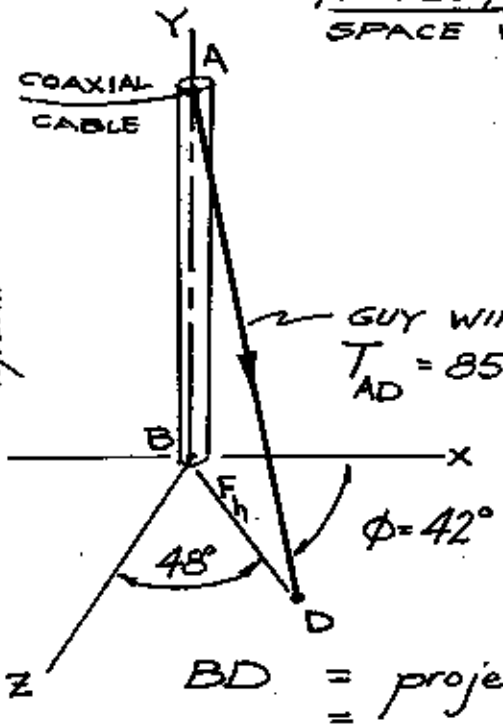
MECH 234 + 235
SPACE VECTORS

PROB. 2.74
P. 54



DETERMINE ALL FORCE COMPONENTS OF $\vec{AD}$ AND ANGLES WITH AXES.

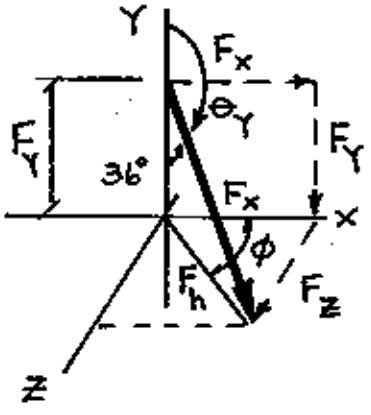
NOTE: YOU ARE ANALYZING THE FORCE ON THE POLE, ∴ the PULL or TENSION on pt. A

LOGICALLY: from A to D

F_x → to the right $+\hat{\imath}$
F_y ↓ down $-\hat{\jmath}$
F_z ↙ forward $+\hat{k}$

BD = projection onto the Horiz. Pl., X-Z Pl. = F_h

$\phi = 42°$ if measured from X-axis



θ_Y = measured FROM Y-axis TO the force vector

$= 180° - 36° = 144°$

Refer to p. 45 and 46

$F_x = F_h \cos\phi$
$F_z = F_h \sin\phi$
} NEED F_h

$F_Y = F \cos\theta_Y = 85^{lb} \cos 144° = -68.77^{lb}\,\hat{\jmath}$

$F_h = F \sin\theta_Y = 85 \sin 144° = 49.96 \approx 50^{lb}$

$\therefore F_x = (F \sin\theta_Y)\cos\phi = 49.96 \cos 42° = 37.13^{lb}\,\hat{\imath}$

$F_z = (F \sin\theta_Y)\sin\phi = 49.96 \sin 42° = 33.43^{lb}\,\hat{k}$

CHECK: mag. $= \sqrt{F_x^2 + F_Y^2 + F_z^2} = \sqrt{(37.13)^2 + (68.77)^2 + (33.43)^2} = 85.003^{lb}$ ✓

$\cos\theta_X = \frac{F_x}{F}$ ∴ $\theta_X = \cos^{-1}\left[\frac{37.13}{85}\right] = 64.1°$

$\cos\theta_Y = \frac{F_Y}{F}$ ∴ $\theta_Y = \cos^{-1}\left[\frac{-68.77}{85}\right] = 144°$

$\cos\theta_Z = \frac{F_z}{F}$ ∴ $\theta_Z = \cos^{-1}\left[\frac{33.43}{85}\right] = 66.84°$