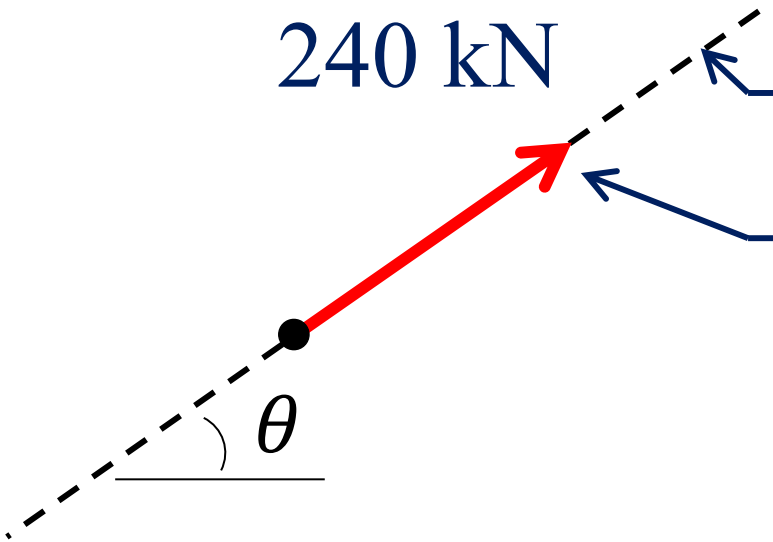
Forces in Two-Dimensional Space

Steven Vukazich
San Jose State University

Definitions and Terminology

Vectors are used to represent forces in space. Forces, like vectors, have both **magnitude** and **direction**.



Magnitude of the force (units of force)

Line of action of the force

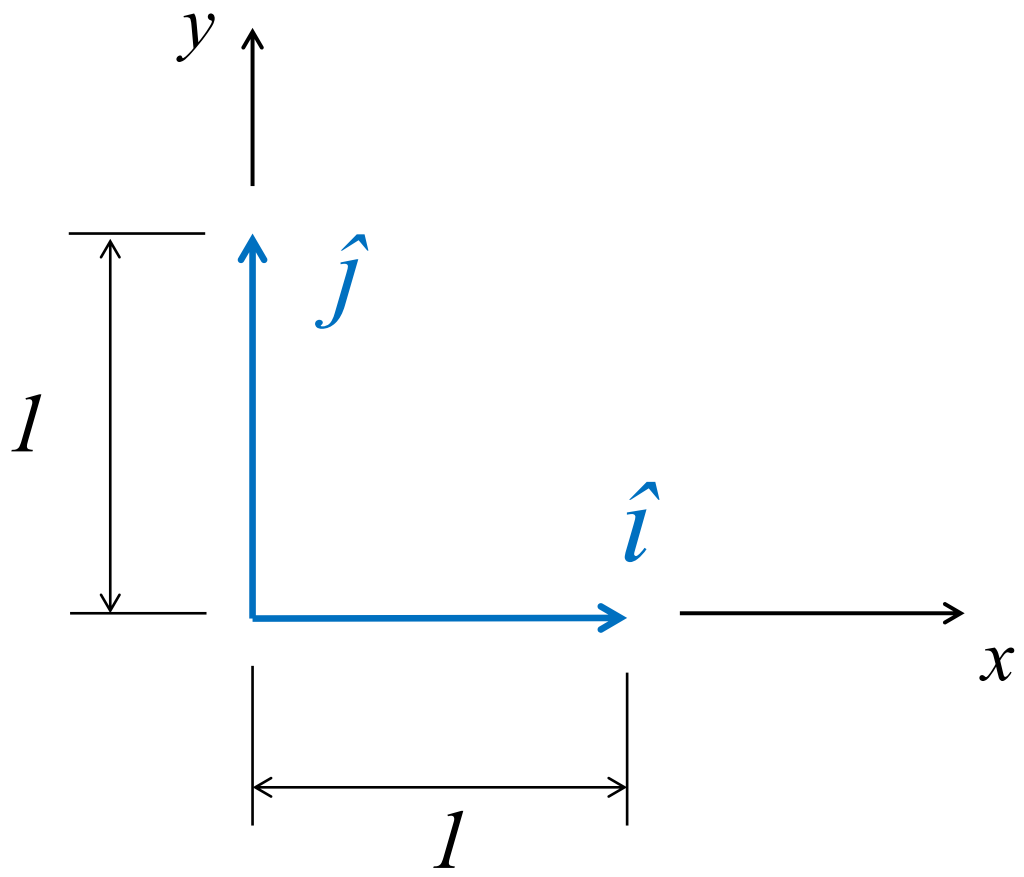
Sense of the force

Direction of the force is defined by:

1. Line of action (θ)
2. Sense (direction of arrow)

Rectangular Components of a Force in Two-Dimensional Space

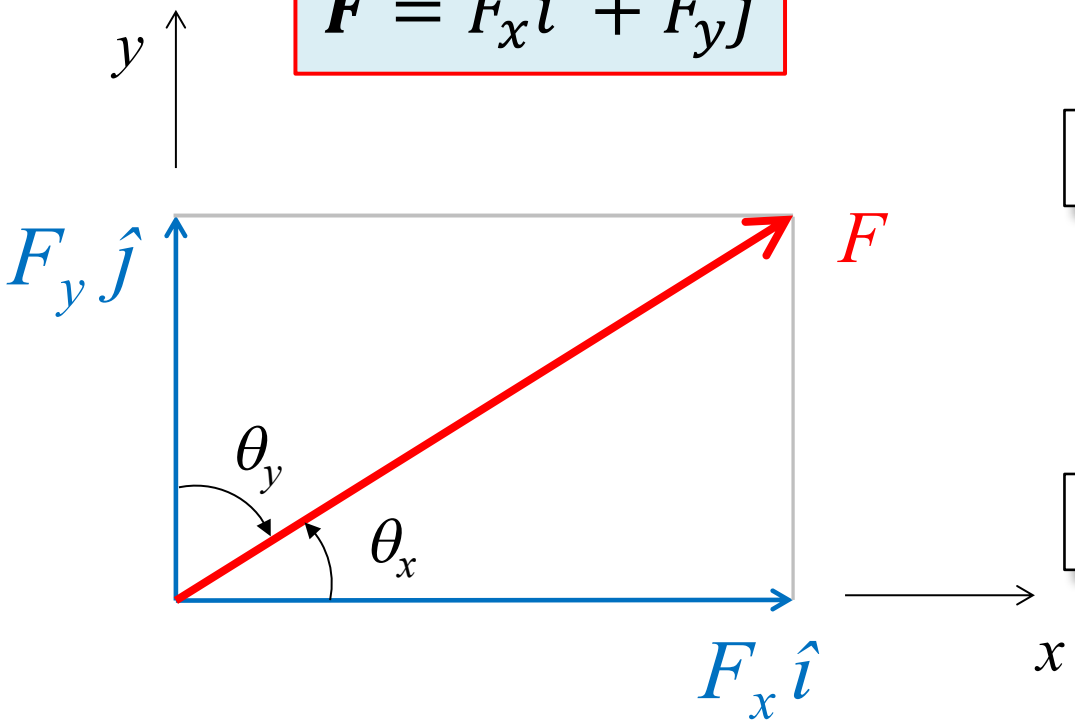
Define unit vectors in the x and the y directions



Rectangular Components of a Force in Two-Dimensional Space

Cartesian Vector Form of $\boldsymbol{F}$

$$\boldsymbol{F} = F_x\hat{\imath} + F_y\hat{\jmath}$$



Scalar components of $\boldsymbol{F}$

$$F_x = F\cos\theta_x$$

$$F_y = F\cos\theta_y = F\sin\theta_x$$

Magnitude of $\boldsymbol{F}$

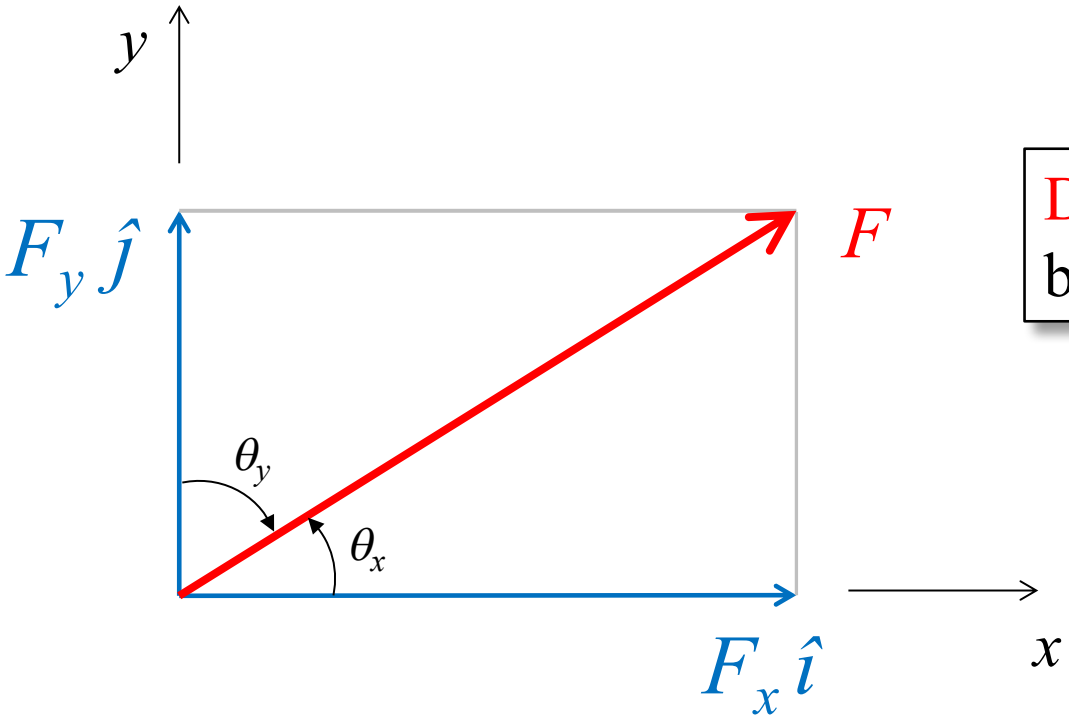
$$F = \sqrt{F_x^2 + F_y^2}$$

Direction of $\boldsymbol{F}$

$$\tan\theta_x = \frac{F_y}{F_x}$$

Rectangular Components of a Force in Two-Dimensional Space

$$\boldsymbol{F} = F_x\hat{\imath} + F_y\hat{\jmath}$$



Magnitude of $\boldsymbol{F}$

$$F = \sqrt{F_x^2 + F_y^2}$$

Direction of $\boldsymbol{F}$ is defined by direction cosines

$$\lambda_x = \cos\theta_x$$

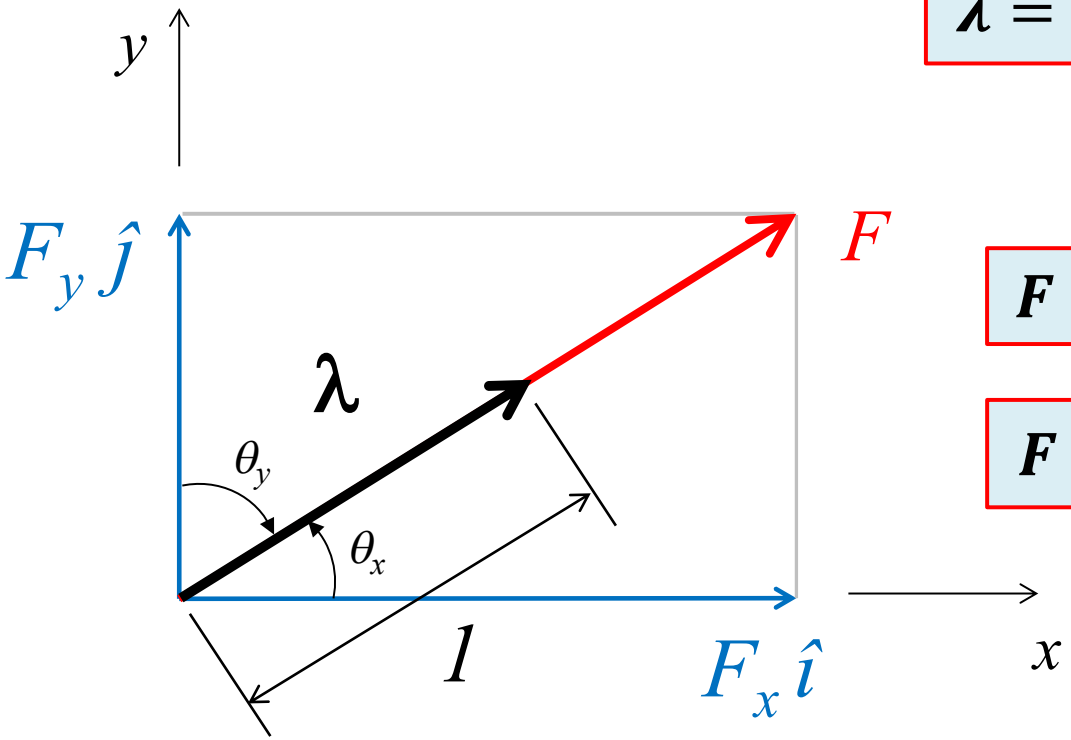
$$\lambda_y = \cos\theta_y$$

Rectangular Components of a Force in Two-Dimensional Space

$$\boldsymbol{F} = F_x\hat{\imath} + F_y\hat{\jmath}$$

unit vector in the direction of $\boldsymbol{F}$

$$\boldsymbol{\lambda} = (\cos\theta_x)\hat{\imath} + (\cos\theta_y)\hat{\jmath}$$



$$\boldsymbol{F} = F\boldsymbol{\lambda}$$

$$\boldsymbol{F} = F\left[(\cos\theta_x)\hat{\imath} + (\cos\theta_y)\hat{\jmath}\right]$$