PHY 321 Classical Dynamics – Chapter 2 Review

I. Concepts
   a. Newton's Laws of Motion
   b. Conservation Theorems (Linear and Angular Momentum, Energy)

II. Terms and Symbols
   a. free body
   b. inertia
   c. inertial vs gravitational mass
   d. equation of motion
   e. path independence
   f. conservative force
   g. *T*, *U*, $\mathbf{p}$, $\mathbf{F}$, $\mathbf{N}=\mathbf{r}\times\mathbf{F}$, $\mathbf{L}=\mathbf{r}\times\mathbf{p}$, …

III. Problem Types
   a. Free Fall $y=v_0t-\frac{1}{2}gt^2, v^2=v_0^2-2gh, v=v_0-gt$
   b. Projectile Motion $x=v_{0x}t, y=v_{0x}t-\frac{1}{2}gt^2, v_y{}^2=v_{0x}^2-2gh, v_y=v_{0x}-gt$
   c. Inclined Plane – no friction $|a|=g\sin\theta, N-mg\cos\theta$ and friction – angle of repose, etc
   d. Types of Forces
      i. Old - Normal, Weight, Tension, Friction, Gravitational,
      ii. New – Drag, Retarding force
   e. Computing forces from *v=v(x)*, or *x=x(t)*
   f. Work: $W_{12}=\int_1^2\mathbf{F}\cdot d\mathbf{r}=\Delta T$
   g. Energy: $(T=\frac{1}{2}mv^2, U_g=mgh, U_s=\frac{1}{2}kx^2)$

IV. Methods
   a. $\mathbf{F}=\frac{d\mathbf{p}}{dt}\Rightarrow m\frac{dv}{dt}=m\ddot{x}=F.$
   b. $\mathbf{F}=-\nabla U$
   c. Energy Methods $\frac{1}{2}mv^2+mgh+\frac{1}{2}kx^2=\text{const}$
   d. $E=T+U\Rightarrow t-t_0=\pm\int_{x_0}^{x}\frac{dx}{\sqrt{\frac{2}{m}(E-U(x))}}$
   e. Potential Energy Plots - $U(x)$ vs *x*, turning points, equilibria
   f. Stability $\frac{dU}{dx}=0$, $\frac{d^2U}{dx^2}=?$