

Lesson 7.3 Slope-Point Form of an Equation of a Line

6. Relate linear relations expressed in:

- slope-intercept form ($y = mx + b$)
- general form ($Ax + By + C = 0$)
- slope-point form ($y - y_1 = m(x - x_1)$) to their graphs

7. Determine the equation of a linear relation, given:

- a graph
- a point and the slope
- two points
- a point and the equation of a parallel or perpendicular line to solve problems

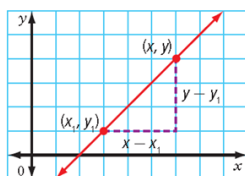
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The slope of a non-vertical line can be determined using $m = \frac{\Delta y}{\Delta x}$

If (x_1, y_1) is one point on the line, then (x, y) could represent any other point on the line. Substitute the coordinates of these two points into the

slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$

The slope of the line could be written as $m = \frac{y - y_1}{x - x_1}$



$$m = \frac{y - y_1}{x - x_1}$$

Multiplying both sides of the above equation by $(x - x_1)$ gives

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

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

This equation is called the slope-point form of a non-vertical line through point (x_1, y_1) with slope m .

The slope-point form is commonly written as $y - y_1 = m(x - x_1)$.

It is more commonly written as $y - y_1 = m(x - x_1)$

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Example 1 Write the Equation of a Line Using a Point and the Slope

- a) Use slope-point form to write an equation of the line through (-2, 5) with slope -3.
- b) Express the equation in slope-intercept form, $y = mx + b$.
- c) Graph the linear relation using technology.

Solution

a) Substitute -3 for m and the coordinates of the point (-2, 5) for (x_1, y_1) .

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

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

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

The equation in slope-point form is $y - 5 = -3(x + 2)$.

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

$$y - 5 = -3x - 6$$

$$+5 \quad +5$$

$$y = -3x - 1$$

b) To express the equation in slope-intercept form, isolate y .

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

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

$$y = -3x - 6 + 5$$

$$y = -3x - 1$$

In slope-intercept form, the equation is $y = -3x - 1$.

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your Turn

- a) Use slope-point form to write an equation of the line through (3, -4) with slope 2. Sketch a graph of the line.
- b) Express the equation in slope-intercept form, $y = mx + b$. Sketch a graph of this line.

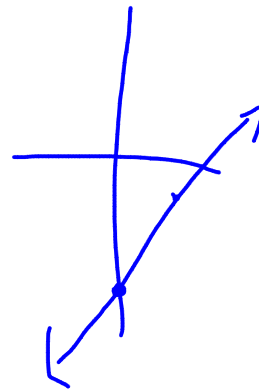
$$y - y_1 = m(x - x_1)$$

$$a. \boxed{y - (-4) = 2(x - 3)}$$

$$y + 4 = 2x - 6$$

$$-4 \quad -4$$

$$b. \boxed{y = 2x - 10}$$



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Example 2 Determine the Equation of a Line Using Two Points

a) Use slope-point form to write an equation of the line through (3, -4) and (5, -1).
 b) Sketch a graph of the line.
 c) Rewrite the equation in general form, $Ax + By + C = 0$.

Solution

a) Points on the line are given. So, you need to determine the slope. Use the two given points, (3, -4) and (5, -1).

$$m = \frac{y - y_1}{x - x_1}$$

$$m = \frac{-1 - (-4)}{5 - 3}$$

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

In slope-point form, substitute $\frac{3}{2}$ for m and the coordinates of either point (3, -4) or point (5, -1) for (x_1, y_1) .

Using (3, -4) for (x, y) , Using (5, -1) for (x, y) ,

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

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

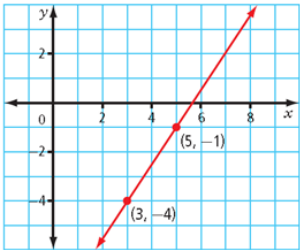
$$y - (-1) = \frac{3}{2}(x - 5)$$

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

Both $y + 4 = \frac{3}{2}(x - 3)$ and $y + 1 = \frac{3}{2}(x - 5)$ are slope-point forms of the equation of the line through (3, -4) and (5, -1).

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b)



c) Express $y + 4 = \frac{3}{2}(x - 3)$ in general form.

$$2[y + 4] = 2 \left[\frac{3}{2}(x - 3) \right]$$

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

$$2y + 8 = 3x - 15$$

$$0 = 3x - 2y - 23$$

The equation, in general form, for the line through (3, -4) and (5, -1) is $3x - 2y - 23 = 0$.

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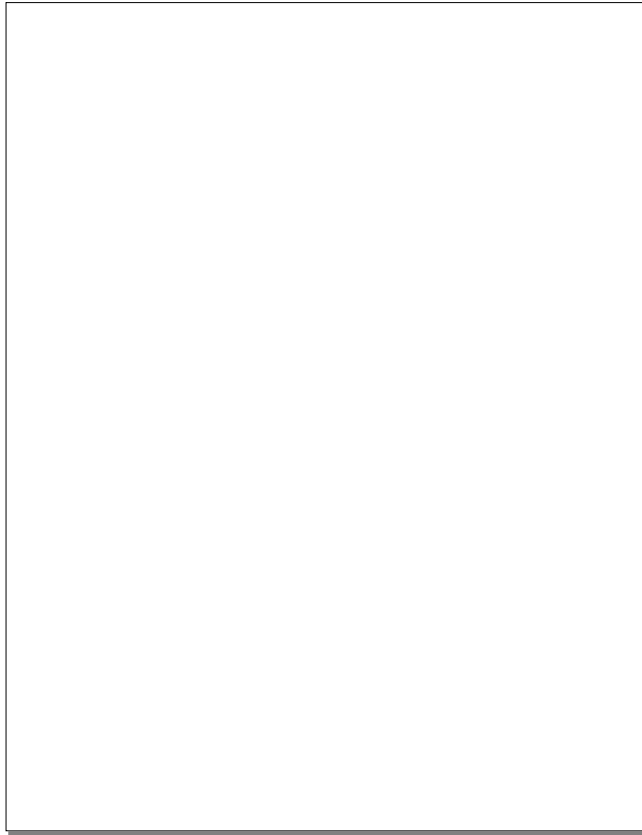
Your Turn

Use slope-point form to write an equation of the line through $(-5, 2)$ and $(-2, 1)$. Explain your steps. Then, write the equation in general form, $Ax + By + C = 0$.

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Homework
Page 377 #1-3 odd letters, 4, 5-6 odd letters, 11, 12, 14, 15, 16.

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