University of Mohamed Khider, Biskra.
Department of Civil Engineering and Hydraulics.
Year: 2023/2024

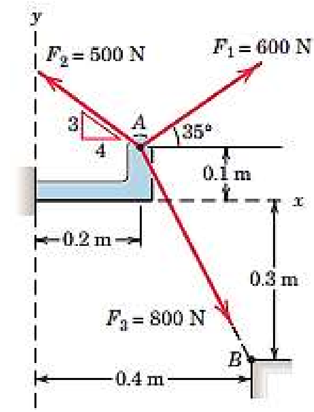
2nd Year Under-graduation
Engineering Mechanics- Statics

Mathematical recall and vector operations

Problem 1:

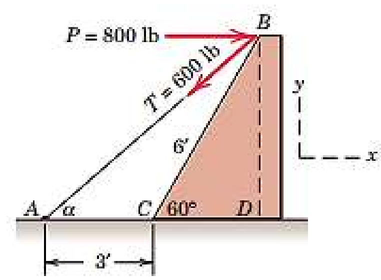
The forces $\mathbf{F}_1$, $\mathbf{F}_2$, and $\mathbf{F}_3$, all of which act on point *A* of the bracket, are specified in three different ways (Fig.1).

- Determine the *x* and *y* scalar components of each of the three forces.



Problem 2:

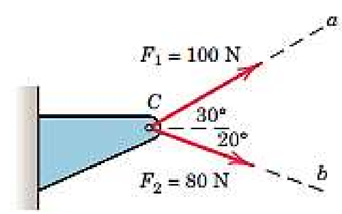
Combine the two forces **P** and **T**, which act on the fixed structure at *B*, into a single equivalent force **R** (Fig.2).



Problem 3:

Forces $\mathbf{F}_1$ and $\mathbf{F}_2$ act on the bracket as shown in (Fig.3). Determine:

1- The magnitude of the resultant force **R**.
2- The projection F_b of their resultant **R** onto the *b*-axis.



Problem 4:

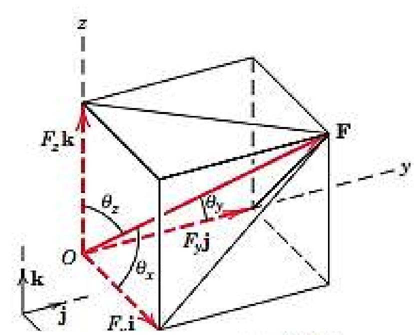
If the force **F** has a magnitude of 1200 N and angle θ_x is 60° and θ_y is 45° (Fig.4).

1- Express the force in Cartesian form.
2- Determine its unit vector.

Problem 5:

If the coordinate direction angles θ_x=112°, θ_y=75° and F_z=5 cm (Fig.4).

- Determine the magnitude of vector **F**.



Problem 6:

A force **F** with a magnitude of 100 N is applied at the origin *O* of the axes *x*-*y*-*z* as shown in (Fig.5). The line of action of **F** passes through a point *A* whose coordinates are 3 m, 4 m, and 5 m. Determine:

1- The *x*, *y*, and *z* scalar components of **F**,
2- The projection F_{xy} of **F** on the *x*-*y* plane,
3- The projection F_{OB} of **F** along the line *OB* using dot product.