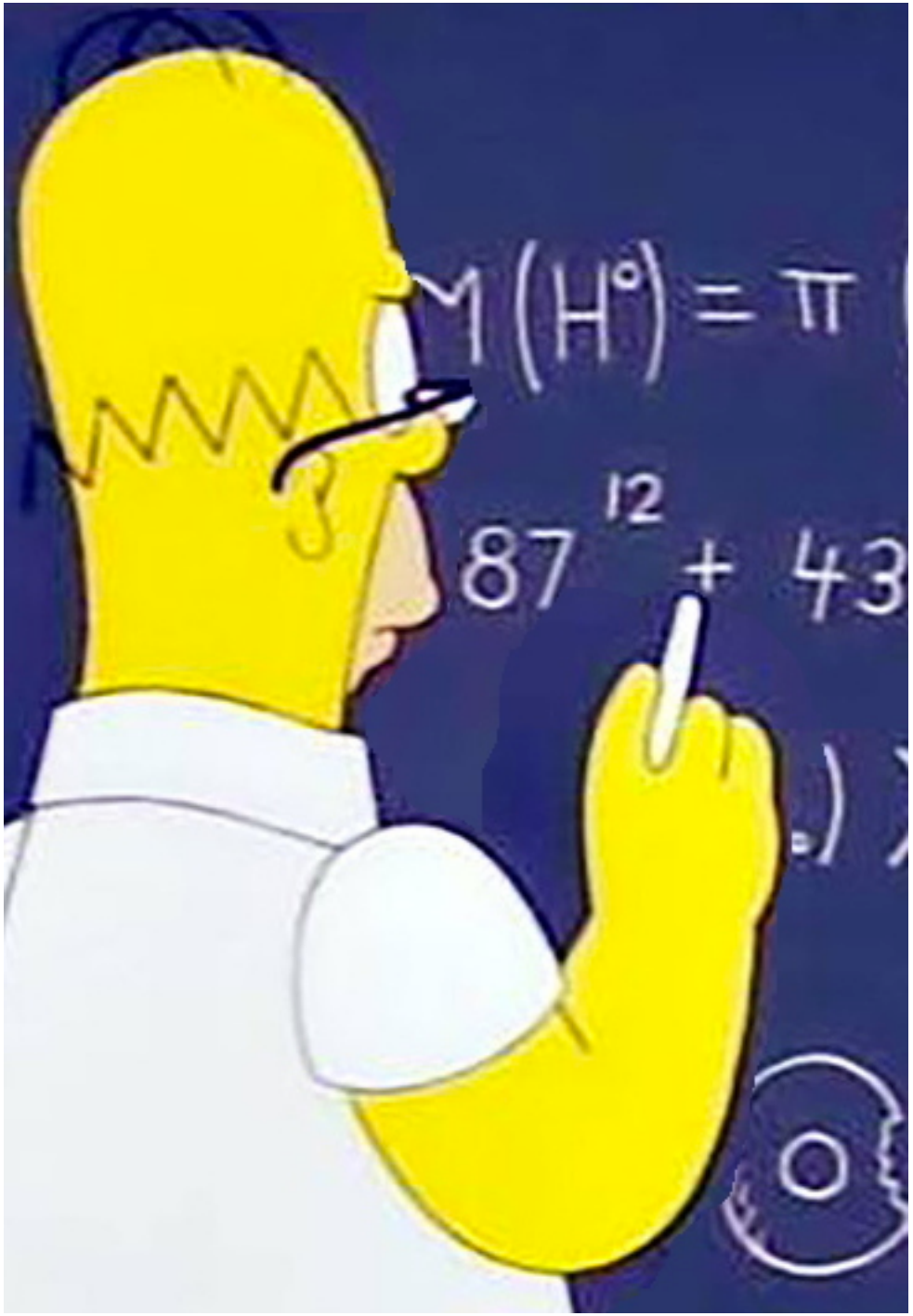
- **Theme Music: Steve Dorff**

  Every which way but loose

- **Cartoon: Bob Thaves**

  Frank & Ernest



The Equation of the Day

Vectors

$$\vec{r} = x\hat{i} + y\hat{j}$$

Physics 131

Review of Vectors (2-dimensional coordinates)

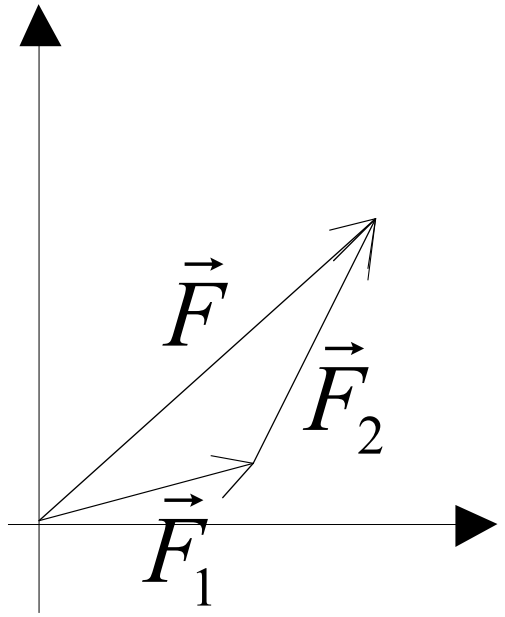
- We have 2 directions to specify. We must
  - Choose a reference point (origin)
  - Pick 2 perpendicular axes (x and y)
  - Choose a scale
- We specify our x and y directions by drawing little arrows of unit length in their positive direction. $\hat{i}, \hat{j}$
- A force vector is written

$$\vec{F} = F_x \hat{i} + F_y \hat{j} = \left(F_x, F_y\right)$$

Adding Forces

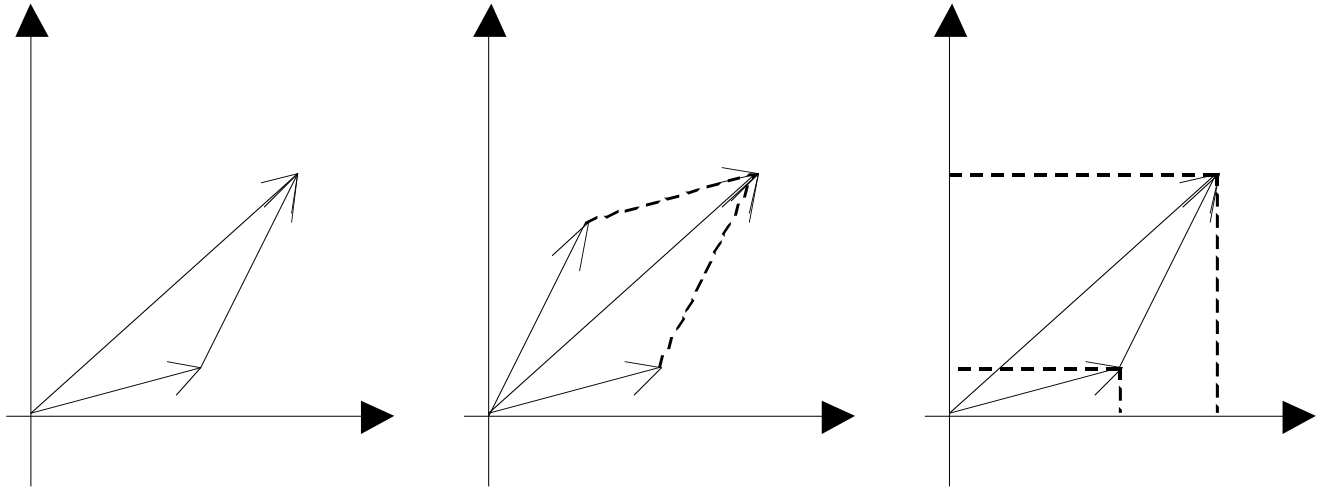
- We define the sum of two vectors as if they were successive displacements.

$$\vec{F} = \vec{F}_1 + \vec{F}_2$$



Adding Vectors: Methods

- There are 3 mathematical ways to add vectors



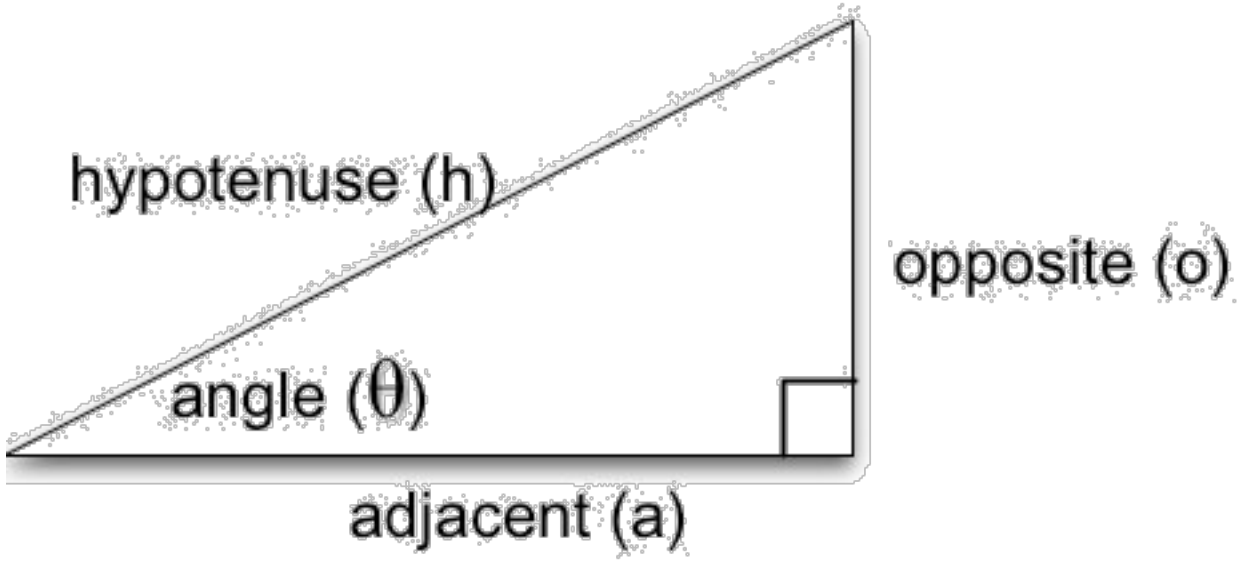
head to tail

parallelogram rule

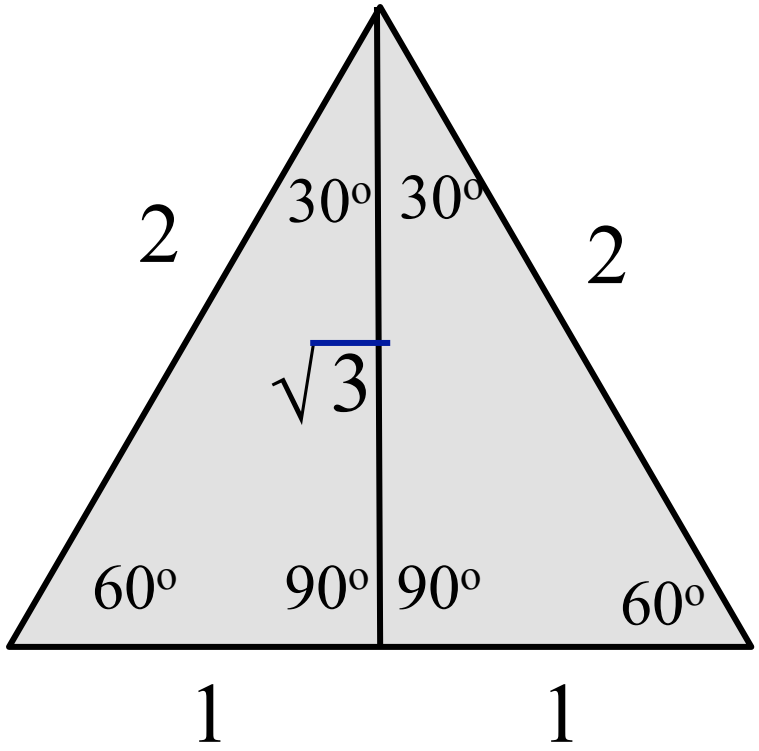
add components (may use trig)

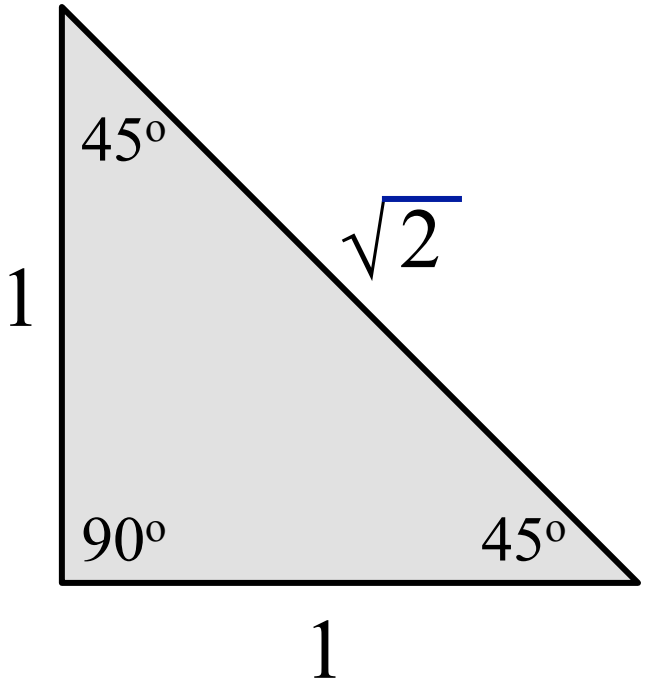
Trig review

- The ratios of a triangle's sides only depend on θ.
  - sin(θ) = opposite/hypotenuse
  - cos(θ) = adjacent/hypotenuse
  - tan(θ) = opposite/adjacent.



Useful examples



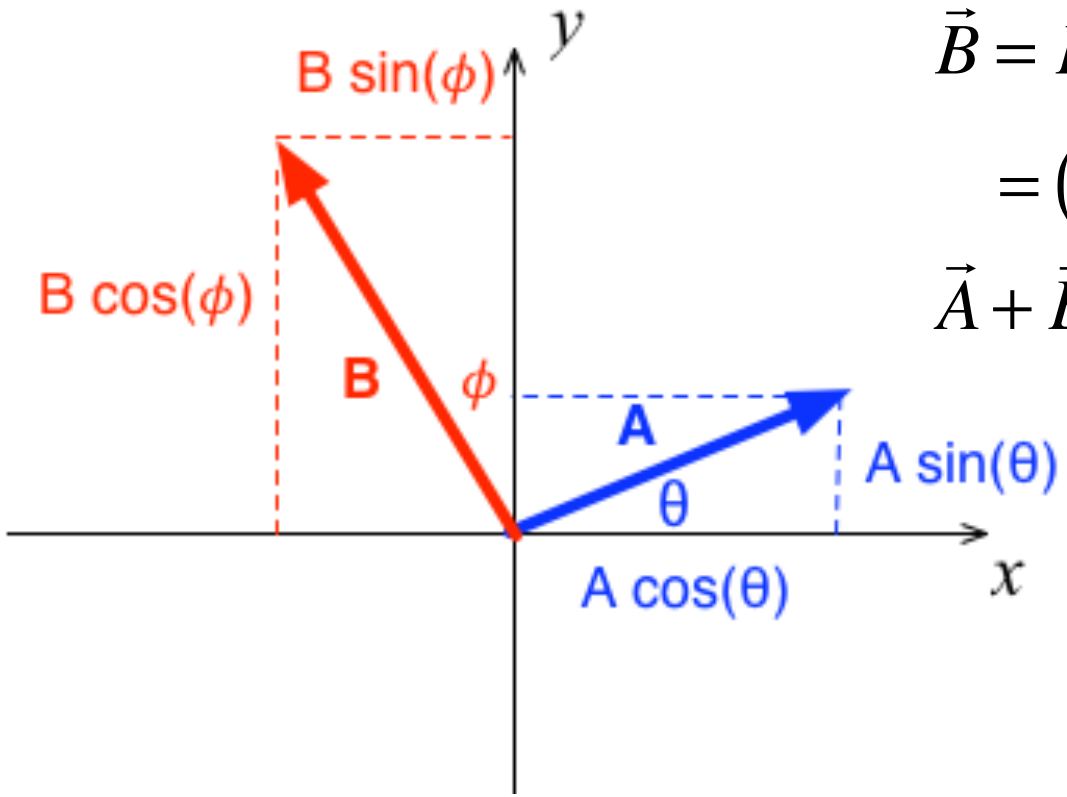


$\sin(30^\circ) = \frac{1}{2}$ $\quad \cos(30^\circ) = \frac{\sqrt{3}}{2}$ $\quad \tan(30^\circ) = \frac{1}{\sqrt{3}}$

$\sin(60^\circ) = \frac{\sqrt{3}}{2}$ $\quad \cos(60^\circ) = \frac{1}{2}$ $\quad \tan(60^\circ) = \sqrt{3}$

$\sin(45^\circ) = \frac{1}{\sqrt{2}}$ $\quad \cos(45^\circ) = \frac{1}{\sqrt{2}}$ $\quad \tan(45^\circ) = 1$

Vectors with trig – by components



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

$$= \big(A\cos(\theta)\big)\hat{i} + \big(A\sin(\theta)\big)\hat{j}$$

$$\vec{B} = B_x\hat{i} + B_y\hat{j}$$

$$= \big(-B\sin(\phi)\big)\hat{i} + \big(B\cos(\phi)\big)\hat{j}$$

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