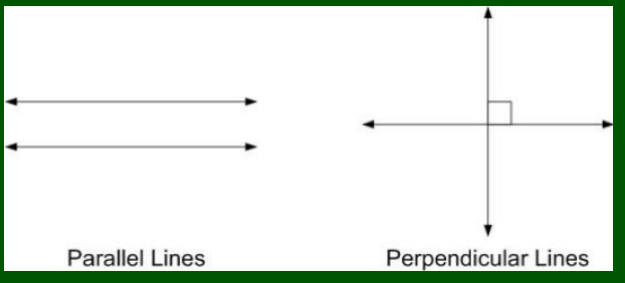
6.4 Parallel and Perpendicular Lines

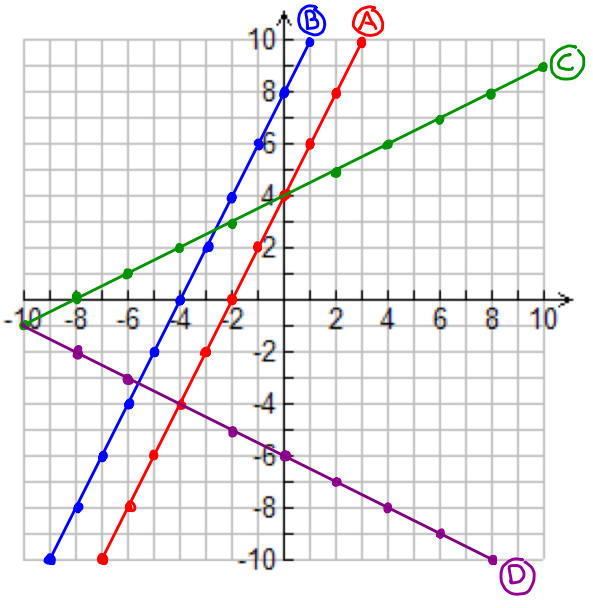
Parallel Lines – lines in the same plane that never meet.
Perpendicular Lines – Two lines that cross at 90 degrees.



DO IT NOW!

Instructions: Draw and label each of the following lines on the grid below:

(A) y = 2x + 4 (B) y = 2x + 8 (C) $y = \frac{1}{2}x + 4$ (D) $y = -\frac{1}{2}x - 6$



1) Which lines are parallel?

Lines A and B are parallel

2) What do you notice about the slopes of lines that are parallel?

They are equivalent (the same)

3) Which lines are perpendicular?

Line D is perpendicular to A and B

4) What do you notice about the slopes of lines that are perpendicular?

They are negative reciprocals of each other.

(the slopes have been "flipped" and the sign is changed)

5) What is the product of the perpendicular slopes?

$2\left(\frac{-1}{2}\right) = \frac{-2}{2} = -1$

Perpendicular slopes always have a product of -1.

6) Does the y-intercept matter when deciding if two lines are parallel or perpendicular?

NO, only the slopes matter.

Consolidation:

Parallel lines will have EQUIVALENT slopes.

Perpendicular lines will have slopes that are NEGATIVE RECIPROCALS. Their product is -1.

Example 1:

a) The equation of a line is $y = 3x - 4$. What is the slope of a line that is parallel to this line?

$m = 3$

b) The equation of a line is $y = -x + 15$. What is the slope of a line that is parallel to this line?

$m = -1$

c) The equation of a line is $y = 2x + 1$. What is the slope of a line that is perpendicular to this line?

$m = 2$; $\perp m = -\frac{1}{2}$

d) The equation of a line is $y = \frac{3}{5}x + 2$. What is the slope of a line that is perpendicular to this line?

$m = \frac{3}{5}$; $\perp m = -\frac{5}{3}$

e) The equation of a line is $y = -\frac{1}{7}x - \frac{3}{7}$. What is the slope of a line that is perpendicular to this line?

$m = -\frac{1}{7}$; $\perp m = \frac{7}{1} = 7$

Example 2: The slopes of two lines are given. Determine whether the lines are parallel, perpendicular or neither.

a) $m = 3, m = -\frac{1}{3}$

$3\left(-\frac{1}{3}\right) = \frac{-3}{3} = -1$

∴ Perpendicular

b) $m = 5, m = -5$

Neither

c) $m = 6, m = \frac{1}{6}$

Neither

d) $m = -2, m = -2$

Parallel

Example 3:

a) Determine the slope of a line that is parallel to the line $2x - 3y - 6 = 0$.

$2x - 3y - 6 = 0$

$-3y = -2x + 6$

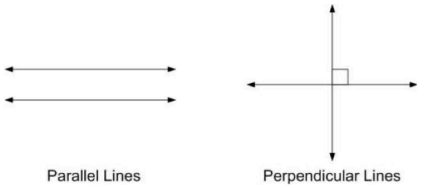
$y = \frac{2}{3}x - 2$

$m = \frac{2}{3}$

b) Determine the slope of a line that is perpendicular to the line $2x - 3y - 6 = 0$.

$m = \frac{2}{3}$; $\perp m = -\frac{3}{2}$

Consolidate:



Parallel Lines Perpendicular Lines

a) Explain how you can determine if the two lines $3x-4y-12=0$ and $4x-3y-24=0$ are parallel, perpendicular or neither.

- Rearrange into slope intercept form ($y=mx+b$)
- Parallel if slopes are the same
- Perpendicular if slopes are negative reciprocals

b) Determine if the two lines $3x-4y-12=0$ and $4x-3y-24=0$ are parallel, perpendicular or neither.

$3x-4y-12=0$

$-4y=-3x+12$

$y=\frac{3}{4}x-3$

$m=\frac{3}{4}$

$4x-3y-24=0$

$-3y=-4x+24$

$y=\frac{4}{3}x-8$

$m=\frac{4}{3}$

The lines are neither parallel or perpendicular