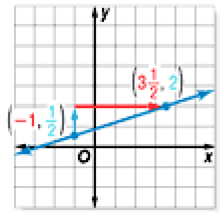
Lesson 5-1

Example 1 Positive Slope

Find the slope of the line that passes through $\left(3\frac{1}{2}, 2\right)$ and $\left(-1, \frac{1}{2}\right)$.

Let $\left(3\frac{1}{2}, 2\right) = (x_1, y_1)$ and $\left(-1, \frac{1}{2}\right) = (x_2, y_2)$.



$m = \dfrac{y_2 - y_1}{x_2 - x_1}$ rise/run

$= \dfrac{\frac{1}{2} - 2}{-1 - \frac{7}{2}}$ Substitute. $3\frac{1}{2} = \frac{7}{2}$

$= \dfrac{\frac{-3}{2}}{\frac{-9}{2}}$ Simplify.

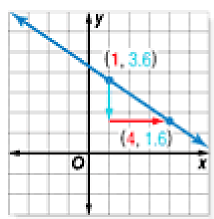
$= \dfrac{1}{3}$ Divide.

The slope is $\frac{1}{3}$.

Example 2 Negative Slope

Find the slope of the line that passes through (1, 3.6) and (4, 1.6).

Let (1, 3.6) = (x_1, y_1) and (4, 1.6) = (x_2, y_2).



$m = \dfrac{y_2 - y_1}{x_2 - x_1}$ rise/run

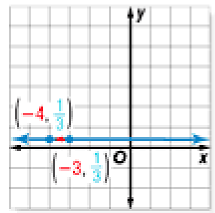
$= \dfrac{1.6 - 3.6}{4 - 1}$ Substitute

$= \dfrac{-2}{3}$ Simplify.

The slope is $-\frac{2}{3}$.

Example 3 Zero Slope

Find the slope of the line that passes through $\left(-3, \frac{1}{3}\right)$ and $\left(-4, \frac{1}{3}\right)$.



Let $\left(-3, \frac{1}{3}\right) = (x_1, y_1)$ and $\left(-4, \frac{1}{3}\right) = (x_2, y_2)$.

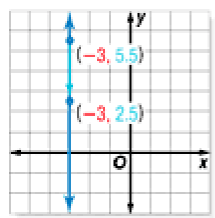
$m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $\qquad \dfrac{\text{rise}}{\text{run}}$

$= \dfrac{\frac{1}{3} - \frac{1}{3}}{-4 - (-3)}$ $\qquad$ Substitute

$= \dfrac{0}{-1}$ or 0 $\qquad$ Simplify.

Example 4 Undefined Slope
Find the slope of the line that passes through (-3, 5.5) and (-3, 2.5).

Let $(-3, 5.5) = (x_1, y_1)$ and $(-3, 2.5) = (x_2, y_2)$.



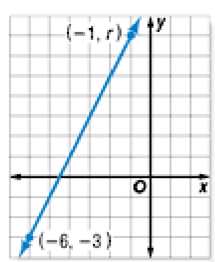
$m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $\qquad \dfrac{\text{rise}}{\text{run}}$

$= \dfrac{2.5 - 5.5}{-3 - (-3)}$ or $\dfrac{-3}{0}$ $\qquad$ Substitute.

Since division by zero is undefined, the slope is undefined.

Example 5 Find Coordinates Given Slope
Find the value of *r* so that the line through (-6, -3) and (-1, *r*) has a slope of 2.

Let $(-6, -3) = (x_1, y_1)$ and $(-1, r) = (x_2, y_2)$.



$m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $\qquad \dfrac{\text{rise}}{\text{run}}$

$2 = \dfrac{r - (-3)}{-1 - (-6)}$ $\qquad$ Substitute.

$\dfrac{2}{1} = \dfrac{r + 3}{5}$ $\qquad$ Subtract. $2 = \dfrac{2}{1}$.

$2(5) = 1(r + 3)$ $\qquad$ Find the cross products.

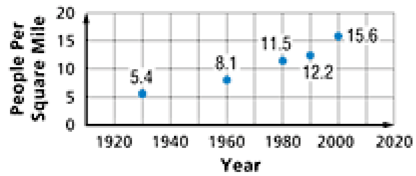
$10 = r + 3$ $\qquad$ Simplify.

$10 - 3 = r + 3 - 3$ $\qquad$ Subtract 3 from each side.

$7 = r$ $\qquad$ Simplify.

Example 6 Find a Rate of Change

The graph shows the density of population for the state of Idaho in various years.



a. Find the rates of change for 1930-1960 and 1990-2000.

Use the formula for slope.

$$\frac{\text{rise}}{\text{run}} = \frac{\text{change in density}}{\text{change in time}}$$

1930 – 1960: $\frac{\text{change in density}}{\text{change in time}} = \frac{8.1 - 5.4}{1960 - 1930}$ Substitute.

$= \frac{2.7}{30}$ or 0.09 Simplify.

Density increased by 2.7 people per square mile in a 30-year period for a rate of change of 0.09 people per square mile per year.

1990-2000: $\frac{\text{change in density}}{\text{change in time}} = \frac{15.6 - 12.2}{2000 - 1990}$ Substitute.

$= \frac{3.4}{10}$ or 0.34 Simplify.

Over this 10-year period, the density increased by 3.4 people per square mile, for a rate of change of 0.34 people per square mile per year.

b. Explain the meaning of the slope in each case.

For 1930-1960, on average, the people per square mile increased by 0.09 from the year before.
For 1990-2000, on average, the people per square mile increased by 0.34 from the year before.

c. How are the different rates of change shown on the graph?

There is a greater vertical change between 1990-2000 than for 1930-1960. Therefore, the section of the graph for 1990-2000 has a steeper slope.