

Warm Up:

1. Write the equation of a line parallel to $4x-6y=12$ and passes through the point $(-9,3)$.

$$3 = \frac{2}{3}(-9) + b$$

$$3 = -6 + b$$

$$9 = b$$

$$y = \frac{2}{3}x + 9$$

$$\frac{-6y}{-6} = \frac{-4x+12}{-6}$$

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

2. Write the equation of a line perpendicular to $y=4$ and passes through the point $(-3,5)$.

$$y = \text{~~4~~} + 4$$

$$x = -3$$

$$\frac{4}{4}y = \frac{-5x+4}{4} \quad || \quad (8, 0)$$

$$0 = -\frac{5}{4}(8) + b$$

$$0 = -10 + b$$

$$10 = b$$

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

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

$$\frac{-3y}{-3} = \frac{8x + 12}{-3}$$

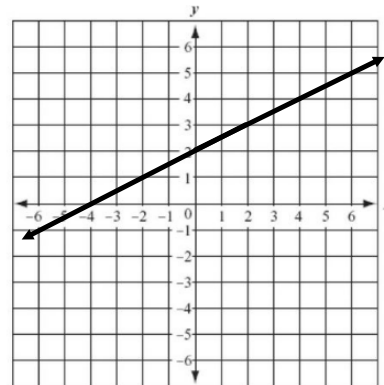
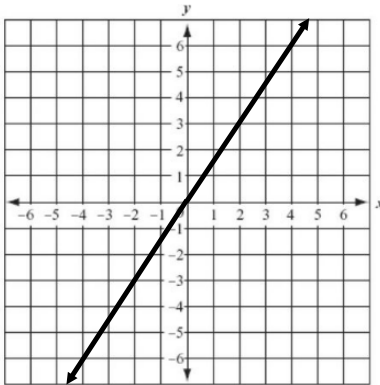
$$-2 = -\frac{3}{8}(-8) + b$$

$$-2 = 3 + b$$

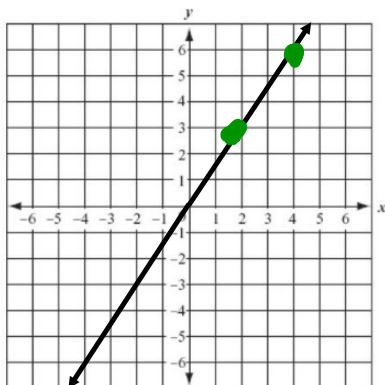
$$-5 = b$$

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

Which of the following graphs shows a proportional relationship?

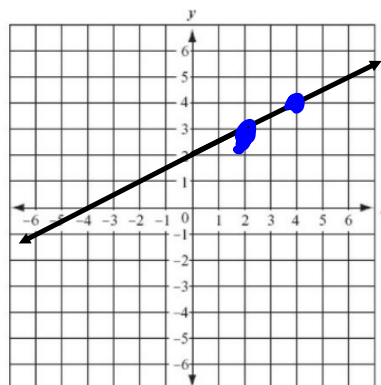


In other words, for which graph is the following true?



$$(2, 3) \quad (4, 6)$$

$$\frac{3}{2} = \frac{6}{4}$$

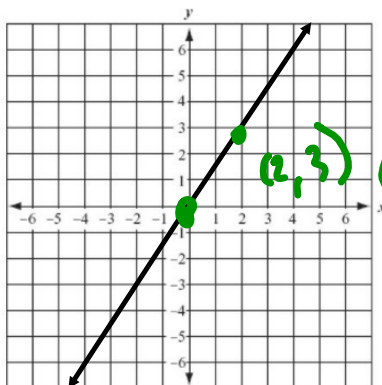


$$(2, 3) \quad (4, 4)$$

$$\frac{3}{2} \neq \frac{4}{4}$$

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

Another name for a proportional relationship is a **direct variation**.



$$y = mx + 0$$

$$y = mx$$

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

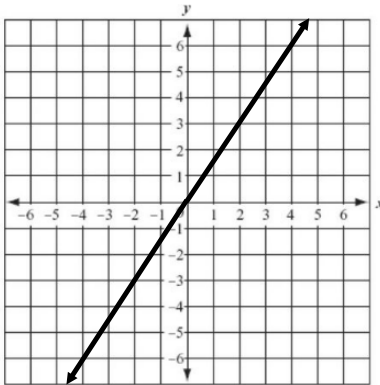
$$y = kx$$

$k = \text{constant of variation} = \text{slope}$

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

$$\frac{y}{x} = \frac{y_2 - y_1}{x_2 - x_1}$$

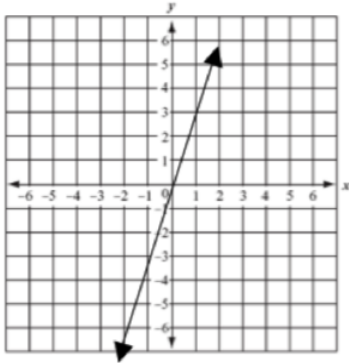
Why can we find k/slope by doing y/x rather than $(y_2 - y_1)/(x_2 - x_1)$?



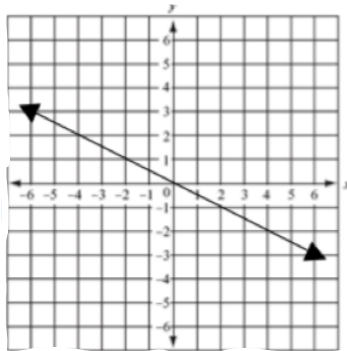
$$y = mx + 0$$

$$y = kx$$

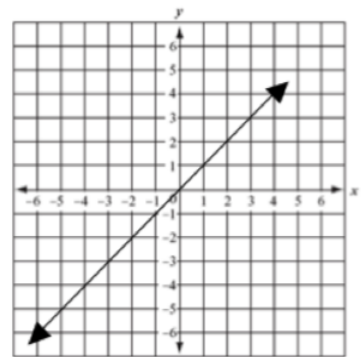
$$\frac{y_1}{x_1} = \frac{y_2}{x_2}$$



$$k = \underline{3}$$



$$k = \underline{-\frac{1}{2}}$$



$$k = \underline{1}$$

Find k for each graph.

$$y=kx$$

y varies directly with x

What if we had different variables?

a varies directly with b $a=k b$

$$\frac{10}{15} = \frac{8}{x}$$

$$10x = 120$$

$$x = 12$$

The amount of money, m, you spend on Big Macs varies directly with the number of Big Mac you purchase, b. $m=k b$

If 10 Big Macs cost you \$15, write the equation: $15=k(10)$

How much would 8 Big Macs cost you? \$12

$$\frac{15}{10} = 1.50$$

$$\frac{y}{x}$$

How do we know if a function is a direct variation?

Same slope/k for each point on the graph.

$$k = \underline{2}$$

x	y
6	12
7	14
8	16

$$\text{Equation: } \underline{y = 2x}$$

$$k = \underline{\frac{1}{3}}$$

x	y
30	10
15	5
9	3

$$\text{Equation: } \underline{y = \frac{1}{3}x}$$

Identify two points that would make a direct variation/proportional relationship.

a. $(3,6)$ $(2,8)$ $(1,2)$ $(5,15)$ $(8,4)$

$$\frac{y}{x}$$

b. $(-4,12)$ $(9,-3)$ $(-3,6)$ $(2,-10)$ $(3,-1)$

$$-\frac{1}{3}$$

$$-\frac{1}{3}$$

Given that a varies directly with b and $a=28$ when $b=7$,

find a when $b=52$.

$$\begin{aligned} a &= kb & a &= 4(52) \\ 28 &= k(7) & a &= 208 \\ 4 &= k \end{aligned}$$

$$\frac{28}{7} = \frac{x}{52}$$

Given that y varies directly with x and $y=3$ when $x=9$,

find y when $x=40.5$.

$$\begin{aligned} y &= kx & y &= \frac{1}{3}(40.5) \\ 3 &= k(9) & y &= 13.5 \\ \frac{1}{3} &= k \end{aligned}$$

$$\frac{3}{9} = \frac{y}{40.5}$$

$$\begin{aligned} 9y &= 121.5 \\ y &= 13.5 \end{aligned}$$

Kyle's test grades vary directly with the amount of time he studies. If he gets a 60 on his test when he studies for 30 minutes, how many minutes did he study if he gets an 82?

$$g = kM$$

$$60 = k(30)$$

$$\frac{60}{30} = k$$

$$82 = kM$$

$$41 = M$$

$$\frac{60}{30} = \frac{82}{x}$$

Hooke's Law for an elastic spring states that the distance a spring stretches varies directly as the force applied. If a force of 160 newtons stretches a spring 5cm, how much will a force of 368 newtons stretch the same spring?

$$d = kf$$

$$5 = k(160)$$

$$\frac{1}{32} = k$$

$$d = \frac{1}{32}(368)$$

$$d = 11.5$$

