Name: ________________________________

Geometry

Unit 3: Parallel and Perpendicular Lines

<u>Priority Standard:</u> G-CO.9: Prove theorems about lines and angles

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Unit "I can" statements:

1. I can identify corresponding, alternating interior, alternate exterior and consecutive interior angles using parallel lines and a transversal.
2. I can apply the relationships between corresponding, alternating interior, alternate exterior and consecutive interior angles to find unknown angle measures.
3. I can use angle relationships to prove that lines are parallel.
4. I can prove lines perpendicular and parallel.
5. I can find slopes given a graph or two ordered pair.
6. I can identify parallel and perpendicular slopes.
7. I can find equations of lines in slope-intercept form.

Common Core State Standards that are addressed in this unit include:
For more information see www.corestandards.org/Math/

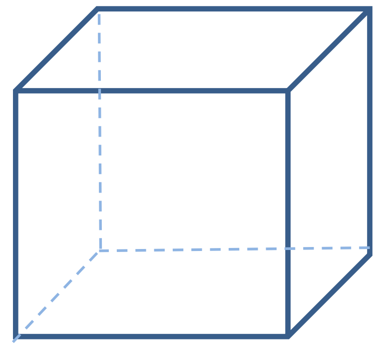
Chapter 3.1: Identify Pairs of Lines

Chapter 3.2: Identify Pairs of Angles using Parallel Lines and Transversals

Objectives:

1. I can identify corresponding, alternating interior, alternate exterior and consecutive interior angles using parallel lines and a transversal.
2. I can apply the relationships between corresponding, alternating interior, alternate exterior and consecutive interior angles to find unknown angle measures.

Definitions:



Perpendicular Lines: two lines that intersect to form a ________________________.

Symbols:

Parallel Lines: two lines that do not ___________________ and are ________________________.

Symbols:

Parallel Planes: two planes that do not ________________________.

Skew Lines: two lines that do not ___________________ and are not ________________________.

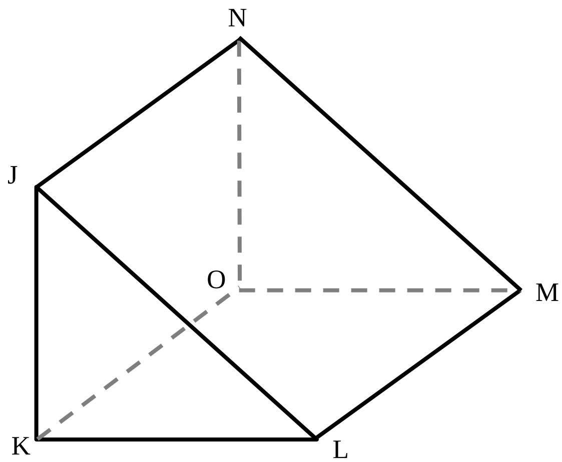
Parallel Postulate #13:

Given a line and a point not on the line, then there is exactly one line through the point _____________________ to the given line.

Perpendicular Postulate #14:

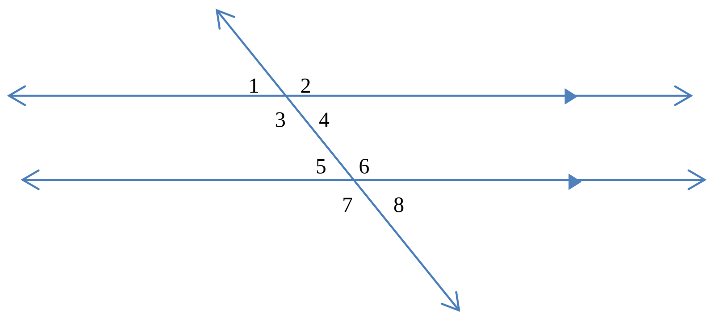
Given a line and a point not on the line, then there is exactly one line through the point _____________________ to the given line.

Example #1: Which line(s) or planes(s) in the figure appear to fit the description?



1. Parallel to $\overleftrightarrow{MN}$ and contains J
2. Skew to $\overleftrightarrow{MN}$ and contain J
3. Perpendicular to $\overleftrightarrow{MN}$ and contains J
4. Name the plane that contains J and appears to be parallel to plane MNO
5. Name the plane that contains J and appears to be perpendicular to plane MNO

______________________: a line that intersects two or more coplanar line at different points



Corresponding Angles: two angles in the ___________ location, matching corners.

Examples:

Corresponding Angles (Postulate 15):

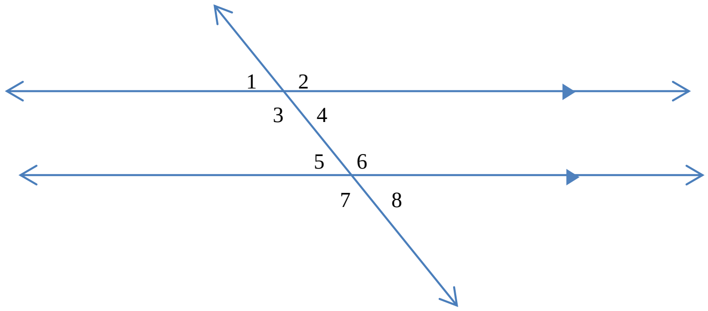
If two parallel lines are cut by a ___________________, then the pairs of **corresponding angles** are __________________.

Alternate Interior Angles: two angles that lie on either side of the ________________ in between the other two lines

Examples:

Alternate Interior Angles (Theorem 3.1):

If two parallel are cut by a ___________________, then the pairs of **alternate interior angles** are __________________.



Alternate Exterior Angles: two angles that lie on either side of the _________________ on the _________________ of the other two lines.

Examples:

Alternate Exterior Angles (Theorem 3.2):

If two parallel lines are cut by a ____________________, then the pairs of **alternate exterior angles** are ___________________.

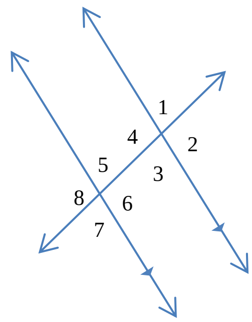
Consecutive Interior Angles: two angles on the ____________ side of the __________________ in between the other two line.

Examples:

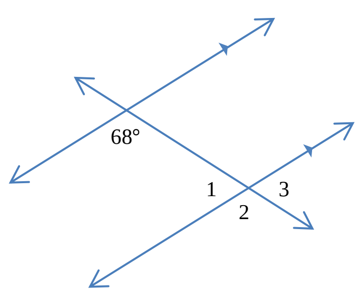
Consecutive Interior Angles (Theorem 3.3):

If two parallel lines are cut by a ____________________, then the pairs of **consecutive interior angles** are ___________________.

Example #2: If m∠7 = 75°, identify three other angles that also are 75°. Tell which postulate or theorem you use in each case.

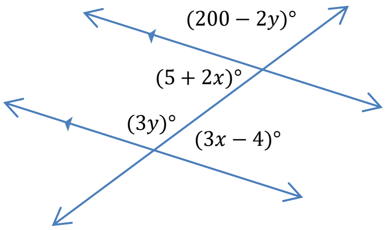


Example #2: Find m∠1 and m ∠2. Explain your reasoning.

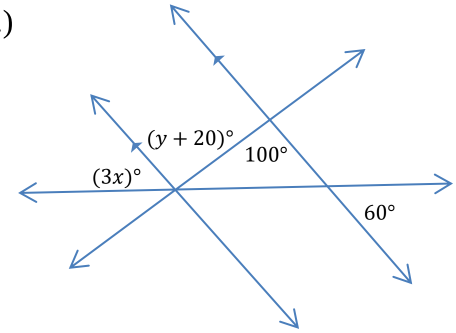


Example #3: Find the values of *x* and *y*.

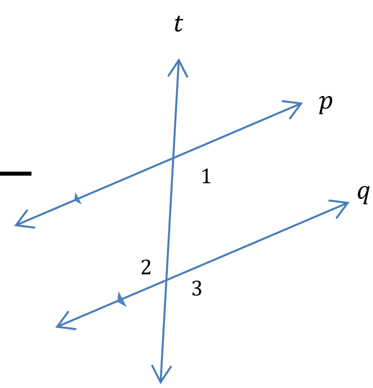
a.)



b.)

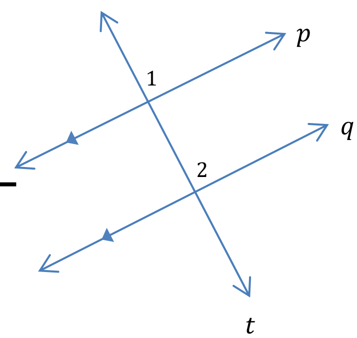


Example #4: **Given:** Two parallel lines $p \parallel q$ are cut by a transversal, *t*.
Prove: The Alternate Interior Angles Theorem: $\angle 1 \cong \angle 2$



Statement	Reason
1. ______________________	1. ______________________
2. ______________________	2. Corresponding Angles Postulate
3. $\angle 3 \cong \angle 2$	3. ______________________
4. ______________________	4. ______________________

Example #5: **Given:** $p \perp t$ and $p \parallel q$
Prove: $q \perp t$



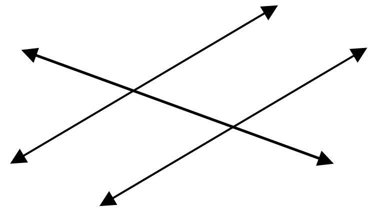
Statement	Reason
1. $p \perp t$	1. ______________________
2. $\angle 1$ is a right angle	2. ______________________
3. ______________________	3. Definition of a Right Angle
4. ______________________	4. Given
5. $\angle 1 \cong \angle 2$	5. ______________________
6. ______________________	6. Definition of Congruent Angles
7. ______________________	7. Transitive Property of Equality
8. $\angle 2$ is a right angle	8. ______________________
9. ______________________	9. ______________________

Chapter 3.3: Prove Lines are Parallel

Objective: I can use angle relationships to prove that lines are parallel

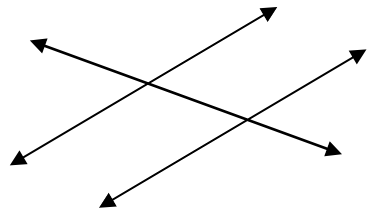
Corresponding Angles Converse (Postulate 16):

If two lines are cut by a transversal so the **Corresponding Angles** are ________________, then the lines are ________________.



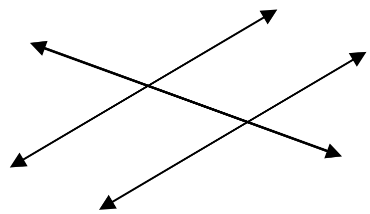
Alternate Interior Angles Converse (Theorem 3.4):

If two lines are cut by a transversal so the **Alternate Interior Angles** are ________________, then the lines are ________________.



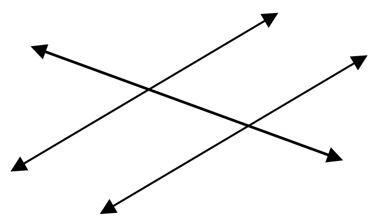
Alternate Exterior Angles Converse (Theorem 3.5):

If two lines are cut by a transversal so the **Alternate Exterior Angles** are ________________, then the lines are ________________.



Consecutive Interior Angles Converse (Theorem 3.6):

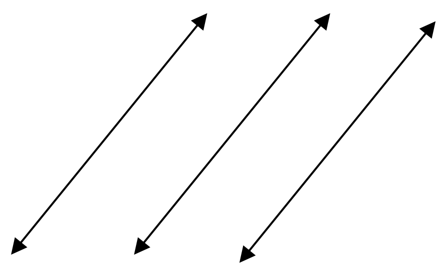
If two lines are cut by a transversal so the **Consecutive Interior Angles** are ________________________, then the lines are ________________.



Transitive Property of Parallel Lines (Theorem 3.7):

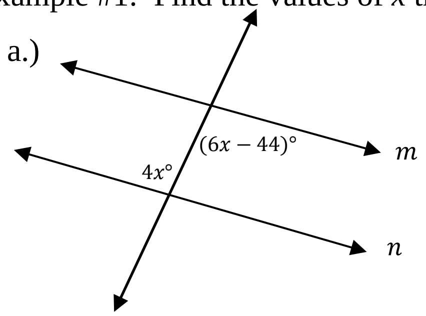
If two lines are parallel to the same line, the they are also.

____________________________________.



Example #1: Find the values of x that makes $m \parallel n$.

a.)



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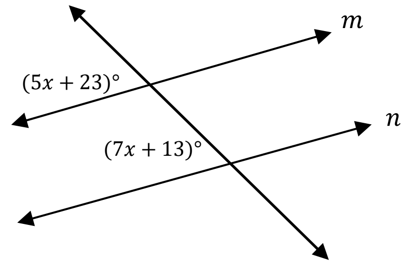
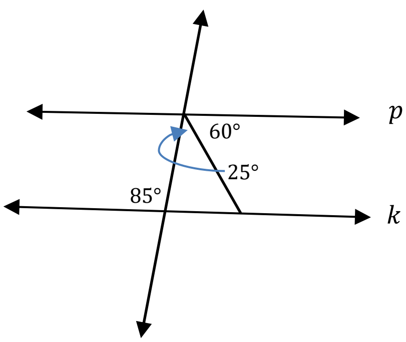
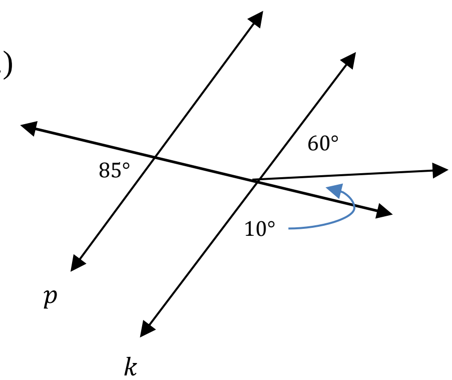


Example #2: Is it possible to prove that line p and k are parallel? If so, state the postulate or theorem you would use.

a.)

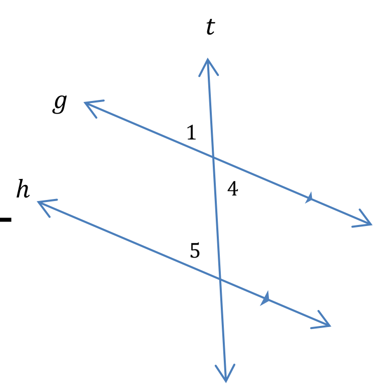


b.)



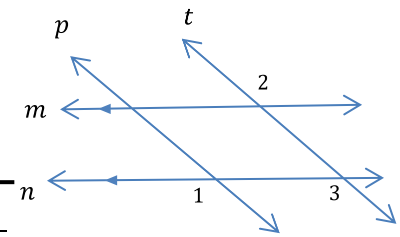
Example #3: **Given:** $\angle 4 \cong \angle 5$

Prove: The Alternate Interior Angles Converse: $g \parallel h$



Statement	Reason
1. ______________________	1. ______________________
2. ______________________	2. ______________________
3. $\angle 1 \cong \angle 5$	3. ______________________
4. ______________________	4. ______________________

Example #4: **Given:** $\angle 1 \cong \angle 2, n \parallel m$
Prove: $p \parallel t$



Statement	Reason
1. ____________________	1. ____________________
1. ____________________	
2. $\angle 2 \cong \angle 3$	2. ____________________
3. ____________________	3. ____________________
4. ____________________	4. ____________________

Chapter 3.6: Prove Theorems about Perpendicular Lines

Objective: I can prove lines perpendicular and parallel.

Congruent Linear Pair Theorem (Theorem 3.8):

If two lines intersect to form a linear pair of congruent angles,

then the lines are ____________________ .

Perpendicular Lines-Right Angles Theorem (Theorem 3.9):

If two lines are perpendicular, then they intersect to form

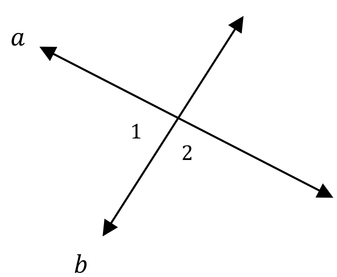
________________________________ .

Complementary Adjacent Acute Angles Theorem (Theorem 3.10):

If two sides of two adjacent acute angles are perpendicular,

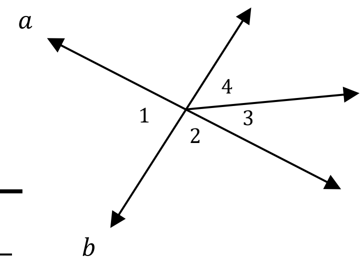
then the angles are ________________________ .

Example #1: In the diagram, $\angle 1 \cong \angle 2$. What can you say about a and b?



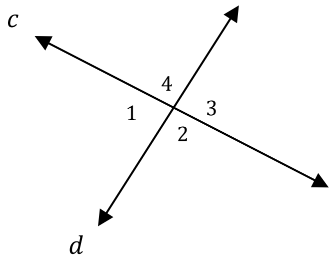
Example #2: **Given:** $\angle 1 \cong \angle 2$.

Prove: $\angle 3$ and $\angle 4$ are complementary angles



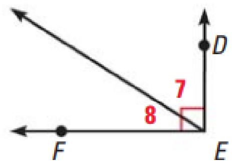
Statement	Reason
1. ____________________	1. ____________________
2. ____________________	2. ____________________
3. ____________________	3. ____________________

Example #3: If $c \perp d$, what do you know about the sum of the measures of $\angle 3$ and$\angle 4$? Explain.



Example #4: **Given:** $\overrightarrow{ED} \perp \overrightarrow{EF}$

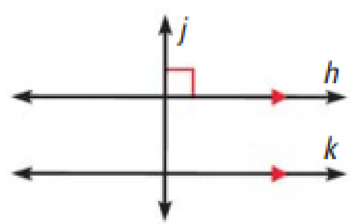
Prove: $\angle 7$ and $\angle 8$ are complementary angles



Statement	Reason
1. ____________________	1. ____________________
2. ____________________	2. ____________________
3. ____________________	3. ____________________
4. ____________________	4. ____________________
5. ____________________	5. ____________________
6. ____________________	6. ____________________

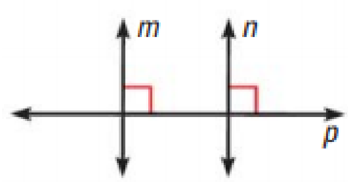
Perpendicular Transversal Theorem (Theorem 3.11):

If a transversal is ______________________________ to one of two parallel lines, the it is perpendicular to the other.

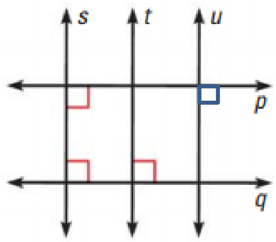


Lines Perpendicular to a Transversal Theorem (Theorem 3.12):

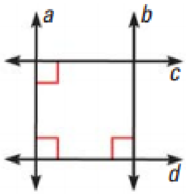
In a plane, if two lines are perpendicular to the same line, then they are ____________________________________ .



Example #5: Determine which lines, if any, must be parallel in the diagram. Explain your reasoning.



Example #6: Is $b \parallel a$? Is $b \perp c$? Explain your reasoning.



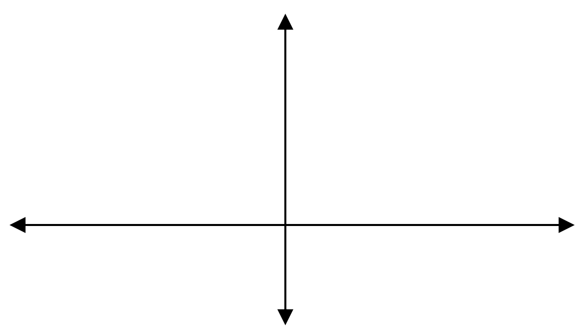
Chapter 3.4: Find and Use Slopes of Lines

<u>Objective:</u> I can find slopes given a graph or two ordered pair.
I can identify parallel and perpendicular slopes.

Slope:

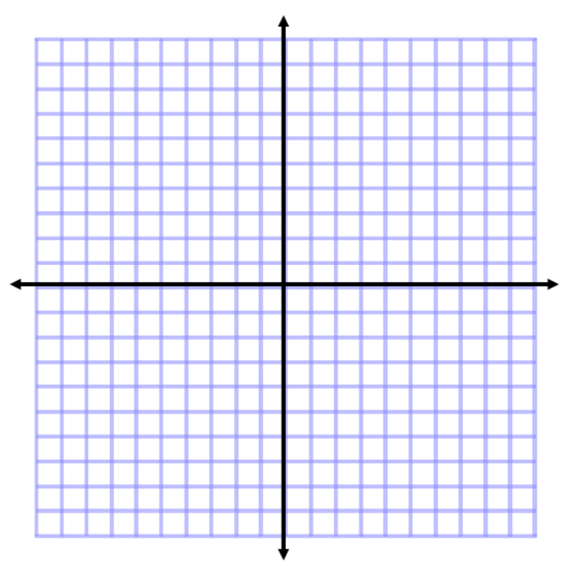
The ______________ of a non-vertical line is the ratio of vertical (____________) to horizontal change (____________) between any two points on the line.

If a line in the coordinate plane passes through points (___, ___) and (___, ___) then the slope *m* is

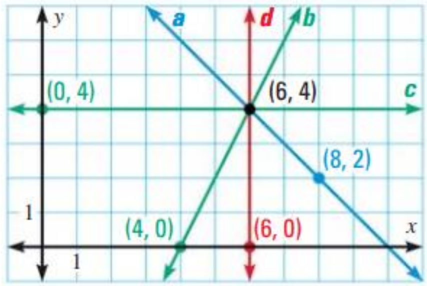


Slope of Lines in the Coordinate Plane:

1. Negative Slope: _____________________________
____
2. Positive Slope: _____________________________
____
3. Zero Slope: ________________________________
____
4. Undefined Slope: ___________________________
____



Example #1: Find the slope of lines *a*, *b*, *c* and *d*.



Example #2: Determine the slope of the line that passes through the given points

a.) (5, -3) and (10, 4)

b.) (-4, 3) and (-4, -5)

c.) (6, 3) and (3, 3)

Slopes of Parallel Lines (Postulate 17):

In a coordinate plane, two non-vertical lines are parallel ______ they have the ____________________________.

Example:

Slopes of Perpendicular Lines (Postulate 18):

In a coordinate plane, two non-vertical lines are perpendicular ______ their slopes are ______________________ ___________________________________.

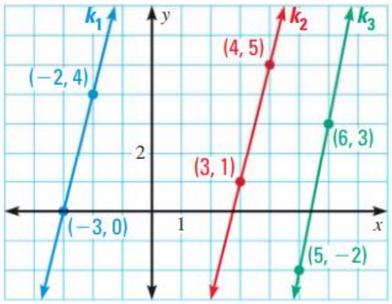
Example:

Example #3: Given the line $y = -\frac{2}{3}x + 5$

What is the slope of a line that is perpendicular to this line?

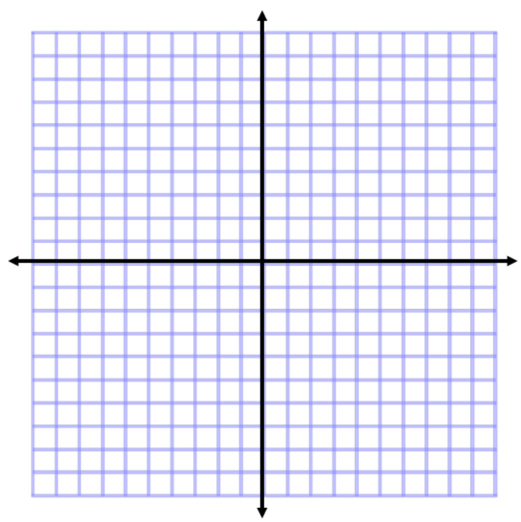
What is the slope of a line that is parallel to this line?

Example #4: Find the slope of each line. Which lines are parallel?



Example #5: Line *c* passes through (2, -2) and (5, 7). Line *d* passes through (-3, 4) and (1, -8). $c \parallel d$? Explain how you know.

Example #6: Line *h* passes through (1, -2) and (5, 6). Graph the line perpendicular to *h* that passes through the point (2, 5).



Example #7: Line *n* passes through (1, 6) and (8, 4). Line *m* passes through (0, 5) and (2, 12). Is $n \perp m$? Explain.

Chapter 3.5: Writing and Graphing Equations

Objective: I can find equations of lines in slope-intercept form.

Linear Equations

Slope-Intercept Form:

Standard Form:

x-intercept:

y-intercept:

The two things you need to know or find to make an equation of a line are:

________________ and at least one _____________

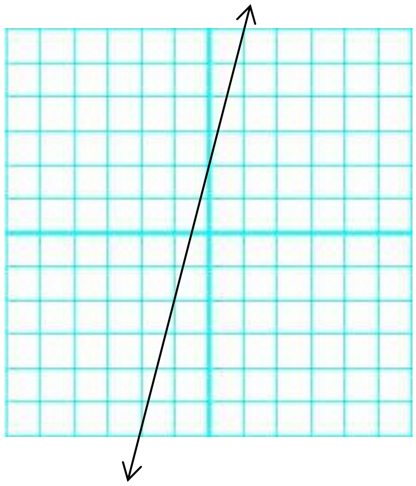
Example #1. Given: slope and y-intercept- Find the equation of a line in slope-intercept form with the slope $-\frac{2}{5}$ and y-intercept 9.

Example #2. Given: slope and a point- Find the equation of a line in slope-intercept form that passes through P (3, -2) and has the slope $m = -2$.

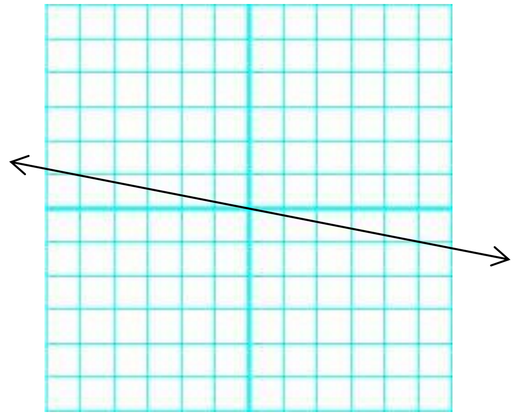
Example #3. Given: two points- Find the equation of a line in slope-intercept form that passes through (0, 3) and (2, -1).

Example #4: Given: a graph- Write an equation of the line in the graph

a.)

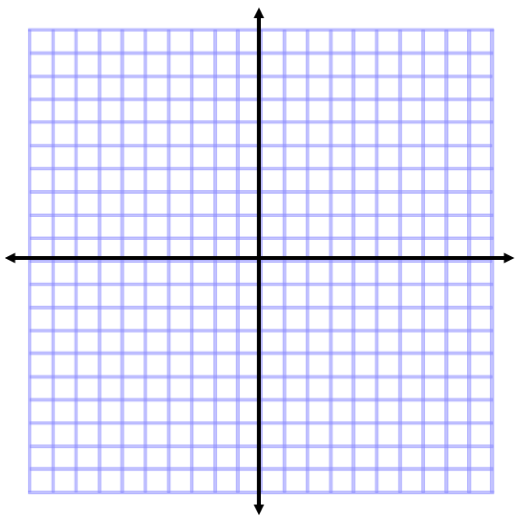


b.)

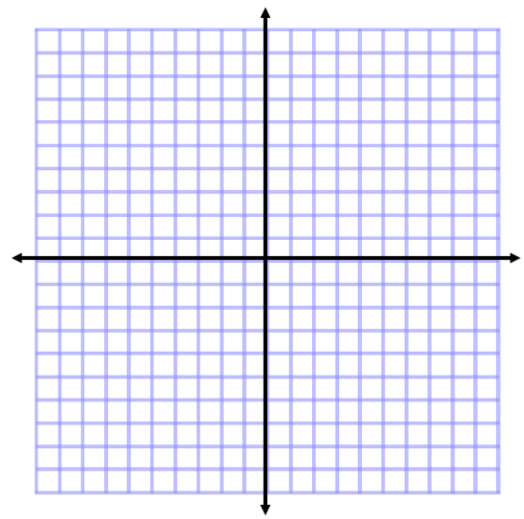


Example #5: Graph the following equations.

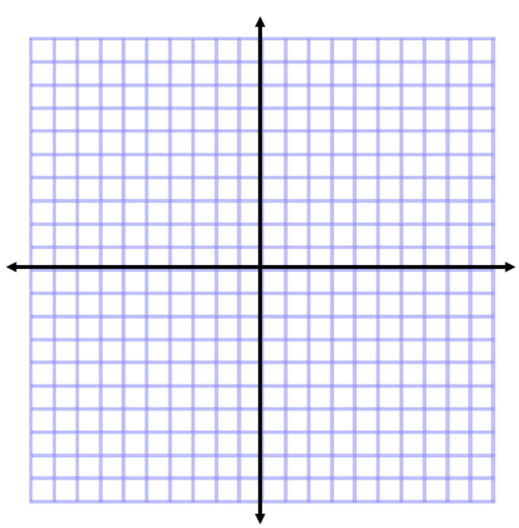
a.) $y = \frac{2}{3}x - 7$



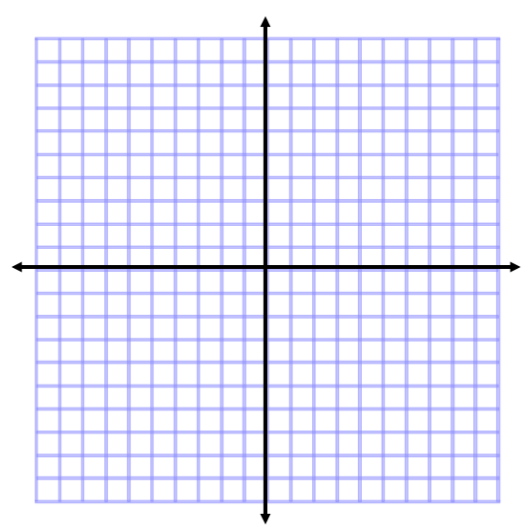
b.) $y = 2x - 3$



c.) $2x - 3y = 6$

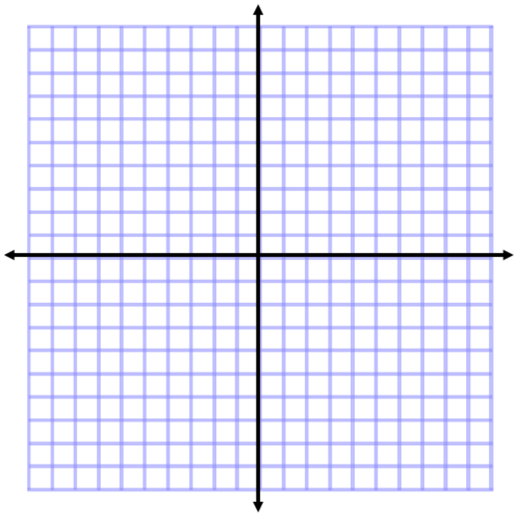


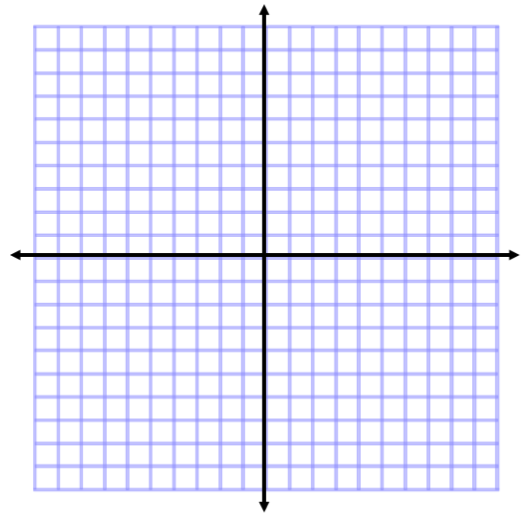
d.) $8x - 2y = 6$



e.) $x - 2 = 4$

f.) $y = -4$





Review #1: Given the line $y = -\frac{2}{7}x + 6$

What is the slope of a line that is <u>perpendicular</u> to this line?

What is the slope of a line that is <u>parallel</u> to this line?

Review #2: Given the line $y = 5x - 1$

What is the slope of a line that is <u>perpendicular</u> to this line?

What is the slope of a line that is <u>parallel</u> to this line?

Example #6: Write an equation in slope-intercept form of the line passing through the point (8, -5) that is **<u>parallel</u>** to the line with the equation $y = -\frac{3}{2}x - 5$

Example #7: Write an equation in slope-intercept form of the line passing through the point (-8, -2) that is **perpendicular** to the line with the equation $y = 4x + 3$

Example #8: Find equations in slope-intercept form of the lines that go through point $P(12, -5)$ and are parallel and perpendicular to line L

L: $y = \frac{3}{4}x + 2$

Parallel Line:

Perpendicular Line: