Phys 2110 - 5 10/12/12

Note Title 10/12/2012

Chap 7: Energy, Work, Cons of Energy

$$E = U + K$$

mgy, $\frac{1}{2}kx^2$, ⋮ → $U(x)$

$\frac{1}{2}mv^2$ → K

$$\Delta E = W_{\text{non-cons}} \quad \text{(friction)}$$

$$\Delta U = -W_{a\to b} = -\int_0^x F_q(x')\,dx'$$

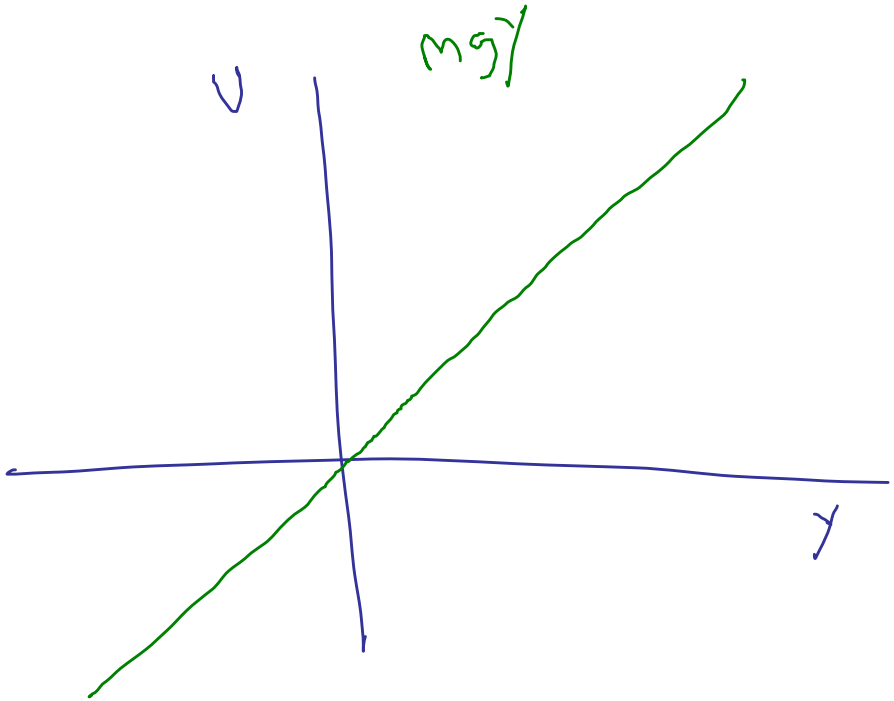
$$F_x(x) = -\frac{dU}{dx}$$

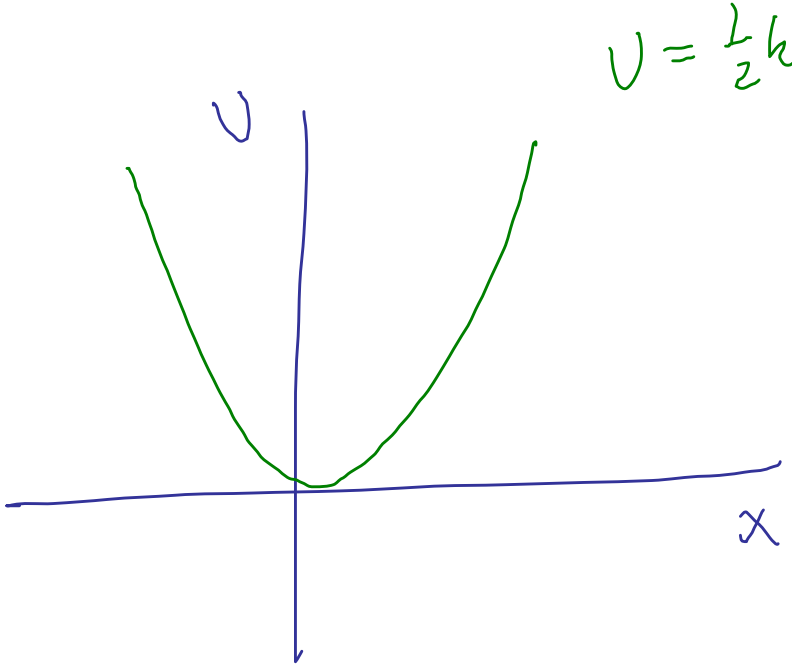
$$\int_a^b f(x)\,dx = F(b) - F(a)$$

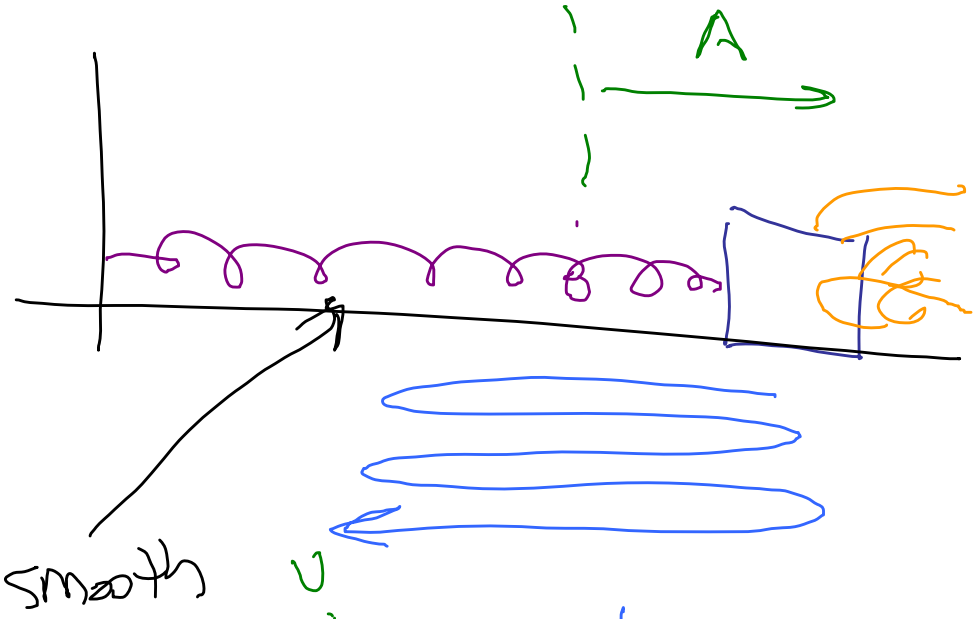
p. 110

$U_{grav} = mgy$ $\quad U_{spr} = \frac{1}{2}kx^2$ $\quad F = -\frac{dU}{dx}$

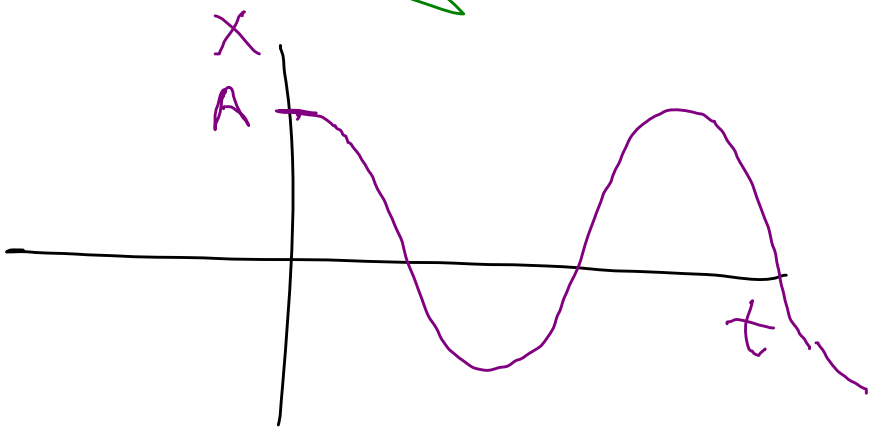
$-\frac{dU}{dy} = -mg = F_y$ $\quad -\frac{dU_{spr}}{dx} = -kx = F_x$



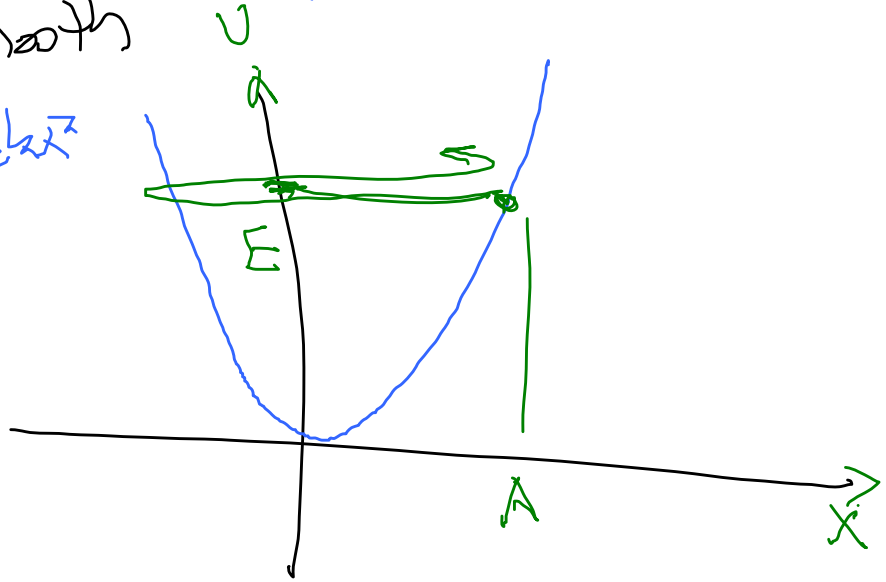




Ch 10



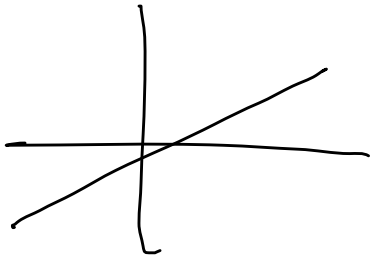
$U = \frac{1}{2}kx^2$

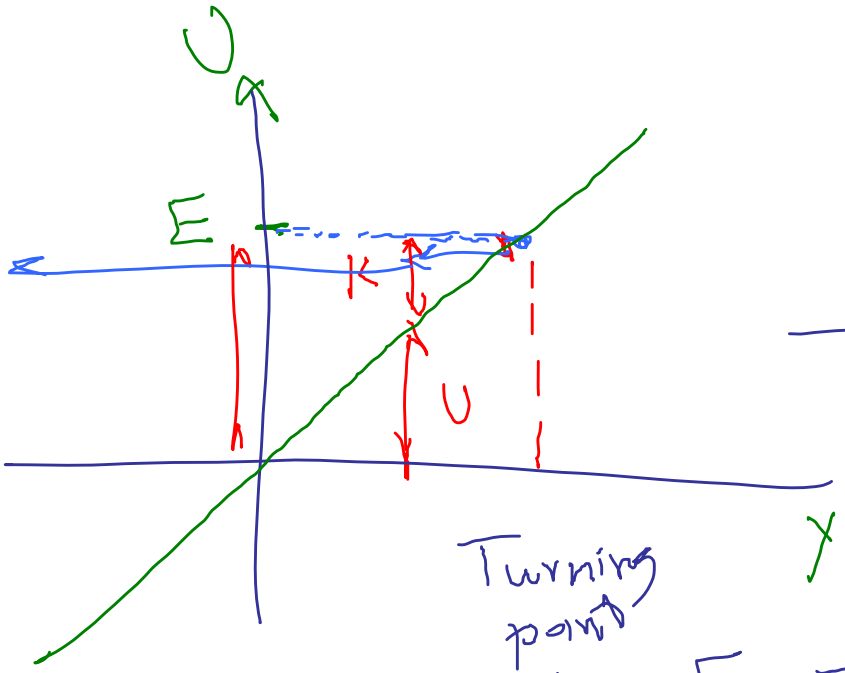


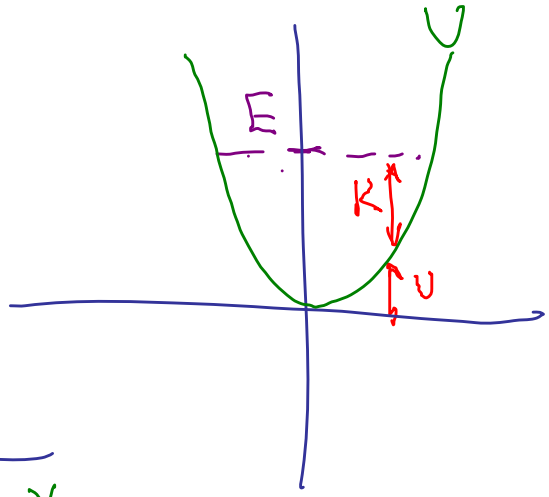
$U(x)$

$F_x = -\frac{dU}{dx}$

Sec 7.4



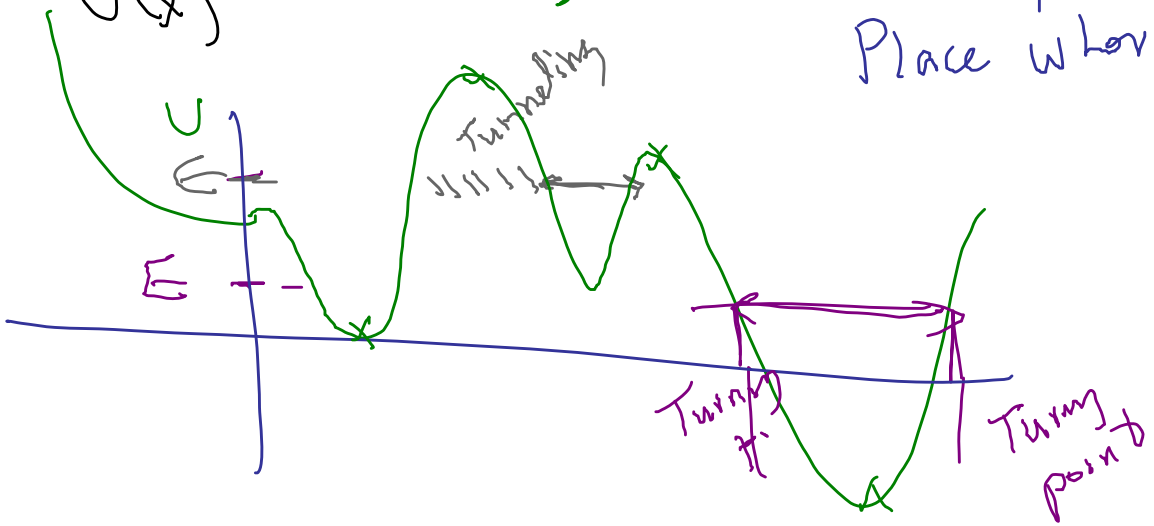




Turning point

Place where $E_{tot} = U$

Wild, Wacky U(x)

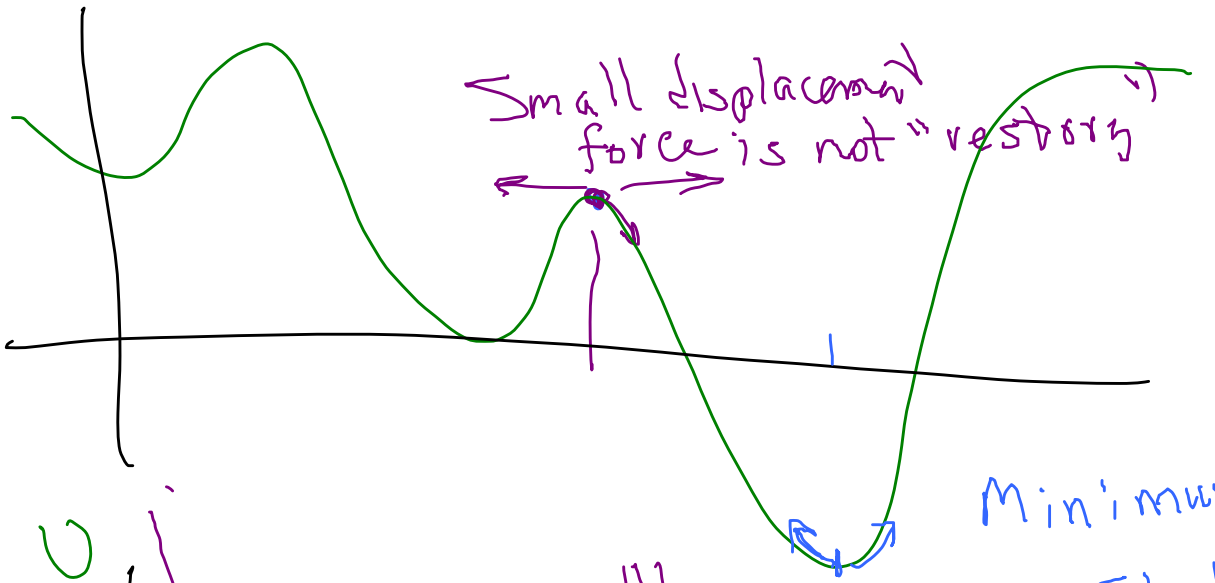


$U = -\frac{dF}{dx}$

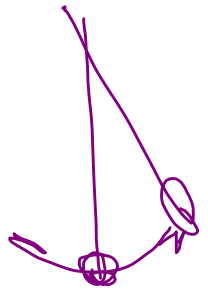
No force, $F_x = 0$

Equilibrium point.

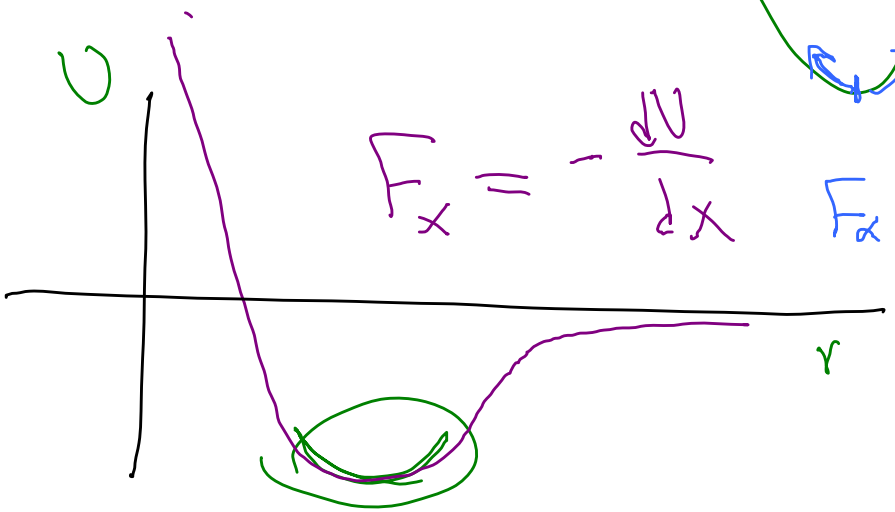
Max & minima of U(x)



Unstable equilibrium

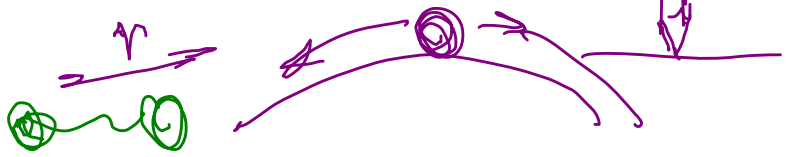


Stable



$F_x = -\frac{dU}{dx}$ $F_x = 0$

Minimum, Stable equilibrium



Unstable

7.48 A particle with total energy 3.5 J is trapped in a potential well described by

$U = 7.0 - 8.0x + 1.7x^2$ U in Joules

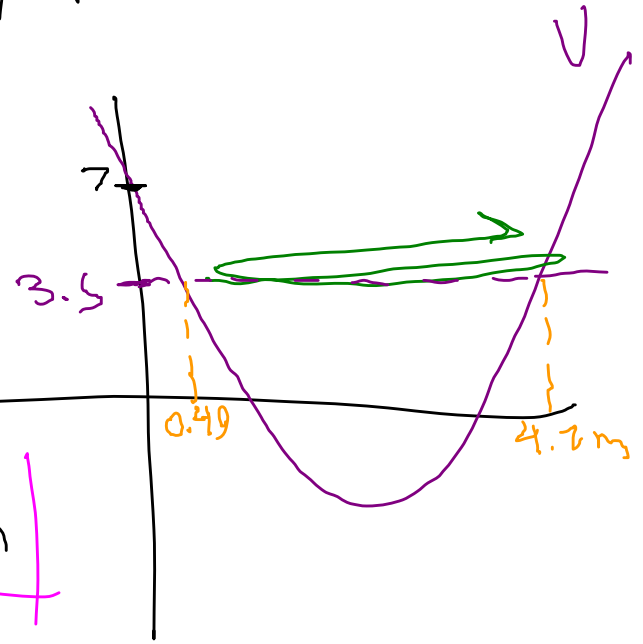
x meters. Find turning points

mm at 2.3m

What is $E_{total} = U$

$3.5 = 7.0 - 8.0x + 1.7x^2$

$x = 4.22\,m \quad x = 0.488\,m$



7.49 a) Derive an expression for the pot'l energy for the force $F_x = ax - bx^3$

$a = 5\ N/m$ $\quad b = 2\ N/m^3$. if $U = 0$ at $x = 0$

$$F_x = -\frac{dU}{dx}$$

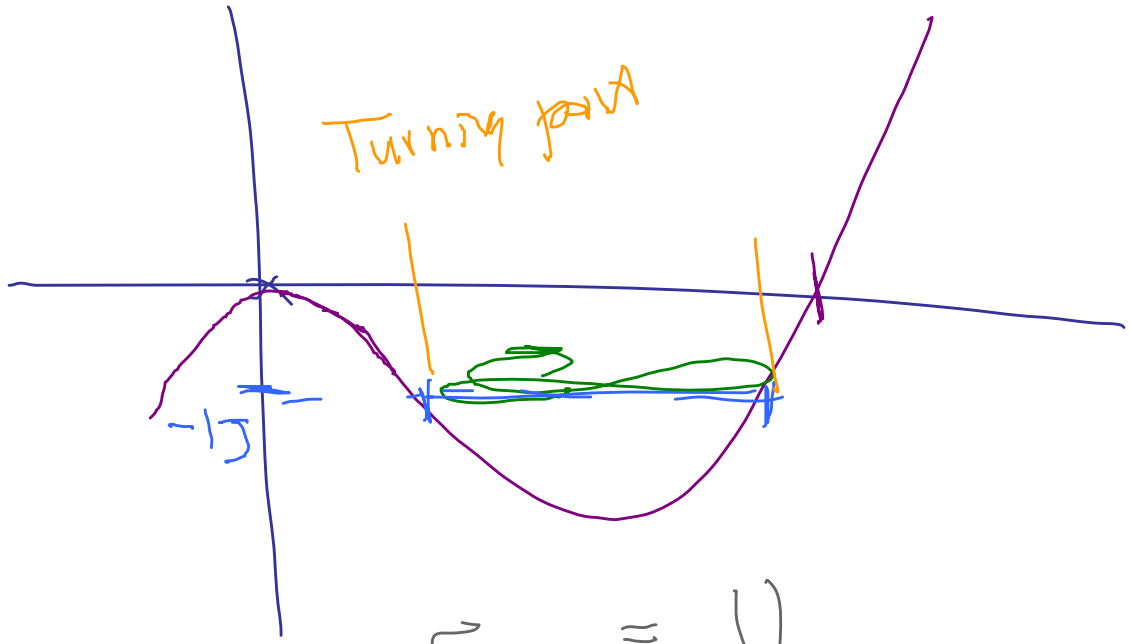
$$\Rightarrow U = -\left[\frac{a}{2}x^2 - \frac{b}{4}x^4\right] + C$$

$$= \frac{x^2}{2}\left[-a - \frac{b}{2}x^2\right]$$

$C = 0$

$U = 0 \quad x = 0$

b) Graph the PE curve for $x > 0$ use it to find turning pts if $E_{Tot} = -1\ J$



$$U = \frac{x^2}{2}\left(-a + \frac{b}{2}x^2\right)$$

$$x = \pm\sqrt{\frac{2a}{b}}$$

Whose bes $\hookrightarrow E_{tot} = U$

$$-1 = -\frac{5}{2}x^2 + \frac{1}{2}x^4$$

Solve this

@ Quadr. eqn in x^2

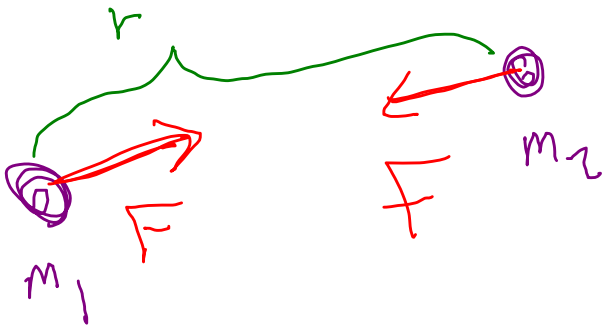
Turning points

$x = 0.7\,m,\ 2\,m$

Skip §

Gravity

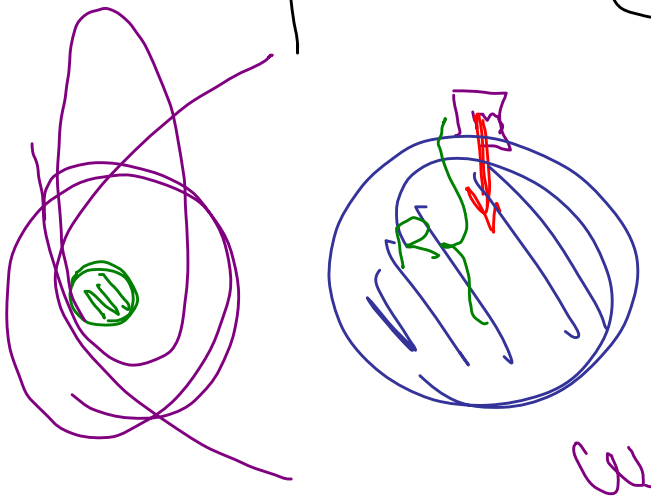
Newton's Law of gravity



Force of attraction

$$F = G\frac{m_1 m_2}{r^2}$$

$$G = 6.67 \times 10^{-11}\ \frac{Nm^2}{kg^2}$$



$mg = F$

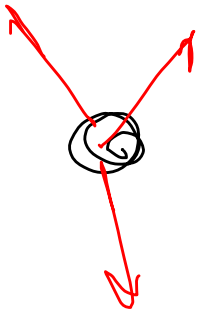
$$F = G\frac{mM}{R^2}$$

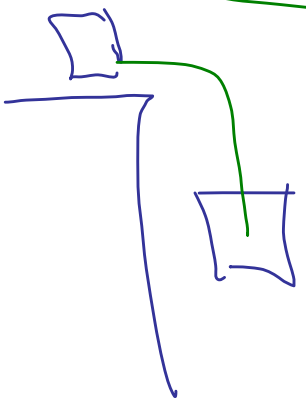
$$g = G\frac{M}{R^2}$$

We will skip this.

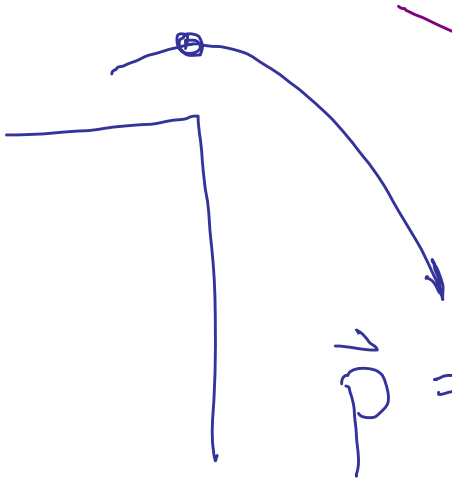
Chap 9

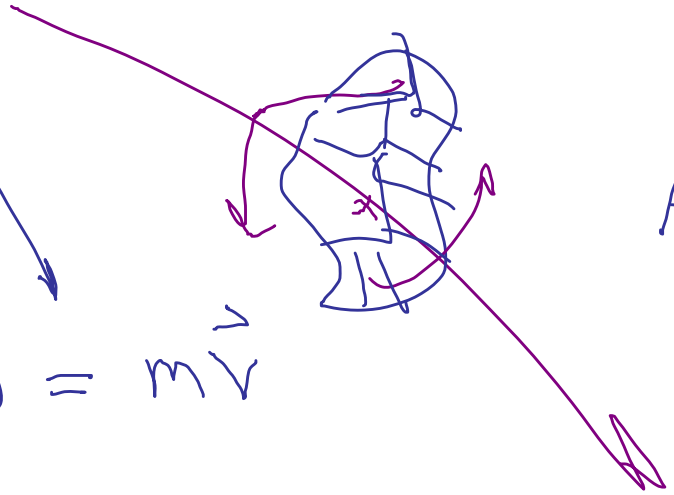
Systems of Particles



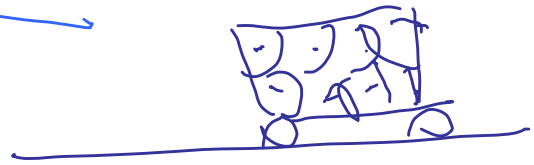


So far: Point particle





$\vec{p} = m\vec{v}$



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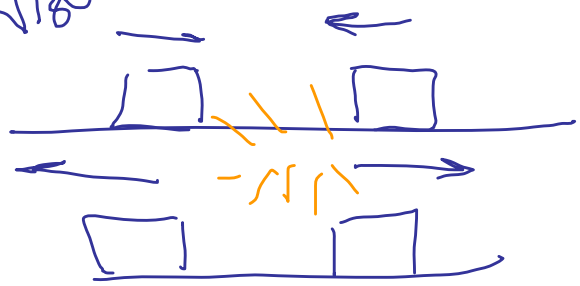

System of particles

$\vec{F} = m\vec{a}$ Single particle

Newton's 3rd Law