Physics 113 - September 13, 2012

- CETL Study group LaTT 106 Wed. 5-6 pm
  Brad Ashcroft@u.rochester.edu Starts next week
- SPS physics help hours
  Physics + Astronomy Library (POA) Mon-Thurs 7-9 pm
  F 2-4 pm
- TA office hours
  - Aaron Bercellie - Wed 2-3, B+L 373
  - Mikhail Davydov - Mon 1-2, B+L 373
  - Robert Fine - Wed 9:30 - 10:30 pm - B+L 208-B

Much help Available
Take advantage of it!

- Jeff Kleykamp - Fri. 11 am - noon - B+L 208-B
- Levi Neukirch - Mon. 2-3 pm, B+L 373

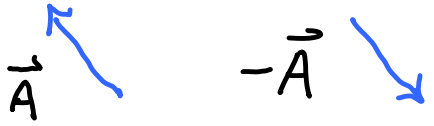
Last Time

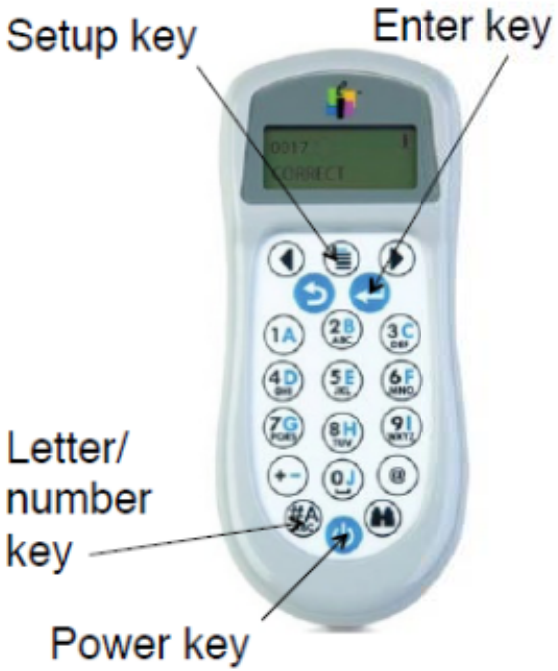
Did a 1-d example problem

Started to think about Multi-dimensional Motion

Scalar ⇒ # magnitude only

Vector ⇒ 3 #s magnitude + Direction





Using your CPS Pulse.
Joining a class.

- To join your class:
  - Turn the unit on (power key).
  - The unit will show that it is searching for a class to join. Wait until it shows "Join:"
  - On the screen that is displayed by your instructor, the RF channel that is being used by the class is shown. Look for "CPS RF(Pulse)<XX>" in the yellow bar on the screen. XX will be replaced by a number that indicates the RF channel associated with your class.
  - Use the numeric key on your unit to enter the RF channel number and press the enter key.
  - You are now connected to your class.
  - When you can enter an answer, the display will show "Q: _". Use the keys to enter your answer and press the enter key.

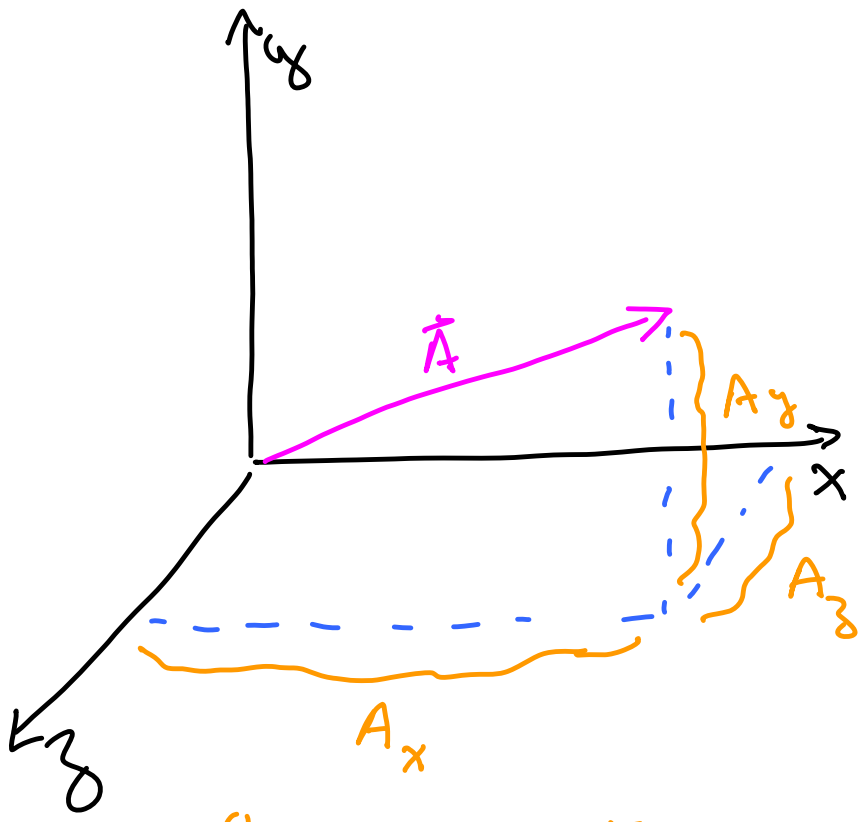
Frank L. H. Wolfs

Department of Physics and Astronomy, University of Rochester

Vectors

(Direction)(Magnitude)

3 #'s



$\vec{A}$

$|\vec{A}| \equiv$ magnitude of the vector

unit vector $\equiv \dfrac{\vec{A}}{|\vec{A}|}$ $\rightarrow$ direction of $\vec{A}$

w/ Magnitude of 1

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

"unit vector in the $\vec{A}$ direction"

Symbolize vectors

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

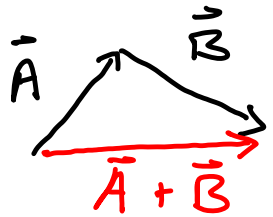
+ others ....

Vector addition

graphically

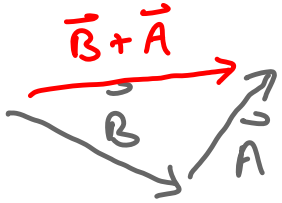
$$\vec{A} + \vec{B} = \vec{C}$$

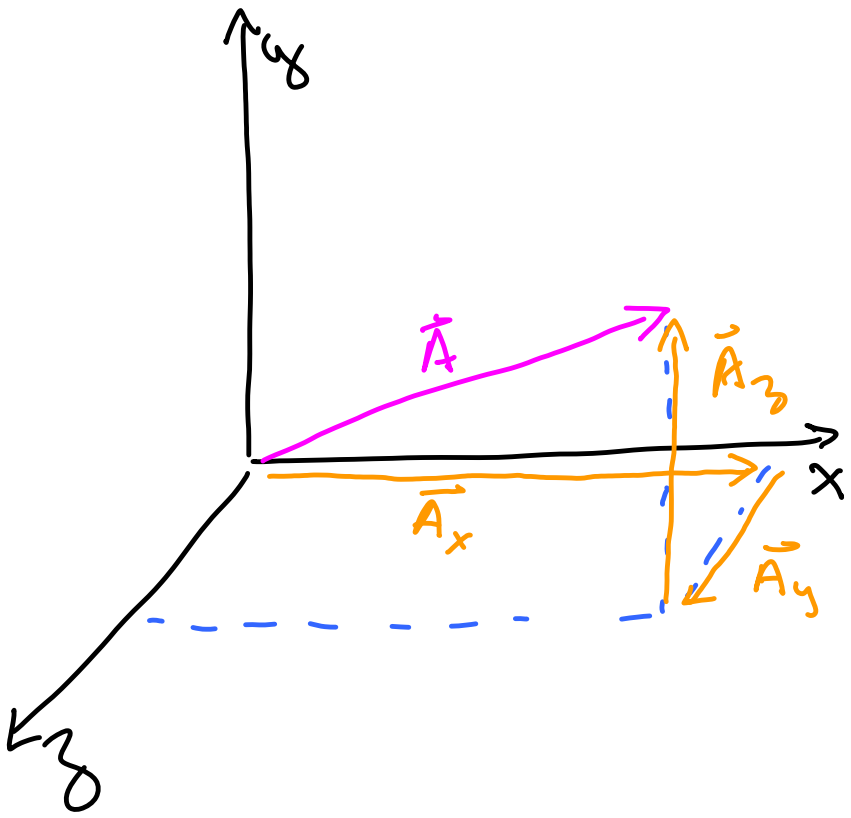
Resultant



note That

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





$$\vec{A} = \vec{A}_x + \vec{A}_y + \vec{A}_z$$

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

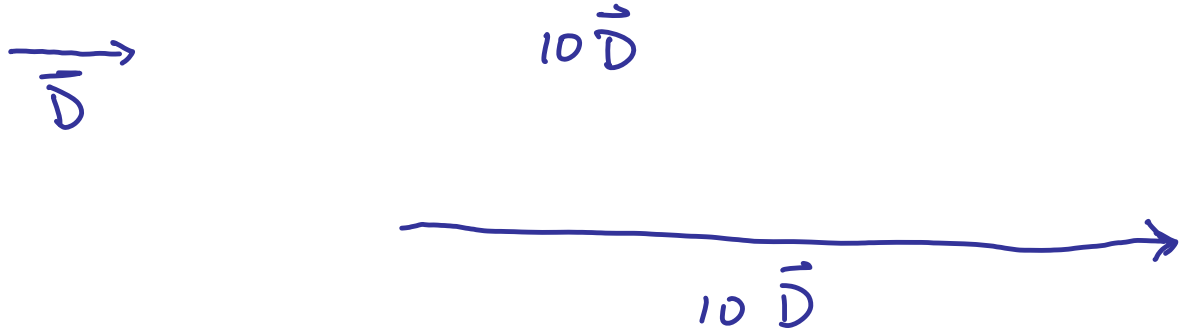
$$\hat{x} \equiv \hat{i}$$

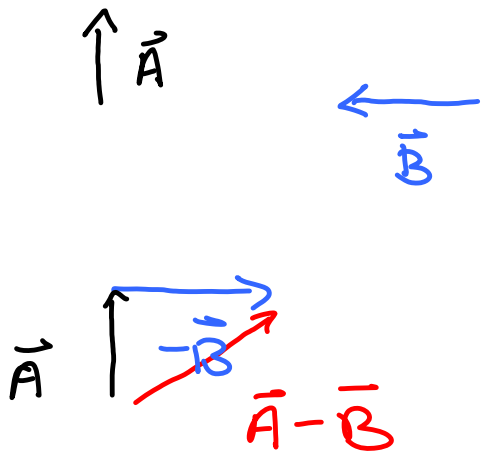
$$\hat{y} \equiv \hat{j}$$

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

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

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



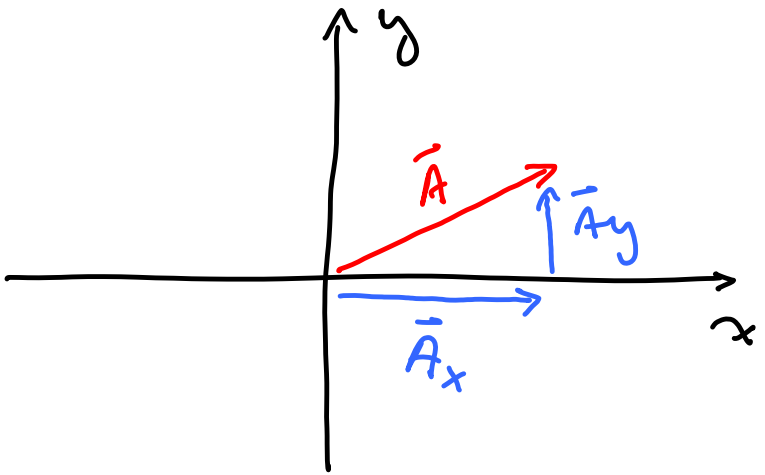


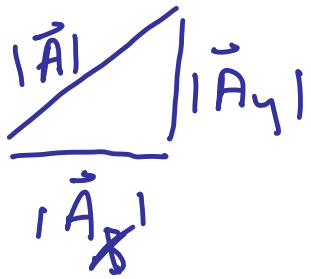
what is the direction of

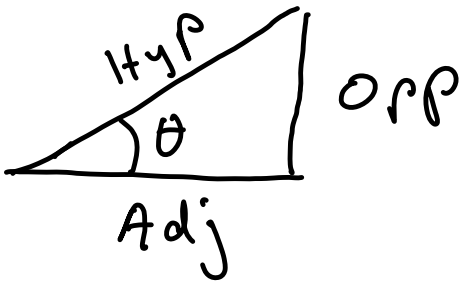
$\vec{A} - \vec{B}$

$\vec{A} + (-\vec{B})$

Analytical addition of vectors



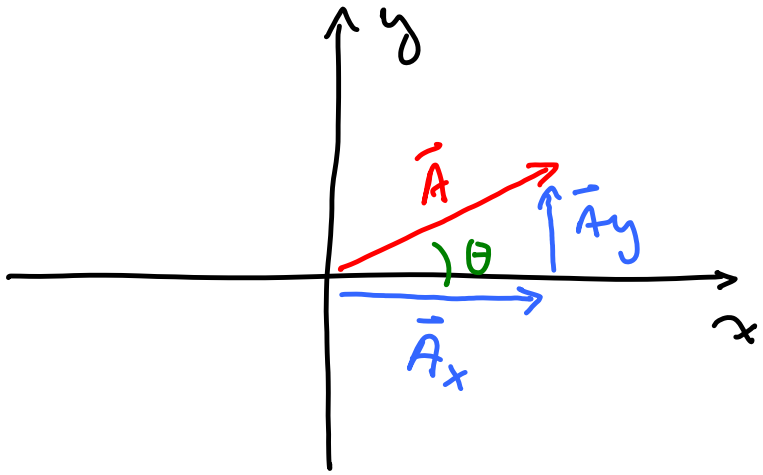




$$\sin\theta = \frac{Opp}{Hyp}$$

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

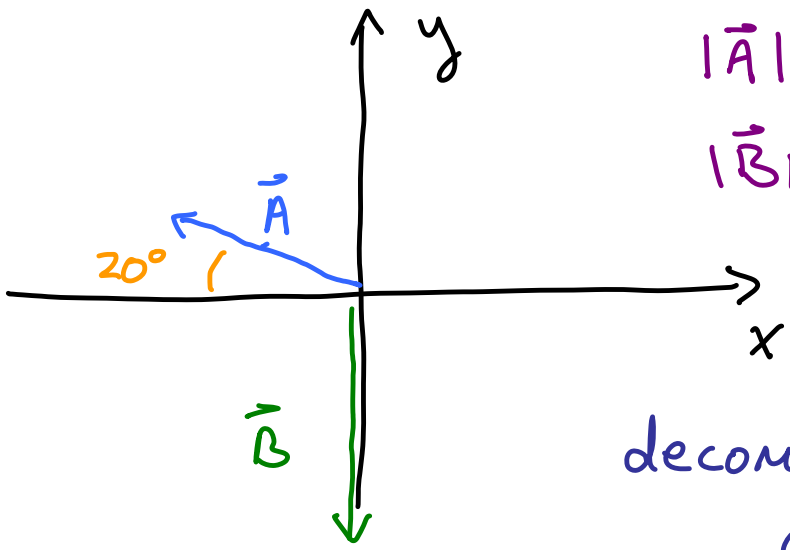
$$\tan\theta = \frac{Opp}{Adj}$$



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

$$\sin\theta = \frac{|\vec{A}_y|}{|\vec{A}|} \qquad \text{TAN}\,\theta = \frac{|\vec{A}_y|}{|\vec{A}_x|}$$

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



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

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

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

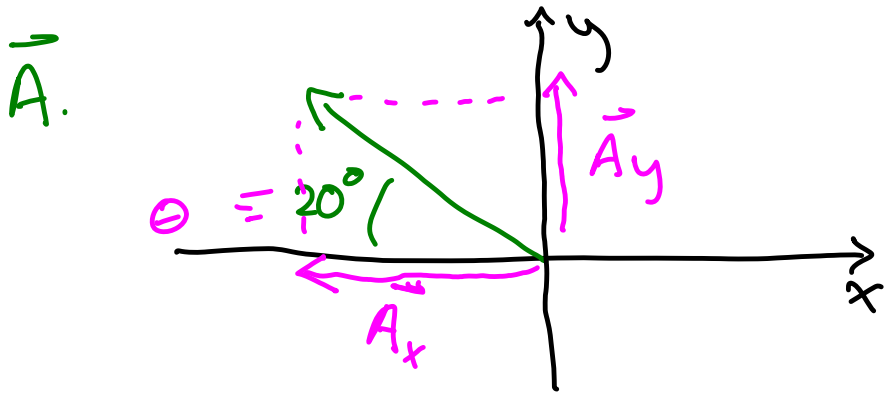
decompose vectors into components along axes

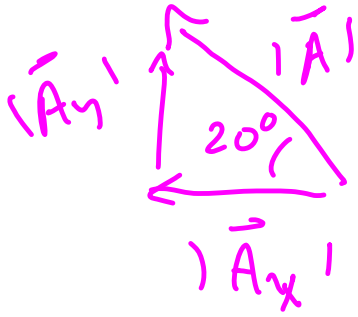
"Resolve" vectors into components

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

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

$|\vec{B}_x| = 0$

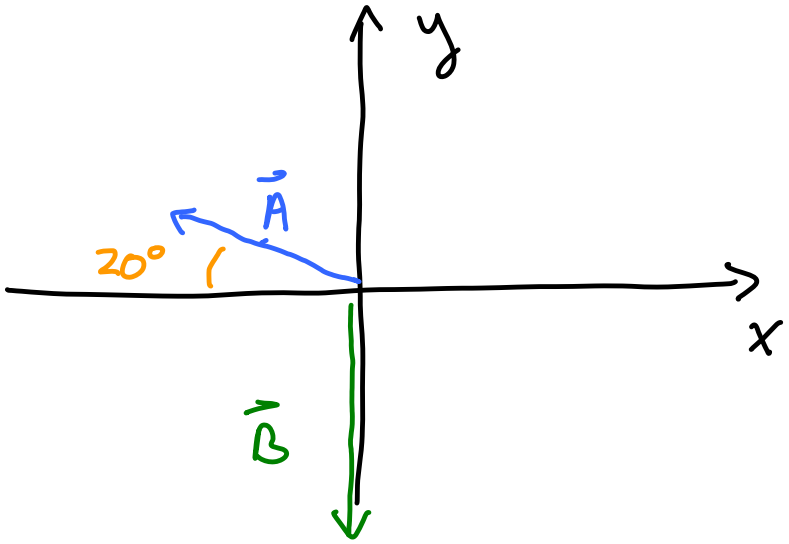




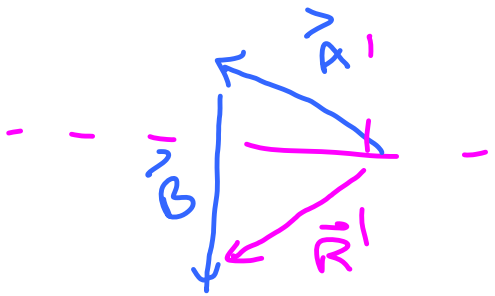
Magn. tudes only

$$\begin{cases} A_x = |\vec{A}| \cos\theta = |\vec{A}| \cos 20 \\ A_y = |\vec{A}| \sin\theta = |\vec{A}| \sin 20 \end{cases}$$

$$\cos\theta = \frac{\text{adj}}{\text{hyp}}$$



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



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

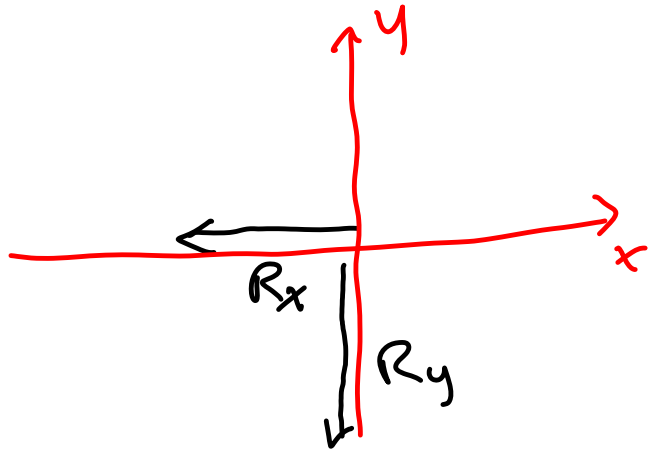
$\vec{R}_x = \vec{A}_x + \vec{B}_x$ → Also incl S. sinc

$\vec{R}_x = -|\vec{A}| \cos\theta \, \hat{x}$ $\quad |R_x| = 4$

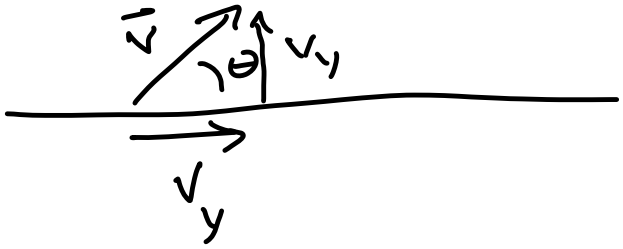
$$\vec{R}_y = \vec{A}_y + \vec{B}_y$$

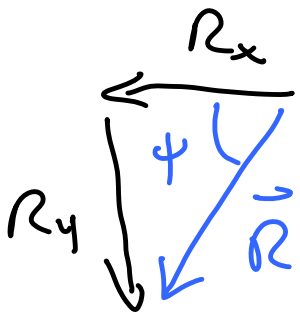
$$|\vec{R}_y| = |\vec{A}_y| - |\vec{B}_y|$$

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



$$v_y = |v| \sin\theta$$





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

$$\sin\psi = \frac{|\vec{R}_y|}{|\vec{R}|}$$