

Objective: TSWBAT- write and graph linear equations using Point-slope form

Essential Understanding You can use the slope of a line and any point on the line to write and graph an equation of the line. Any two equations for the same line are equivalent.

take note

Key Concept Point-Slope Form of a Linear Equation

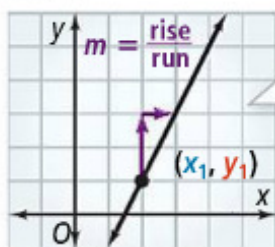
Definition

The **point-slope form** of an equation of a nonvertical line with slope m and through point (x_1, y_1) is $y - y_1 = m(x - x_1)$.

Symbols

$$\begin{array}{cccc} y - y_1 = m(x - x_1) \\ \uparrow \quad \uparrow \quad \uparrow \\ \text{y-coordinate} \quad \text{slope} \quad \text{x-coordinate} \end{array}$$

Graph



When you use $y - y_1 = m(x - x_1)$, (x_1, y_1) represents a *specific* point and (x, y) represents *any* point.

Here's Why It Works Given a point (x_1, y_1) on a line and the line's slope m , you can use the definition of slope to derive point-slope form.

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

Use the definition of slope.

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

Let (x, y) be any point on the line. Substitute (x, y) for (x_2, y_2) .

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

Multiply each side by $(x - x_1)$.

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

Simplify the left side of the equation.



Problem 1 Writing an Equation in Point-Slope Form

A line passes through $(-3, 6)$ and has slope -5 . What is an equation of the line?

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

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

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

(b) What is the slope-intercept form of the line?

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

$$y - 6 = -5x - 15$$

$$\begin{array}{cc} +6 & +6 \end{array}$$

$$\boxed{y = -5x - 9}$$

Got It? 1. A line passes through $(8, -4)$ and has slope $\frac{2}{3}$. What is an equation point-slope form of the line?

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

$$y - (-4) = \frac{2}{3}(x - 8)$$

$$y + 4 = \frac{2}{3}x - \frac{16}{3}$$

(b) What is the slope-intercept form of the line?

$$y + 4 = \frac{2}{3}x - \frac{16}{3}$$

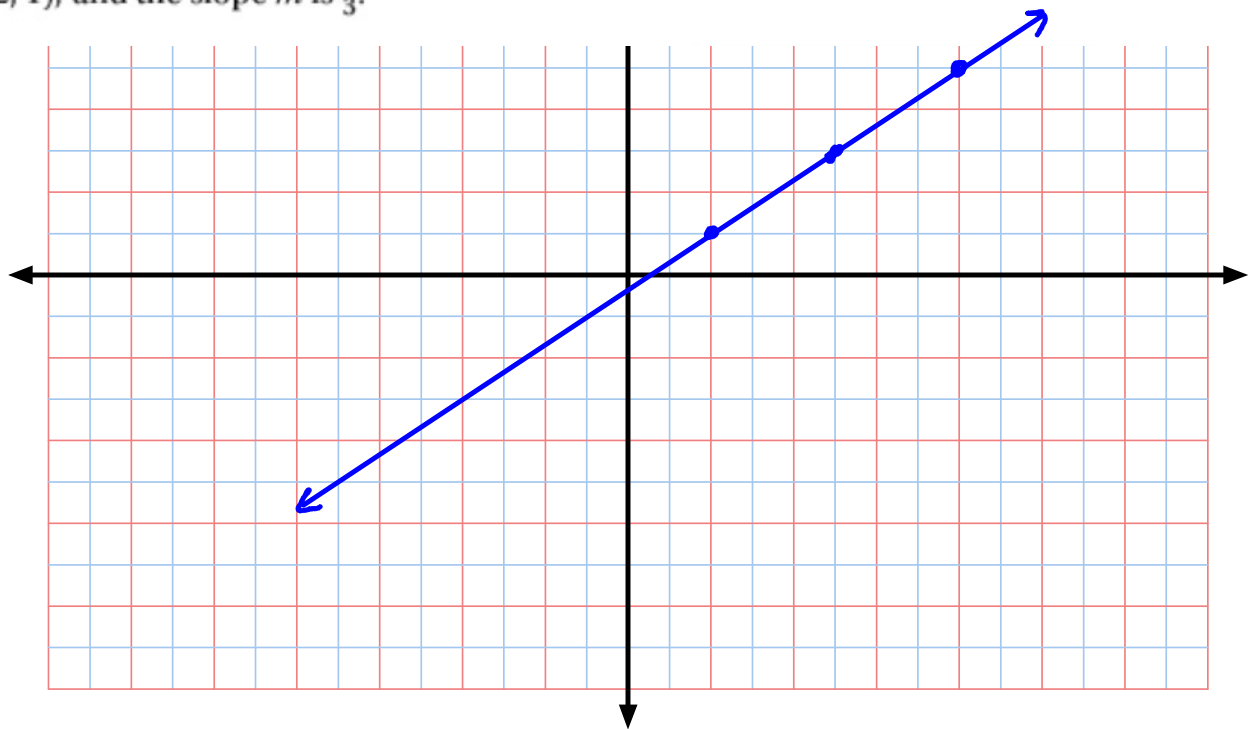
$$\begin{array}{cc} -4 & -4 \end{array}$$

$$\boxed{y = \frac{2}{3}x - \frac{28}{3}}$$

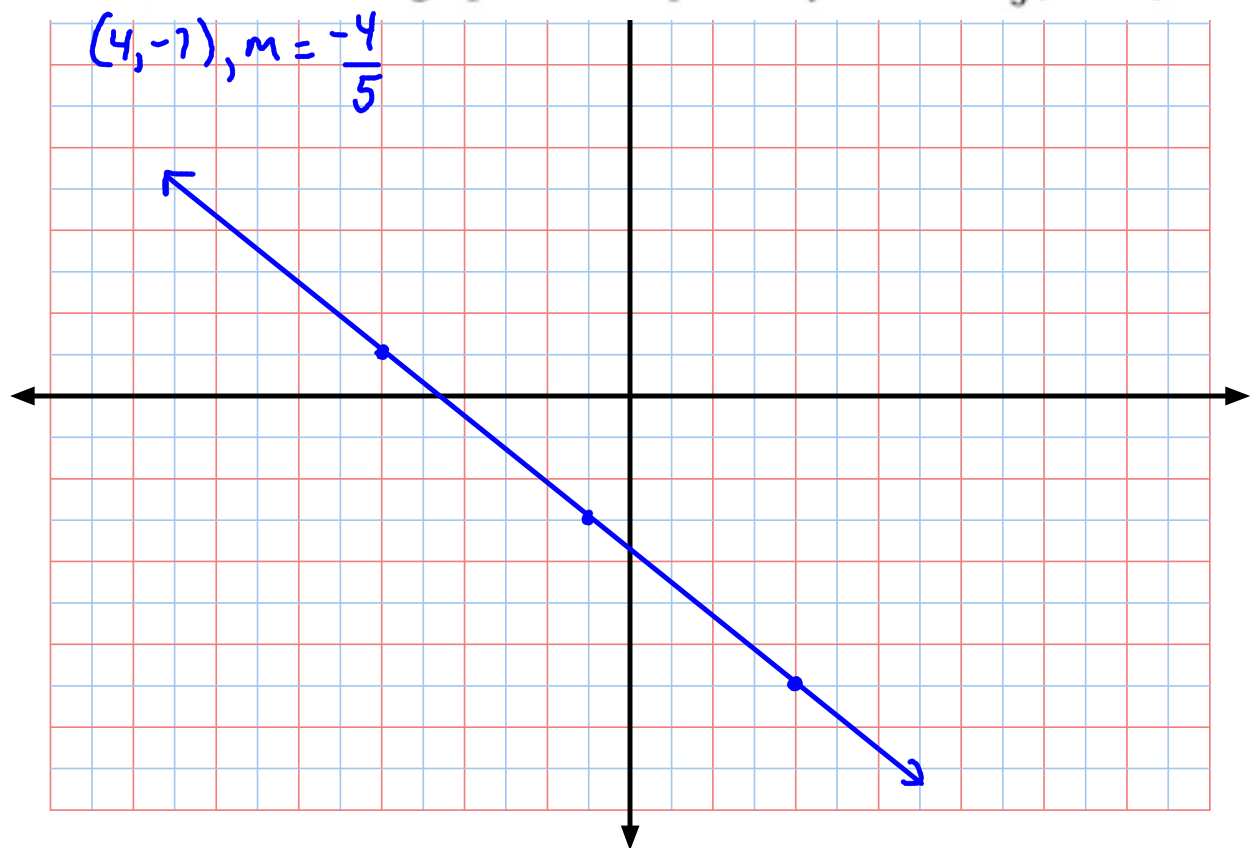
Problem 2 Graphing Using Point-Slope Form

What is the graph of the equation $y - 1 = \frac{2}{3}(x - 2)$?

The equation is in point-slope form, $y - y_1 = m(x - x_1)$. A point (x_1, y_1) on the line is $(2, 1)$, and the slope m is $\frac{2}{3}$.



Got It? 2. What is the graph of the equation $y + 7 = -\frac{4}{5}(x - 4)$?



You can write the equation of a line given any two points on the line. First use the two given points to find the slope. Then use the slope and one of the points to write the equation.



Problem 3 Using Two Points to Write an Equation

What is an equation of the line at the right?

Think

You need the slope m , so start with the slope formula.

Use the given points to find the slope.

Use point-slope form.

Use either given point for (x_1, y_1) . For example, you can use $(1, 4)$.

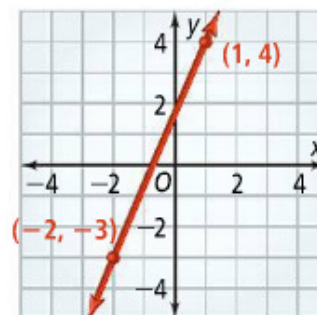
Write

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

$$m = \frac{-3 - 4}{-2 - 1} = \frac{-7}{-3} = \frac{7}{3}$$

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

$$y - 4 = \frac{7}{3}(x - 1)$$



Got It? 3. a. In the last step of Problem 3, use the point $(-2, -3)$ instead of $(1, 4)$ to write an equation of the line.

b. **Reasoning** Rewrite the equations in Problem 3 and part (a) in slope-intercept form. Compare the two rewritten equations. What can you conclude?



Problem 4 Using a Table to Write an Equation

Recreation The table shows the altitude of a hot-air balloon during its linear descent. What equation in slope-intercept form gives the balloon's altitude at any time? What do the slope and y-intercept represent?

$$m = \frac{590 - 640}{30 - 10} = -2.5$$
 Use two points, such as (10, 640) and (30, 590), to find the slope.

$$y - y_1 = m(x - x_1)$$
 Use point-slope form.

$$y - 640 = -2.5(x - 10)$$
 Use the data point (10, 640) and the slope -2.5 .

$$y = -2.5x + 665$$
 Rewrite in slope-intercept form.

Hot-Air Balloon Descent

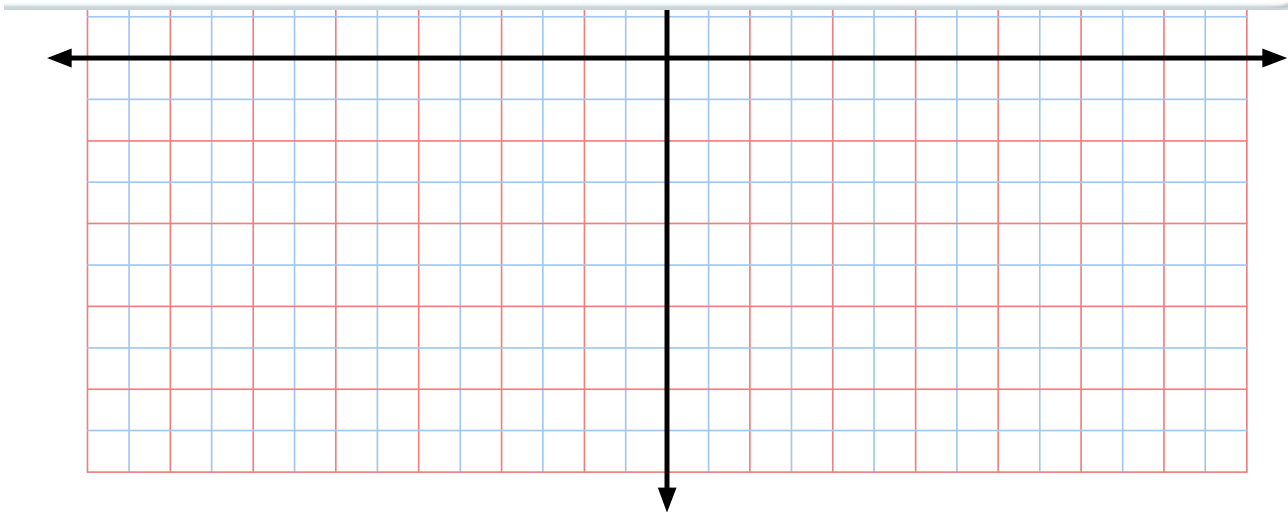
Time, x (s)	Altitude, y (m)
10	640
30	590
70	490
90	440

The slope -2.5 represents the rate of descent of the balloon in meters per second.
The y-intercept 665 represents the initial altitude of the balloon in meters.

- of It?** 4. a. The table shows the number of gallons of water y in a tank after x hours. The relationship is linear. What is an equation in point-slope form that models the data? What does the slope represent?
- b. **Reasoning** Write the equation from part (a) in slope-intercept form. What does the y -intercept represent?

Volume of Water in Tank

Time, x (h)	Water, y (gal)
2	3320
3	4570
5	7070
8	10,820



Homework: Pages 318-319, 8-21