Module 8a: Transversals & the Parallel Postulate

Math Practice(s):

-Construct viable arguments & critique the reasoning of others.

-Model with mathematics.

Learning Target(s):

-Understand theorems related to the parallel postulate.

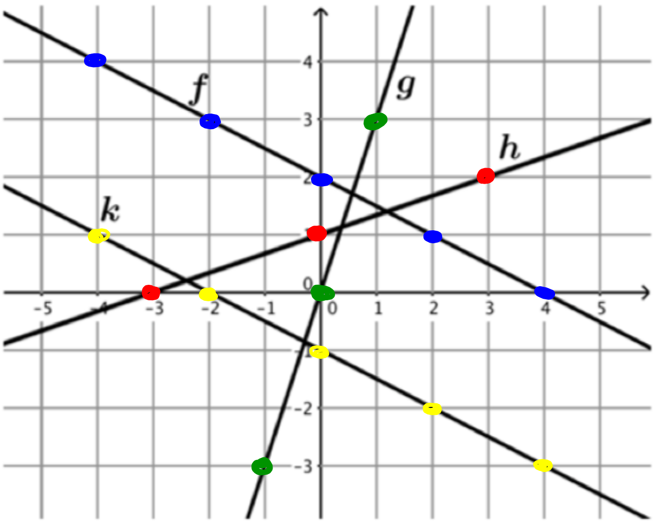
Homework:

HW#12: 8a #1-10

Warm-up

1. The graphs of four linear functions are shown in the coordinate plane below.

A. State the slope of each function.



slope of ***f***: $-\frac{1}{2}$

slope of ***g***: 3

slope of ***h***: $\frac{1}{3}$

slope of ***k***: $-\frac{1}{2}$

B. State which two functions have graphs that do NOT intersect ***and*** describe what you notice about the slopes of these lines.

Lines k & f do not intersect, & they have the same slope.

(erase to show)

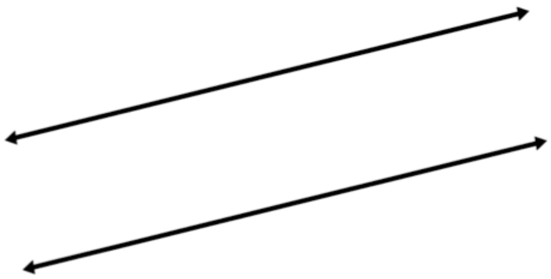
Parallel Lines in the Coordinate Plane

Two distinct lines in the coordinate plane are *parallel* if they have the same slope.

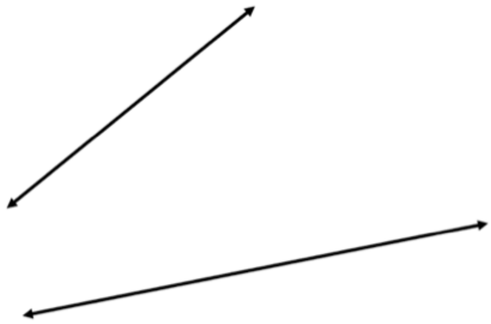
- Any two distinct vertical lines are parallel (i.e., they both have slope values that are undefined).

If we are given two lines that are ***not*** *in the coordinate plane*, how can we tell if they are parallel?

For example, why are these lines parallel…



while these lines are not?



lines should be at the "same angle"

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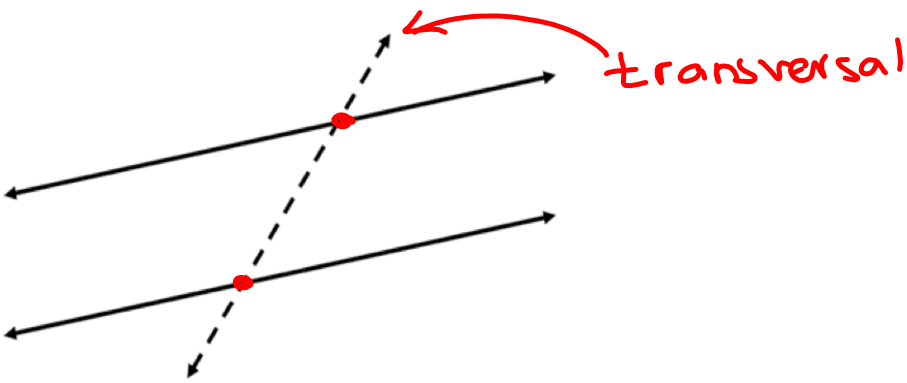
Transversal

Given two lines in a plane, a transversal is a line that intersects both of those lines at two distinct points.



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Example 1:

In the diagram below, $\overline{AB} \parallel \overline{CD}$, and $\overline{FE}$ is a transversal. Use a protractor to find the angle measures.

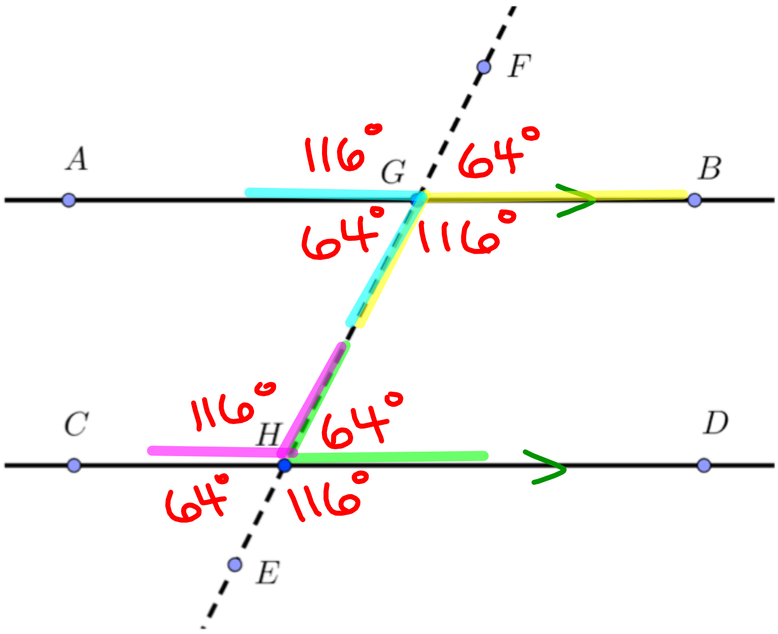
Angles involving $\overline{AB}$:

$m\angle AGF$ = ~~115°~~ 116°

$m\angle FGB$ = ~~63°~~ 64°

$m\angle AGH$ = ~~63°~~ 64°

$m\angle BGH$ = 116°



Angles involving $\overline{CD}$:

$m\angle CHG$ = 116°

$m\angle GHD$ = 64°

$m\angle CHE$ = ~~65°~~ 64°

$m\angle DHE$ = 116°

What do you notice about all of the angle measures you just determined? List as many *unique* pairs of congruent and supplementary angles as you can find.

Congruent		Supplementary	
∠AGF ≅ ∠BGH	∠BGH ≅ ∠CHG	∠AGF & ∠FGB	∠CHG & ∠GHD
∠AGF ≅ ∠CHG	∠BGH ≅ ∠DHE	∠AGF & ∠AGH	∠CHG & ∠CHE
∠AGF ≅ ∠DHE	∠AGH ≅ ∠GHD	∠AGF & ∠GHD	∠DHE & ∠GHD
∠FGB ≅ ∠AGH	∠AGH ≅ ∠CHE	∠AGF & ∠CHE	∠DHE & ∠CHE
∠FGB ≅ ∠GHD	∠CHG ≅ ∠DHE	∠BGH & ∠FGB	
∠FGB ≅ ∠CHE	∠GHD ≅ ∠CHE	∠BGH & ∠AGH	
		∠BGH & ∠GHD	
		∠BGH & ∠CHE	

Analyze each of the following pairs of angles that you measured in the diagram on the previous page:

- Compare $m\angle BGH$ and $m\angle GHD$

  They are supplementary

- Compare $m\angle AGH$ and $m\angle GHC$

  They are also supplementary

(erase to show)

The Parallel Postulate

Two lines are parallel if and only if, when they are cut by a transversal, the measure of **two interior angles on the same side of the transversal add up to** 180° (aka same-side interior angles).

(supplementary)

- This is known as the *Parallel Postulate* and is one of Euclid's Five Postulates for Geometry.

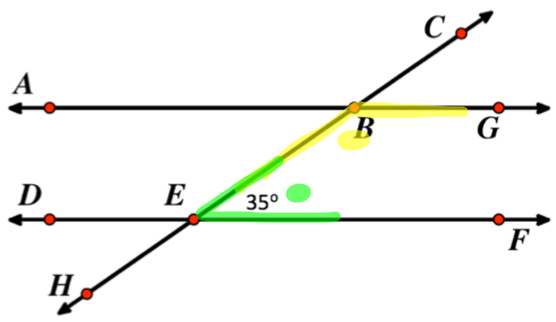
Example 2: Given $\overline{AG} \parallel \overline{DF}$, find $m\angle EBG$ and $m\angle BED$.

$\angle BED$ & $\angle BEF$ are linear pairs so they are supplementary.

$m\angle BED + m\angle BEF = 180°$

$m\angle BED + \cancel{35} = 180$
$\quad - 35 \qquad -35$

$\boxed{m\angle BED = 145°}$



$\angle EBG$ & $\angle BEF$ are same side interior $\angle$s, so they are supplementary

$m\angle EBG + m\angle BEF = 180° \longrightarrow \boxed{m\angle EBG = 145°}$

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****Linear Pair (#VOC):** Two adjacent angles that form a straight angle.

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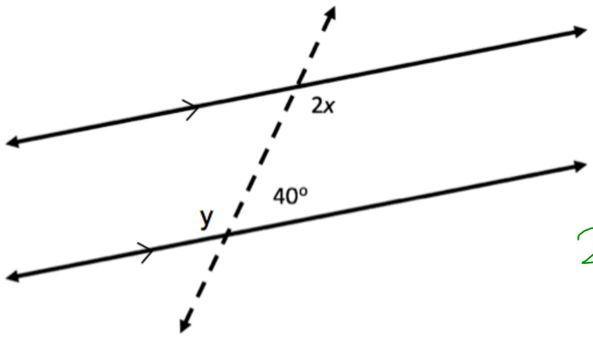
Example 3: Find the value of *x* and *y*.

A.



$y + \cancel{40} = 180$ (linear pairs are supp.)

$\quad -\cancel{40} \quad -40$

$\boxed{y = 140°}$

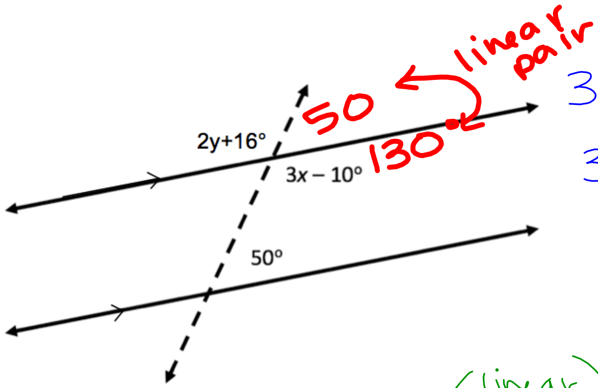
$2x + \cancel{40} = 180$ (same side int ∠'s are supp.)

$\quad -\cancel{40} \quad -40$

$\frac{\cancel{2}x}{\cancel{2}} = \frac{140}{2}$

$\boxed{x = 70}$

B.



$3x - 10 + 50 = 180$ (ss int ∠s are supp.)

$3x + \cancel{40} = 180$

$\quad -\cancel{40} \quad -40$

$\frac{\cancel{3}x}{\cancel{3}} = \frac{140}{3}$

$\boxed{x = \frac{140}{3} \approx 46.7}$

$2y + 16 + 50 = 180$ (linear pairs supp)

$2y + 16 = 130$

$2y = 114$

$\boxed{y = 57}$