Formulas

Gravitational force

near earth's surface: mg

far from earth's surface: $\frac{mgR^2}{(R+x)^2}$ where R is the radius of the earth.

Definition: The Wronskian of two differential functions, f and g is

$$W(f,g) = fg' - f'g = \begin{vmatrix} f & g \\ f' & g' \end{vmatrix}$$

$cos(y \mp x) = cos(x \mp y) = cos(x)cos(y) \pm sin(x)sin(y)$

Mechanical Vibrations:

$$mu''(t) + \gamma u'(t) + ku(t) = F_{external}, \quad m, \gamma, k \geq 0$$
$$mg - kL = 0, \qquad F_{viscous}(t) = \gamma u'(t)$$

m= mass,
k = spring force proportionality constant,
γ = damping force proportionality constant
g = 9.8 m/sec

Electrical Vibrations:

$$L\frac{dI(t)}{dt} + RI(t) + \frac{1}{C}Q(t) = E(t), \quad L, R, C \geq 0 \text{ and } I = \frac{dQ}{dt}$$

L = inductance (henrys),
R = resistance (ohms)
C = capacitance (farads)
$Q(t)$ = charge at time t (coulombs)
$I(t)$ = current at time t (amperes)
$E(t)$ = impressed voltage (volts).

1 volt = 1 ohm $\cdot$ 1 ampere = 1 coulomb / 1 farad = 1 henry $\cdot$ 1 amperes/ 1 second