Lecture 2

Test Sections 34

Principles: Vectors Added, Components Vectors Formed

Position + Displacement
Problem Set introduced 2D vectors

Force Vectors -> Component Conceptual

Head forces are "applied" on means of direct contact, at a distance
Along straight lines

The resolution of a force is not observable
in 2D space / As opposed to a position vector on a displacement vector

Adding force vectors

We begin with concurrent force systems

All forces have lines of action
that intersect at a common point

The line that connects points A and B is referred to

as the line of action of force F. This line can be expressed as a position vector denoted as \( \overrightarrow{AB} \)

Vector \( \overrightarrow{AB} \) has a magnitude that can be written as \( |\overrightarrow{AB}| \)

The direction \( \overrightarrow{AB} \) (which is also the direction of the line of action of \( F \)) is then defined as

\[
\frac{\text{direction of } \overrightarrow{AB}}{\text{magnitudes of } \overrightarrow{AB}}
\]

\[\text{Vector} = \left( \frac{\text{magnitude}}{\text{magnitudes}} \right) \times \text{direction} \]
Consider two vector displacements, first displacement \( \vec{F}_1 \) is in positive \( x \) direction and second \( \vec{F}_2 \) is in positive \( y \) direction.

We can then use vector addition to define a new vector \( \vec{F} \) where

\[
\vec{F} = \vec{F}_1 + \vec{F}_2
\]

Now consider two “special vectors” that have directions defined by the positive \( x \)-axis and positive \( y \)-axis, respectively, and which have magnitudes equal to only.

These are referred to as unit vectors and the have symbols \( \hat{i} \) and \( \hat{j} \).

\[
\begin{align*}
\hat{i} \text{ is in the positive } x \text{-axis direction,} \\
\hat{j} \text{ is in the positive } y \text{-axis direction.}
\end{align*}
\]

So any vector \( \vec{F} = (\hat{i}+\hat{j})F \) can be written as \( \vec{F} = (\hat{i}+\hat{j})F \).