

UNIVERSITY OF MANITOBA

October 22, 2015

MIDTERM EXAMINATION

(7:00 PM - 9:00 PM)

Formula Sheet

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COURSE NO: PHYS 1050

TIME: 2 hours

EXAMINATION: Physics 1: Mechanics

EXAMINERS: Sirker, J., Lin, F., Hu, C.-M.

Mathematics

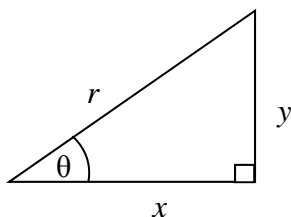
Quadratic equation:

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometry

$$x^2 + y^2 = r^2$$



$$\sin \theta = y / r$$

$$\cos \theta = x / r$$

$$\tan \theta = y / x$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

Calculus:

$$\frac{d}{dt}(a \cdot t^n) = a \cdot n t^{n-1}$$

$$\int x^n dx = \frac{x^{n+1}}{n+1}$$

Translational Kinematics

Three dimensions:

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

$$\vec{v}_{av} = \frac{\Delta \vec{r}}{\Delta t} = \frac{\vec{r}_2 - \vec{r}_1}{t_2 - t_1}$$

$$\vec{v} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$$

$$\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$

$$\vec{a} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}$$

One dimension:

$$v_{x,av} = \frac{\Delta x}{\Delta t}$$

$$v_x = \lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$$

$$a_{x,av} = \frac{\Delta v_x}{\Delta t}$$

$$a_x = \lim_{\Delta t \rightarrow 0} \frac{\Delta v_x}{\Delta t} = \frac{dv_x}{dt}$$

Constants and Units

kilo: k = 10³

micro: μ = 10⁻⁶

nano: n = 10⁻⁹

c = 3.0 × 10⁸ m/s

g = 9.80 m/s²

Constant acceleration in one dimension:

$$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$$

$$v_x = v_{0x} + a_x t$$

$$v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$$

Uniform circular motion:

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

Particle Dynamics

$$W = mg \quad \Sigma \vec{F} = m\vec{a}$$

$$\left. \begin{aligned} f_s &\leq \mu_s N \\ f_k &= \mu_k N \end{aligned} \right\} N = \text{normal force}$$

Relative Motion

$$\vec{v}_{PA} = \vec{v}_{PB} + \vec{v}_{BA} \quad (PA \text{ means } P \text{ relative to } A, \text{ etc.})$$