UNITS

MOST (BUT NOT ALL) PHYSICAL QUANTITIES ARE ASSOCIATED WITH A UNIT. IT IS MEANINGLESS (AND WRONG) TO QUOTE A PHYSICAL QUANTITY WITHOUT THE CORRECT UNIT.

EXAMPLES

DISTANCE: METERS [m] "[m]" ≡ "UNITS OF METERS"

MASS: KILOGRAMS [kg] METERS – KILOGRAMS – SECONDS

TIME: SECONDS [s] ⟹ "MKS" UNITS ⟺

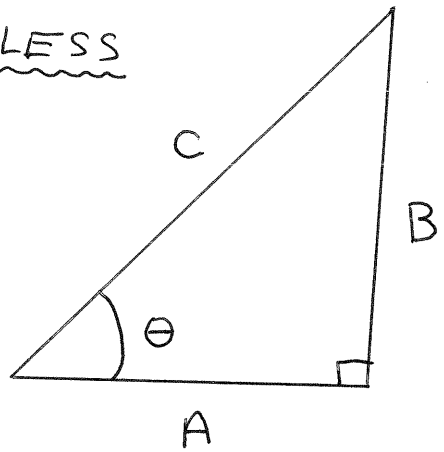
"SI" ≡ "STANDARD INTERNATIONAL" UNITS

[m], [kg], [s] ≡ "FUNDAMENTAL" UNITS

OTHER UNITS ARE "DERIVED" FROM FUNDAMENTAL UNITS ⟹ $\text{SPEED} \equiv \frac{\text{DISTANCE}}{\text{TIME}} \equiv \frac{[m]}{[s]} \equiv [m/s]$

SOME QUANTITIES ARE DIMENSIONLESS

EXAMPLE TRIG FUNCTIONS



A, B, C ≡ DISTANCES [m]

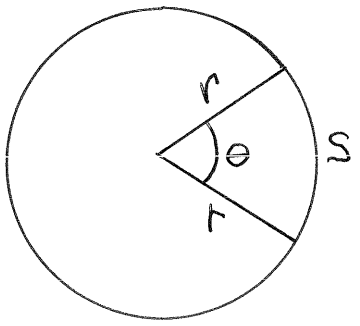
$\sin\theta = \frac{B}{C}$ $\cos\theta = \frac{A}{C}$ $\tan\theta = \frac{B}{A}$

$\sin\theta, \cos\theta, \tan\theta \equiv \frac{\text{Length}}{\text{Length}} \equiv$ DIMENSIONLESS

SOME "UNITS" ARE ACTUALLY DIMENSIONLESS:

EXAMPLE

RADIAN MEASURE FOR ANGLES



$S \equiv$ ARC LENGTH [m]

$r \equiv$ RADIUS OF CIRCLE [m]

$\theta \equiv \frac{S}{r} \equiv$ ANGLE IN "RADIANS"

$$\text{"RADIANS"} \equiv \frac{\text{LENGTH [m]}}{\text{LENGTH [m]}} \equiv \text{DIMENSIONLESS}$$

WE CARRY "RADIANS" AS A UNIT TO REMIND OURSELVES THAT WE HAVE DEFINED θ IN THIS WAY, BUT "RADIANS" ARE PHYSICALLY DIMENSIONLESS.

NOTE BY CARRYING THE UNITS SPECIFICALLY THROUGH OUR CALCULATIONS WE CAN AVOID ALGEBRA ERRORS. IT IS IMPERITIVE THAT ALL QUANTITIES ENTERED IN A CALCULATION BE STATED IN THE CORRECT, CONSISTANT UNITS. THIS OFTEN REQUIRES THE CONVERSION OF A GIVEN QUANTITY TO THE CORRECT UNIT REQUIRED FOR A CALCULATION.

EXAMPLE

CONVERT 1 MILE TO METERS:

$$1\,\text{mi} \times \frac{5{,}280\,\text{ft}}{\text{mi}} \times \frac{12\,\text{in}}{\text{ft}} \times \frac{2.54\,\text{cm}}{\text{in}} \times \frac{1\,\text{m}}{100\,\text{cm}} = 1609.3\,\text{m}$$

PREFIXES FOR POWERS OF 10

PICO	10^{-12}
NANO	10^{-9}
MICRO	10^{-6}
MILLI	10^{-3}
CENTI	10^{-2}
DECI	10^{-1}
DEKA	10
HECTO	10^{2}
KILO	10^{3}
MEGA	10^{6}
GIGA	10^{9}