Vocabulary:
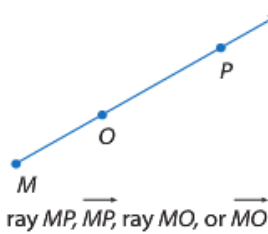
Ray: Part of a line having one endpoint and extending indefinitely in one direction.
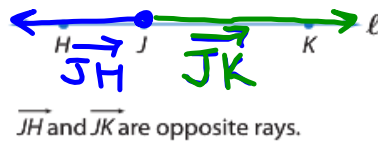
A ray's name ALWAYS begins with its endpoint.

$\overrightarrow{MP}$ or $\overrightarrow{MO}$

ray MP, $\overrightarrow{MP}$, ray MO, or $\overrightarrow{MO}$
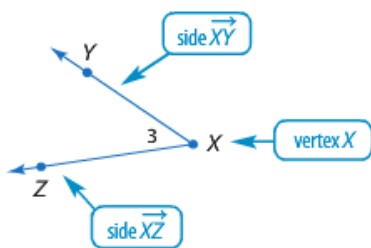
Opposite Rays:

If you choose a point on a line, that point determines exactly two rays called **opposite rays**. Since both rays share a common endpoint, opposite rays are collinear

$\overrightarrow{JH}$ $\overrightarrow{JK}$

$\overrightarrow{JH}$ and $\overrightarrow{JK}$ are opposite rays.

straight angle
180°

Angle: <u>formed by 2 noncollinear rays that have a common endpoint.</u>

side $\overrightarrow{XY}$

Y

3

Z   X   ← vertex X

side $\overrightarrow{XZ}$

How do we name this angle?

With ONE letter: $\angle X$

With THREE letters: $\angle YXZ$ or $\angle ZXY$

*With a NUMBER: $\angle 3$

*only if the vertex is marked with a number.

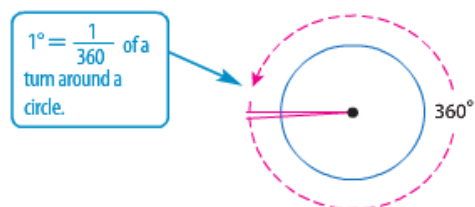vertex in the middle

Interior vs. Exterior

An angle divides a plane into three distinct parts.

- Points Q, M, and N lie on the angle.
- Points S and R lie in the **interior** of the angle.
- Points P and O lie in the **exterior** of the angle.

Degrees
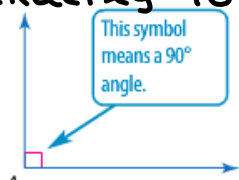
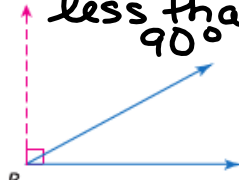$1° = \dfrac{1}{360}$ of a turn around a circle.

360°
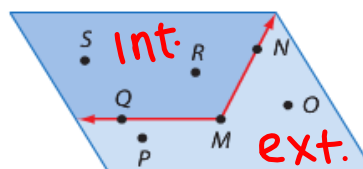
Angles are measured in units called degrees. The <mark>degree</mark> results from dividing the distance around a circle into 360 parts.

Classifying Angles

KeyConcept Classify Angles   By degrees

right angle	acute angle	obtuse angle
exactly 90°	less than 90°	greater than 90° but less than 180°
This symbol means a 90° angle.		
A	B	C
$m\angle A = 90$	$m\angle B < 90$	$180 > m\angle C > 90$

examples 1a and 1b: Classify each angle as *right*, *acute*, or *obtuse*. Then use a protractor to measure each angle.
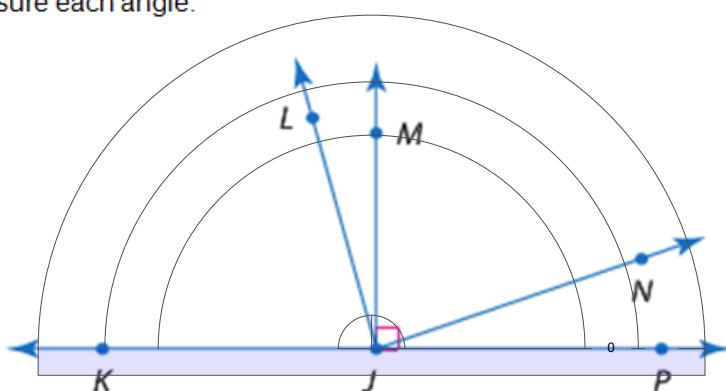
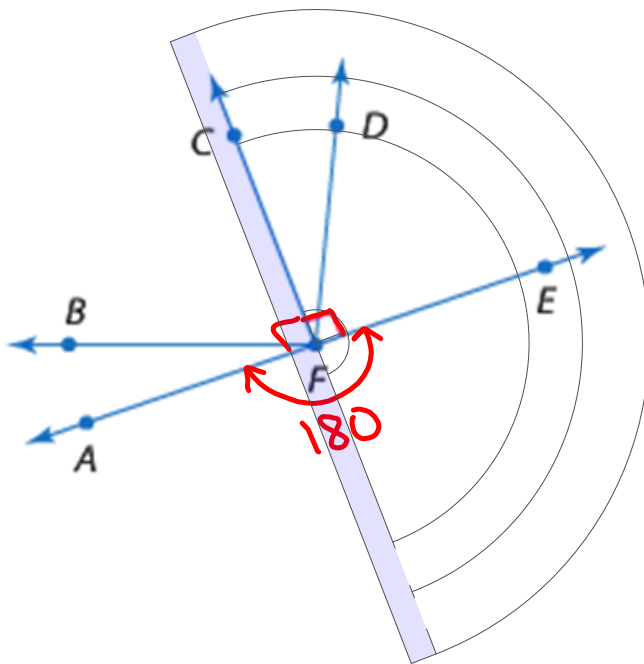

example 1a)

∠*MJP* <u>right 90°</u>

∠*LJP* <u>obtuse 105°</u>

∠*NJP* <u>acute   19°</u>

example 1b)

∠AFB acute 19°

∠CFA right 90°

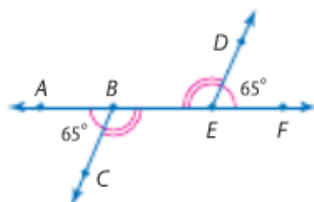∠AFD obtuse 115°

∠CFD acute 27°

Congruent Angles

Congruent Angles Just as segments that have the same measure are congruent segments, angles that have the same measure are *congruent angles*.

In the figure, since $m\angle ABC = m\angle FED$, then $\angle ABC \cong \angle FED$. Matching numbers of arcs on a figure also indicate congruent angles, so $\angle CBE \cong \angle DEB$.
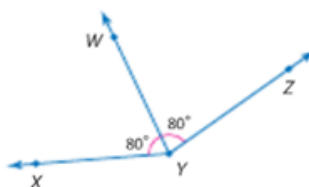

You can produce an angle congruent to a given angle using a construction.

StudyTip

Segments A line segment can also bisect an angle.

A ray that divides an angle into two congruent angles is called an **angle bisector**. If $\overrightarrow{YW}$ is the angle bisector of $\angle XYZ$, then point W lies in the interior of $\angle XYZ$ and $\angle XYW \cong \angle WYZ$.

Just as with segments, when a line, segment, or ray divides an angle into smaller angles, the sum of the measures of the smaller angles equals the measure of the largest angle. So in the figure, $m\angle XYW + m\angle WYZ = m\angle XYZ$.

Angle Addition Postulate

examples:

ALGEBRA In the figure, $\overrightarrow{KJ}$ and $\overrightarrow{KM}$ are opposite rays and $\overrightarrow{KN}$ bisects $\angle JKL$. If $m\angle JKN = 8x - 13$ and $m\angle NKL = 6x + 11$, find $m\angle JKN$.

2)

$$\angle JKN \cong \angle NKL$$
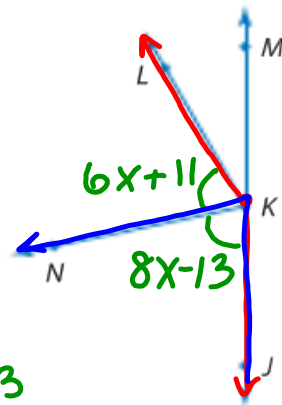
$$m\angle JKN = m\angle NKL$$

$$8x - 13 = 6x + 11$$

$$\underline{-6x + 13 \mid -6x + 13}$$

$$\frac{2x}{2} = \frac{24}{2} \quad x = 12$$

$m\angle JKN =$
$8(12) - 13$
$96 - 13$
$\boxed{83}$

3. Suppose $m\angle JKL = 9y + 15$ and $m\angle JKN = 5y + 2$. Find $m\angle JKL$.

$$m\angle JKN = \tfrac{1}{2} m\angle JKL$$

$$\boxed{2\,m\angle JKN = m\angle JKL}$$

$$2(5y + 2) = 9y + 15$$

$$10y + 4 = 9y + 15$$

$$\underline{-9y - 4 \mid -9y - 4}$$

$$y = 11$$

$m\angle JKL = 9(11) + 15$
$= 99 + 15$
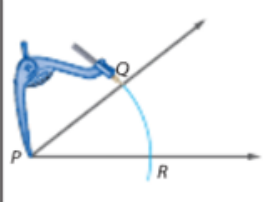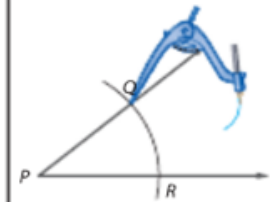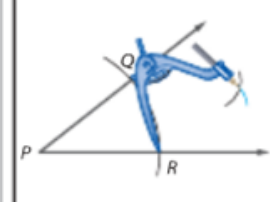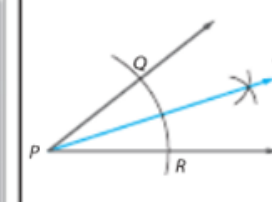$= \boxed{114}$

Copy an Angle:

Construction Copy an Angle

Step 1 Draw an angle like ∠B on your paper. Use a straightedge to draw a ray on your paper. Label its endpoint G.

Step 2 Place the tip of the compass at point B and draw a large arc that intersects both sides of ∠B. Label the points of intersection A and C.

Step 3 Using the same compass setting, put the compass at point G and draw a large arc that starts above the ray and intersects the ray. Label the point of intersection H.

Step 4 Place the point of your compass on C and adjust so that the pencil tip is on A.

Step 5 Without changing the setting, place the compass at point H and draw an arc to intersect the larger arc you drew in Step 4. Label the point of intersection F.

Step 6 Use a straightedge to draw $\overrightarrow{GF}$. ∠ABC ≅ ∠FGH

Copy ∠A.

A

B

Bisect an Angle:

Construction Bisect an Angle

Step 1 Draw an angle on your paper. Label the vertex as *P*. Put your compass at point *P* and draw a large arc that intersects both sides of ∠*P*. Label the points of intersection *Q* and *R*.	**Step 2** With the compass at point *Q*, draw an arc in the interior of the angle.	**Step 3** Keeping the same compass setting, place the compass at point *R* and draw an arc that intersects the arc drawn in Step 2. Label the point of intersection *T*.	**Step 4** Draw $\overrightarrow{PT}$. $\overrightarrow{PT}$ is the bisector of ∠*P*.

Bisect ∠*ABC*.