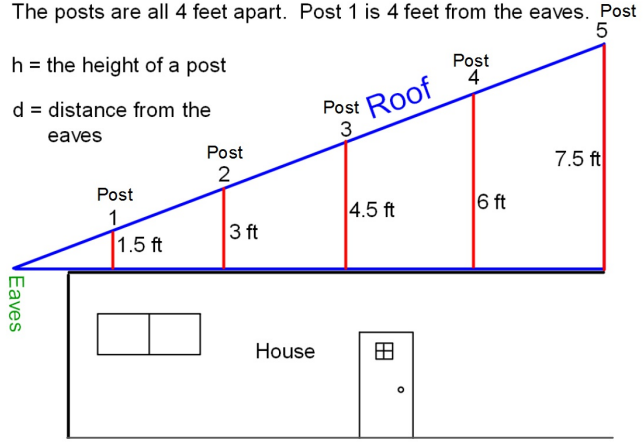
The posts are all 4 feet apart. Post 1 is 4 feet from the eaves.

h = the height of a post

d = distance from the eaves

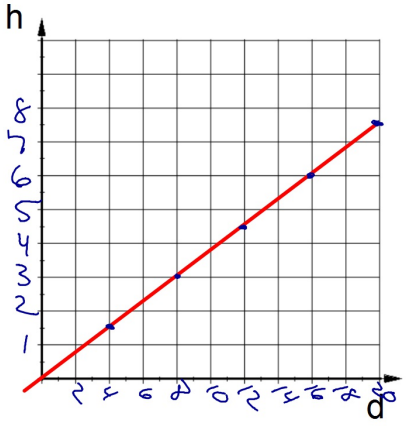


Fill in the d column. Then find the ratio $\frac{h}{d}$ for each post.

POST	d	h	$\frac{h}{d}$
1	4	1.5	.375
2	8	3	.375
3	12	4.5	.375
4	16	6	.375
5	20	7.5	.375

This shows that $\frac{h}{d}$ is a Constant Ratio

Make a scatter plot of the data in the table.



d	h
4	1.5
8	3
12	4.5
16	6
20	7.5

This becomes a line that passes through the origin.

Lines that pass through the origin have the following equation:

$y = mx$

These lines are called Direct Variation.

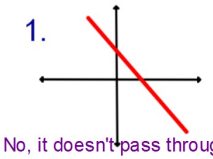
When is the only time that a line written in Standard Form will pass through the origin?

$Ax + By = C$ the only time that Standard Form will be Direct Variation (passes through the origin) is if C=0.

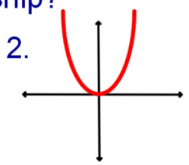
Graph of direct variation

- The graph must be a line that passes through the origin.

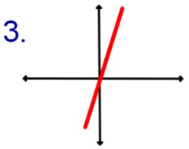
Does each graph represent a Direct Variation relationship?

1. 

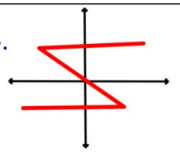
No, it doesn't pass through the origin.

2. 

No, this isn't a line

3. 

Yes

4. 

No, this isn't a line.
In fact, it's not even a function.

You'll also see the following equation for Direct Variation: y = kx

k = slope of the line

k is also called the variation constant.

Solve the equation $y = kx$ for k.

$\frac{y}{x} = \frac{kx}{x}$

$k = \frac{y}{x}$

Since k(slope) is the same everywhere on a given line it is said that Direct Variation is a

Constant Ratio

Since $k = slope = \frac{Y}{X}$ then $\frac{Y}{X}$ is always the same anywhere on a Direct Variation line.

Sec 2-3: Direct Variation Equations

Direct Variation is a special Linear Function.

- It has a constant ratio $\frac{Y}{X} = k$

  k = the Variation Constant

- Direct Variation Equation:

  $\frac{y}{x} = k$ or $y = kx$

Does each table of values represent a Direct Variation relationship?

1.

X	Y	$\frac{Y}{X}$
6	28.5	4.75
11	52.25	4.75
19	89	4.69
26	119.6	
42	201.6	

No, y/x is not a constant ratio

2.

X	Y	$\frac{Y}{X}$
4	5.4	1.35
14	18.9	1.35
22	21.6	0.98
27	36.45	
34	45.9	

No, y/x is not a constant ratio

Direct Variation Equations:

$\frac{y}{x} = k$ or $y = kx$

Is each equation direct variation?
If yes, find the variation constant.

1. $4x + 2y = 10$

No, since C isn't zero this line won't go through the origin.
Also, if you solve for y you won't get y = kx, there will by a y-intercept other than zero.

2. $6 + 7y = 5 - 3x + 1$

First, simplify

$6 + 7y = 6 - 3x$

$-6 \quad -6$

$\frac{7y}{7} = \frac{-3x}{7}$ → $y = \frac{-3}{7}x$

Yes, this really was a Direct Variation Equation.

Given the table shows a direct variation relationship, find the value of ?.

To solve Direct Variation situations you can use either equation or you can use a Proportion

Since the ratio y/x is a constant, you could use any of the rows in the table to set up a proportion.

X	Y	$\frac{Y}{X}$
4	9	2.25
10	22.5	
24	54	
35	?	

$y = 2.25x$

$y = 2.25(35)$

$y = 78.75$

$\frac{9}{4} = \frac{?}{35}$

If you cross multiple you get the same answer for y: y = 78.75

1. Use this table to write a Direct Variation equation.

X	Y	$\frac{Y}{X}$
2	12.2	6.1
9	54.9	
15	91.5	
18	109.8	
23	140.3	

$\frac{Y}{X} = 6.1$ or $y = 6.1x$

2. Find the value of x when y=50

$x = 8.20$ $\quad \frac{50}{6.1} = \frac{6.1}{6.1}x$

3. Find the value of y when x=20

$y = 6.1(20)$

$y = 122$

Remember the phrase: "Y varies directly with X"

The amount of water in the tub varies directly with the amount of time the water has running. After 5 minutes there are 12 gallons in the tub.

$K = \frac{y}{x}$

$K = \frac{12\text{ gal}}{5\text{ min}}$

$K = 2.4\text{ gal/min}$

1. Model this situation with a Direct Variation equation.

$y = 2.4x$

2. Find the amount of time it takes to fill a 32 gallon tub.

$\frac{32}{2.4} = \frac{2.4}{2.4}x$ $\quad x = 13.33\text{ min}$