text{Subtract } 4y \text{ from both sides.}$$

$$y = 7 \quad \text{Add 1 to both sides.}$$

**1-3****Measuring and Constructing Angles****Check It Out! Example 4a Continued**

**Step 2** Find  $m\angle PQS$ .

$$m\angle PQS = 5y - 1$$

$$= 5(7) - 1$$

*Substitute 7 for y.*

$$= 34^\circ$$

*Simplify.*

**1-3****Measuring and Constructing Angles****Check It Out! Example 4b**

Find the measure of each angle.

$\overrightarrow{JK}$  bisects  $\angle LJM$ ,  $m\angle LJK = (-10x + 3)^\circ$ , and  $m\angle KJM = (-x + 21)^\circ$ . Find  $m\angle LJM$ .

**Step 1** Find  $x$ .

$$\angle LJK = \angle KJM$$

*Def. of  $\angle$  bisector*

$$(-10x + 3)^\circ = (-x + 21)^\circ$$

*Substitute the given values.*

*Add  $x$  to both sides.*

$$\begin{array}{r} -10x + 3 \\ +x \\ \hline \end{array} = \begin{array}{r} -x + 21 \\ +x \\ \hline \end{array}$$

*Simplify.*

*Subtract 3 from both sides.*

$$-9x + 3 = 21$$

$$\begin{array}{r} -9x + 3 \\ -3 \\ \hline \end{array} = \begin{array}{r} 21 \\ -3 \\ \hline \end{array}$$

*Divide both sides by  $-9$ .*

$$-9x = 18$$

$$x = -2$$

*Simplify.*

**1-3****Measuring and Constructing Angles****Check It Out! Example 4b Continued**

**Step 2** Find  $m\angle LJM$ .

$$m\angle LJM = m\angle LJK + m\angle KJM$$

$$= (-10x + 3)^\circ + (-x + 21)^\circ$$

$$= -10(-2) + 3 - (-2) + 21$$
 *Substitute -2 for x.*

$$= 20 + 3 + 2 + 21$$
 *Simplify.*

$$= 46^\circ$$



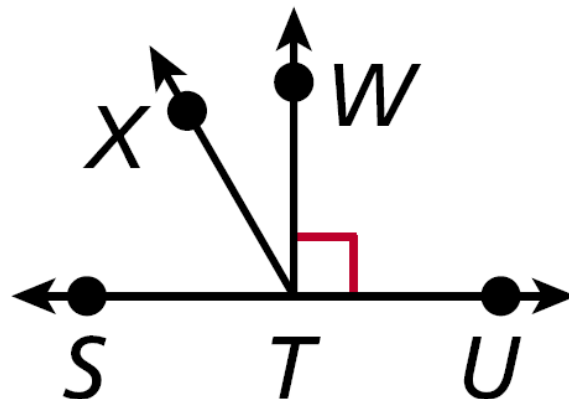
# 1-3 Measuring and Constructing Angles

## Lesson Quiz: Part I

Classify each angle as acute, right, or obtuse.

1.  $\angle XTS$  acute

2.  $\angle WTU$  right



3.  $K$  is in the interior of  $\angle LMN$ ,  $m\angle LMK = 52^\circ$ , and  $m\angle KMN = 12^\circ$ . Find  $m\angle LMN$ .

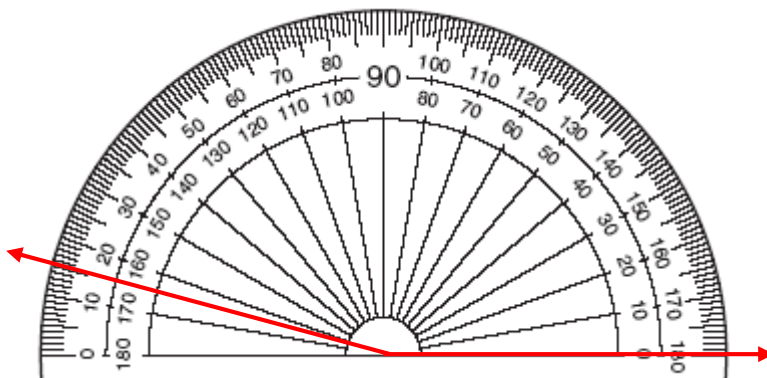
$64^\circ$

**1-3****Measuring and Constructing Angles****Lesson Quiz: Part II**

4.  $\overrightarrow{BD}$  bisects  $\angle ABC$ ,  $m\angle ABD = \left(\frac{1}{2}y + 10\right)^\circ$ , and  $m\angle DBC = (y + 4)^\circ$ . Find  $m\angle ABC$ .

**32°**

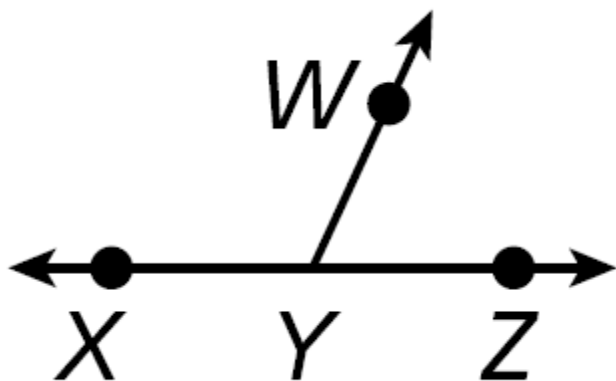
5. Use a protractor to draw an angle with a measure of  $165^\circ$ .



# 1-3 Measuring and Constructing Angles

## Lesson Quiz: Part III

6.  $m\angle WYZ = (2x - 5)^\circ$  and  $m\angle XYW = (3x + 10)^\circ$ .  
Find the value of  $x$ .



**35**