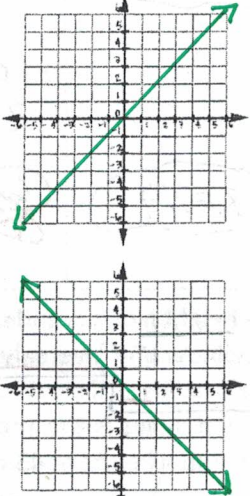
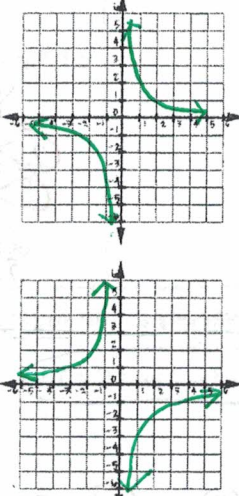
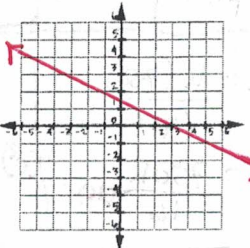
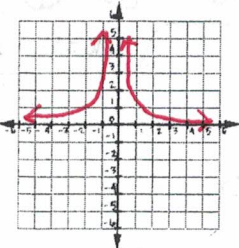


	DIRECT VARIATION (multiplication)	INVERSE VARIATION (Division)
What is it?	A set of INPUTS (x) and OUTPUTS (y) with a <u>product</u> that has a constant called "k".	A set of INPUTS (x) and OUTPUTS (y) with a <u>ratio</u> that has a constant called "k".
Equation	$y = kx$	$y = \frac{k}{x}$
Examples	$y = \frac{1}{5}x \rightarrow k = \frac{1}{5}$ $y = -2x \rightarrow k = -2$	$y = \frac{5}{x} \rightarrow k = 5$ $y = -\frac{4}{x} \rightarrow k = -4$
Non-Examples	$y = 7x + 5$ $y = -18 + \frac{1}{2}x$	$y = \frac{x}{6} \rightarrow$ "x" is in the numerator vs denominator; "Direct variation" $y = \frac{-3}{x} - 3$
How do you test?	Check the direction; both up or both down. <u>If you divide every y by its x, it should be the same.</u>	Check the direction; going opposite. <u>If you multiply every y by its x, it should be the same.</u>
Graph Examples	 <p>Always Goes Through Origin</p>	
Graph Non-Examples	 <p>does not go through the origin.</p>	

Direct Variation Equation: $y = kx$
 here k is called the constant of variation

Inverse Variation Equation: $y = \frac{k}{x}$
 where k is called the constant of variation

Wording: y varies directly with x } y is proportional to x

Wording: y varies inversely with x

Steps to Solve Direct and Inverse Variation Problems →

- 1.) Create an equation based on how the problem is worded where the constant of variation "k" is unknown.
- 2.) Substitute values in for each variable in the problem where then you will have to solve for k.
- 3.) Rewrite your equation (where k is now known) so you can answer questions using the completed equation.

Examples: Complete each problem using the appropriate type of variation.

1.) Suppose y varies directly with x where y = 21 when x = 7.

a.) Write an equation for this variation. $y = kx$

$$21 = \frac{k(7)}{7} \rightarrow y = 3x$$

$k = 3$

b.) Find y when x = 15.

$$y = 3x$$

$$y = 3(15)$$

$$y = 45$$

c.) Find x when y = 72.

$$y = 3x$$

$$\frac{72}{3} = \frac{3x}{3}$$

$$x = 24$$

2.) Suppose y varies inversely with x where y = 2 when x = 9.

a.) Write an equation for this variation. $y = \frac{k}{x}$

$$(9) 2 = \frac{k}{9} \rightarrow y = \frac{18}{x}$$

$k = 18$

b.) Find y when x = 3.

$$y = \frac{18}{x}$$

$$y = \frac{18}{(3)} \rightarrow y = 6$$

c.) Find x when y = $\frac{2}{3}$.

$$y = \frac{18}{x}$$

$$\frac{2}{3} = \frac{18}{x}$$

$$2x = \frac{54}{2} \rightarrow x = 27$$

3.) Suppose z varies directly with x and inversely with y where x = 6, y = 2, when z = 15.

a.) Write an equation for this variation. $z = \frac{kx}{y}$

$$(15) 15 = \frac{k(6)}{2} \rightarrow z = \frac{5x}{y}$$

$30 = 6k$
 $k = 5$

b.) Find z when x = 4 and y = 2.

$$z = \frac{5x}{y}$$

$$z = \frac{5(4)}{2} \rightarrow z = 10$$

c.) Find x when y = 10 and z = 6.

$$z = \frac{5x}{y}$$

$$6 = \frac{5x}{10} \rightarrow x = 12$$

$$5x = 60$$

4.) A varies directly as B and inversely as the square root of C where $A = \frac{3}{2}$ when B = 2 and C = 16.

Find C when A = 9 and B = 6.

$$A = \frac{kB}{\sqrt{C}}$$

$$\frac{3}{2} = \frac{k(2)}{\sqrt{16}} \rightarrow \frac{3}{2} = \frac{2k}{4}$$

$4k = 12 \rightarrow k = 3$

$$A = \frac{3B}{\sqrt{C}} \rightarrow 9 = \frac{3(6)}{\sqrt{C}}$$

$$(9) 9 = \frac{18}{\sqrt{C}} \rightarrow 9\sqrt{C} = 18$$

$$\frac{9\sqrt{C}}{9} = \frac{18}{9}$$

$$\sqrt{C} = 2$$

$$(\sqrt{C})^2 = (2)^2$$

$$C = 4$$

5.) The height h of a cylinder varies directly with the volume of the cylinder and inversely with the square of the cylinder's radius. If a cylinder's height is 147.2 ft, volume is 750 ft³, and radius is 4 ft, then what is the radius of a cylinder with a height of 43.6 ft and a volume of 500 ft³?

$$h = \frac{kV}{r^2}$$


$$h = \frac{3.14V}{r^2}$$

$$147.2 = \frac{k(750)}{(4)^2}$$

$$(10) 147.2 = \frac{750k}{16}$$

$$2355.2 = 750k$$

$$\frac{2355.2}{750} = \frac{750k}{750}$$

$k = 3.14$
 π

$$43.6 = \frac{3.14(500)}{r^2}$$

$$(9) 43.6 = \frac{1570}{r^2}$$

$$43.6r^2 = 1570$$

$$\frac{43.6r^2}{43.6} = \frac{1570}{43.6}$$

$$r^2 = 36.01$$

$$\sqrt{r^2} = \sqrt{36.01}$$

$$r = 6 \text{ ft}$$