

GRAPHING LINEAR FUNCTIONS

Meteorologists are interested in the rate at which a hurricane is approaching land.

Time (hours)	0	1	2	3	4
Distance from Land (miles)	350	325	300	275	250

$\overset{+1}{\uparrow}$ $\overset{+1}{\uparrow}$ $\overset{+1}{\uparrow}$ $\overset{+1}{\uparrow}$
 \downarrow \downarrow \downarrow \downarrow
 -25 -25 -25 -25

This rate can be expressed as $\frac{\text{change in distance}}{\text{change in time}} = \frac{-25 \text{ miles}}{1 \text{ hour}}$

Notice that the rate of change is CONSTANT. The hurricane moves 25 miles closer every 1 hour(s).

Functions that have a constant rate of change are called LINEAR.

Determine if the following data sets represent linear functions.

a.

x	0	2	4	6
f(x) (y)	-1	2	5	8

$\overset{+2}{\uparrow}$ $\overset{+2}{\uparrow}$ $\overset{+2}{\uparrow}$
 \downarrow \downarrow \downarrow
 +3 +3 +3

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

Linear

b.

x	-1	2	5	8
f(x)	0	1	3	6

$\overset{+3}{\uparrow}$ $\overset{+3}{\uparrow}$ $\overset{+3}{\uparrow}$
 \downarrow \downarrow \downarrow
 +1 +2 +3

not Linear

x	-2	-1	2	4
y	8	6	0	-4

$\overset{+1}{\uparrow}$ $\overset{+3}{\uparrow}$ $\overset{+7}{\uparrow}$
 \downarrow \downarrow \downarrow
 -2 -2 -4 -4

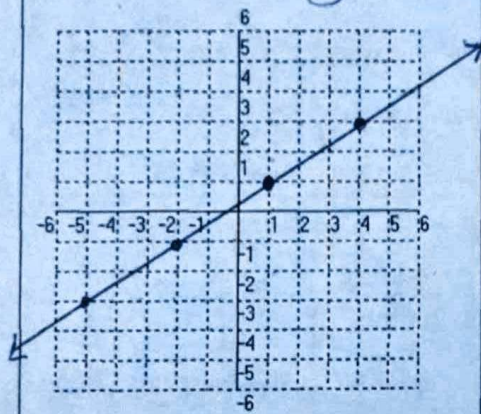
$$-2, -2, -4, -4$$

The constant rate of change for a linear function is its SLOPE. The SLOPE of a linear function is the ratio $\frac{\text{change in } f(x)}{\text{change in } x}$, or $\frac{\Delta y}{\Delta x}$.

You can graph lines by using the slope and a point.

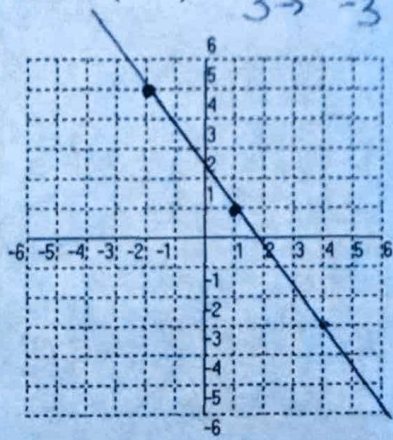
a. line with slope $\frac{2}{3}$ that passes through $(1,1)$

$\frac{2 \uparrow}{3 \rightarrow}$



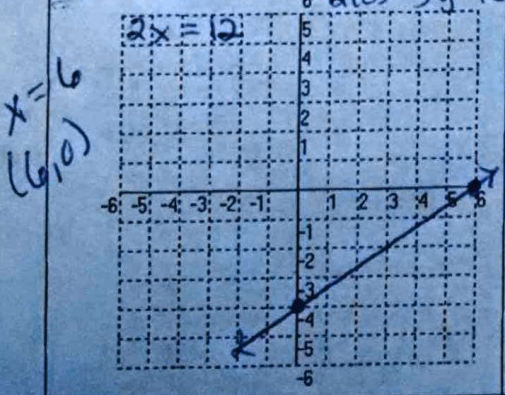
b. line with slope $-\frac{4}{3}$ that passes through $(-2,5)$

$\frac{-4 \downarrow}{3 \rightarrow} \frac{4}{-3}$

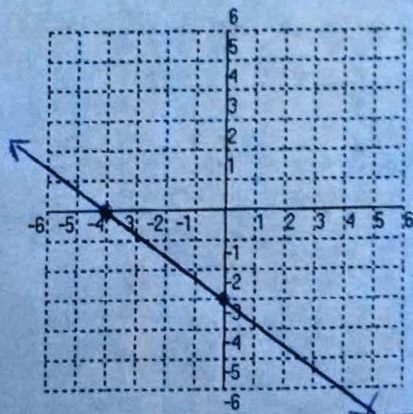


Or 2 points by finding the intercepts of each line

a. $2x - 3y = 12$
 $(x, 0)$ $(0, y)$
 $2x - 3(0) = 12$ $2(0) - 3y = 12$



b. $6x + 8y = -24$
 $(-4, 0)$ $(0, -3)$

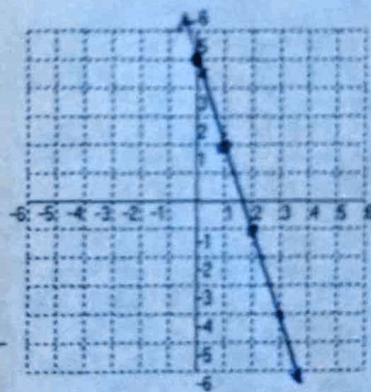


$3x + y = 5$

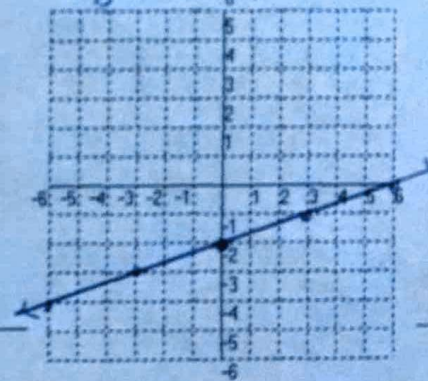
Linear functions can also be expressed as linear equations in the form $y = mx + b$. When a linear function is written in the form $y = mx + b$, the functions is said to be in SLOPE - INTERCEPT form because m is the slope and b is the y-intercept. Notice that slope-intercept form is the equation solved for y.

Write each function in slope-intercept form. Then graph.

a. $3x + y = 5$
 $-3x \quad -3x$ $m = -\frac{3}{1}$
 $y = -3x + 5$ $b = (0, 5)$

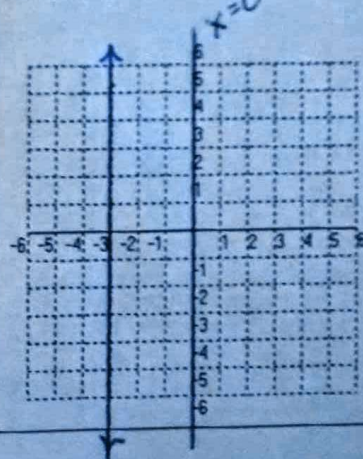


b. $5x = 15y + 30$
 $-30 \quad -30$ $m = \frac{1}{3}$
 $\frac{5x - 30 = 15y}{15 \quad 15 \quad 15}$ $b = -2$
 $\frac{1}{3}x - 2 = y$

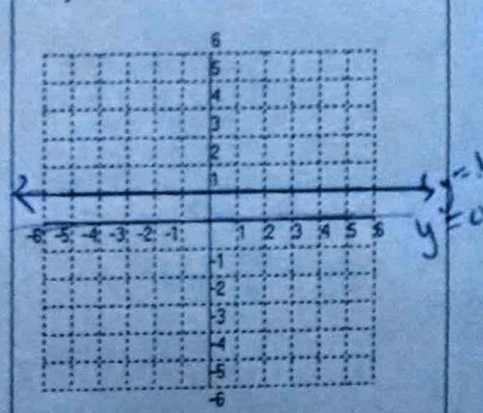


Determine if each line is vertical or horizontal. Then graph.

a. $x = -3$



b. $y = 1$



PROPORTIONAL RELATIONSHIPS

Cross Products Property		
Words	Numbers	Algebra
The cross products of a proportion are equal.	$\frac{3}{5} = \frac{9}{15}$	For real numbers $a, b, c,$ and $d,$ where $b \neq 0$ and $d \neq 0$: If $\frac{a}{b} = \frac{c}{d},$ then $ad = bc$

<p>a. $\frac{22}{9} = \frac{x}{13.5}$</p> <p>$22(13.5) = 9x$</p> <p>$297 = 9x$</p> <p>$x = 33$</p>	<p>b. $\frac{512}{16} = \frac{64}{w}$</p> <p>$512w = 16(64)$</p> <p>$w = 2$</p>
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<p>c. $\frac{y-5}{12} = \frac{77}{84}$</p> <p>$84(y-5) = 12(77)$</p> <p>$84y - 420 = 924$</p> <hr style="width: 100%;"/> <p style="text-align: center;">$84y = 1344$</p> <p style="text-align: center;">$y = 16$</p>	<p>d. $\frac{15}{5x-3} = \frac{2.5}{7}$</p> <p>$2.5(5x-3) = 15(7)$</p> <p>$12.5x - 7.5 = 105$</p> <p>$12.5x = 112.5$</p> <p>$x = 9$</p>
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<p>e. $\frac{2x+3}{x+4} = \frac{3}{5}$</p> <p>$5(2x+3) = 3(x+4)$</p> <p>$10x + 15 = 3x + 12$</p> <p>$7x = -3$</p> <p>$x = -\frac{3}{7}$</p>	<p>f. $\frac{4}{x+6} = \frac{10}{2x+12}$</p> <p>$10(x+6) = 4(2x+12)$</p> <p>$10x + 60 = 8x + 48$</p> <hr style="width: 100%;"/> <p style="text-align: center;">$2x + 60 = 48$</p> <p style="text-align: center;">$2x = -12$</p> <p style="text-align: center;">$x = -6$</p>
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← 100

a) A college brochure states that 11.5% of the students attending the college are majoring in engineering. If 2400 students are attending the college, how many are majoring in engineering?

$$\frac{\text{Eng}}{\text{Total}} = \frac{11.5}{100} = \frac{x}{2400}$$
$$\frac{100}{11.5} = \frac{2400}{x}$$

x = 276

~~b) A pedometer measures how far a jogger has run. To set her pedometer, Rita must know her stride length. Rita counts 328 strides as she runs once around a 400-meter track. A meter is about 39.37 inches. How long is her stride in inches?~~

c. A rock climber wants to know the height of a cliff. The climber measures the shadow of her friend, who is 5 feet tall and standing beside the cliff, and measures the shadow of the cliff. If the friend's shadow is 4 feet long and the cliff's shadow is 60 feet long, how tall is the cliff?

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