Physics 113 – Sept. 14, 2006

1-d Motion, vectors → multidimensional Motion

organizational crap –

Workshop Room changes

Last time –

Always True

$$x - x_0 = \int_{t_0}^{t} v\,dt$$

$$v - v_0 = \int_{t_0}^{t} a\,dt$$

is F constant? F = ma

Assumes a = constant

this form also assumes $t_0 = 0$

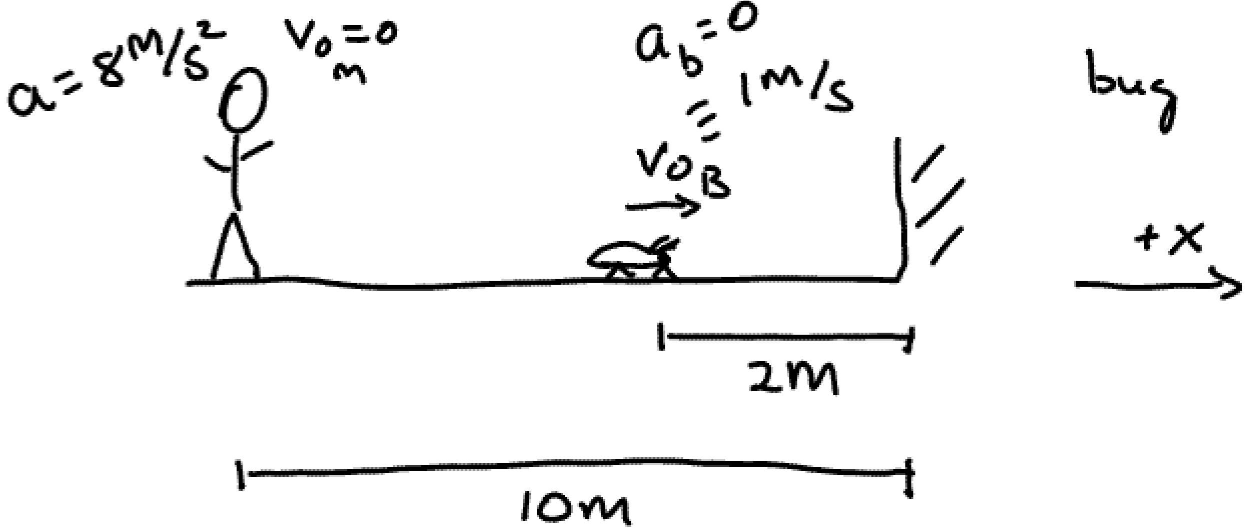
Constant Acceleration Equations

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$

$$x = x_0 + \left(\frac{v + v_0}{2}\right) t$$

$$v^2 = v_0^2 + 2a(x - x_0)$$



Bug to wall time

$$x = \cancelto{0}{x_0} + v_0 t + \frac{1}{2}\cancelto{0}{a} t^2 \qquad x_{0_B} = 0$$

$$x = v_{0_B} t \qquad 2\,m = 1\,m/s\; t$$

$$t = 2\,s$$

person to wall time

$$x_M = \cancelto{0}{x_{0_M}} + \cancelto{0}{v_{0_M}} t_M + \frac{1}{2} a_M t_M^2 \qquad x_{0_M} = 0$$

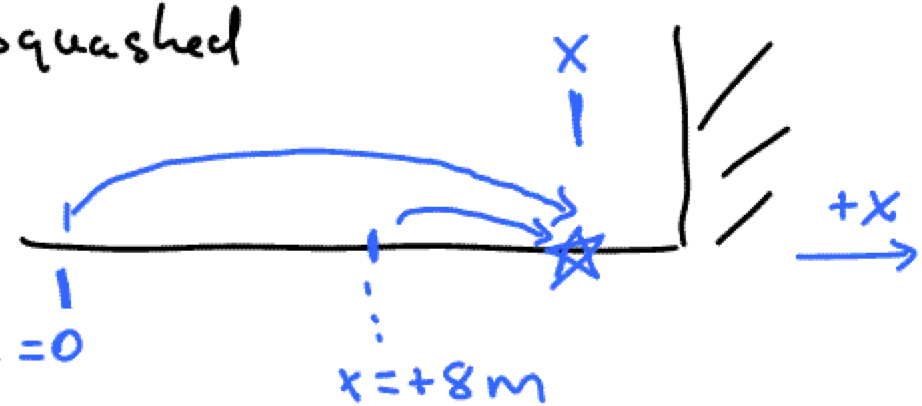
$$x_M = \frac{1}{2} a_M t_M^2$$

$$10\,m = \frac{1}{2}(8\,m/s^2)\, t_m^2$$

$$t_m = 1.6\ s$$

where to put wreath ?

↳ is bug squashed



Person

$$x = \underbrace{\cancel{x_0}}_{0} + \underbrace{\cancel{v_0}}_{0} t + \frac{1}{2} a t^2 \qquad x_m = \frac{8}{2} t_m^2 \ ✓$$

where person is along floor (t)

Bug

$$x_B = \underbrace{x_{oB}}_{+8} + \underbrace{v_{oB}}_{1\,m/s} t_B + \underbrace{\tfrac{1}{2}a}_{0} t_B^2$$

$$x_B = 8 + t_B$$ where bug is along floor (t)

Bug squashed $\rightarrow$ $x_M = x_B = x$

$t_M = t_B = t$

$$\frac{8}{2}t^2 = 8 + t \rightsquigarrow \underbrace{a}_{a} t^2 \underbrace{-\frac{2}{8}}_{b} t \underbrace{-2}_{c} = 0$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{+\frac{2}{8} \pm \sqrt{\left(\frac{2}{8}\right)^2 + 4(1)(2)}}{2}$$

$\boxed{t = 1.54\ s}$ or $t = -1.3\ s$

$x = 8 + t = 9.54\ m$

~~Numbers~~ s

height

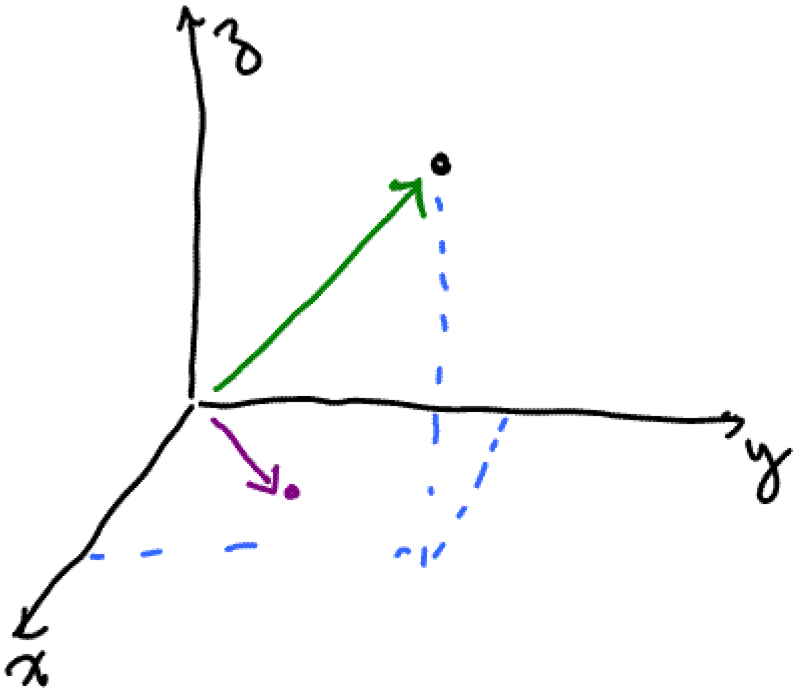
temperature

Scaler
Scalar

1-d Motion

(sign)(scalar)

multidimensional motion



$\Rightarrow$ 3 #'s

Vectors $\longrightarrow$ 3 # quantity

has magnitude

<u>and</u>

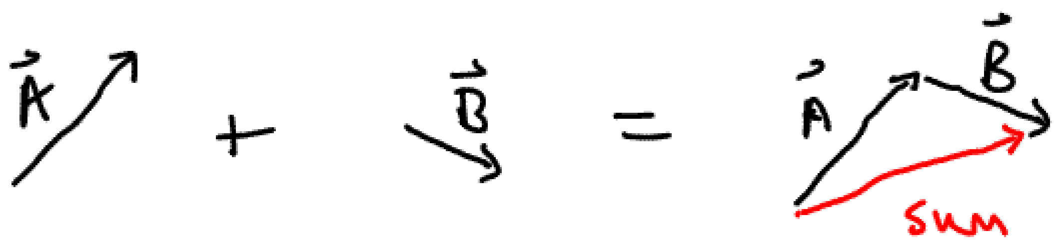
direction

$\nearrow \equiv \vec{A}$ or (x, y, z) #

$\swarrow \equiv -\vec{A}$ same magnitude opposite direction

Length of vector
Magnitude $\equiv |\vec{A}| \equiv$ #

vector addition graphical



$(\vec{A}+\vec{B}) = \vec{C}$

Also known as the resultant