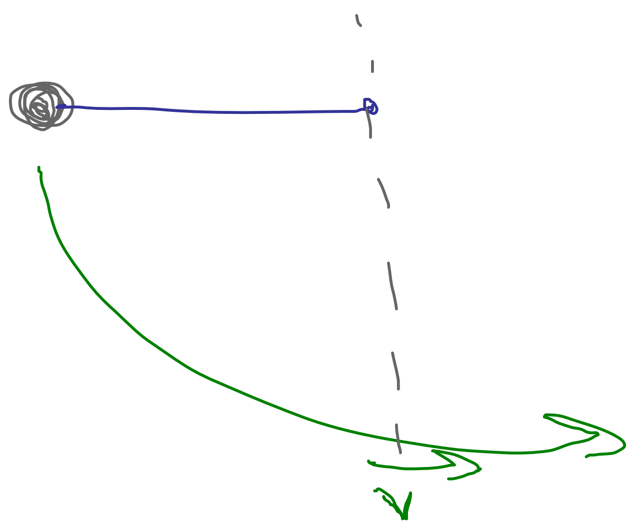
Phys 2110-4 2/20/12

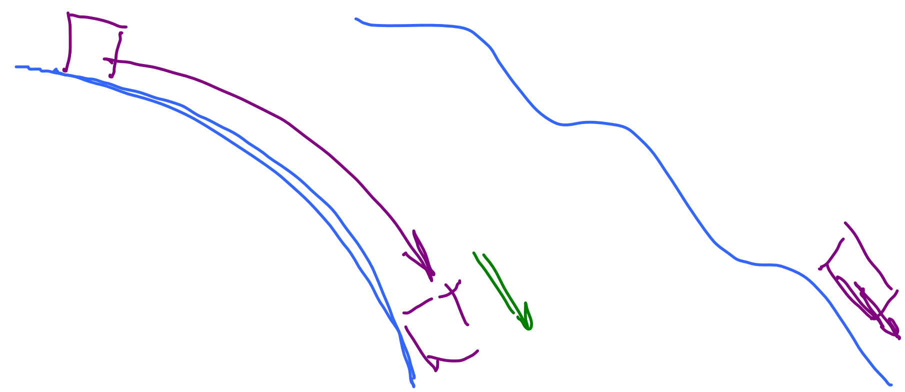
Note Title 2/20/2012

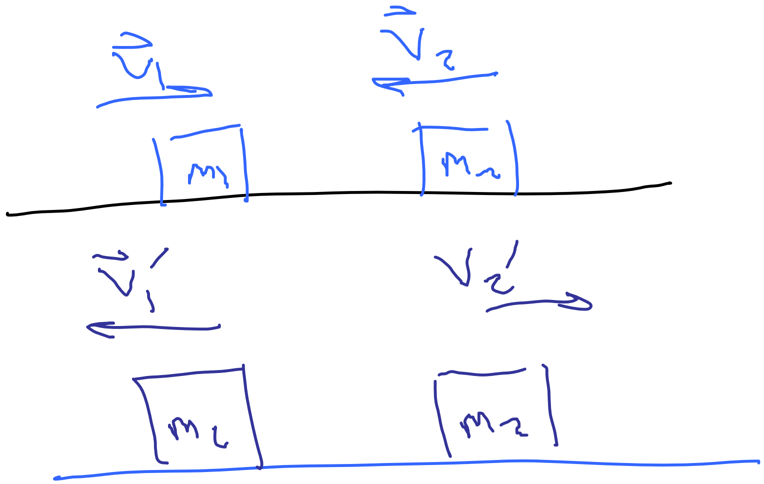
Chap. 6

Kinematics → Forces

→ $\vec{F} = m\vec{a}$







collision. $\Longrightarrow$ Work, Energy

To solve problems
New concepts

Chap 6, 7

Work, Energy

Chap 9

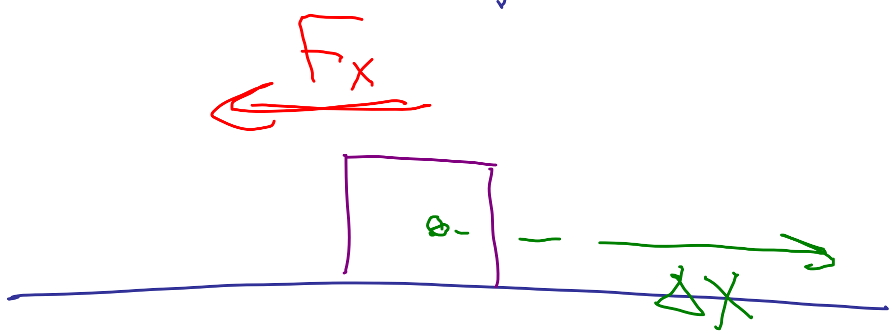
Momentum

Definitions: Work, Kinetic Energy, Potential Energy

Theorems: Work-Energy Thm
Cons of Energy Thm

p86

Work (Done by a Force)



Constant force

$W = F_x \Delta x$

could be negative.

Units $\quad W = F_x \Delta x$

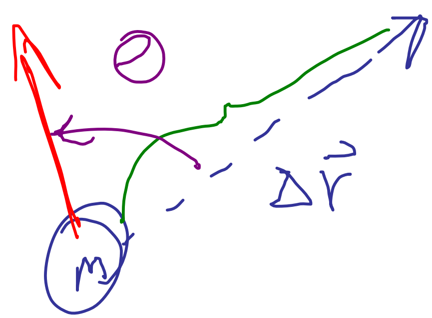
Units $\quad$ [Force][Distance] $= N \cdot m = \frac{kg\,m}{s^2} \cdot m$

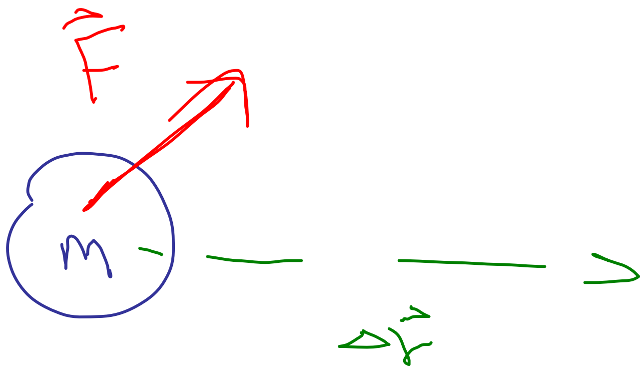
$= \frac{kg\,m^2}{s^2} = 1$ joule $= 1\,J$

More general def: $\vec{F}$

Constant force

$W = |\vec{F}|\,|\Delta\vec{r}| \cos\theta$

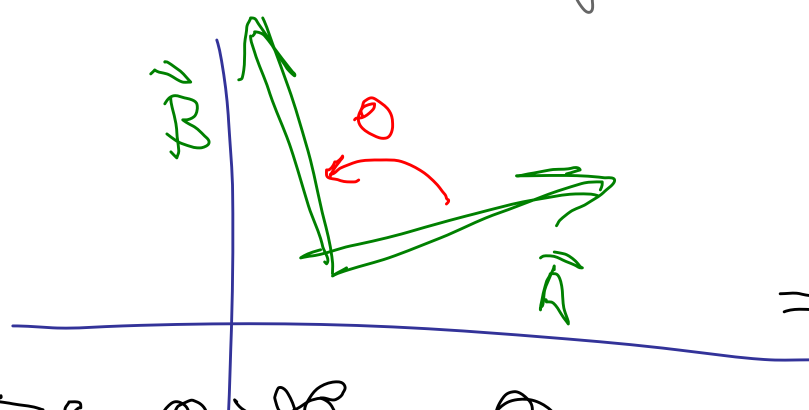




$$W = F\,|\Delta\vec r|\cos\theta$$

$$= \vec F\cdot\Delta\vec r$$

Dot product of two vectors:



$$\vec A\cdot\vec B = AB\cos\theta$$

$$= A_xB_x + A_yB_y + A_zB_z$$

If $\theta > 90$ $\cos\theta$ neg.

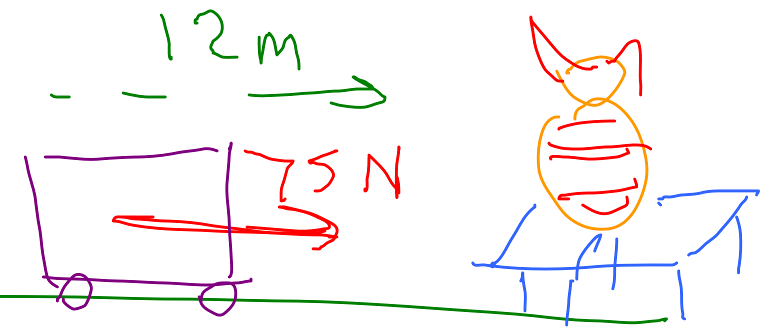
6.11 How much work do you do as you exert a 75-N force to push a cart thru 12m-long aisle

$= F_x \Delta x$

$W = (75\,N)(12\,m)$

$= 900\ N \cdot m$

$= 900\ J$



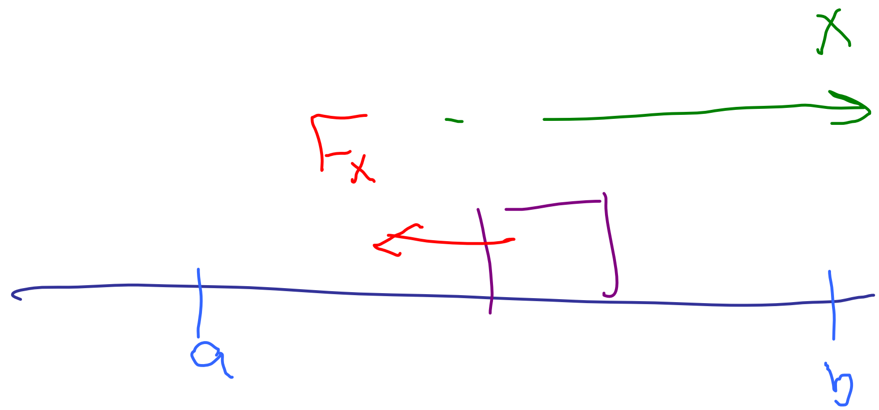
Force not constant

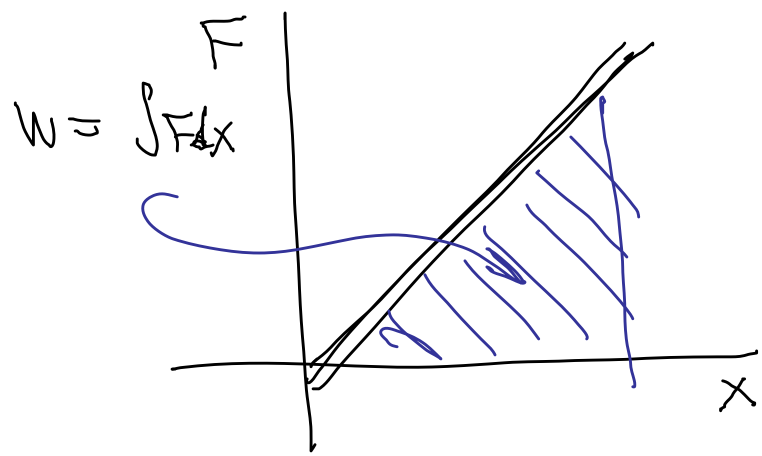
$$W = F_x \Delta x$$

Small motion:

$$dW = F_x(x)\,dx$$

$$\Rightarrow \quad W = \int_a^b F_x(x)\,dx$$

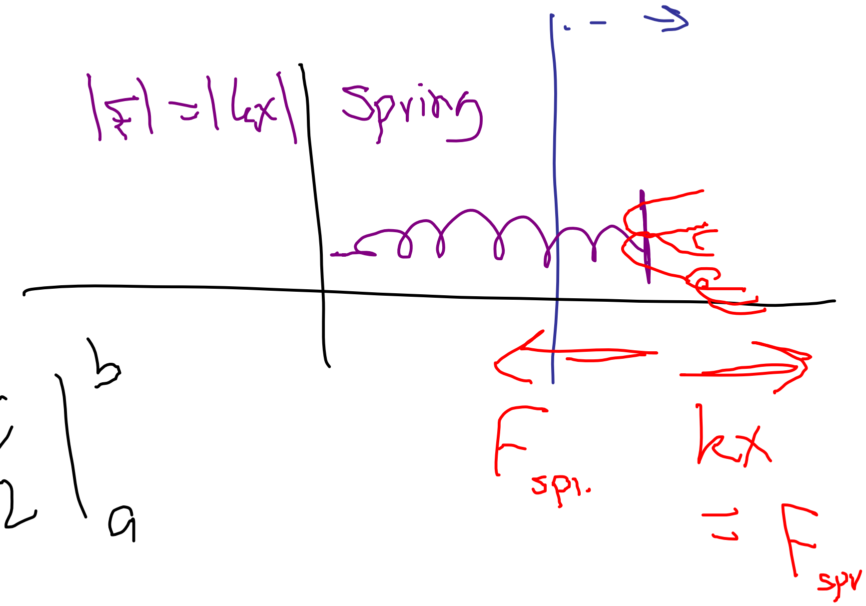




$$W_{\text{salon}} = \int_a^b F(x)\,dx$$

$$= \int_a^b kx\,dx = k\,\frac{x^2}{2}\Big|_a^b$$

$$= \frac{k}{2}\left(b^2 - a^2\right) = \frac{1}{2}kb^2 - \frac{1}{2}ka^2$$

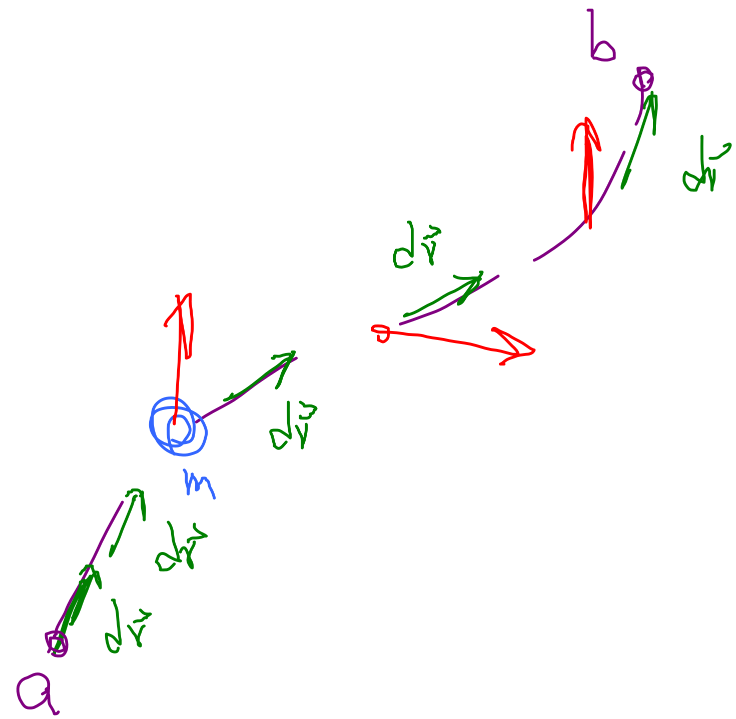


Most General Def

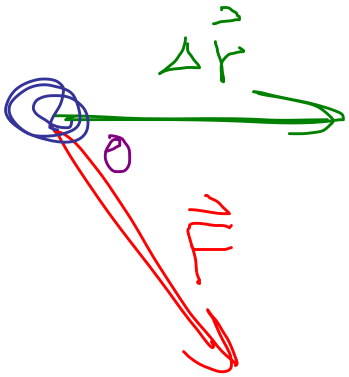
$$\sum \vec{F}_i \, d\vec{r}_i$$

$$= \int_a^b \vec{F} \cdot d\vec{r}$$

Line integral

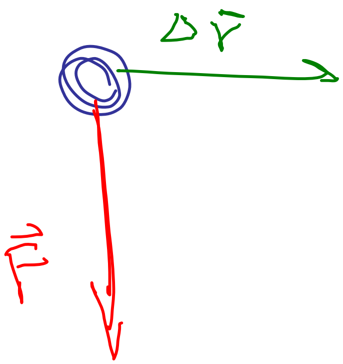


W is a scalar

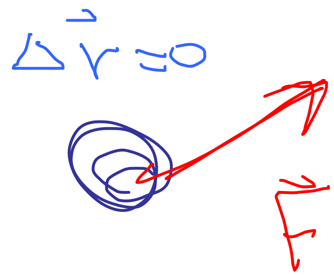


$\theta < 90$ W is pos

$\theta > 90$ W is neg.



$\theta = 90$ No work



No work

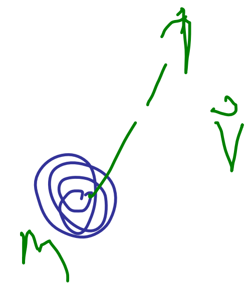
Definition: Kinetic Energy

$$K = \frac{1}{2} m v^2$$

Number, scalar

mass

speed



Units

$$(kg)\left(\frac{m}{s}\right)^2 = \frac{kg\, m^2}{s^2} = 1 \text{ joule}$$

$$= 1 \text{ J}$$

$$= 1 \text{ N} \cdot \text{m}$$

Def. Can we use it?

Work-Energy Theorem

$$W_{Total} = \Delta K$$