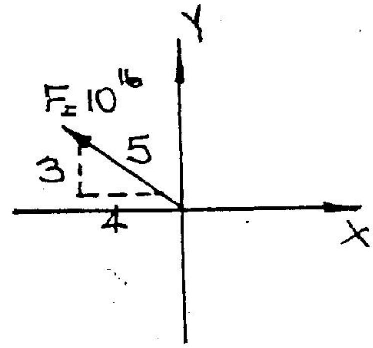
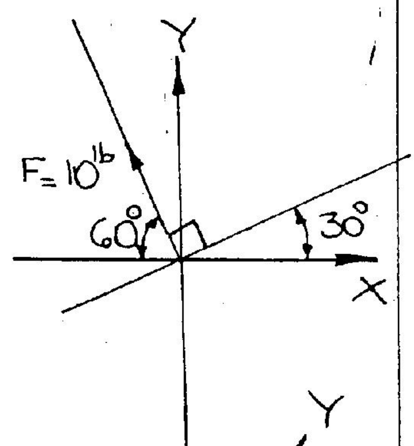
PROBLEM 2.32



(a) $\vec{F} = F_x\vec{I} + F_Y\vec{J}$

$= -\frac{4}{5} * 10\vec{I} + \frac{3}{5} * 10\vec{J}$ (−8) (+6)

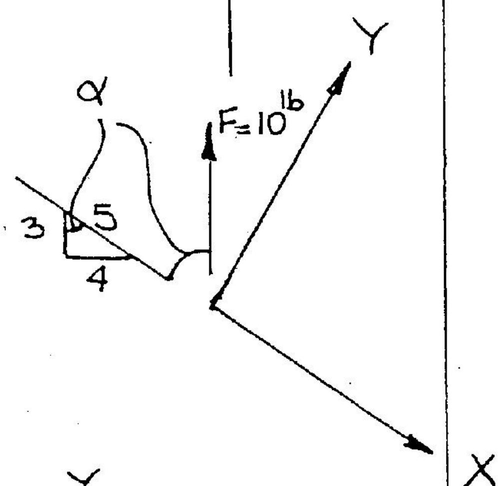
$\underline{\underline{\vec{F} = -8\vec{I} + 6\vec{J}}}$ (lb)



(b) $\vec{F} = F_x\vec{I} + F_Y\vec{J}$

$= -10(\cos 60)\vec{I} + (10\sin 60)\vec{J}$

$\underline{\underline{\vec{F} = -5.0\vec{I} + 8.66\vec{J}}}$ (lb)

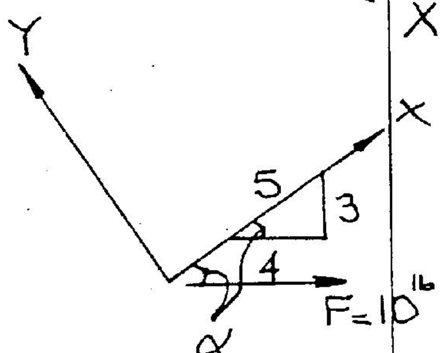


(c) $\vec{F} = F_x\vec{I} + F_Y\vec{J}$

$= -(10\cos\alpha)\vec{I} + (10\sin\alpha)\vec{J}$

$\vec{F} = \left(-10 \times \frac{3}{5}\right)\vec{I} + \left(10 \times \frac{4}{5}\right)\vec{J}$

$\underline{\underline{\vec{F} = -6\vec{I} + 8\vec{J}}}$ (lb)

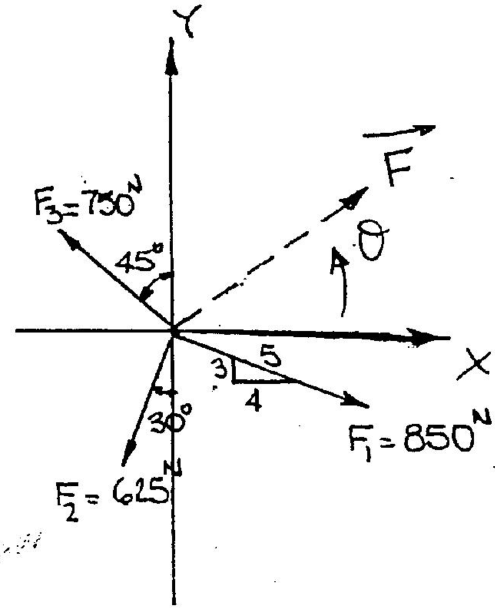


(d) $\vec{F} = (10\cos\alpha)\vec{I} - (10\sin\alpha)\vec{J}$

$= \left(10 \times \frac{4}{5}\right)\vec{I} - \left(10 \times \frac{3}{5}\right)\vec{J}$

$\underline{\underline{\vec{F} = 8\vec{I} - 6\vec{J}}}$ (lb)

PROBLEM 2.36



$$\vec{F_1} = \left(850 \times \tfrac{4}{5}\right)\vec{I} - \left(850 \times \tfrac{3}{5}\right)\vec{J}$$
$$= 680\vec{I} - 510\vec{J}$$

$$\vec{F_2} = -\left(625 \times \sin 30\right)\vec{I} - \left(625 \cos 30\right)\vec{J}$$
$$= -312.5\vec{I} - 541.27\vec{J}$$

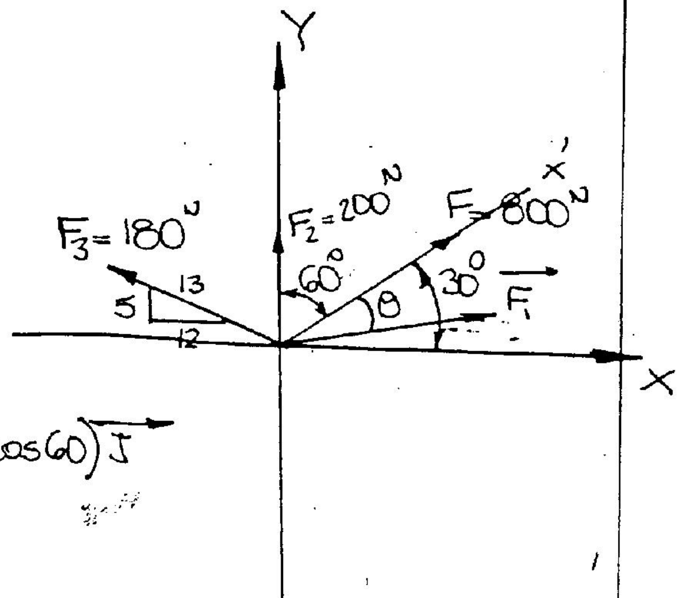
$$\vec{F_3} = -\left(750 \cos 45\right)\vec{I} + \left(750 \cos 45\right)\vec{J}$$
$$= -530.33\vec{I} + 530.33\vec{J}$$

$$\vec{F} = \vec{F_1} + \vec{F_2} + \vec{F_3}$$
$$= \left(680 - 312.5 - 530.33\right)\vec{I} + \left(-510 - 541.27 + 530.33\right)\vec{J}$$
$$= -162.83\vec{I} - 520.94\vec{J}$$

$$F = \sqrt{162.83^2 + 520.94^2} = \underline{\underline{545.80^N = F}}$$

$$\theta = \tan^{-1}\left(\frac{-520.94}{+162.83}\right) + 180.0^\circ = \underline{\underline{\quad\quad = \theta}}$$

PROBLEM 2.56



$$\vec{F} = \vec{F_1} + \vec{F_2} + \vec{F_3}$$

$$\vec{F_1} = \vec{F} - \vec{F_2} - \vec{F_3}$$

$$\vec{F} = (800 \sin 60)\vec{I} + (800 \cos 60)\vec{J}$$

$$= 692.82\vec{I} + 400\vec{J}$$

$$\vec{F_2} = 0\vec{I} + 200\vec{J}$$

$$\vec{F_3} = \left(-\frac{12}{13} \times 180\right)\vec{I} + \left(\frac{5}{13} \times 180\right)\vec{J}$$

$$= -166.15\vec{I} + 69.23\vec{J}$$

$$\vec{F} - \vec{F_2} - \vec{F_3} = (692.82 + 166.15)\vec{I} + (400 - 200 - 69.23)\vec{J}$$

$$\vec{F_1} = (858.97)\vec{I} + (130.77)\vec{J}$$

$$F_1 = \sqrt{858.97^2 + 130.77^2} = \underline{\underline{868.86^N = F_1}}$$

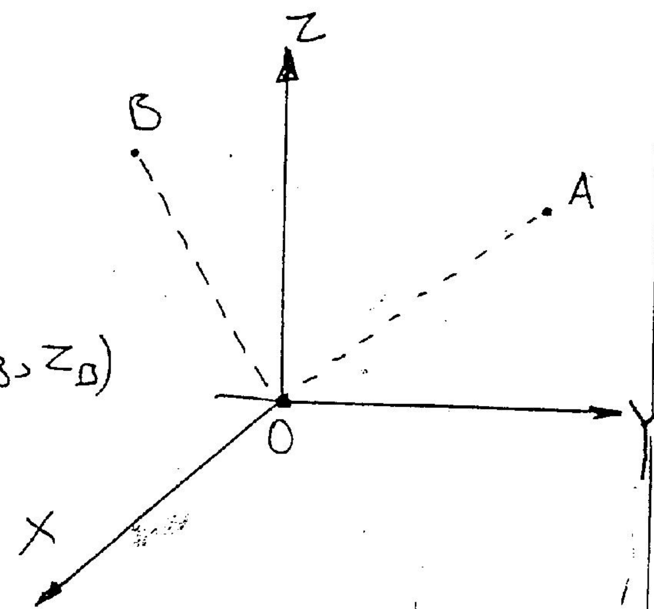
$$\theta = 30^\circ - \tan^{-1}\left(\frac{130.77}{58.97}\right) = \underline{\underline{21.35 = \theta}}$$

PROBLEM 2-88

OA = 460^{M}

OB = 653^{M}

$A(X_A, Y_A, Z_A)$ $B(X_B, Y_B, Z_B)$



$Z_A = 460^M(\sin 40) = 295.68^M$

$X_A = -(460^M \cos 40)(\sin 30) = -176.19^M$

$Y_A = (460 \cos 40)(\cos 30) = 305.17^M$

$Z_B = 653^M(\sin 55) = 534.91^M$

$X_B = -653(\cos 55)(\sin 60) = -324.37^M$

$Y_B = -653(\cos 55)(\cos 60) = -187.27^M$

$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = \overrightarrow{OB} - \overrightarrow{OA}$

$= (-324.37 + 176.19)\overrightarrow{I} + (-187.27 - 305.17)\overrightarrow{J}$

$+ (534.91 - 295.68)\overrightarrow{K}$

$= -148.18\overrightarrow{I} - 492.44\overrightarrow{J} + 239.23\overrightarrow{K}$

$AB = \sqrt{148.18^2 + 492.44^2 + 239.23^2} = \underline{\underline{567.17^M = AB}}$

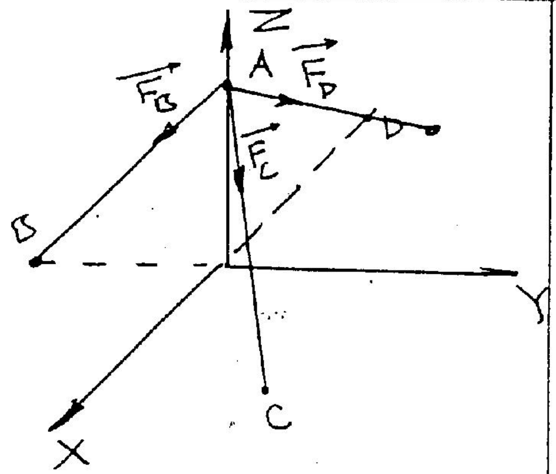
PROBLEM 2_100

$B(0,-10,0)^{M}$

$C(16,18,0)^{M}$

$D(-12,8,0)^{M}$

$A(0,0,24)^{M}$



$F_B = 520^{N}$, $F_C = 680^{N}$, $F_D = 560^{N}$

$$\vec{AB} = \vec{OB} - \vec{OA} = 0\vec{I} + (-10)\vec{J} + (-24)\vec{K}$$

$$\vec{AC} = \vec{OC} - \vec{OA} = 16\vec{I} + 18\vec{J} + (-24)\vec{K}$$

$$\vec{AD} = \vec{OD} - \vec{OA} = -12\vec{I} + 8\vec{J} + (-24)\vec{K}$$

UNIT VECTORS:

$$\vec{U_{AB}} = \frac{\vec{AB}}{AB} = \frac{1}{\sqrt{10^2+24^2}}\vec{AB} = \frac{\vec{AB}}{26}$$

$$\vec{U_{AC}} = \frac{\vec{AC}}{AC} = \frac{\vec{AC}}{\sqrt{16^2+18^2+24^2}} = \frac{\vec{AC}}{34}$$

$$\vec{U_{AD}} = \frac{\vec{AD}}{AD} = \frac{\vec{AD}}{\sqrt{12^2+8^2+24^2}} = \frac{\vec{AD}}{28}$$

$$\vec{F} = \vec{F_{AB}} + \vec{F_{AC}} + \vec{F_{AD}} = \vec{F_B} + \vec{F_C} + \vec{F_D} = \left(\frac{520}{26}\right)\vec{AB} + \left(\frac{680}{34}\right)\vec{AC} + \left(\frac{560}{28}\right)\vec{AD}$$

$$= 20\vec{AB} + 20\vec{AC} + 20\vec{AD}$$

$$= (20\times16 - 20\times12)\vec{I} + (-20\times10 + 20\times18 + 20\times8)\vec{J} + (-20\times24 - 20\times24 - 20\times24)\vec{k}$$

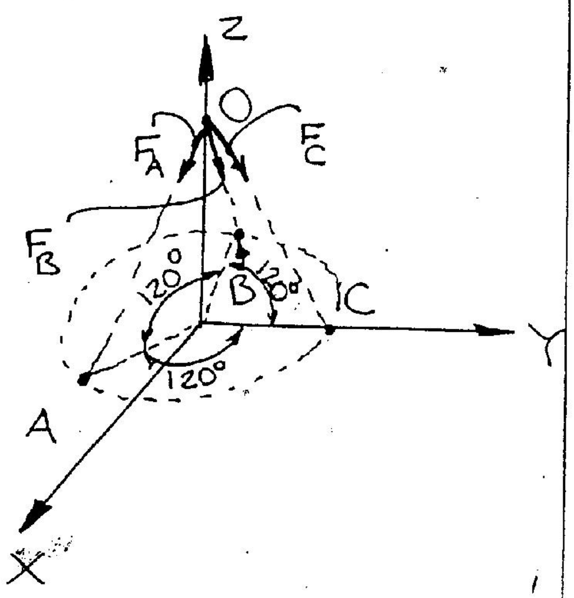
$$= 80\vec{I} + 320\vec{J} - 1440\vec{K} \quad (N)$$

$$F = \sqrt{80^2 + 320^2 + 1440^2} = \underline{\underline{1477.30^{N}}} = F$$

$$\vec{U_F} = \frac{80\vec{I} + 320\vec{J} - 1440\vec{K}}{1477.30} = \underline{\underline{\text{DIRECTION OF } \vec{F}}}$$

DIRECTION COSINES
α WITH X- = 86.9°
β WITH Y = 77.5°
γ WITH Z = $\cancel{12.9^{\circ}}$ 167.1°

PROBLEM 2-108



RADIUS = 4'

$F_A = F_B = F_C$

$F = 130^{lb}$ RESULTANT

DUE TO SYMMETRY :

$$\vec{F} = F_{AZ}\vec{K} + F_{BZ}\vec{K} + F_{CZ}\vec{K}$$

&

$$F_{AZ} = F_{BZ} = F_{CZ} = F_Z$$

HENCE, $\vec{F} = 3F_Z\vec{K} = -130^{lb}\vec{K}$

$$F_Z = F_{AZ} + F_{BZ} + F_{CZ} = -130^{lb}$$

$$F_A = F_B = F_C = \frac{\sqrt{6^2+4^2}}{6} * \frac{130}{3}^{lb}$$

$$\underline{F_A = F_B = F_C = \frac{156.24}{3}^{lb} = 52.08^{lb}}$$