

**Fractions**

$$\frac{a}{b} \text{ means } a \div b \qquad a \text{ is the same as } \frac{a}{1}$$

**Equality of Fractions**

$$\text{If } \frac{a}{b} = \frac{c}{d}, \text{ then } a \times d = b \times c$$

(cross multiplication; equivalent to multiplying both sides by bd)

**Multiplying Fractions**

$$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$$

**Dividing Fractions**

$$\frac{a}{b} \div \frac{c}{d} \equiv \frac{a}{b} \times \frac{d}{c} = \frac{a \times d}{b \times c} \quad \left( \text{same as } \frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a \times d}{b \times c} \right)$$

**Scientific Notation**

The basis of all science is measurement. Using very large or very small numbers becomes cumbersome. In these cases, we rewrite the numbers in scientific notation ( $a.bcd \times 10^e$ ). For example, 342587 becomes  $3.42587 \times 10^5$  and 0.000864 can be written as  $8.64 \times 10^{-4}$ .

**Multiplying Numbers in Scientific Notation**

multiply numbers and add exponents

$$(a \times 10^x) \times (b \times 10^y) = ab \times 10^{x+y}$$

**Dividing Numbers in Scientific Notation**

divide numbers and subtract exponents

$$(a \times 10^x) \div (b \times 10^y) = \frac{a}{b} \times 10^{x-y}$$

**Percent (%) = (parts) per hundred**

In a basket of 40 apples, 10 are rotten; % rotten apples =  $\frac{10}{40} \times 100 = 25\%$

**ppm** = parts per million; **ppb** = parts per billion

A 555,000 g sample of water contains 35 g of a toxic substance;  
express the amount of the toxic substance in ppm.

$$\text{ppm} = \frac{35 \text{ g toxic substance}}{555,000 \text{ g water}} \times 1,000,000 = 63 \text{ ppm}$$

**Find the error in the story below.**

*Vancouver Sun, Aug. 24, 1987, B1*

Brodeur (Canuck's No.1 goaltender for the last 7 years) was offered a new one-year (plus option) contract that includes both a pay cut at the major league level and a minor league clause. The latter would, according to Watters (Brodeur's agent), mean a 200 per cent pay cut if Brodeur was sent to the minors. Brodeur is reportedly paid \$300,000 per season.

**Direct Proportionality**

For any material, the mass and volume are directly proportional; if the volume is doubled, the mass doubles, etc.

$$M \propto V \text{ or } M = kV \text{ (k is a constant)}$$

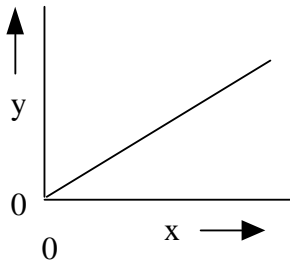
$$\frac{M}{V} = k \text{ (if two variables are directly proportional, the *ratio* is constant)}$$

y	28	15	0.96
x	12	5	0.28

are y and x directly proportional?

(Ans. No)

usual form is  $y = kx$  which is the equation for a straight line graph through the origin (0,0)



**Inverse Proportionality**

For a sample of a gas at constant temperature, the volume is inversely proportional to the pressure; if the pressure is doubled, the volume is halved, etc.

$$V \propto \frac{1}{P} \text{ or } V = k \times \frac{1}{P}$$

$$\text{or } PV = k \text{ (if two variables are inversely proportional, the *product* is constant)}$$

y	3	6	4.5
x	18	9	12

are y and x inversely proportional?

(Ans. Yes)

If  $xy = k$ , a graph of y vs x is a curve, but a graph of y vs 1/x is a straight line

