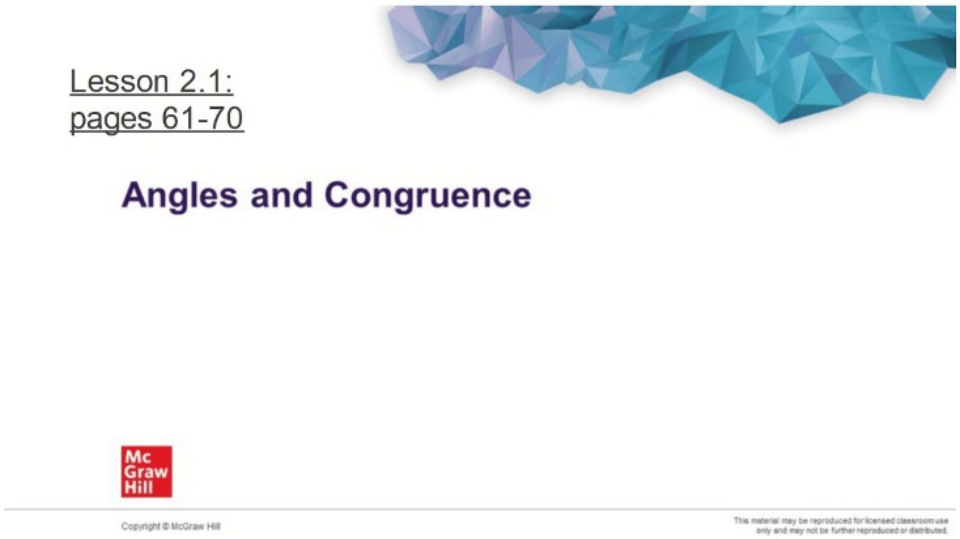
Lesson 2.1: Angles and Congruence

Sunday, September 11, 2022 8:44 PM

2-1 Angles Congrue...



Florida's B.E.S.T. Standards for Mathematics

MA.912.GR.1.6
Solve mathematical and real-world problems involving congruence or similarity in two-dimensional figures.

MA.912.GR.5.1
Construct a copy of a segment or an angle.

MA.912.GR.5.2
Construct the bisector of a segment or an angle, including the perpendicular bisector of a line segment.

Lesson Objectives

Content Objective

Students identify and use angles, angle parts, and special angle pairs.

line $\overleftrightarrow{AB}$

$\overline{AB}$

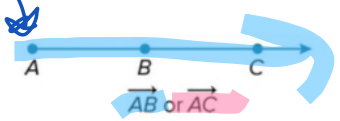
Learn
Angles

endpoint

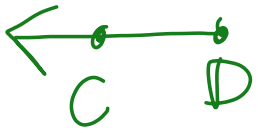
Lines and portions of lines intersect to form angles.

extends forever in one direction

A **ray** is the part of a line consisting of a point on the line, called the *endpoint of the ray*, together with all of the collinear points on one side of the endpoint.



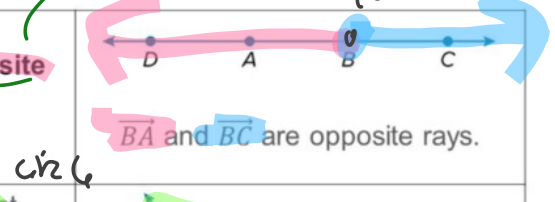
Rays are named by stating the endpoint first and then another point on the ray.



$\overrightarrow{DC}$

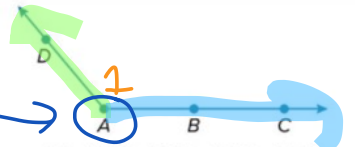
Learn
Angles

Two collinear rays with a common endpoint are **opposite rays**. Opposite rays form a **straight angle**, which has a measure of 180°.



$\overrightarrow{BA}$ and $\overrightarrow{BC}$ are opposite rays.

An **angle** is a pair of rays that have a common endpoint.



∠A, ∠DAB, ∠DAC, ∠CAD, ∠BAD

line (common (same) endpoint

360°

half a circle

Point A (Vertex)

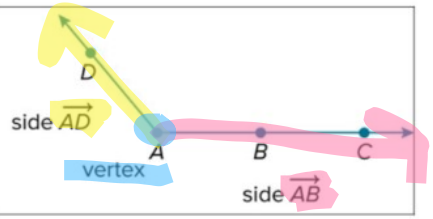
(vertex)

m∠A m∠1

$\overrightarrow{AD}$ 1

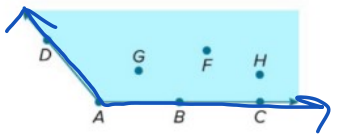
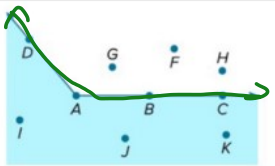
$\overrightarrow{AB}$ 1

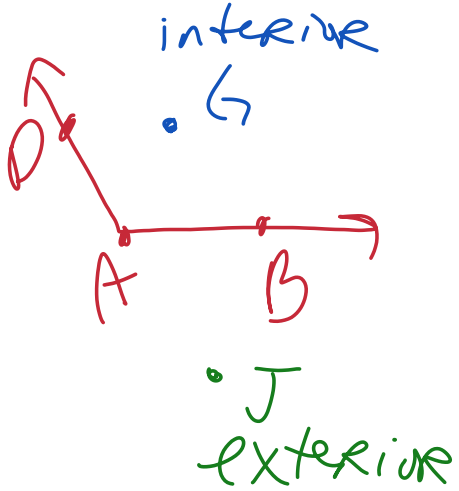
Learn
Angles

The rays are called **sides** of the angle. The common endpoint is the **vertex**.	

Learn
Angles

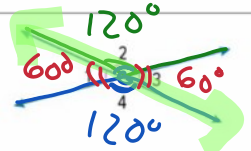
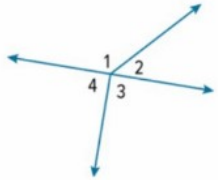
An angle divides a plane into three distinct parts.

Points *D*, *A*, *B*, and *C* lie on the angle. Points *G*, *F*, and *H* lie in the **interior** of the angle. inside	
Points *I*, *J*, and *K* lie in the **exterior** of the angle. Outside	

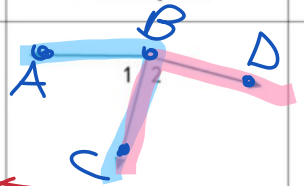
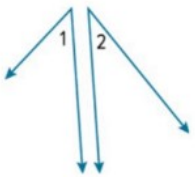


Learn
Special Angle Pairs

≅ congruent (same) (equal)

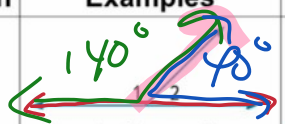
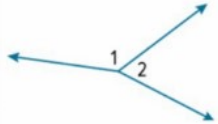
Special Angle Pairs		
Special Angle Pair Definition	**Examples**	**Nonexamples**
Vertical angles are the two nonadjacent angles formed by two intersecting lines. Vertical angles are congruent. equal	 ∠1 and ∠3 are vertical angles. ∠2 and ∠4 are vertical angles.	

Learn
Special Angle Pairs

Special Angle Pairs		
Special Angle Pair Definition	**Examples**	**Nonexamples**
Adjacent angles are two angles that lie in the same plane, have a common vertex and a common side, but have no common interior points.	 ∠1 and ∠2 are adjacent angles.	

Learn

Special Angle Pairs

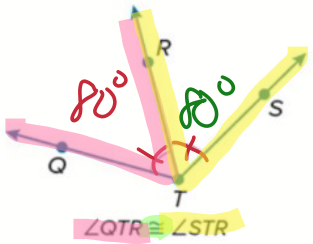
Special Angle Pairs		
Special Angle Pair Definition	**Examples**	**Nonexamples**
A **linear pair** is a pair of adjacent angles with noncommon sides that are opposite rays.	 ∠1 and ∠2 are a linear pair.	
The sum of the angle measures is 180°.		

line

not a straight line doesn't = 180

Learn
Congruent Angles

The measure of an angle is the measure in degrees of the space between the sides of the angle. Angles that have the same measure are **congruent angles**. Congruent angles are indicated on the figure by a matching number of arcs.



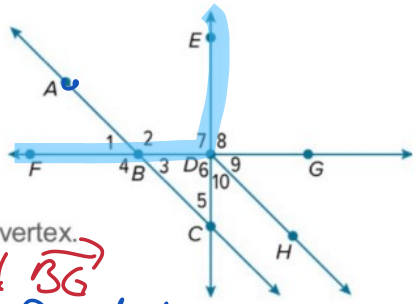
equal
same

$\overline{AM} \cong \overline{MB}$

M is midpoint

Example 1
Identify Angles

Use the figure to identify the angles or parts of angles that satisfy each given condition.



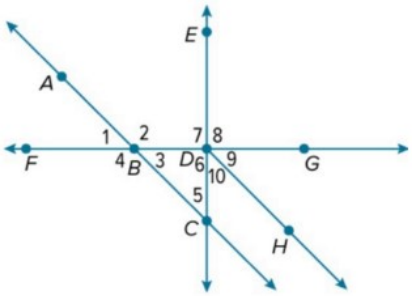
a. Name all the angles that have *D* as a vertex.

b. Name the sides of ∠2.

c. Name a point in the interior of ∠*FDE*.

d. Name all of the points in the exterior of ∠*FDE*.

Example 1
Identify Angles



a. Name all the angles that have *D* as a vertex.

∠*EDF*, ∠*EDG*, ∠*FDC*, ∠*GDC*, ∠*EDH*, ∠*EDC*, ∠*GDF*, ∠*GDH*, ∠*CDH*, ∠*FDH*

b. Name the sides of ∠2.

$\overrightarrow{BA}$ and $\overrightarrow{BG}$

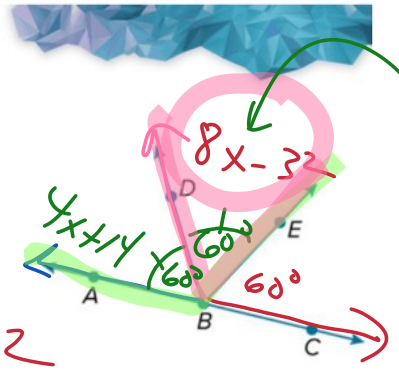
c. Name a point in the interior of ∠*FDE*. *A*

d. Name all of the points in the exterior of ∠*FDE*. *C*, *H*, and *G*

Example 2
Congruent Angles and Angle Bisectors

line
180°

In the figure, $\overrightarrow{BA}$ and $\overrightarrow{BC}$ are opposite rays and $\overrightarrow{BD}$ bisects $\angle ABE$. If $m\angle ABD = (4x + 14)°$ and $m\angle DBE = (8x - 32)°$, find $m\angle DBE$.



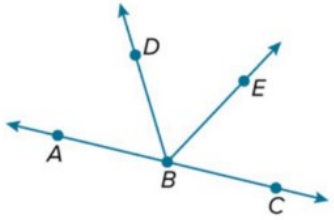
$4x+14 = 8x-32$
$+32 \quad +32$
$4x+46 = 8x$
$-4x \quad -4x$
$46 = 4x$
$\frac{46}{4} = \frac{4x}{4}$
$x = 11.5$

$\angle ABD \cong \angle EBD$

$8(11.5) - 32$
$92 - 32$
$60°$

Example 2
Congruent Angles and Angle Bisectors

We can solve for this in two steps. First, solve for x. Then find $m\angle DBE$.



Step 1 Solve for x.

Because $\overrightarrow{BD}$ bisects $\angle ABE$, $\angle ABD \cong \angle DBE$. By the definition of congruence, the measures of these angles are equal.

Example 2
Congruent Angles and Angle Bisectors

$m\angle ABD = m\angle DBE$	Definition of congruent angles
$(4x + 14)° = (8x - 32)°$	Substitution
$14° = 4x° - 32°$	Subtract $4x°$ from each side.
$46° = 4x°$	Add 32° to each side.
$11.5 = x$	Divide each side by 4°.

Example 2
Congruent Angles and Angle Bisectors

Step 2 Find the angle measure.

Because we are asked to find $m\angle DBE$, we substitute 11.5 for x in the expression.

$m\angle DBE = (8x - 32)°$ Given

$= [8(11.5) - 32]°$ Substitute.

$= 92° - 32°$ or $60°$ Simplify.

$m\angle DBE = 60°$