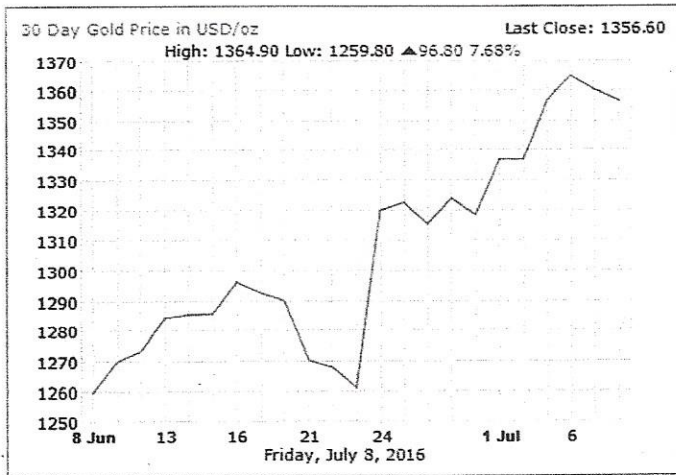


Rate of Change: Ratio (fraction) comparing how much 1 quantity changes (on average) relative to another quantity.
For many real world problems, the rate of change is not constant
So it makes sense to look at: average rate of change.

Example: The graph on the left shows the price fluctuation of gold over 30 days in 2016. The graph on the right shows the digital music and book sales from 2004 to 2009. Find the average rate of change for each graph.

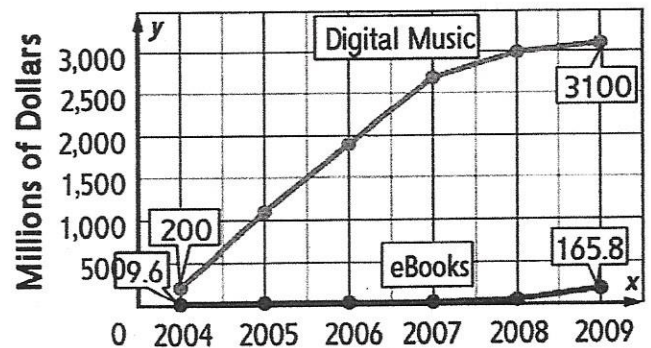


June 8, 1260
July 8, 1360

price of gold/30 days
$$\frac{1360 - 1260}{30}$$

$$= \frac{100}{30} \approx \$3.30/\text{day}$$

U.S. Digital Music and eBook Sales

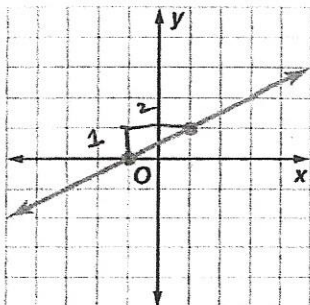


Digital Music
 (2004, 200) $\frac{3100 - 200}{6 \text{ yrs}} = \frac{2900}{6} \approx 483 \frac{1}{3}$
 (2009, 3100)
 eBooks
 (2004, 9.6) $\frac{165.8 - 9.6}{16 \text{ yrs}} = \frac{156.2}{16} \approx 9.8$
 (2009, 165.8)

Linear Functions Rate of Change & Slope

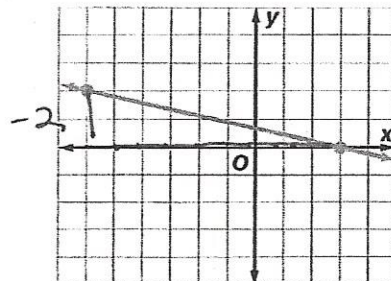
Slope - ratio of change in y to change in x

A linear equation has a constant rate of change or constant slope.



$$\frac{\text{rise}}{\text{run}} = \frac{1}{2}$$

$$m = \frac{1}{2}$$



$$\frac{\text{rise}}{\text{run}} = \frac{-2}{9}$$

$$m = \frac{-2}{9}$$

Determine the rate of change for each linear equation. (hint: $y = mx + b$)

1) $5x - 8y = 20$
 $-5x \quad -5x$
 $+8y = -5x + 20$
 $+8$
 $y = \frac{5}{8}x - \frac{5}{2}$

slope = $\frac{5}{8}$

2) $33 + 7x = 3y - 7$
 $+7 \quad +7$
 $40 + 7x = \frac{1}{3}y$
 $\frac{40}{3} + \frac{7x}{3} = \frac{1}{3}y$

$y = \frac{7}{3}x + \frac{40}{3}$

slope = $\frac{7}{3}$

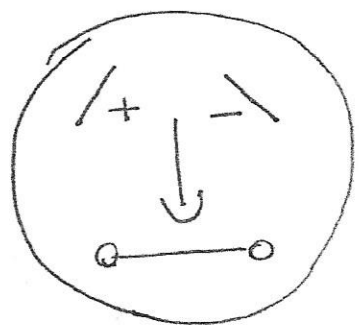
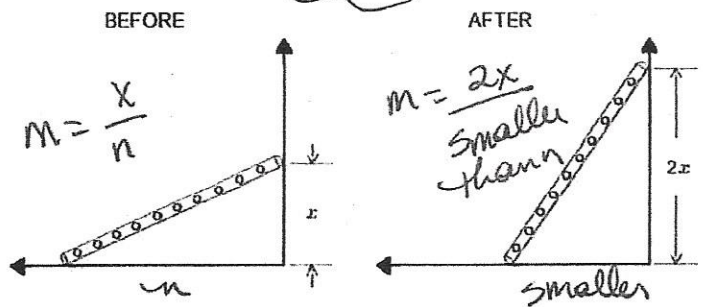
Find the value of "r" so that the line passing through the pair of points has the given slope.

3) $(4, r)$ and $(-6, 2)$ $m = 0.2$
 $x_1, y_1 \quad x_2, y_2$
 $m = \frac{y_2 - y_1}{x_2 - x_1}$
 $0.2 = \frac{2 - r}{-6 - 4}$
 $0.2 = \frac{2 - r}{-10}$
 $-2 = 2 - r$
 $-4 = -r$
 $r = 4$

4) $(r, -7)$ and $(0, 3)$ $m = -\frac{5}{2}$
 $x_1, y_1 \quad x_2, y_2$
 $m = \frac{y_2 - y_1}{x_2 - x_1}$
 $-\frac{5}{2} = \frac{3 - (-7)}{0 - r}$
 $-\frac{5}{2} = \frac{10}{-r}$
 $5r = 20$
 $r = 4$

Stretch your brain!

Draw "The Man" to remember slope.



Suppose that you have a ladder leaning against a wall. Now suppose that you adjust the slant of the ladder so that it reaches exactly twice as high on the wall, as pictured below.

- The slope of the ladder is—
- (a) Less than twice what it was.
 - (b) Exactly twice what it was.
 - (c) More than twice what it was.
 - (d) The same as what it was before.
 - (e) There is not enough information to determine if any of (a) through (d) is correct.

Because the length of "n" got smaller, the slope is more than twice as steep.

Slope would be twice as steep if length along ground didn't change