Theme Music: Steve Dorff

Every which way but loose

Cartoon: Bob Thaves

Frank & Ernest

I never really understood geometry until the instructor brought up pizzas.
Vectors

\[ \vec{r} = x\hat{i} + y\hat{j} \]
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
\[
\vec{F} = F_x \hat{i} + F_y \hat{j} = (F_x, F_y)
\]
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 $\theta$.

- $\sin(\theta) = \text{opposite}/\text{hypotenuse}$
- $\cos(\theta) = \text{adjacent}/\text{hypotenuse}$
- $\tan(\theta) = \text{opposite}/\text{adjacent}$. 
Useful examples

\[
\begin{align*}
\sin(30^\circ) &= \frac{1}{2} & \sin(60^\circ) &= \frac{\sqrt{3}}{2} & \sin(45^\circ) &= \frac{1}{\sqrt{2}} \\
\cos(30^\circ) &= \frac{\sqrt{3}}{2} & \cos(60^\circ) &= \frac{1}{2} & \cos(45^\circ) &= \frac{1}{\sqrt{2}} \\
\tan(30^\circ) &= \frac{1}{\sqrt{3}} & \tan(60^\circ) &= \sqrt{3} & \tan(45^\circ) &= 1
\end{align*}
\]
Vectors with trig –
by components

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

\[ = (A \cos(\theta)) \hat{i} + (A \sin(\theta)) \hat{j} \]

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

\[ = (-B \sin(\phi)) \hat{i} + (B \cos(\phi)) \hat{j} \]

\[ \vec{A} + \vec{B} = ? \]