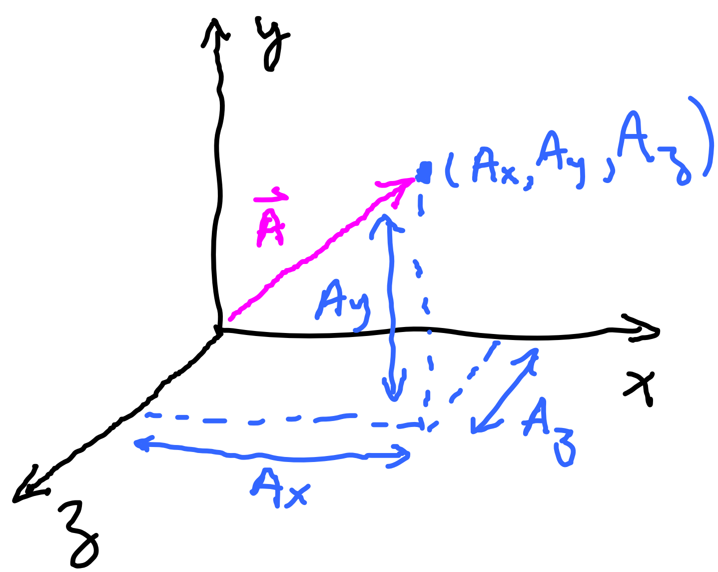
Physics 113 - September 17, 2013

- Workshops far ?
- POA Library - Location
- SPS help hours
- TA office hours posted on class website
  - Mon 4-5:30 POA Library - Tanveer Karim
  - Wed 10:45-12:15 B+L 208B - Jeff Kleykamp
  - Wed 2-3:30 POA Library - Kevin Silverstein
  - Thurs 4:30-6 POA Library - Dilyana Mihalova
  - Fri 8:30-10 AM Gleason quiet study area Jun Yin
  - Fri 2:45-4:15 POA Library - Alicia Gomez

Final EXAM Thurs Dec 19 1915

Scalars #'s magnitude

vectors magnitude $\underline{\underline{\text{and}}}$ direction



3 #'s

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

$\longrightarrow$ 1 #, No direction

Always positive

unit vector $\equiv \dfrac{\vec{A}}{|\vec{A}|} \longrightarrow$ gives Direction of $\vec{A}$

w/ magnitude 1

$\equiv$

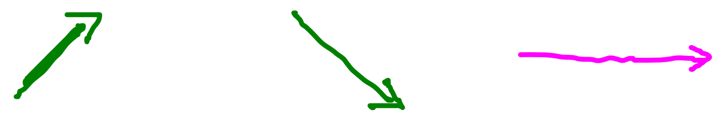
$\hat{A} \equiv$ "A-hat"

$$\vec{A} = (A_x, A_y, A_z) \quad + \text{ other} \ldots$$

Vector Addition

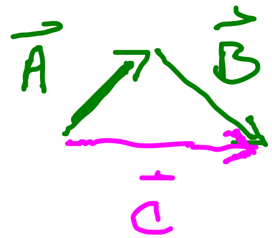
graphically

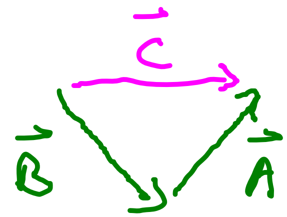
$$\vec{A} + \vec{B} = \vec{C}$$



Resultant

$$\vec{A} + \vec{B} = \vec{B} + \vec{A}$$

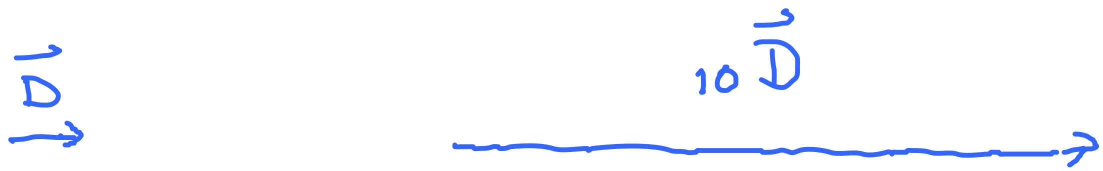


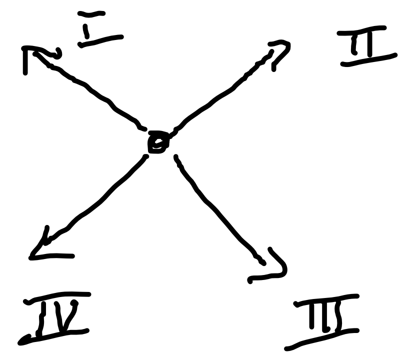


$\vec{B} + \vec{A}$

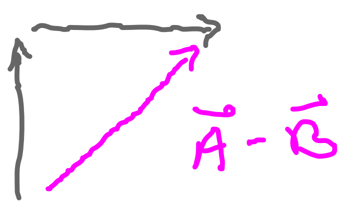
$c\vec{A} = |c\vec{A}|$ in same direction as $\vec{A}$

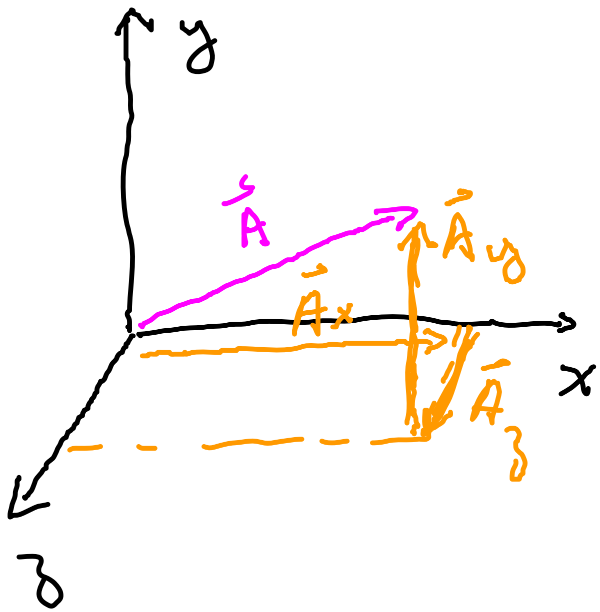
$= |c\vec{A}|\,\hat{A}$





Direction of $\vec{A}-\vec{B}$ is best described by ↗ ?





$$\vec{A} = (A_x, A_y, A_z)$$

$$\vec{A} = A_x \hat{x} + A_y \hat{y} + A_z \hat{z}$$

$$\hat{x} \equiv \hat{i}$$

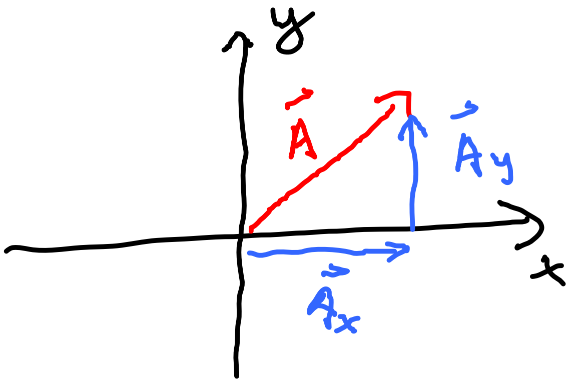
$$\hat{y} \equiv \hat{j}$$

$$\hat{z} \equiv \hat{k}$$

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

$$\vec{A} = |\vec{A}_x| \hat{i} + |\vec{A}_y| \hat{j} + |\vec{A}_z| \hat{k}$$

Addition of vectors (Analytical)

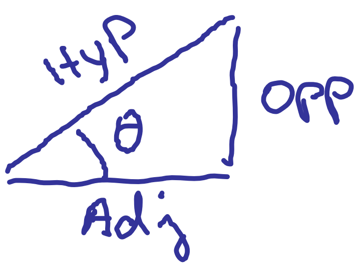


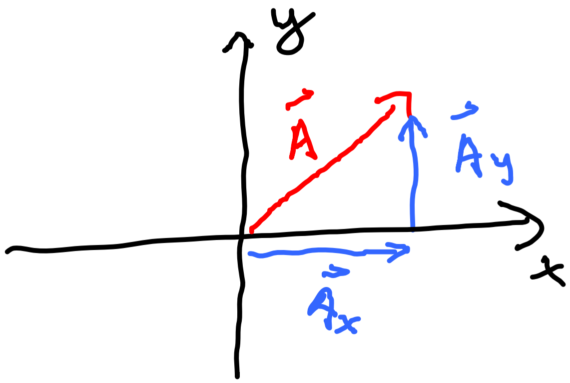
$$\vec{A} = \vec{A}_x + \vec{A}_y = |\vec{A}_x|\hat{x} + |\vec{A}_y|\hat{y}$$

$$\sin\theta = \frac{\text{Opp}}{\text{Hyp}}$$

$$\cos\theta = \frac{\text{Adj}}{\text{Hyp}}$$

$$\text{TAN}\,\theta = \frac{\text{Opp}}{\text{Adj}}$$



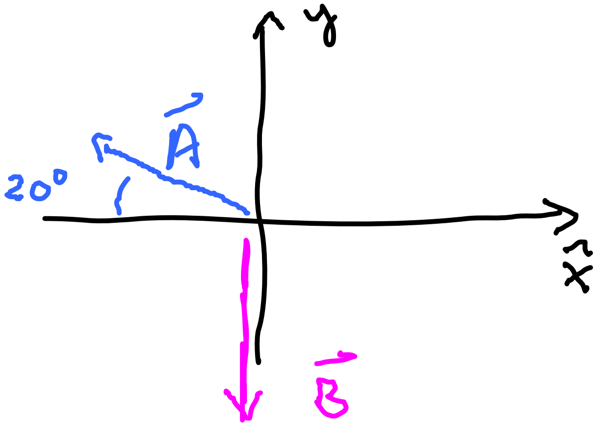


$$|\vec{A}|^2 = |A_x|^2 + |A_y|^2$$

$$\sin\theta = \frac{|\vec{A}_y|}{|\vec{A}|}$$

$$\cos\theta = \frac{|\vec{A}_x|}{|\vec{A}|}$$

$$\tan\theta = \frac{|\vec{A}_y|}{|\vec{A}_x|}$$



Find $\vec{A} + \vec{B} = \vec{R}$

?

$|\vec{A}| = 4\,m$

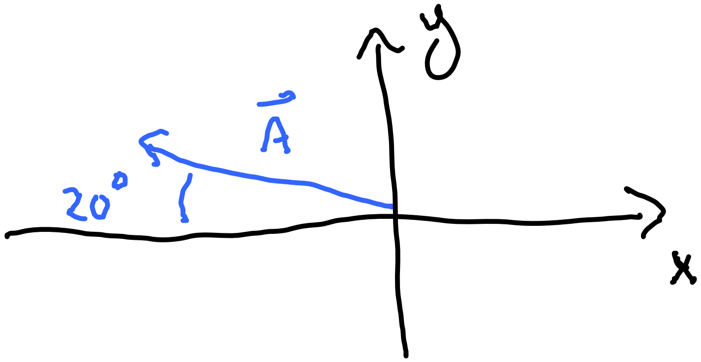
$|\vec{B}| = 5\,m$

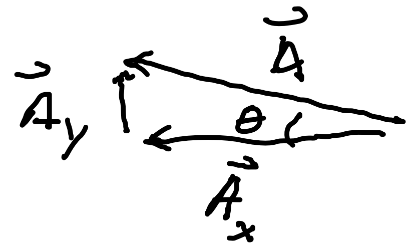
- Decompose vectors → components along axes
- Add algebraically (each axis)
- Recombine

$\vec{B}$ .... along $\hat{y}$

$|\vec{B}_y| = B_y = 5\,m$

$B_x = 0$



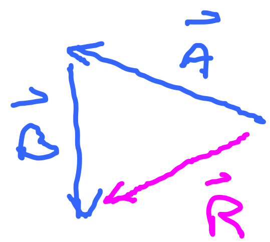


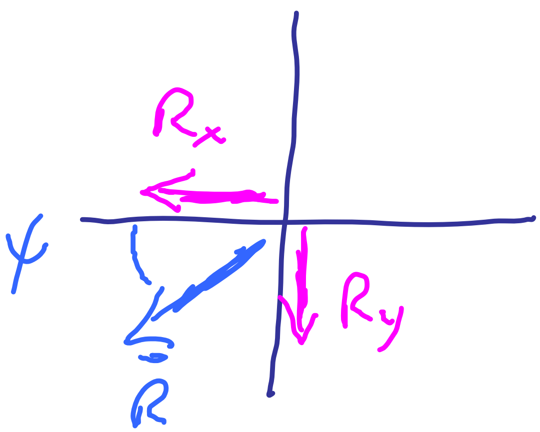
$$\sin\theta = \frac{|\vec{A}_y|}{|\vec{A}|} \qquad |\vec{A}_y| = |\vec{A}| \sin\theta$$

$$\cos\theta = \frac{|\vec{A}_x|}{|\vec{A}|} \qquad |\vec{A}_x| = |\vec{A}| \cos\theta$$

$$\vec{R}_x = -|\vec{A}| \cos\theta \ \hat{x}$$

$$\vec{R}_y = \left[-|\vec{B}_y| + |\vec{A}| \sin\theta \right] \hat{y}$$





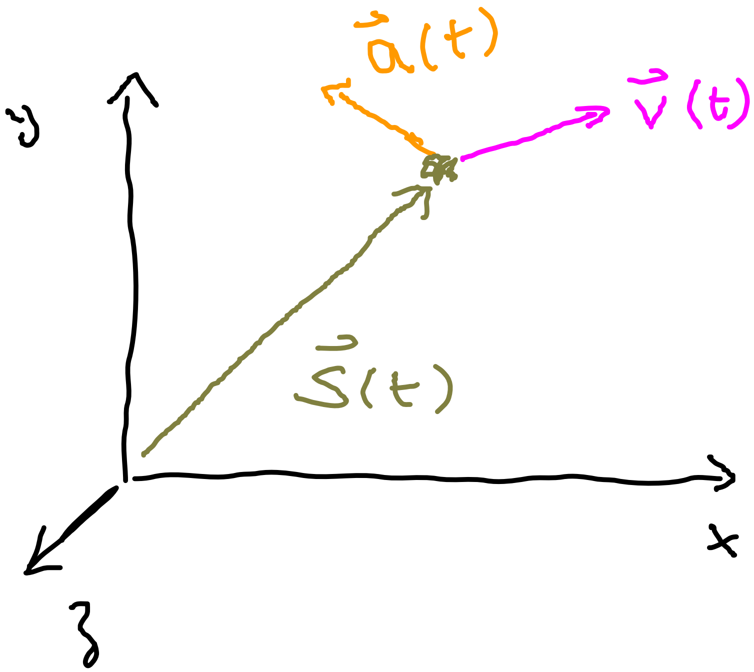
$$\vec{R}_x = -4\cos 20\ \hat{x}$$

$$\vec{R}_y = [-5 + 4\sin 20]\ \hat{y}$$

$$|\vec{R}|^2 = |\vec{R}_x|^2 + |R_y|^2$$

$$\tan\psi = \frac{R_y}{R_x}$$

3d Motion



$$\vec{S}(t) = S_x \hat{i} + S_y \hat{j} + S_z \hat{k}$$

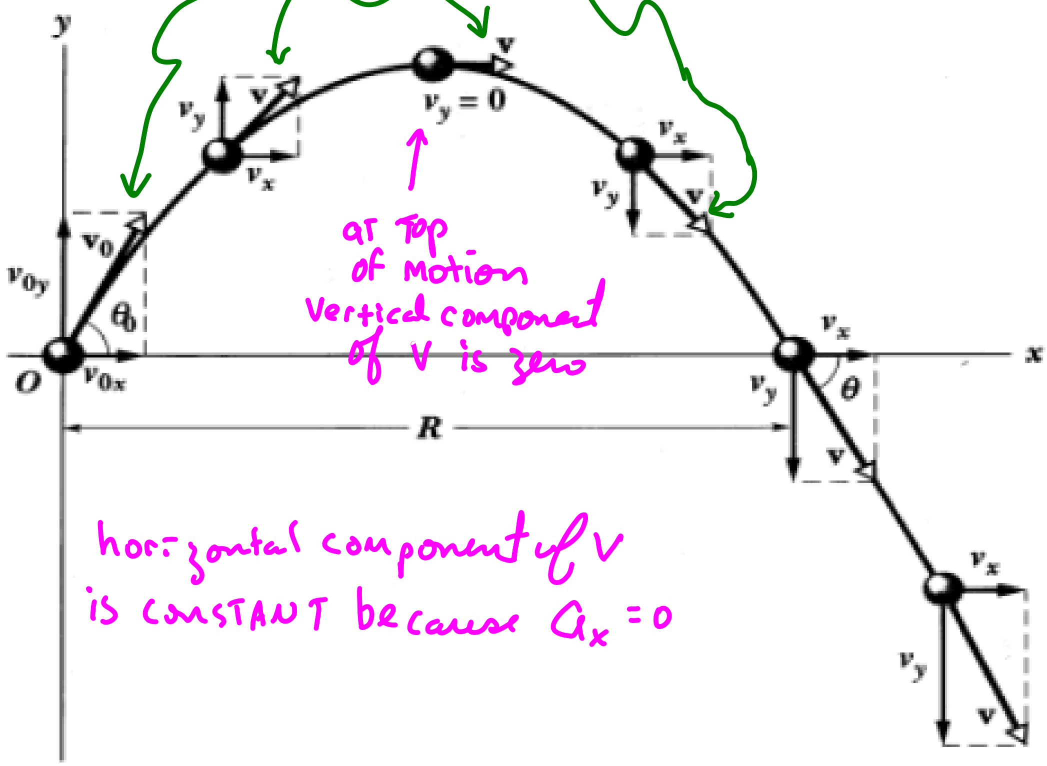
$$\frac{d\vec{S}(t)}{dt} = \frac{dS_x}{dt}\hat{i} + \frac{dS_y}{dt}\hat{j} + \frac{dS_z}{dt}\hat{k}$$

$$\vec{V}(t) = V_x \hat{i} + V_y \hat{j} + V_z \hat{k}$$

$$\vec{a}(t) = a_x \hat{i} + a_y \hat{j} + a_z \hat{k}$$

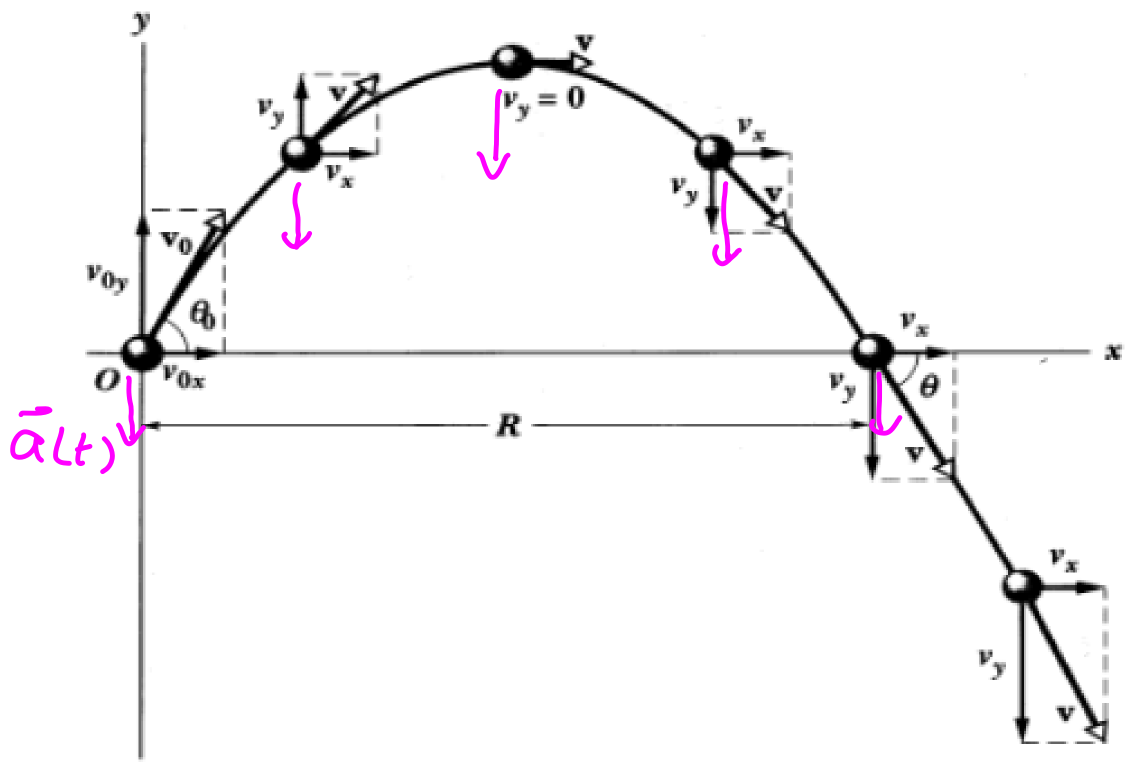
Projectile Motion

Total velocity vector - Also shown are the Horizontal + Vertical components



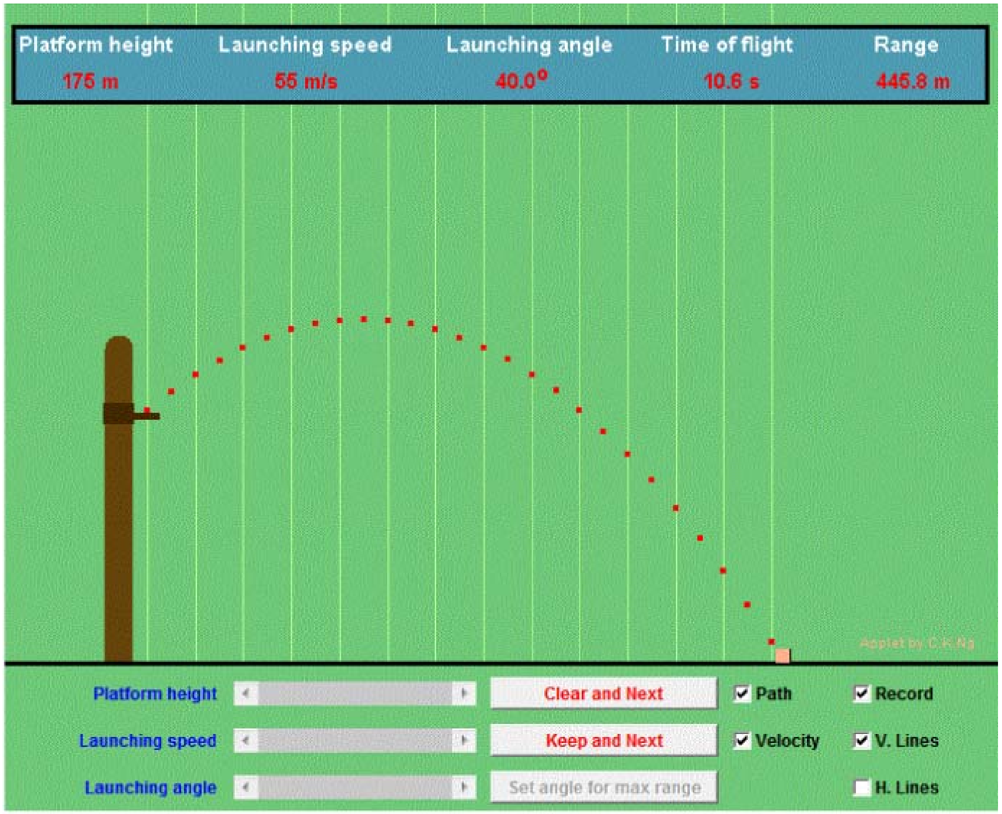
at top of motion vertical component of v is zero

horizontal component of v is CONSTANT because $a_x = 0$



y
v
v_y
v
$v_y = 0$
v_x
v_x
v_y
v
v_0
v_{0y}
θ_0
v_x
x
O
v_{0x}
v_y
θ
$\vec{a}(t)$
R
v
v_x
v_y
v

http://ngsir.netfirms.com/englishhtm/ThrowABall.htm



Projectile motion