

PHYS 111-01 - FIRST MIDTERM EXAM - VALID STARTING EQUATIONS

The equations given below may be used as starting points for solving problems on the first midterm exam. They can be used without explanation. Vector quantities are shown in **bold** type.

Motion and Vectors:

$$\mathbf{v} = \Delta \mathbf{r} / \Delta t$$

$$\mathbf{a} = \Delta \mathbf{v} / \Delta t$$

$$\mathbf{r} = \mathbf{r}_0 + \mathbf{v} \Delta t$$

$$\mathbf{v} = \mathbf{v}_0 + \mathbf{a} \Delta t$$

$$\mathbf{v}_{13} = \mathbf{v}_{12} + \mathbf{v}_{23} \text{ (Relative Velocity)}$$

Special case of linear motion with constant acceleration: $x = x_0 + v_{x0}t + a_x t^2 / 2$

$$v_x = v_{x0} + a_x t$$

$$v_x^2 = v_{x0}^2 + 2a_x \Delta x$$

Uniform circular motion: $a_{cp} = v^2 / r$

For angles measured from positive x-axis:

$$A_x = A \cos \theta \quad A_y = A \sin \theta$$

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

$$\theta = \tan^{-1} (A_y / A_x)$$

Forces:

$$\Sigma \mathbf{F} = \mathbf{F}_{net} = m\mathbf{a}$$

$$\Sigma F_x = ma_x$$

$$\Sigma F_y = ma_y$$

$$\mathbf{F}_{21} = -\mathbf{F}_{12}$$

$$\mathbf{w} = m\mathbf{g}$$

Friction:

$$f_s \leq \mu_s N$$

$$f_k = \mu_k N$$

Spring force: $F = -kx$ where x is the extension of the spring

$$\mathbf{F}_{cp} = mv^2 / r \text{ toward center}$$

Other types of forces: Tension (**T**); Normal Force (**N**)

<u>QUANTITY</u>	<u>SYMBOL</u>	<u>UNIT OR VALUE</u>	<u>COMMENTS</u>
Mass	m	kg	
Length	l	m	
Time	t	s	
Position	r	m	Components x,y
Displacement	$\Delta \mathbf{r}$	m	Components $\Delta x, \Delta y$
Velocity	v	m/s	Magnitude is speed
Acceleration	a	m/s ²	
Force	F	N	N=kg-m/s ²
Acceleration of gravity	g or g	9.80 m/s ² or N/kg	
Coefficient of static friction	μ_s	dimensionless	
Coefficient of kinetic friction	μ_k	dimensionless	
Spring constant	k	N/m	