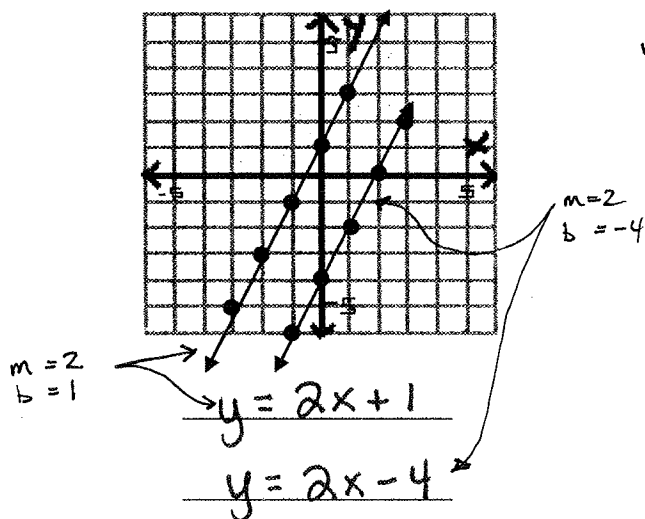


Directions: Copy all notes into your notebook and do the Understanding Checks.

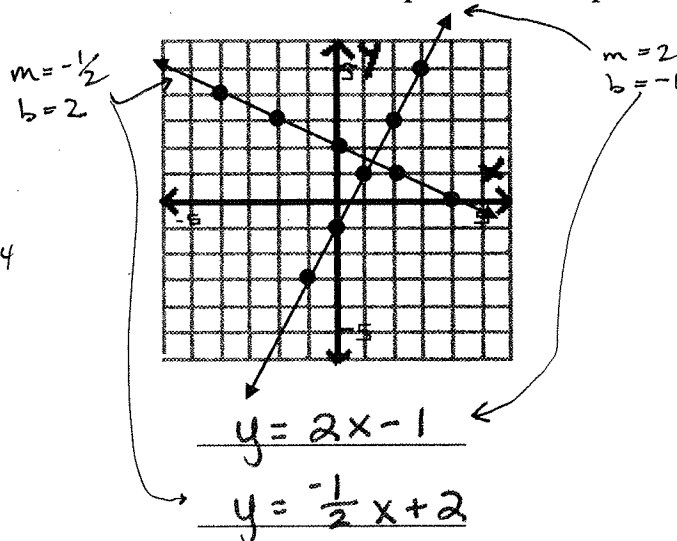
# 5-5 Parallel and Perpendicular Lines (page 259)

Video Tutor Code: bae-0505

In the graph below, the lines are parallel. Write the equation of each line and compare their slopes.



In the graph below, the lines are perpendicular. Write the equation of each line and compare their slopes.



Slopes of Parallel Lines:  
slopes are the same

Slopes of Perpendicular Lines:  
slopes are reciprocal and opposite signs.

## Understanding Check:

Circle the line that is parallel to the given line:

a.  $y=3x+5$

a.  $y=3x-2$

b.  $y=-\frac{1}{3}x-1$

c.  $y=-3x+5$

d.  $y=\frac{1}{3}x+5$

b.  $y=\frac{1}{2}x+4$

a.  $y=2x-4$

b.  $y=-\frac{1}{2}x-1$

c.  $y=-2x+4$

d.  $y=\frac{1}{2}x+5$

Circle the line that is perpendicular to the given line:

a.  $y=3x+5$

a.  $y=3x-2$

b.  $y=-\frac{1}{3}x-1$

c.  $y=-3x+5$

d.  $y=\frac{1}{3}x+5$

b.  $y=-5x+5$

a.  $y=-5x-2$

b.  $y=-\frac{1}{5}x-1$

c.  $y=5x+1$

d.  $y=\frac{1}{5}x+3$

### Example 1: Determining Whether Lines Are Parallel

To determine if two lines are parallel from their equations, get both equations into the slope intercept form, then compare their slopes.

Are the graphs of  $y = -\frac{1}{3}x + 5$  and  $2x + 6y = 12$  parallel?

$$\begin{array}{c} \uparrow \\ m = \frac{1}{3} \end{array}$$

$$\begin{array}{r} 2x + 6y = 12 \\ \xrightarrow{-2x} \\ 6y = -2x + 12 \\ \xrightarrow{\div 6} \\ y = -\frac{2}{6}x + \frac{12}{6} \end{array}$$

$$y = -\frac{1}{3}x + 2$$

yes, the lines are parallel

$$\begin{array}{c} \uparrow \\ m = \frac{1}{3} \end{array}$$

### ✓ Understanding Check:

Decide if each set of lines are parallel or not.

a.  $y = -\frac{1}{2}x + 6$  and  $2x - 4y = 12$

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

$$\begin{array}{r} 2x - 4y = 12 \\ \xrightarrow{-2x} \\ -4y = -2x + 12 \\ \xrightarrow{\div -4} \\ y = \frac{1}{2}x - 3 \end{array}$$

b.  $-6x + 8y = -24$  and  $y = \frac{3}{4}x - 7$

\*No, not parallel!

$$y = \frac{1}{2}x - 3$$
$$m = \frac{1}{2}$$

### Example 2: Writing the Equations of Parallel Lines:

Write an equation for the line that contains (5, 1) and is parallel to  $y = \frac{3}{5}x - 4$

Step 1 Use the same slope for m.

Step 2 Substitute the point - slope formula.

Step 3 Solve for y.

$$\begin{array}{r} \boxed{m = \frac{3}{5}} \\ y - 1 = \frac{3}{5}(x - 5) \\ y - 1 = \frac{3}{5}x - 3 \\ \xrightarrow{+1} \\ y = \frac{3}{5}x - 2 \end{array}$$

### ✓ Understanding Check:

1. Write an equation for the line that contains (2, -6) and is parallel to

$$y = 3x + 9$$

$$\boxed{m = 3}$$

$$y - -6 = 3(x - 2)$$

$$y + 6 = 3x - 6$$

$$\begin{array}{r} y + 6 = 3x - 6 \\ \xrightarrow{-6} \\ y = 3x - 12 \end{array}$$

2. Write an equation for the line that contains (4, 3) and is parallel to

$$y = \frac{1}{2}x - 4$$

do this

do this

### Example 3: Determining Whether Lines Are Perpendicular

To determine if two lines are perpendicular from their equations, get both equations into the slope intercept form, then compare their slopes.

Are the graphs of  $y = \frac{1}{3}x + 4$  and  $3x + y = 7$  perpendicular?

Reciprocal

not opposite!

$$\begin{aligned} &\rightarrow -3x \\ &y = -3x + 7 \\ &m = -3 \end{aligned}$$

Yes, perpendicular

### ✓ Understanding Check:

Decide if each set of lines are perpendicular or not.

a.  $-6x + 8y = -24$  and  $y = \frac{4}{3}x - 7$

$$\begin{aligned} &\rightarrow +6x \\ &\frac{8y}{8} = \frac{6x - 24}{8} \\ &y = \frac{3}{4}x - 3 \end{aligned}$$

$$m = 4/3$$

No, not opposite signs!

b.  $y = 2x + 3$  and  $-6y - 3x = 12$

do this

### Example 4: Writing Equations for Perpendicular Lines (not in the book)

Write an equation for the line that contains (4, 2) and is perpendicular to  $y = -\frac{1}{3}x + 2$

Step 1 Change the given slope into its opposite sign and its reciprocal

$$m = -\frac{1}{3}$$

$$m = 3$$

Step 2 Use the point-slope formula.

$$\begin{aligned} y - 2 &= 3(x - 4) \\ y - 2 &= 3x - 12 \\ &\rightarrow +2 \\ y &= 3x - 10 \end{aligned}$$

Step 3 Solve for y.

### ✓ Understanding Check:

1. Write an equation for the line that contains (4, -6) and is perpendicular

to  $y = 2x + 3$   $m = 2$

$$\begin{aligned} y - (-6) &= -\frac{1}{2}(x - 4) \\ y + 6 &= -\frac{1}{2}x + 2 \\ &\rightarrow -6 \\ y &= -\frac{1}{2}x - 4 \end{aligned}$$

2. Write an equation for the line that contains (-4, 7) and is perpendicular

to  $y = -\frac{2}{5}x - 2$

do this