Equations from Proportionality Statements ... and back

In $y \propto x$, the $\propto$ symbol is replaced by $= k$ to make an equation.

equation ---> proportionality statement

To go from an equation to a proportionality statement, replace all the constants with a proportionality symbol i.e $y = kx$ becomes $y \propto x$.

1. Write the proportionality statement in your notes for each of the following equations:

   (a) $V = \frac{4}{3}\pi r^3$;the relationship between V and r $V \propto r^3$

   (b) $F = \frac{mv^2}{r}$; between F and v $F \propto v^2$

   (c) same equation as (b); between F and r $F \propto \frac{1}{r}$

   (d) $F = \frac{Gm_1m_2}{r^2}$; between F and m_1 $F \propto m_1$

   (e) same equation as (d); between F and r $F \propto \frac{1}{r^2}$

   (f) $K = \frac{R^3}{T^2}$; between R and T $R \propto \sqrt[3]{T^2}$ or $T \propto \sqrt{R^3}$

proportionality statement ----> equation

To go from a proportionality statement to an equation, replace the $\propto$ symbol with $= k$. Substitute in a set of values and solve for k. Now use the equation to solve other similar cases.

2. If $a \propto b^3$ and a = 4 when b = 3.5, what is a when b = 7 ? $a = 32$

3. If $d \propto at^2$ and a = 2 when t = 4 and d = 16, what will d be when a = 4 and t = 12 ? $d = 288$

4. If $p \propto \frac{q^3}{r^2}$ and p = 400 when q = 5 and r = 3, what will p be when q = 15 and r = 5 ? $p = 3.888$

5. If $E \propto mv^2$ and E = 98 when m = 4 and v = 7, what will E be when m = 10 and v = 42 ? $E = 8,820$

combining the Multiplier Method

6. a) Determine the proportionality statement that describes the data below using the Multiplier Method. $y \propto \frac{1}{x^2}$ $\left(x^2 \propto \frac{1}{y}\right)$

x	0.2	0.4	0.6	0.8	1
y	200	50	22.2	12.5	8

b) Write an equation relating y and x. $y = \frac{8}{x^2}$

c) If x = 0.55, what would y be? $y = 26.4$

Practice

Determine the proportion for each of the following tables of values.

A	B
2	100
8	200
50	500
200	1000

$A \propto B^2$

C	D
3	120
6	60
9	40
12	30

$C \propto \frac{1}{D}$

E	F
2	90
54	270
16	180
250	450

$E \propto F^3$

G	H
6	5
12	20
18	45
42	245

$G^2 \propto H$

K	L
7	800
35	32
28	50
70	8

$K^2 \propto \frac{1}{L}$

M	N
2	3
4	24
6	81
8	192

$M^3 \propto N$

2. A slider that starts from rest and slides down an inclined air track covers the distances d in the times t. Using graphical methods, determine the relationship between d and t.

t	0	0.8	1.0	1.2	1.4
d	0	12.8	20.0	28.8	39.2

$d \propto t^2$

$d = 20t^2$

3. An experiment is performed to find the relationship between two physical quantities, B and A. The following data is obtained.

A	100	64	49	36	25	16
B	1.99	1.59	1.39	1.19	1.00	0.80

Determine the relationship between B and A.

$A \propto B^2$ $\quad A = 25B^2$