List of physical constants

- Gravitational acceleration:

$$|g| = 9.81\,\mathrm{ms}^{-2}$$

Formula list

I. Section 0

- Gradient of a straight line graph between two points $(x_1, y_1), (x_2, y_2)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

- Trigonometry definitions

$$\sin\theta = \frac{\text{opposite}}{\text{hypothenuse}} \qquad \cos\theta = \frac{\text{adjacent}}{\text{hypothenuse}} \qquad \tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$
$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

- Trigonometric identities

$$\cos^2\theta + \sin^2\theta = 1$$

- Double angle formula

$$\sin 2\theta = 2\sin\theta\cos\theta$$
$$\cos 2\theta = \cos^2\theta - \sin^2\theta$$
$$\tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$$

- Common trigo values

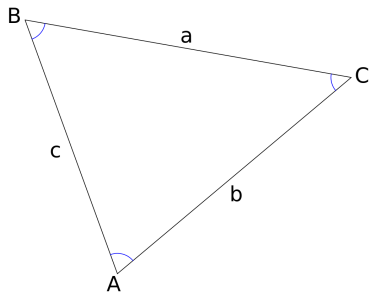
Common trigonometric expressions to know

- $\cos 45 = \sin 45 = \frac{1}{\sqrt{2}}, \tan 45 = 1$
- $\cos 30 = \frac{\sqrt{3}}{2}, \sin 30 = \frac{1}{2}, \tan 30 = \frac{1}{\sqrt{3}}$
- $\cos 60 = \frac{1}{2}, \sin 60 = \frac{\sqrt{3}}{2}, \tan 60 = \sqrt{3}$

- Sin and cos rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$c^2 = a^2 + b^2 - 2ab\cos C$$

where the angles and sides are as defined in the diagram below



- Pythogoras theorem

$$|\vec{A}| = \sqrt{A_x^2 + A_y^2}$$

- Common prefixes

TABLE 1.2 Common prefixes

Prefix	Abbreviation	Power of 10
mega-	M	10^6
kilo-	k	10^3
centi-	c	10^{-2}
milli-	m	10^{-3}
micro-	μ	10^{-6}
nano-	n	10^{-9}

II. Section 1

- Definitions of kinematic quantities

$$\vec{v} = \frac{\Delta\vec{x}}{t} \qquad\qquad a = \frac{\vec{v} - \vec{u}}{\Delta t}$$

- Kinematic equations

$$s = ut + \frac{1}{2}at^2$$
$$s = \frac{1}{2}(u+v)t$$
$$v = u + at$$
$$v^2 = u^2 + 2as$$

- Range and height of projectiles

$$H = \frac{u^2 \sin^2\theta}{2g} \qquad R = \frac{u^2 \sin 2\theta}{g}$$

- Trajectory equation

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

- Centripetal acceleration

$$a_c = \frac{v^2}{r}$$

- Relative velocity

$$\vec{v}_{A|B} = \vec{v}_{A|O} - \vec{v}_{B|O}$$

where $\vec{v}_{A|B}$ is velocity of A with respect to B,
$\vec{v}_{A|O}$ is velocity with A respect to the origin and
$\vec{v}_{B|O}$ is velocity with B respect to the origin

III. Section 2

- Relevant forces:

$$W = mg$$
$$f_{s_{\max}} = \mu_s N$$
$$f_k = \mu_k N$$
$$\vec{F}_{\text{spring}} = -k\Delta\vec{x}$$

where W is weight
$f_{s_{\max}}$ is maximum static friction
f_k is kinetic friction
μ_s and μ_k are coefficient of static and kinetic friction respectively
F_{spring} is spring force
k is the spring constant
Δx is the extension/compression of the spring.

- Newton's second law

$$\sum \vec{F} = m\vec{a}$$

- Centripetal force

$$F = \frac{mv^2}{r}$$

IV. Section 3.1

- Work

$$W = F_{||}s = Fs\cos\theta$$

- Kinetic energy

$$K = \frac{1}{2}mv^2$$

- Gravitational potential energy

$$U_g = mgh$$

- Spring potential energy

$$U_s = \frac{1}{2}k\Delta x^2$$

- Conservation of energy

$$E_f - E_i = 0$$

- Work-energy theorem (i.e conservation of energy in an open/non-isolated system)

$$E_f - E_i = W$$

- Power

$$P = \frac{W}{t}$$