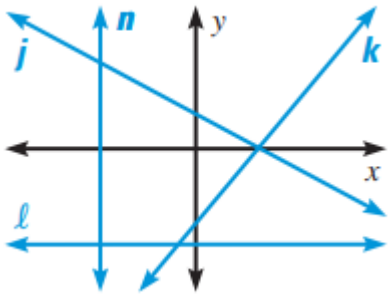
3.4/3.5 Slope of Lines/Graph Equations

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{rise}{run}$$

Slope of Lines in the Coordinate Plane



- **Negative slope**: falls from left to right as in line k.
- **Positive slope:** falls from right to left as in line j.
- **Zero slope:** horizontal as in line ℓ.
- **Undefined slope:** vertical as in line n.

Find the slope of the line that passes through the points given.

1. (2, 3), (9, 7)

$\frac{7-3}{9-2} = \frac{4}{7}$

2. (2, -1), (5, -3)

$\frac{-3-(-1)}{5-2} = \frac{-2}{3}$

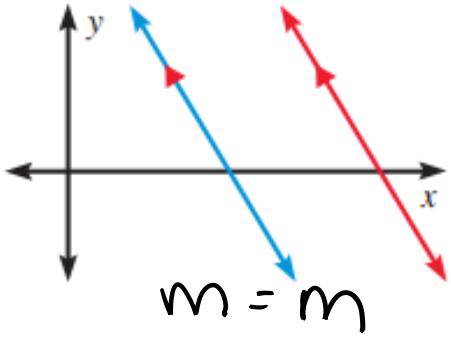
3. (-5, 4), (-5, -1)

$\frac{-1-4}{-5-(-5)} = \frac{-5}{0}$

undefined

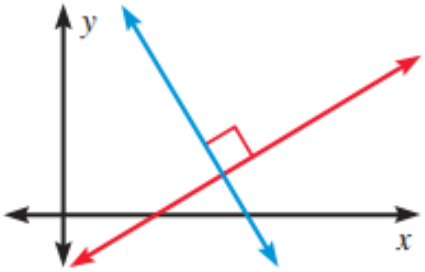
POSTULATE 17 Slopes of Parallel Lines

In a coordinate plane, two nonvertical lines are parallel if and only if they have same slope.



POSTULATE 18 Slopes of Perpendicular Lines

In a coordinate plane, two nonvertical lines are perpendicular if and only if they have opposite recip slope.



// = parallel ⊥ = perpendicular

Find the slope of the line that passes through these points, then find the slope of the line that is parallel to the line you found and perpendicular to the line you found.

4. $\left(\frac{5}{2},-\frac{3}{2}\right),\left(-\frac{1}{2},\frac{1}{2}\right)$

$\frac{\frac{1}{2}-\left(\frac{3}{2}\right)}{-\frac{1}{2}-\frac{5}{2}}=\frac{\frac{4}{2}}{\frac{-6}{2}}=\frac{2}{-3}$

// $m = -2/3$ ⊥ $m = 3/2$

5. (-2, 3), (8, 3)

$\frac{3-3}{8-(-2)}=\frac{0}{10}=0$

$\frac{-10}{0}$

// $m = 0$ (horizontal) ⊥ $m =$ undefined (vertical)

6. (5, - 8), (7, -5)

$\frac{-5-(-8)}{7-5}=\frac{3}{2}$

// $m = \frac{3}{2}$ ⊥ $m = -\frac{2}{3}$

Slope Intercept Form

$$y = mx + b$$

m: slope b: y-intercept

Find the slope of each line, the slope of the parallel line, and the slope of the perpendicular line.

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

m = 2/3

// = 2/3

⊥ = -3/2

8. $y = 3x+4$

m = 3

// = 3

⊥ = -1/3

9. $y=-\frac{3}{7}x+9$

m = -3/7

// = -3/7

⊥ = 7/3

Write each equation in slope-intercept form. Determine if the two lines are parallel, perpendicular, or neither.

10. y = -2x + 11 **and** y + 2x = 23

$y = -2x + 23$

parallel

11. 3y = 2x + 14 **and** 2x - 3y = 2

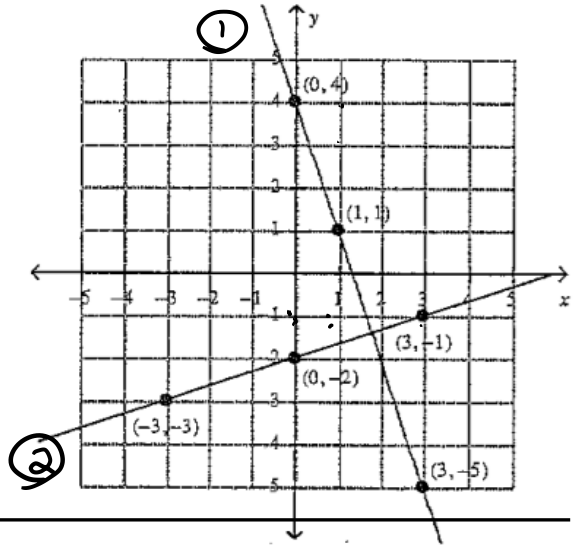
$y = \frac{2}{3}x + \frac{14}{3}$

$-3y = -2x + 2$

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

parallel

12. Find the slope of each line to the right.
Are the lines parallel, perpendicular or neither?



① $\frac{4-1}{0-1} = \frac{3}{-1}$

② $\frac{-1-(-2)}{3-0} = \frac{1}{3}$

Writing Equations of Lines

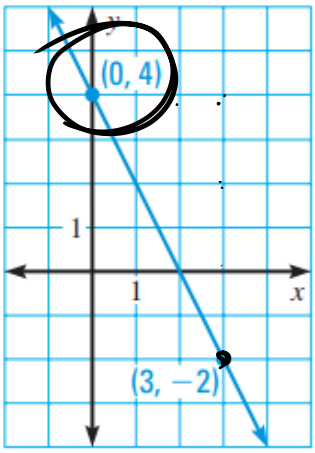
**Remember*: *To write the equation of ANY line, you must have a* Slope *and a* point

Write the equation of the line in slop-intercept form using the graph to the right.

$y = mx + 4$

$y = -2x + 4$

$\frac{6}{-3}$



Write the equation of the line with the given characteristics.

$y = mx + b$

1. $m = -\frac{2}{5}$ and b = 9

$y = -\frac{2}{5}x + 9$

2. $m = 3$ through (4, -3)

$y - y_1 = m(x - x_1)$

$y - (-3) = 3(x - 4)$

$y + 3 = 3x - 12$

$y = 3x - 15$

Write an equation for the line that is <u>parallel</u> to the given line and passes through the given point.

3. $y = -3x + 4$ thru (2, -5)

$y = -3x + b$

$y - y_1 = -3(x - x_1)$

$y - (-5) = -3(x - 2)$

$y + 5 = -3x + 6 \rightarrow y = -3x + 1$

4. $y = 2x - 3$ thru (-1, 1)

$y = 2x + b$

$1 = 2(-1) + b$

$1 = -2 + b$

$3 = b$

$y = 2x + 3$

Write an equation for the line that is <u>perpendicular</u> to the given line and passes through the given point.

5. $y = -\frac{2}{3}x - 7$ thru (6, 4)

$y = \frac{3}{2}x + b$

$y - y_1 = \frac{3}{2}(x - x_1)$

$y - 4 = \frac{3}{2}(x - 6)$

$y - 4 = \frac{3}{2}x - 9 \rightarrow y = \frac{3}{2}x - 5$

6. $y = -2x + 2$ thru (2, 3)

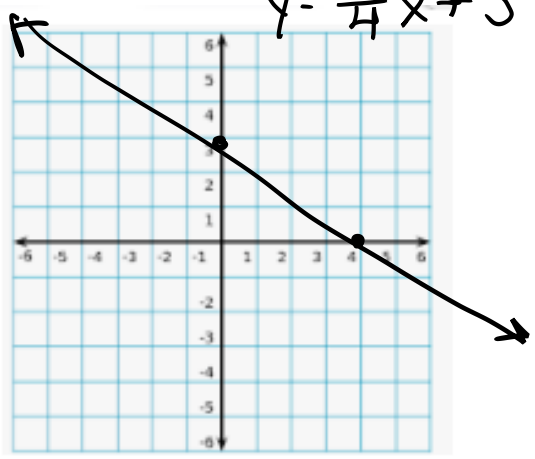
$y - 3 = \frac{1}{2}(x - 2)$

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

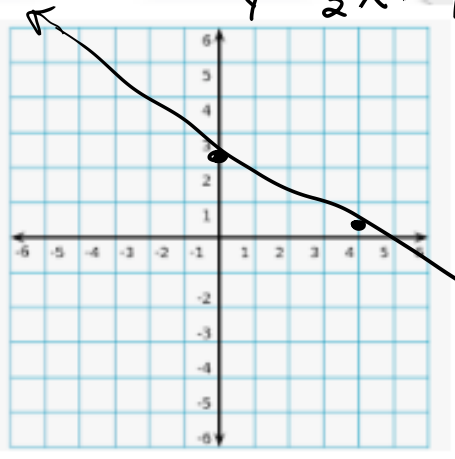
$y = \frac{1}{2}x + 2$

Use the equation given to graph the line in standard form.

1. $3x + 4y = 12$ $4y = -3x + 12$ $y = -\frac{3}{4}x + 3$



2. $2y - 4 = -x + 1$ $2y = -x + 5$ $y = -\frac{1}{2}x + 5/2$



$\frac{5}{2} = 2.5$