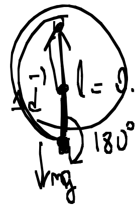
Note Title 4/11/2012

$W \cdot s \Rightarrow \quad \frac{E}{\cancel{t}} \times \cancel{t} = E \qquad F \cdot \cancel{x} = W \qquad F \cdot x = W \qquad kg \frac{m^2}{s^2} \Rightarrow m^2$

$\underset{m}{(kg)} \underset{a}{\left(\frac{m}{s^2}\right)} \rightarrow F \times A \neq E$



$\vec{F} \cdot \Delta\vec{d} = W$

$\rightarrow |\vec{F}||\Delta d| \underbrace{\cos 180°}_{-1} = -mg\,\Delta d = -0.5 \times 10 \times 1.6$

$= -8\,J$

3. $\vec{F} \cdot \Delta\vec{d} \Rightarrow [30\hat{i} - 40\hat{j}] \cdot [-9\hat{i} - 3\hat{j}]$

$30 \times -9 \underbrace{(\hat{i} \cdot \hat{i})}_{1} + -40 \times -3 \underbrace{(\hat{j} \cdot \hat{j})}_{1} = -270 + 120$

$= \underline{-150\,J}$

$v = 0$ $\Rightarrow$ $\overset{2E}{\longleftarrow} \underset{m_1}{o} \quad \underset{m_2}{o} \overset{E}{\longrightarrow}$ $\qquad \frac{m_1}{m_2}$

Initial $\qquad$ Final $\rightarrow P_2$, $P_1 \leftarrow$

condition $\qquad P_i = P_f \quad \vec{\ } \rightarrow \Rightarrow$

$0 = 0 = \vec{P}_1 + \vec{P}_2$

$P_1 = -P_2$

$\therefore |\vec{P}_1| = |\vec{P}_2| = P$

$KE = \frac{1}{2} m v^2 = \frac{1}{2} \frac{m^2}{m} v^2$ $\quad p^2$

$P = mv \qquad \boxed{KE = \frac{p^2}{2m}}$

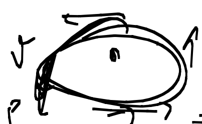
$KE_1 = 2E = p^2/2m_1$

$KE_2 = E = p^2/2m_2$

$\frac{m_1}{m_2} = \frac{\cancel{p^2}/4\cancel{E}}{\cancel{p^2}/2\cancel{E}} = \frac{1/4}{1/2} = 1/2$

$\left.\begin{array}{l} KE_1 = 2\,J \\ KE_1 = 1\,J \end{array}\right\}$

$\vec{F} \perp \vec{v} \qquad \vec{v} = \frac{d\vec{x}}{t} \qquad \vec{F} \perp \vec{x} \Rightarrow W = \vec{F} \cdot \vec{x} \Rightarrow 0$



$\frac{1}{2} m v^2 = KE \qquad |\vec{p}| \qquad \frac{v^2}{R} = a \qquad v = \frac{2\pi R}{T}$

$P = m\vec{v} \rightarrow |\vec{p}|$ is const but $\vec{p}$ is not

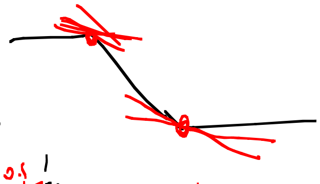
$KE = \frac{1}{2} m v^2 \qquad KE < 0$

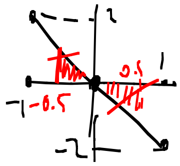
$\sum_{x=1}^{n} x^3 \Rightarrow 1^3 + 2^3 + 3^3 + \ldots + n^3 =$

$1 + 2 + 3 + \ldots + n = \frac{n(n+1)}{2} \qquad \left[\frac{n(n+1)}{2}\right]^2$

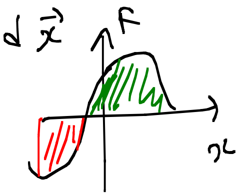
$(n+1)n/2$

$\left.\begin{array}{l} 1 + 2 + 3 + \ldots (n-1) + n \\ \hline n + (n-1) + \ldots \quad 2 + 1 \end{array}\right\}$





$w = \int \vec{F} \cdot d\vec{x}$



$F = cx \Rightarrow = 2$ $\quad -c = 2 \quad c = -2$

$F = -2x \qquad \int_{-0.5}^{0.5} F \cdot dx \qquad U(x=0) = 0$

$-\frac{\partial U}{\partial x} = F = -2x \Rightarrow \frac{\partial U}{\partial x} = 2x \Rightarrow U = x^2 + \cancel{c}$ $\quad \boxed{x^2 + \cancel{2}}$

$F = +2 \Rightarrow F = -\frac{\partial U}{\partial x} \Rightarrow U = -2x + c$

$U = \int -F\,dx = \int -2\,dx = -2x + c \qquad 1 = 2 + c \to c = -1$

$x^2 \Rightarrow -1 \to +1 \Big\} (x = -1) \qquad x^2 = -2x + c$ at $x = -1$

$-2x + c \Rightarrow -2 \to -1$

$1 \Rightarrow 3 \quad F = -2 \quad -\frac{\partial U}{\partial x} = F \Rightarrow U = -\int F\,dx$

match the values at $x = 1$ $\qquad U = -\int (-2)\,dx = 2x + c$

of $U(x) = x^2$ $\qquad$ at $x = 1$ $\qquad x^2 = 2x + c$ at $x = 1$

$U(x) = 2x + c \qquad 1 = 2 + c \Rightarrow c = -1$

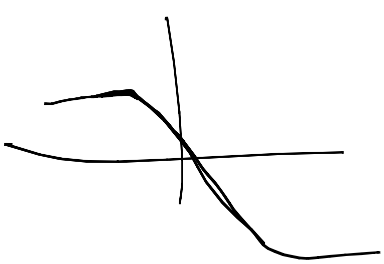
$u(x) = 2x - 1$

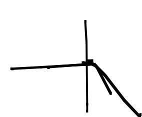
$U(x) = x^2$

$-\infty \to (-1) \Rightarrow -2x - 1$ $\;4J \Rightarrow x = -2.5$

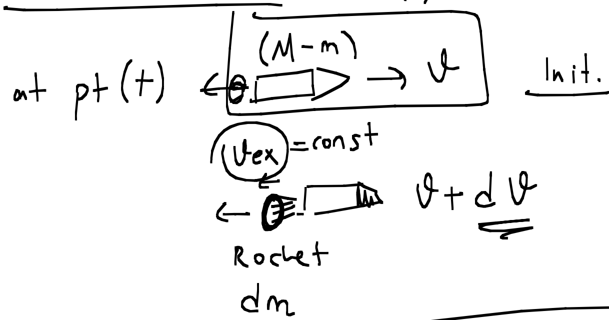
$-1 \to 1 \Rightarrow x^2 \Big\} \Rightarrow 1J \Rightarrow 1J$

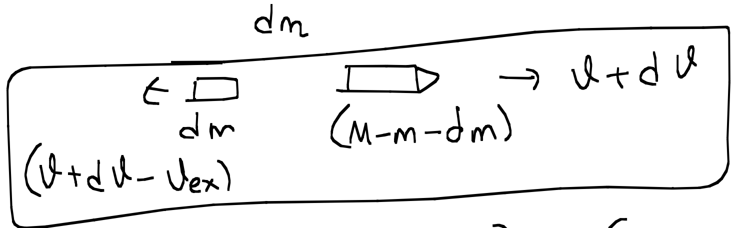
$1 \to \infty \Rightarrow 2x - 1 \Rightarrow x = 2.5 \Rightarrow 4J$





Rocket Launch $\quad (M_T) = M$





$$(M-m)\,v = dm\,(v+dv-v_{ex}) + (M-m-dm)(v+dv)$$

$$\cancel{Mv} - \cancel{mv} = \cancel{dm\,v} + \cancel{dm\,dv} - dm\,v_{ex} + \cancel{Mv} + M\,dv - \cancel{mv} - m\,dv - \cancel{dm\,v} - \cancel{dm\,dv}$$

$$dm\,v_{ex} + m\,dv = M\,dv$$

$$v_{ex}\,dm = (M-m)\,dv$$

$$\int_0^m \frac{dm}{M-m} = \int_{v_0}^{v_f} \frac{1}{v_{ex}}\,dv \Rightarrow \frac{1}{v_{ex}}(v_f - v_0)$$

$dm = -dm'$

$m' = (M-m)$

$$\Rightarrow -\int_M^{M-m} \frac{dm'}{m'} \Rightarrow -\ln m' \Big|_M^{M-m}$$

$$\ln \frac{M}{M-m} = \frac{1}{v_{ex}}(v_f - v_0)$$

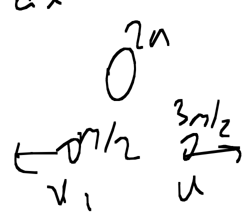
$$\boxed{v_f = v_0 + v_{ex} \ln \frac{m_0}{m}}$$

$\frac{d}{dt}$

$$\frac{d}{dt}[mv] = m\frac{dv}{dt} = ma$$

$F = ax^2$

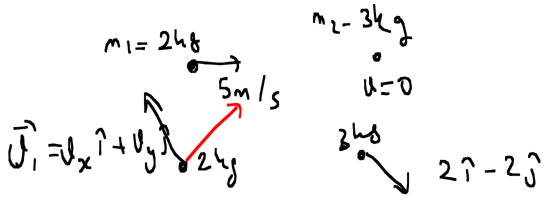
$$\frac{d}{dt}[mv] = \frac{dm}{dt}v + m\frac{dv}{dt}$$



$m_1 = 2kg$

$\vec{u}_{01} = 5\hat{\imath}$

$v_1 = ?$



Initial

final

$\vec{P}_i = \vec{P}_f \Rightarrow$ 2 eqns   2 unknowns

(1) $P_{xi} = P_{xf} \Rightarrow \quad 2 * 5 = 2[u_x] + 3[2]$

(2) $P_{yi} = P_{yf} \Rightarrow \quad 10 = 2u_x + 6 \Rightarrow$

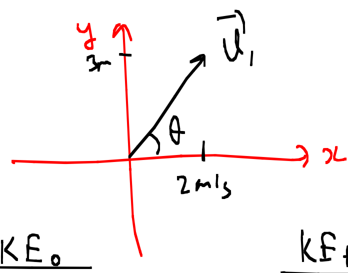
$10 - 6 = 2u_x \Rightarrow \boxed{u_x = 2 m/s}$

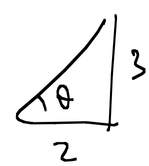
$P_i = 0 \Rightarrow P_f = 0$

$m_1 u_{1y} + m_2 u_{2y} = 0 \Rightarrow \quad 2 * u_y + 3(-2) = 0$

$\boxed{u_y = 3 m/s}$

$|\vec{u}_1| = \sqrt{u_x^2 + u_y^2} = \sqrt{2^2 + 3^2} = \boxed{\sqrt{13} = |\vec{u}_1|}$





$\Rightarrow \theta = \tan^{-1}(3/2)$

2 , -2

KE_0

$\frac{1}{2} m_1 u_{10}^2$

$5^2 = 25$

$25 =$

KE_f

$\frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2$

$13 + 12$

25

$u_2 = \sqrt{2^2 + 2^2}$

$2\sqrt{2}$

$\frac{8 * 3}{2}$

$u_2^2 = 8$

$\vec{r}_{cm} = \frac{\sum m_i \vec{r}_i}{\sum m_i} = \frac{m_1 \vec{r}_1 + m_2 \vec{r}_2}{(m_1 + m_2)} \Rightarrow u_{cm} = \frac{m_1 \vec{u}_1 + \cancel{m_2 \vec{u}_2}}{(m_1 + m_2)}$ 5

$\frac{2 * 5\hat{\imath}}{5} = 2\hat{\imath}$

$\vec{F}\cdot(2\,dx)$

$\int \vec{F}\cdot d\vec{l}$