

Announcements

- ❑ Last MATLAB Clinics today
- ❑ TAM 210 and 211 share Compass TAM 210 Space
- ❑ No OH on Labor Day
- ❑ Quiz scope posted on Schedule page

❑ Upcoming deadlines:

- Tuesday (1/22)
 - PrairieLearn HW1
- Friday (1/25)
 - Written Assignment 1

Lecture Objectives

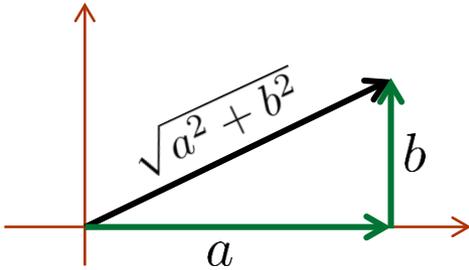
- 2D and 3D vector representations
- Resultant force
- Position vector
- Force vector along a line

2D Vector Representation

Magnitude:

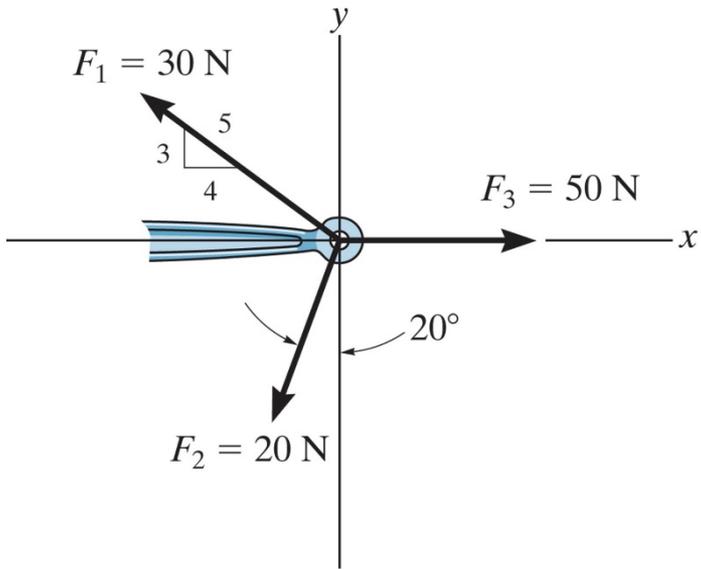
$$A = |\mathbf{A}| = \sqrt{A_x^2 + A_y^2}$$

Direction:



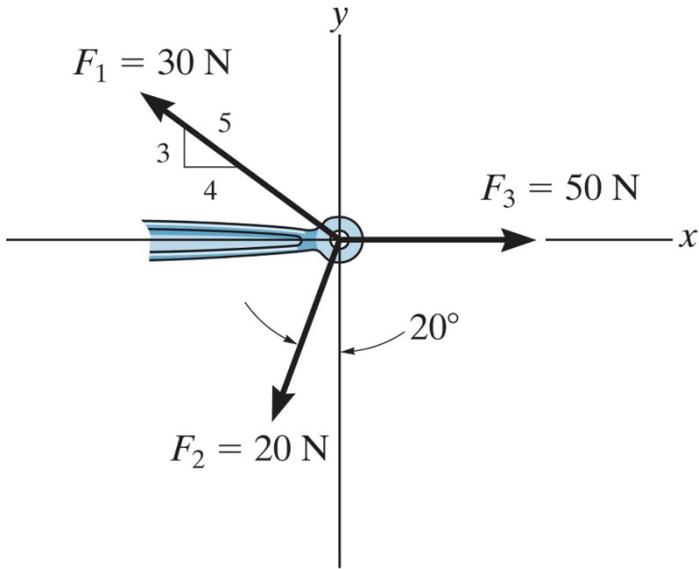
Example

Express force vector \mathbf{F}_1 using the Cartesian vector form.



Example

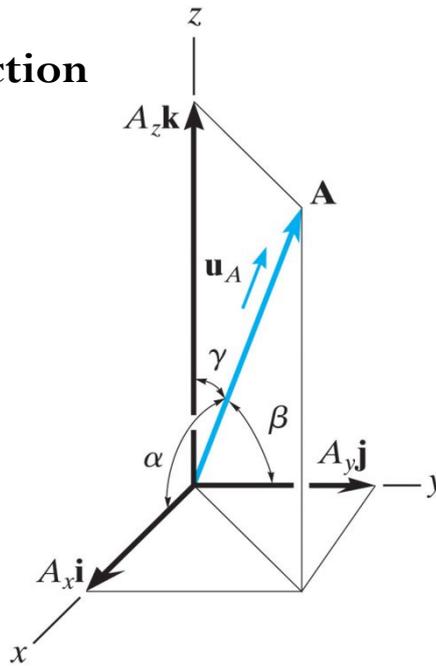
Determine of resultant force of \mathbf{F}_1 and \mathbf{F}_3 in Cartesian vector form.



3D Vector Representation – Direction

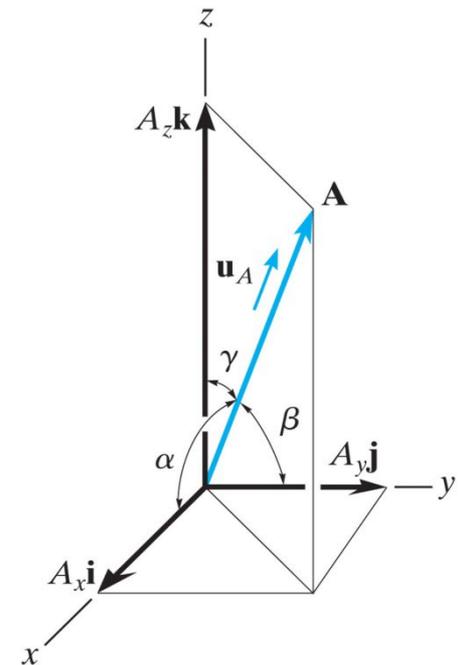
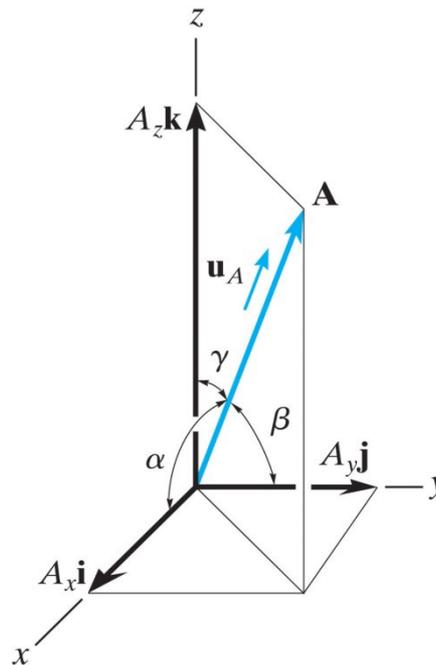
Expressing the direction using a unit vector:

$$\begin{aligned} \mathbf{u}_A &= \frac{\mathbf{A}}{A} \\ &= \frac{A_x}{A} \mathbf{i} + \frac{A_y}{A} \mathbf{j} + \frac{A_z}{A} \mathbf{k} \end{aligned}$$



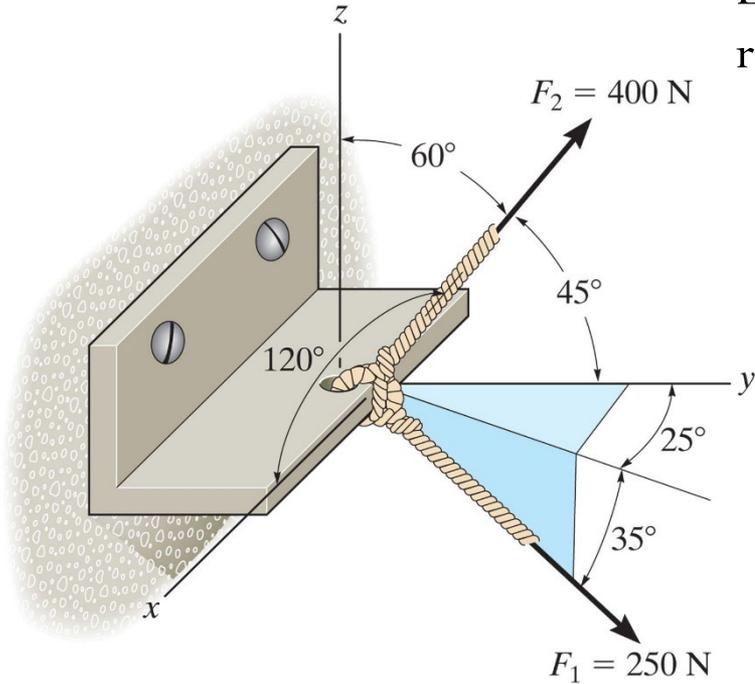
Direction cosines are the components of the unit vector:

$$\begin{aligned} \cos(\alpha) &= \frac{A_x}{A} \\ \cos(\beta) &= \frac{A_y}{A} \\ \cos(\gamma) &= \frac{A_z}{A} \end{aligned}$$

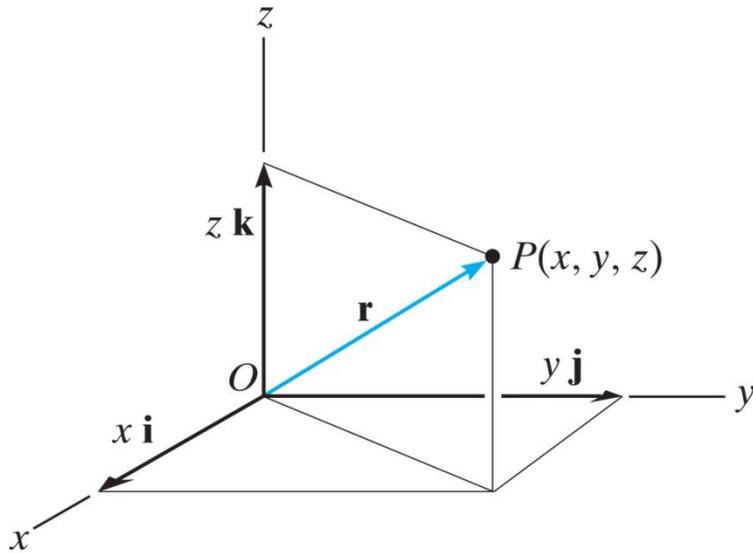


Example

The bracket is subjected to the two forces on the ropes. Determine the magnitude and direction cosines of the resultant force vector.



Position vectors

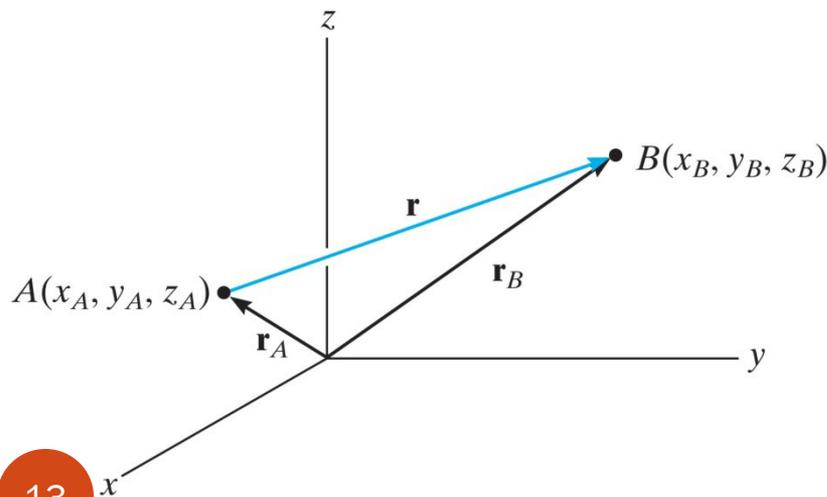


A position vector \mathbf{r} is defined as a fixed vector which locates a point in space relative to another point. For example,

$$\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$$

expresses the position of point $P(x, y, z)$ with respect to the origin O .

The position vector \mathbf{r} of point B with respect to point A is obtained from



Thus, the (i, j, k) components of the position vector \mathbf{r} may be formed by taking the coordinates of the tail (point A) and subtracting them from the corresponding coordinates of the head (point B).

i>clicker time

Which cartesian components of force exist in strut AO?

- (A) **i** and **j**
- (B) **j** and **k**
- (C) **i** and **k**
- (D) **i**, **j**, and **k**

