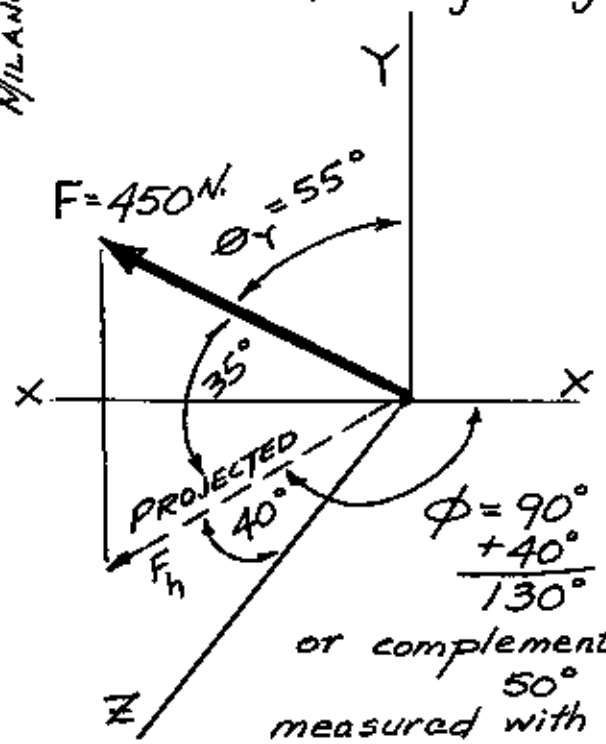
MECH 234 + 235
SPACE VECTORS

PROB. 2.72
p. 54

DETERMINE X, Y, Z components of 450 N. force. and corresponding angles θ_x, θ_y, θ_z

MILANO



SHOWN:
FORCE VECTOR = 450 N.

PROJECTION onto HORIZONTAL X-Z PLANE
— F_h

40° angle shown is relative to Z-axis.
use position relative to X-axis
$\phi = 50°$ or $130°$

NOTE $\theta_y = 55°$ measured from Y-axis to FORCE VECTOR.

Refer to equations on p. 45

$F_h = F \sin\theta_y$ $\qquad F_y = F\cos\theta_y$

then $F_x = F_h \cos\phi = (F\sin\theta_y)\cos\phi$

$F_z = F_h \sin\phi = (F\sin\theta_y)\sin\phi$

Use $\phi = 130°$ $\qquad \theta_y = 55°$ $\qquad F = 450$ N.

$F_x = (450\text{ N}\sin 55°)\cos 130° = -236.94\,\hat{i}$

$F_y = 450\text{ N}\cos 55° = 258.11\,\hat{j}$

$F_z = (450\text{ N}\sin 55°)\sin 130° = 282.38\,\hat{k}$

Refer to p. 46

$F_x = F\cos\theta_x \quad \therefore \quad \theta_x = \cos^{-1}\frac{F_x}{F} = \cos^{-1}\frac{-236.94}{450} = 121.8°$

$F_y = F\cos\theta_y \quad \therefore \quad \theta_y = \cos^{-1}\frac{F_y}{F} = \cos^{-1}\frac{258.11}{450} = 55°$

$F_z = F\cos\theta_z \quad \therefore \quad \theta_z = \cos^{-1}\frac{F_z}{F} = \cos^{-1}\frac{282.38}{450} = 51.1°$