

## Equation Sheet for Midterm and Final EXSC 365

### Linear Kinematics

$$\text{speed} = \frac{\text{dist}}{\text{time}} \quad \text{velocity} = \frac{\text{displacement}}{\text{time}} \quad \text{acceleration} = \frac{\Delta \text{velocity}}{\Delta \text{time}}$$

### Projectile Equations

$$Y = Y_0 + v_v t + \frac{1}{2} g t^2 \quad X = X_0 + v_h t \quad \text{MaxHeight} = \frac{v_v^2}{-2g} \quad \text{FlightTime} = \frac{2v_v}{-g}$$

$$\text{HorizontalDisp} = v_h (\text{FlightTime}) \quad \text{FlightTime} = \frac{-v_v - \sqrt{v_v^2 - 2gh}}{g}$$

### Linear Kinetics

$$W = mg \quad F_{\text{Friction}} = \mu N \quad \text{Linear Momentum: } L = mv \quad F_{\text{slope}} = mg \sin \theta$$

Perfectly elastic collision:  $m_A v_A = m_B v_B$

Coefficient of restitution:  $e = \sqrt{\frac{\text{bounceheight}}{\text{dropheight}}}$  or  $e = \frac{v_2 - v_1}{u_1 - u_2}$

Impulse/Momentum:  $F\Delta t = m\Delta v$

### Work, Power, & Energy

$$U = Fd \quad KE = \frac{1}{2} mv^2 \quad GPE = -mgh \quad SE = \frac{1}{2} k\Delta x^2$$

$$U = \Delta KE + \Delta GPE + \Delta SE \quad P = \frac{U}{t} = Fv$$

### Stress and Strain

$$\sigma = \frac{F}{A} \quad \varepsilon = \frac{l_{\text{new}} - l_{\text{old}}}{l_{\text{old}}} \quad E = \frac{\sigma}{\varepsilon}$$

### Center of Mass

$$CM_x = X_{\text{Pr ox}} + L\%(X_{\text{Dist}} - X_{\text{Pr ox}}) \quad CM_y = Y_{\text{Pr ox}} + L\%(Y_{\text{Dist}} - Y_{\text{Pr ox}}) \quad CM_{\text{Body}} = \frac{\Sigma(CM_{\text{seg}} m_{\text{seg}})}{\Sigma(m_{\text{total}})}$$

### Fluid Mechanics

$$P = \frac{F}{A} \quad \rho = \frac{m}{V} \quad F_{\text{Drag}} = \frac{1}{2} C_D \rho A v^2 \quad F_{\text{Lift}} = \frac{1}{2} C_L \rho A v^2 \quad v = \sqrt{\frac{-2mg \sin(\theta)}{C_D \rho A}}$$

### Conversions

1 lb = 4.45 N	1 mile = 1609 m	1 m = 3.28 ft	1 kg = 2.20 lb
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