Phys 195 Formula Sheet for Exam 1

Ch. 1 – Units, Physical Quantities and Vectors

$A_x = A\cos\theta,\ A_y = A\sin\theta, \quad A = \sqrt{{A_x}^2 + {A_y}^2}$

$\vec{\boldsymbol{R}} = \vec{\boldsymbol{A}} + \vec{\boldsymbol{B}}\ , \quad R_x = A_x + B_x\ , \quad R_y = A_y + B_y,$

$\vec{\boldsymbol{D}} = c\vec{\boldsymbol{A}}\ , \quad D_x = cA_x, \quad D_y = cA_y, \quad \left|\vec{\boldsymbol{D}}\right| = |c|\left|\vec{\boldsymbol{A}}\right|$

$\vec{\boldsymbol{A}} = A_x\hat{\boldsymbol{\imath}} + A_y\hat{\boldsymbol{\jmath}} + A_z\hat{\boldsymbol{k}}\ , \quad \vec{\boldsymbol{R}} = \vec{\boldsymbol{A}} + \vec{\boldsymbol{B}} = (A_x + B_x)\hat{\boldsymbol{\imath}} + \left(A_y + B_y\right)\hat{\boldsymbol{\jmath}} + (A_z + B_z)\hat{\boldsymbol{k}}$

Ch. 2 – Motion Along a Straight Line

$\Delta x = x_2 - x_1\ ,\ \Delta t = t_2 - t_1$

$v_{av-x} = \frac{\Delta x}{\Delta t} = \frac{x_2 - x_1}{t_2 - t_1}\ , \qquad v_x = \lim_{\Delta t\to 0}\frac{\Delta x}{\Delta t} = \frac{dx}{dt}\ , \quad v = |v_x|$

$a_{av-x} = \frac{\Delta v_x}{\Delta t} = \frac{v_{2x} - v_{1x}}{t_2 - t_1}\ , \qquad a_x = \lim_{\Delta t\to 0}\frac{\Delta v_x}{\Delta t} = \frac{dv_x}{dt} = \frac{d^2x}{dt^2}\ , \quad a = |a_x|$

$v_x = v_{0x} + a_x t\ , \quad x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2\ , \quad {v_x}^2 = {v_{0x}}^2 + 2a_x(x - x_0)\ ,$

$x - x_0 = \frac{1}{2}(v_{0x} + v_x)t$

$a_y = -g\ , \quad g = 9.80\ \text{m/s}^2$

$v_x = v_{0x} + \int_0^t a_x\,dt\ , \qquad x = x_0 + \int_0^t v_x\,dt$

Ch. 3 – Motion in 2 or 3 Dimensions

$\vec{\boldsymbol{r}} = x\hat{\boldsymbol{\imath}} + y\hat{\boldsymbol{\jmath}} + z\hat{\boldsymbol{k}}\ ,$

$\vec{\boldsymbol{v}}_{av} = \frac{\Delta\vec{\boldsymbol{r}}}{\Delta t} = \frac{\vec{\boldsymbol{r}}_2 - \vec{\boldsymbol{r}}_1}{t_2 - t_1}\ , \quad v_{av-x} = \frac{\Delta x}{\Delta t} = \frac{x_2 - x_1}{t_2 - t_1}\ , \quad v_{av-y} = \frac{\Delta y}{\Delta t} = \frac{y_2 - y_1}{t_2 - t_1}\ , \quad v_{av-z} = \frac{\Delta z}{\Delta t} = \frac{z_2 - z_1}{t_2 - t_1}$

$\vec{\boldsymbol{v}} = \lim_{\Delta t\to 0}\frac{\Delta\vec{\boldsymbol{r}}}{\Delta t} = \frac{d\vec{\boldsymbol{r}}}{dt}\ , \quad v_x = \frac{dx}{dt}\ , \ v_y = \frac{dy}{dt}\ , \quad v_z = \frac{dz}{dt}$

$\vec{\boldsymbol{a}}_{av} = \frac{\Delta\vec{\boldsymbol{v}}}{\Delta t} = \frac{\vec{\boldsymbol{v}}_2 - \vec{\boldsymbol{v}}_1}{t_2 - t_1}\ , \ a_{av-x} = \frac{\Delta v_x}{\Delta t} = \frac{v_{2x} - v_{1x}}{t_2 - t_1}\ , \ a_{av-y} = \frac{\Delta v_y}{\Delta t} = \frac{v_{2y} - v_{1y}}{t_2 - t_1}\ , \ a_{av-z} = \frac{\Delta v_z}{\Delta t} = \frac{v_{2z} - v_{1z}}{t_2 - t_1}$

$\vec{\boldsymbol{a}} = \lim_{\Delta t\to 0}\frac{\Delta\vec{\boldsymbol{v}}}{\Delta t} = \frac{d\vec{\boldsymbol{v}}}{dt}\ , \quad a_x = \frac{dv_x}{dt}\ , \ a_y = \frac{dv_y}{dt}\ , \quad a_z = \frac{dv_z}{dt}$

$v_x = v_{0x} + a_x t\ , \ x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2\ , \quad v_y = v_{0y} + a_y t\ , \quad y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$

Projectile motion: $a_x = 0,\ a_y = -g$

$x = x_0 + (v_0\cos\alpha_0)t, \qquad y = y_0 + (v_0\sin\alpha_0)t - \frac{1}{2}gt^2$

$v_x = v_{0x}\ , \quad v_y = v_{0y} - gt\ , \qquad v_{0x} = v_0\cos\alpha_0\ , \quad v_{0y} = v_0\sin\alpha_0$