Algebra 2 | Monday 3-11-13 | Class Notes

Ch. 5-1 Variation Functions

Vocabulary:
- Direct Variation
- Joint Variation
- Inverse Variation
- Combined Variation

Direct Variation — A linear relationship between 2 variables (say x and y) that can be written in the form $y = kx$

read, using variation language, as "y varies directly as x"

k ⇒ constant of variation

A direct variation is just a linear equation $y = mx + b$ when $b = 0 \Rightarrow y = kx$.

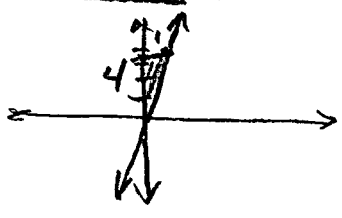
The slope, m and constant of variation k, ARE the SAME thing!

A direct variation will graph as a line passing through the origin.

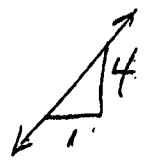
(EX 1) Pg 313 y varies directly as x, $y = 14$ when $x = 3.5$. Write and then graph the Direct Variation equation.

$y = kx$, $14 = k\,3.5$ $\therefore k = \frac{14}{3\frac{1}{2}}$

$\therefore \boxed{y = 4x}$ Eq. of D.V. $\leftarrow$ $k = \frac{14}{\frac{7}{2}} = 4$



$m = \frac{4}{1}$



Solving D.V. problems:

(Ex2) Pg 314 The circumference of a circle varies directly as the radius r, and $C = 7\pi$ ft. when $r = 3.5$ ft. Find r when $C = 4.5\pi$ ft.

$C = kr$ for all (r, C) pairs

$\therefore \frac{C}{r} = k$ for all (r, C) pairs

or $\frac{C}{r} = m$

Since $(3.5, 7\pi)$, $(r, 4.5\pi)$
$r \quad C$

$\frac{7\pi}{3.5} = \frac{4.5\pi}{r}$ Use cross-products

$7\pi r = (3.5)(4.5)\pi$

$r = \frac{(3\frac{1}{2})(4\frac{1}{2})}{7} = \left(\frac{7}{2}\right)\left(\frac{9}{2}\right)\left(\frac{1}{7}\right)$

$\boxed{r = \frac{9}{4} = 2\frac{1}{4} \text{ ft}}$

Joint Variation A relation among 3 variables that can be written in the form $y = kxz$

(k: constant of variation)

"y varies jointly as x and z"

(EX3) The Area A of a triangle varies jointly as the base b and height h. $A = 12\,m^2$ when $b = 6m$ and $h = 4m$.

Find b when $A = 36\,m^2$ and $h = 8m$

$A = kbh$ Find k

$\frac{12}{24} = \frac{k(6)(4)}{24}$

$\frac{1}{2} = k$ $\therefore$ $A = \frac{1}{2}bh$

$\therefore 36 = \frac{1}{2}b\,8$

$36 = 4b$

$9m = b$

(Ex) The lateral surface area (L) of a cone varies jointly as the base radius r, and the slant height ℓ.

$L = 63\pi\ m^2$ when $r = 3.5\ m$ and $\ell = 18\ m$.

Find r to nearest tenth when $L = 8\pi\ m^2$ and $\ell = 5\ m$

$L = krl$ Find k

$\frac{63\pi}{\left(\frac{7}{2}\right)(18)} = \frac{k(3.5)(18)}{\left(\frac{7}{2}\right)(18)}$

$\pi = k$

$L = \pi r \ell$

$8\pi = \pi r 5$

$\frac{8}{5\ m} = r$

$1.6\ m = 1\frac{3}{5}\ m$

Inverse Variation

As one variable increases, the other decreases

$$y = k\frac{1}{x} \text{ or } \frac{k}{x}$$

"y varies inversely as k"

(Ex 4) pg 315 y varies inversely as x and $y = 3$ when $x = 8$. Write and graph the inverse variation function.

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

$$3 = \frac{k}{8} \quad \therefore \boxed{k = 24}$$

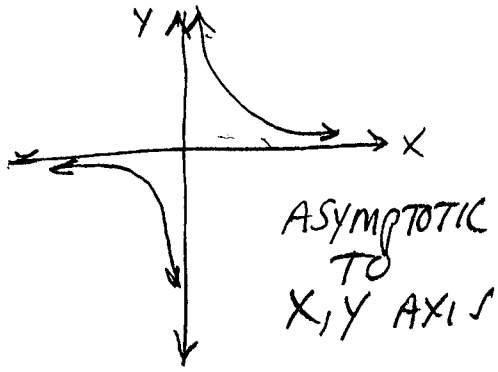
$$\boxed{y = \frac{24}{x}}$$

$x \neq 0$ why?

T-Table

x	y
-3	-8
-4	-6
-8	-3
-12	-2

x	y
3	8
4	6
8	3
12	2



asymptotic to x, y axis

Direct Variation

$y = kx$

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

↑ quotient (ratio) is constant

Inverse Variation

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

$k = xy$

↑ product is constant

Combined variation A relationship that has both direct AND inverse variations

---

(Ex 7) pg 316 $V = \frac{kT}{P}$ Volume varies directly as temp. and inversely as pressure

---

$V = 10\ell,\ T = 300K,\ P = 1.5$ atm

$\therefore 10 = \frac{k300}{\frac{3}{2}}$ $\therefore k = \frac{1}{20} = .05$

$V = \frac{.05T}{P}$

If $V = 7.5\ell,\ T = 350K,\ P = ?$

$7.5\ell = \frac{.05(350)}{P}$ $\therefore P = \frac{35}{2} \cdot \frac{2}{15_3}$

$P = \frac{7}{3}$ atm $= 2\frac{1}{3}$ atm