

## Variation

### I. General steps:

#### A. Set up equation:

1. Depending on the type of relationship, set up the right equation.
2. Using the additional information, solve for K.
3. Plug in the K value from step 2 into the equation from step 1.

#### B. Evaluate for the desired variable:

1. After setting up the equation, you now have a relationship between the variables. All that is left is to plug in known variable into equation and solve for unknown.

### II. Variations:

#### A. Direct –

1. Given in the form of :

Y varies directly with X

Gives you  $Y = K X$  as the equation.

2. **Ex: s varies directly with the square of t, s = 32 when t = 4, find s when t is 3:**

1) general equation:  $S = k t^2$

2) plug in to solve for k:  $32 = k(4)^2 \rightarrow 32 = 16k \rightarrow k = 2$

3) plug k into general equation(step 1):  $S = 2 t^2$

4) Find S when t = 3:  $S = 2(3)^2 \rightarrow S = 18$

B. Indirect:

1. Generally given in the form of:

Y varies indirectly with x

so  $Y = \frac{k}{x}$  will be the general equation.

2. **Ex: W varies indirectly with the cube of R, if w = 4 when R = 2, find W when r is 3:**

a) set up the equation:  $W = \frac{k}{x^3}$

b) plug in and solve for K:  $4 = \frac{k}{2^3} \rightarrow 4(2^3) = k \rightarrow 4(8) = k \rightarrow 32$

c) plug in k to equation from step a  $\rightarrow W = \frac{32}{x^3}$

d) find the desired variable:  $W = \frac{32}{(3)^3} = \frac{32}{27}$

C. Jointly:

1. Generally can be used to define one variable in terms of two;

Y varies jointly with x and z:

So the equation is,  $Y = k XZ$ .

2. **Ex: Q varies jointly with X and Y. If x = 2, y = 1 when Q=4. Find X when q = 6, y = 3:**

a)  $Q = k XY \rightarrow$  general equation:

b) plug in known quantities and solve for k  $4 = k (2) (1)$

$4 = 2k \rightarrow 2 = k$ .

c)  $Q = 2 XY$  plug in the k value to the general equation.

d) plug in the known quantities and solve for the unknown variable:  $6 = 2 X (3) \rightarrow 6 = 6X \rightarrow x = 1$

