FUNDAMENTAL CONSTANTS AND PHYSICAL DATA

Gravitational constant.. $G = 6.67 \times 10^{-11} \, \text{N} \cdot \text{m}^2/\text{kg}^2$

Constant in Coulomb's Law .... $k = 9.00 \times 10^{9} \, \text{N} \cdot \text{m}^2/\text{C}^2$

Elementary charge... $e = 1.60 \times 10^{-19} \, \text{C}$

Mass of electron .... $m_e = 9.11 \times 10^{-31} \, \text{kg}$

Mass of proton .... $m_p = 1.67 \times 10^{-27} \, \text{kg}$

Permeability of free space .... $\mu_o = 4\pi \times 10^{-7} \, \text{T} \cdot \text{m}/\text{A}$

Speed of light.. $c = 3.00 \times 10^{8} \, \text{m/s}$

Earth

radius .... $= 6.38 \times 10^{6} \, \text{m}$

mass .... $= 5.98 \times 10^{24} \, \text{kg}$

acceleration due to gravity at the surface of Earth
(for the purposes of this examination).................................. $g = 9.80 \, \text{m/s}^2$

period of rotation... $= 8.61 \times 10^{4} \, \text{s}$

radius of orbit around Sun .... $= 1.50 \times 10^{11} \, \text{m}$

period of orbit around Sun... $= 3.16 \times 10^{7} \, \text{s}$

Moon

radius .... $= 1.74 \times 10^{6} \, \text{m}$

mass .... $= 7.35 \times 10^{22} \, \text{kg}$

period of rotation... $= 2.36 \times 10^{6} \, \text{s}$

radius of orbit around Earth... $= 3.84 \times 10^{8} \, \text{m}$

period of orbit around Earth... $= 2.36 \times 10^{6} \, \text{s}$

Sun

mass .... $= 1.98 \times 10^{30} \, \text{kg}$

MATHEMATICAL FORMULAE

METRIC PREFIXES			
Prefix	**Symbol**	**Numerical**	**Exponential**
mega	M	1 000 000	10^6
kilo	k	1 000	10^3
hecto	h	100	10^2
deca	da	10	10^1
		1	10^0
deci	d	0.1	10^{-1}
centi	c	0.01	10^{-2}
milli	m	0.001	10^{-3}
micro	μ	0.000001	10^{-6}

N
W ⬥ E
S
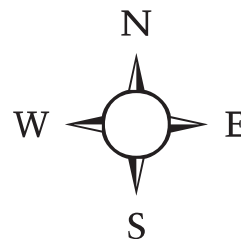
For Right-angled Triangles:
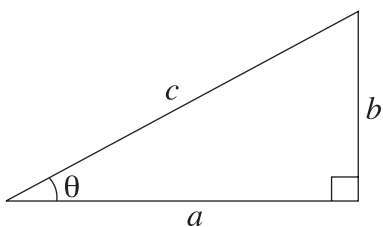
$$a^2 + b^2 = c^2$$

$$\sin\theta = \frac{b}{c} \quad \cos\theta = \frac{a}{c} \quad \tan\theta = \frac{b}{a}$$

$$\text{area} = \frac{1}{2}ab$$

For All Triangles:
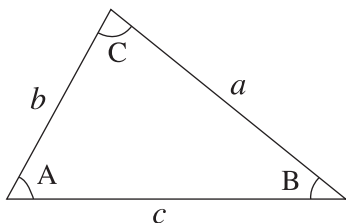
$$\text{area} = \frac{1}{2}\text{base} \times \text{height}$$

Sine Law : $\quad \dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$

Cosine Law : $\quad c^2 = a^2 + b^2 - 2ab\cos C$

Circle:

$$\text{Circumference} = 2\pi r$$

$$\text{Area} = \pi r^2$$

Quadratic Equation:

If $ax^2 + bx + c = 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Vector Kinematics in Two Dimensions:

$$v = v_0 + at \qquad \bar{v} = \frac{v + v_0}{2}$$

$$v^2 = v_0{}^2 + 2ad \qquad d = v_0 t + \frac{1}{2}at^2$$

Vector Dynamics:

$$F_{net} = ma \qquad F_g = mg$$

$$F_{fr} = \mu F_N$$

Work, Energy, and Power:

$$W = Fd \qquad E_p = mgh$$

$$E_k = \frac{1}{2}mv^2 \qquad P = \frac{W}{\Delta t}$$

Momentum:

$$p = mv \qquad \Delta p = F\Delta t$$

Equilibrium:

$$\tau = Fd$$

Circular Motion:

$$T = \frac{1}{f}$$

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$$

Gravitation:

$$F = G\frac{m_1 m_2}{r^2} \qquad E_p = -G\frac{m_1 m_2}{r}$$

Electrostatics:

$$F = k\frac{Q_1 Q_2}{r^2} \qquad E = \frac{F}{Q} \qquad E = \frac{kQ}{r^2}$$

$$\Delta V = \frac{\Delta E_p}{Q} \qquad E = \frac{\Delta V}{d}$$

$$E_p = k\frac{Q_1 Q_2}{r} \qquad V = \frac{kQ}{r}$$

Electric Circuits:

$$I = \frac{Q}{\Delta t} \qquad V = IR$$

$$V_{terminal} = \mathcal{E} \pm Ir \qquad P = VI$$

Electromagnetism:

$$F = BIl \qquad F = QvB$$

$$B = \mu_0 nI = \mu_0 \frac{N}{l}I \qquad \mathcal{E} = Blv$$

$$\Phi = BA \qquad \mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}$$

$$V_{back} = \mathcal{E} - Ir$$

$$\frac{V_s}{V_p} = \frac{N_s}{N_p} = \frac{I_p}{I_s}$$