KEY

5.3 Write Linear Equations in Point-Slope Form

Goal •Write linear equations in point-slope form.

2 FORMS OF LINEAR EQUATIONS THAT DESCRIBE A GIVEN LINE.

Your Notes

VOCABULARY

(2) P/S Point-slope form MEMORIZE USE WHEN NOT GIVEN THE Y-INT.

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

- Coordinates of a given point (x_1, y_1)
- m = slope

(1) S/I SLOPE-INTERCEPT FORM $y = mx + b$

m = slope
b = y-intercept
x and y variables

POINT-SLOPE FORM

The point-slope form of the equation of the nonvertical line through a given point (x_1, y_1) with a slope of m is

P/S $y - y_1 = m(x - x_1)$

Example 1 *Write an equation in point-slope form*

Write an equation in point-slope form on the line that passes through the point (3, 2) and has a slope of 2.

Solution

P/S $y - y_1 = m(x - x_1)$ **Write point-slope form.**

$y - 2 = 2(x - 3)$ **Substitute 2 for m, 3 for x_1, and 2 for y_1.**

x_1 y_1
Point (3, 2)
M = 2

Docheckpt #1

P/S: $y - y_1 = m(x - x_1)$

Your Notes

EXAMPLE 2

Graph the equation $y - 2 = \frac{1}{2}(x - 2)$.

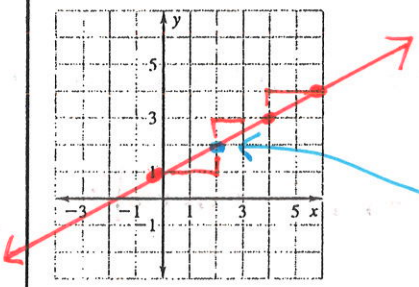
m, y_1, x_1

* remember to take the opposite of the x_1 and y_1.

Solution

Because the equation is in point-slope form, you know that the line has a slope of $\frac{1}{2}$ and passes through the point (2, 2). $x_1 = 2$ $y_1 = 2$

Plot the point (2, 2). Find a second point on the line using the slope. Draw a line through the points.



STEP I: plot point (2, 2)

STEP II: use slope to find additional points

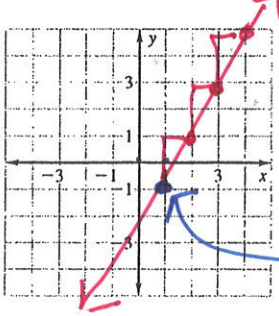
$m = \frac{1}{2} = \frac{\text{Rise}}{\text{Run}}$

Checkpoint Complete the following exercises.

1. Write an equation in point-slope form of the line that passes through the point (−3, 5) and has a slope of 4.

P/S $y - 5 = 4(x + 3)$

2. Graph the equation $y + 1 = 2(x - 1)$.



$m = 2/1$

pt (1, −1)

∞ number of points ⟶ ∞ # of P/S EQUATIONS
$y - y_1 = m(x - x_1)$

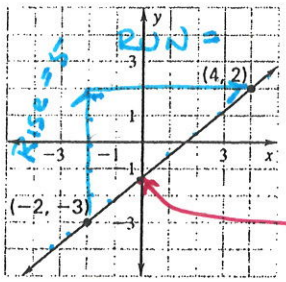
1 yintercept ⟶ 1 S/I EQUATION ($y = mx + b$)

Your Notes

Example 3 *Use point-slope form to write an equation*

Write an equation in point-slope form of the line shown.

3 EQUATIONS TO DESCRIBE line.



yint is a fraction ($b \stackrel{?}{=} -\frac{4}{3}$)

P/S: (4, 2) $y - 2 = \frac{5}{6}(x - 4)$

P/S: (−2, −3) $y + 3 = \frac{5}{6}(x + 2)$

S/I: $b = -\frac{4}{3}$ $y = \frac{5}{6}x - \frac{4}{3}$

Solution

Step 1 Find the slope of the line.

$m = \frac{\text{Rise}}{\text{RUN}}$

$m = \frac{5}{6}$ ← simplified

=

=

Step 2 Write the equation in point-slope form. You can use either given point.

$m = 5/6$

Method 1 Use (−2, −3).

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

$y + 3 = \frac{5}{6}(x + 2)$

Method 2 Use (4, 2).

P/S $y - y_1 = m(x - x_1)$

$y - 2 = \frac{5}{6}(x - 4)$

P/S

Notice SIGNS become Positive

P/S

S/I

S/I

CHECK Check that the equations are equivalent by writing them in slope-intercept form.

$y + 3 = \frac{5}{6}x + \frac{5}{3}$ (−3 −3)

$y = \frac{5}{6}x - \frac{4}{3}$

$y - 2 = \frac{5}{6}x - \frac{10}{3}$ (+2 +2)

$y = \frac{5}{6}x - \frac{4}{3}$

Same

yint = $b = -\frac{4}{3} = -1\frac{1}{3}$

Scrappaper $1\frac{2}{3} - 3 = -1\frac{1}{3}$

Scrap work $-3\frac{1}{3} + 2 = -1\frac{1}{3} = -\frac{4}{3}$

WRITING EQUATIONS WITH 2 POINTS GIVEN.

5.2 (CONT.) Use Linear Equations in Slope-Intercept Form

Goal • Write an equation of a line using points on the line.

Example 4 *Write an equation given two points*

Given 2 points →

Write an equation of the line that passes through (2, −3) and (−2, 1).

Solution

Step 1 Calculate the slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{-3-1}{2+2} = \frac{-4}{4} \qquad m = -1$$

STEP 2 PUT IN POINT SLOPE FORM.

PICK EITHER POINT. Use the slope and the point (2, −3).

You can also find the y-intercept using the coordinates of the other given point.

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

P/S $y + 3 = -1(x - 2)$

Step 3 Write an equation of the line. IN SLOPE INTERCEPT (WHEN ASKED)

Write slope-intercept form.

S/I $y = -x - 1$

$$y + 3 = -x + 2$$
$$-3 \qquad -3$$

S/I $y = -x - 1$

What is a 3RD EQUATION TO DESCRIBE THIS LINE?

P/S (−2, 1) $y - 1 = -1(x + 2)$

Your Notes

Checkpoint Complete the following exercise.

2. Write an equation for the line that passes through (−8, −13) and (4, 2).

$m = \frac{\Delta y}{\Delta x} = \frac{-13-2}{-8-4} = \frac{-15}{-12}$ $M = 5/4$

① P/S (4, 2) → $y - 2 = \frac{5}{4}(x-4)$

② S/I $y - 2 = \frac{5}{4}x - 5$, $+2$ $+2$

$y = 5/4x - 3$

③ P/S $y + 13 = \frac{5}{4}(x+8)$

3. Write an equation for the line that passes through (−3, 4) and (1, −2).

$M = \frac{\Delta y}{\Delta x} = \frac{4+2}{-3-1} = \frac{6}{-4}$ $M = -3/2$

① P/S (−3, 4) → $y - 4 = -\frac{3}{2}(x+3)$

② S/I $y - 4 = -\frac{3}{2}x - 9/2$, $+4$ $+4$

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

③ P/S (1, −2) $y + 2 = \frac{-3}{2}(x-1)$

Scrapwork: $-4\ 1/2 + 4 = -1/2$

HOW TO WRITE EQUATIONS IN SLOPE-INTERCEPT FORM $y = mx + b$

1. Given slope m and y-intercept b. then plug m + b into S/I EQ $y = mx + b$

2. Given slope m and one point.
   - (a) plug m and (x_1, y_1) into P/S $y - y_1 = m(x - x_1)$
   - (b) use algebra to put into $y = mx + b$

3. Given two points.
   - (a) Use the points to find the slope $m = \frac{\Delta y}{\Delta x}$
   - (b) Pick a point and plug into P/S $y - y_1 = m(x - x_1)$
   - (c) use algebra to put into $y = mx + b$

STEP 1
To find slope

① Given a graph
$M = \frac{\text{Rise}}{\text{Run}}$

② Given 2 points
$M = \frac{\Delta y}{\Delta x}$

5.3 (cont.) Writing Equations for Horizontal and Vertical Lines

Your Notes:

- The equation of a **HORIZONTAL LINE** is $y = b$ where b = y intercept ↳ $(0, b)$ and the slope is Zero.
- The equation of a **VERTICAL LINE** is $x = a$ where a = x intercept $(a, 0)$ and the slope is UNDEFINED.

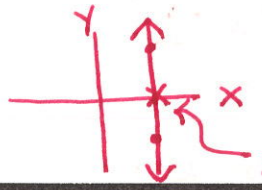
EXAMPLE 1

- Write the equation of the line that goes through the points (5, -2) and (5, 2)

x x $x = 5$

STEP I: FIND $m = \frac{\Delta y}{\Delta x} = \frac{-2-2}{5-5} = \frac{-4}{0}$ m = UNDEFINED

STEP II Sketch a Graph



STEP 3 ALL VERTICAL LINES HAVE THE EQ $x = a$ where a = x int

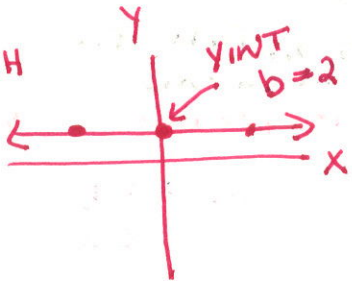
EXAMPLE 2

- Write the equation of the line that goes through the points (-3, 2) and (3, 2)

$y = 2$

STEP I FIND $m = \frac{\Delta y}{\Delta x} = \frac{2-2}{-3-3} = \frac{0}{-6}$ $m = 0$ (Y Y)

STEP II SKETCH



STEP III FILL IN $y = mx + b$

$m = 0$ $b = 2$

$y = 0x + 2$

$y = 2$

EXAMPLE 3

- Write the equation of for the Horizontal and Vertical Lines that go through the point (5, 10)

HORIZONTAL LINE $y = 10$

VERTICAL LINE $x = 5$