

### 3-4 Equations of Lines

Write an equation in slope-intercept form of the line having the given slope and  $y$ -intercept or given points. Then graph the line.

14.  $m: -7, b: -4$

**SOLUTION:**

The slope-intercept form of a line of slope  $m$  and  $y$ -intercept  $b$  is given by  $y = mx + b$ .

Here,  $m = -7$  and  $y$ -intercept  $= -4$ .

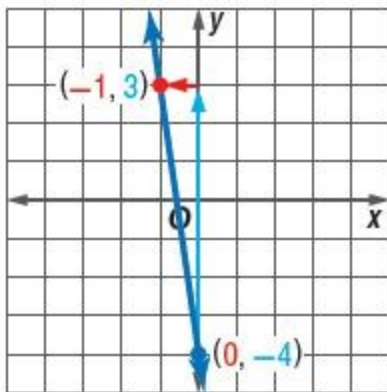
$$y = mx + b \quad \text{Slope-intercept form}$$

$$y = -7x + (-4) \quad \text{Substitution.}$$

$$y = -7x - 4 \quad \text{Simplify.}$$

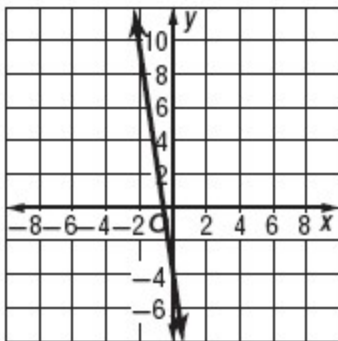
So, the equation of the line is  $y = -7x - 4$ .

Graph the  $y$ -intercept  $-4$ . Use the slope  $-7$  to find another point 7 units up and 1 unit right. Then draw a line through the two points.



**ANSWER:**

$$y = -7x - 4$$



Write an equation in point-slope form of the line having the given slope that contains the given point. Then graph the line.

20.  $m = 4, (-4, 8)$

**SOLUTION:**

The point-slope form of a line is  $y - y_1 = m(x - x_1)$

where  $m$  is the slope and  $(x_1, y_1)$  is a point on the line.

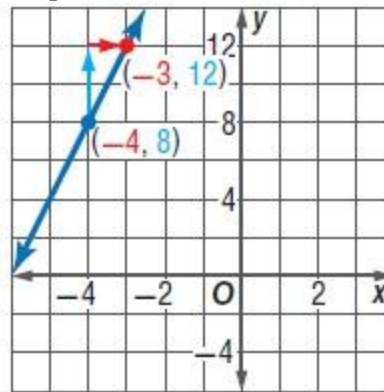
Here,  $m = 4$  and  $(x_1, y_1) = (-4, 8)$ .

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$

$$y - 8 = 4(x - (-4)) \quad \text{Substitution.}$$

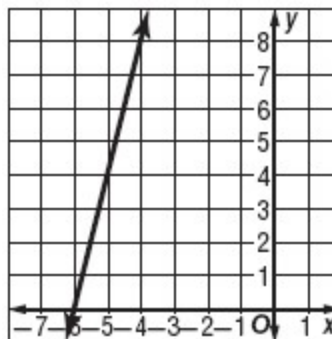
$$y - 8 = 4(x + 4) \quad \text{Simplify.}$$

Graph  $(-4, 8)$ . Use the slope 4 to find another point 4 units up and 1 unit right. Then draw a line through the two points.



**ANSWER:**

$$y - 8 = 4(x + 4)$$



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22.  $m = \frac{5}{7}, (-2, -5)$

**SOLUTION:**

The point-slope form of a line is  $y - y_1 = m(x - x_1)$  where  $m$  is the slope and  $(x_1, y_1)$  is a point on the line.

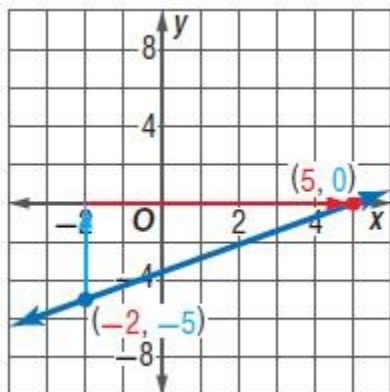
$$m = \frac{5}{7} \text{ and } (x_1, y_1) = (-2, -5)$$

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$

$$y - (-5) = \frac{5}{7}(x - (-2)) \quad \text{Substitution.}$$

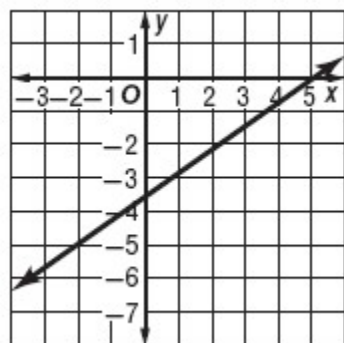
$$y + 5 = \frac{5}{7}(x + 2) \quad \text{Simplify.}$$

Graph  $(-2, -5)$ . Use the slope  $\frac{5}{7}$  to find another point 5 units up and 7 unit right. Then draw a line through the two points.



**ANSWER:**

$$y + 5 = \frac{5}{7}(x + 2)$$



**Write an equation of the line through each pair of points in slope-intercept form.**

26.  $(2, -1)$  and  $(2, 6)$

**SOLUTION:**

Use the slope formula to find the slope of the line.

Let  $(x_1, y_1) = (2, -1)$  and  $(x_2, y_2) = (2, 6)$ .

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{6 - (-1)}{2 - 2} \\ &= \frac{7}{0} \end{aligned}$$

Division of any number by zero is undefined. So, the slope of the line is undefined. So, the line is a vertical line. The  $x$ -coordinates of both the points are 2. So, the equation of the line is  $x = 2$ .

**ANSWER:**

$$x = 2$$

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28. (0, 5) and (3, 3)

**SOLUTION:**

Use the slope formula to find the slope of the line.

Let  $(x_1, y_1) = (0, 5)$  and  $(x_2, y_2) = (3, 3)$ .

$$\begin{aligned}m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3 - 5}{3 - 0} \\ &= \frac{-2}{3} \\ &= -\frac{2}{3}\end{aligned}$$

Use the slope and one of the points to write the equation of the line in point-slope form.

The point-slope form of a line is  $y - y_1 = m(x - x_1)$

where  $m$  is the slope and  $(x_1, y_1)$  is a point on the line.

Here,  $m = -\frac{2}{3}$  and  $(x_1, y_1) = (3, 3)$ .

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$

$$y - 3 = -\frac{2}{3}(x - 3) \quad \text{Substitution.}$$

$$y - 3 = -\frac{2}{3}x + 2 \quad \text{Simplify.}$$

$$y - 3 + 3 = -\frac{2}{3}x + 2 + 3 \quad \text{Add 3 to each side.}$$

$$y = -\frac{2}{3}x + 5 \quad \text{Simplify.}$$

**ANSWER:**

$$y = -\frac{2}{3}x + 5$$

**Write an equation in slope-intercept form for each line described.**

37. passes through  $(-7, -4)$ , perpendicular to  $y = \frac{1}{2}x + 9$

**SOLUTION:**

The slope of the line  $y = \frac{1}{2}x + 9$  is  $\frac{1}{2}$ . So, the slope of the line perpendicular to the given line is  $-2$ .

Use the slope and the point to write the equation of the line in point-slope form.

The point-slope form of a line is  $y - y_1 = m(x - x_1)$  where  $m$  is the slope and  $(x_1, y_1)$  is a point on the line.

Here,  $m = -2$  and  $(x_1, y_1) = (-7, -4)$ .

$$y - y_1 = m(x - x_1) \quad \text{Point-Slope form}$$

$$y - (-4) = -2(x - (-7)) \quad \text{Substitution.}$$

$$y + 4 = -2x - 14 \quad \text{Simplify.}$$

$$y + 4 - 4 = -2x - 14 - 4 \quad \text{Subtract 4 to each side.}$$

$$y = -2x - 18 \quad \text{Simplify.}$$

**ANSWER:**

$$y = -2x - 18$$

41. **PLANNING** Karen is planning a graduation party for the senior class. She plans to rent a meeting room at the convention center that costs \$400. There is an additional fee of \$10.50 for each person who attends the party.

a. Write an equation to represent the cost  $y$  of the party if  $x$  people attend.

b. Graph the equation.

c. There are 285 people in Karen's class. If  $\frac{2}{3}$  of these people attend, how much will the party cost?

d. If the senior class has raised \$3500 for the party, how many people can attend?

**SOLUTION:**

a. The rent for the room is \$400 and there is an additional fee of \$10.50 for each person who attends the party. So, if  $x$  is the number of people attending the party and  $y$  is the total cost then the equation is  $y = 10.5x + 400$ .

b. Draw the line representing the equation  $y = 10.5x + 400$  on a coordinate plane.

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c. Two-thirds of 285 people, attended the party. That

is,  $\frac{2}{3}(285) = 190$  people attended the party.

Substitute  $x = 190$  in the equation.

$$y = 10.5(190) + 400$$

$$= 2395$$

The party expenses will cost \$2395.

d. Substitute  $y = 3500$  and solve for  $x$ .

$$3500 = 10.50x + 400$$

$$3100 = 10.50x$$

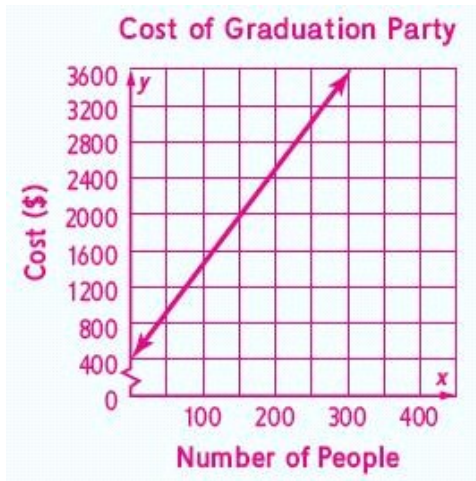
$$295.24 \approx x$$

So, a total of 295 people can attend the party.

**ANSWER:**

a.  $y = 10.5x + 400$

b.



c. \$2395

d. 295