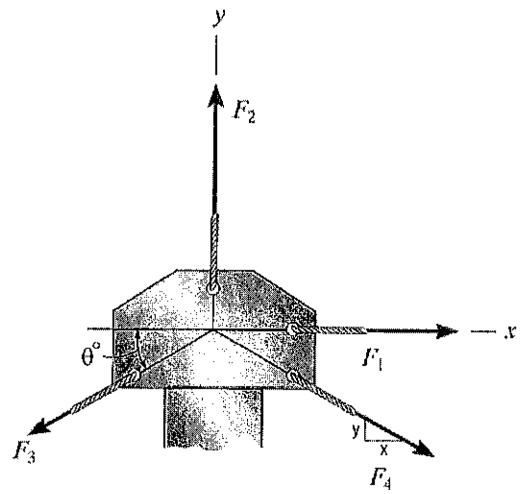
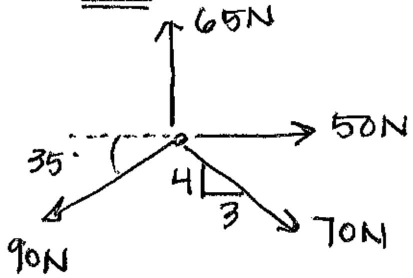
Problem #1



Calculate the magnitude and direction (from positive x-axis) of the resultant force. F_1 = 50 N, F_2 = 65 N, F_3 = 90 N, F_4 = 70 N, x = 3, y = 4, $\theta = 35^0$.

FBD

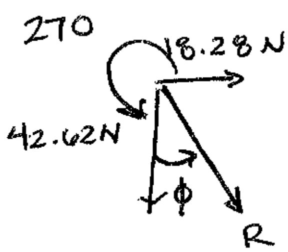


USE VALUES.

$$R_x = \overrightarrow{\Sigma F_x} = 50N - 90N\cos 35 + \tfrac{3}{5}(70N) = 18.28N \rightarrow$$

$$R_y = \Sigma F_y \uparrow = 65N - 90N\sin 35 - \tfrac{4}{5}(70N) = -42.62N$$
$$= 42.62N \downarrow$$

$$R = \sqrt{R_x^2 + R_y^2} = \sqrt{(18.28N)^2 + (-42.62N)^2} = 46.4N$$

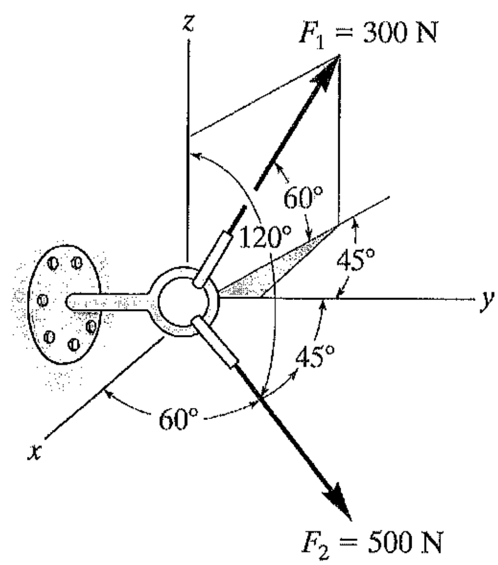


$$\theta = 270° + \phi = 270° + \tan\frac{18.28N}{42.62N}$$

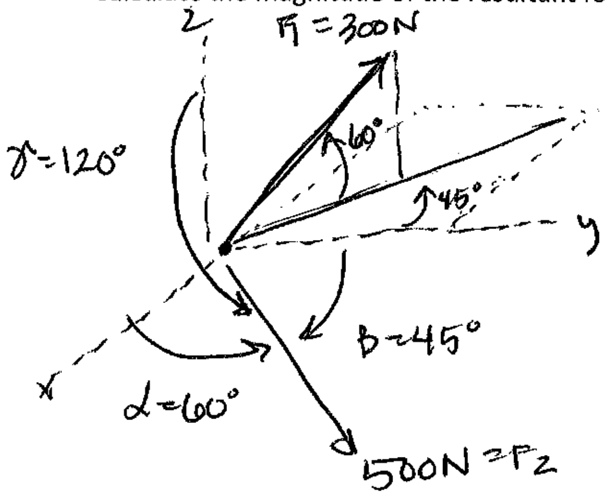
$$= 270° + 23.2° = 293.2°$$

$$\boxed{R = 46.4N @ 293.2°}$$

Problem #2



Calculate the magnitude of the resultant force and the direction cosine angles (alpha, beta, and gamma).



$$\bar{F}_1 = \{-300\cos 60 \sin 45\,\bar{i} + 300\cos 60\cos 45\,\bar{j} + 300\sin 60\,\bar{k}\}\text{ N}$$

$$= \{-106.1\,\bar{i} + 106.1\,\bar{j} + 259.8\,\bar{k}\}\text{ N}$$

$$\bar{F}_2 = \{500\cos 60\,\bar{i} + 500\cos 45\,\bar{j} + 500\cos 120\}\text{ N}$$

$$= \{250\,\bar{i} + 353.6\,\bar{j} - 250\,\bar{k}\}\text{ N}$$

$$R_x = \Sigma F_x \swarrow = -106.1 + 250 = 143.9\text{ N}$$

$$R_y = \Sigma F_y \rightarrow = 106.1 + 353.6 = 459.7\text{ N}$$

$$R_z = \Sigma F_z \uparrow = 259.8 - 250 = 9.8\text{ N}$$

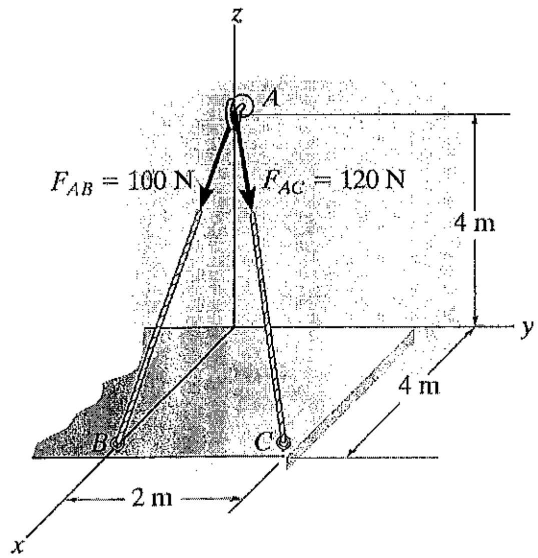
$$R = \sqrt{(143.9)^2 + (459.7\text{ N})^2 + (9.8\text{ N})^2} = \boxed{481.8\text{ N} = R}$$

$$\alpha = \cos^{-1}\frac{143.9}{481.8} = \boxed{72.6°}$$

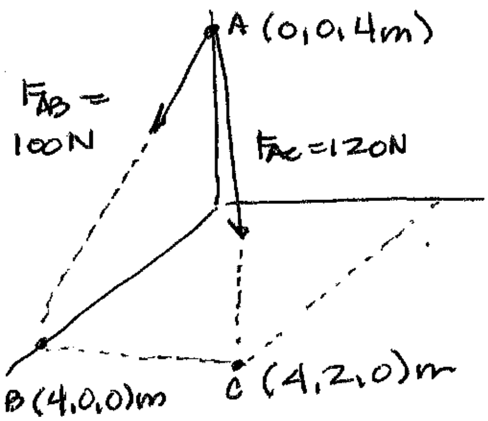
$$\beta = \cos^{-1}\frac{459.7}{481.8} = \boxed{17.4°}$$

$$\gamma = \cos^{-1}\frac{9.8}{481.8} = \boxed{88.8°}$$

Problem #3



Write each force in Cartesian Vector Form and then calculate the magnitude of the resultant force and it's direction cosine angles (alpha, beta, and gamma).



$\bar{F}_{AB} = 100\text{N}\,\bar{u}_{AB} = 100\text{N}\,\frac{\bar{r}_{AB}}{|r_{AB}|}$

$\bar{r}_{AB} = \{4\bar{i} + 0\bar{j} - 4\bar{k}\}\text{m}$ $\quad |r_{AB}| = \sqrt{4^2+4^2} = \sqrt{32}\,\text{m}$

$\bar{u}_{AB} = \{\frac{4}{\sqrt{32}}\bar{i} + 0\bar{j} - \frac{4}{\sqrt{32}}\bar{k}\}$

$\bar{F}_{AB} = 100\text{N}\{\frac{4}{\sqrt{32}}\bar{i} + 0\bar{j} - \frac{4}{\sqrt{32}}\bar{k}\}$

$= \{70.71\bar{i} + 0\bar{j} - 70.71\bar{k}\}\text{N}$

$\bar{F}_{AC} = 120\text{N}\,\bar{u}_{AC} = 120\text{N}\,\frac{\bar{r}_{AC}}{|r_{AC}|}$

$\bar{r}_{AC} = \{4\bar{i} + 2\bar{j} - 4\bar{k}\}\text{m}$

$|r_{AC}| = \sqrt{4^2+2^2+4^2} = 6\text{m}$

$|\bar{u}_{AC}| = \{\frac{2}{3}\bar{i} + \frac{1}{3}\bar{j} - \frac{2}{3}\bar{k}\}$

$F_{AC} = 120\text{N}\{\frac{2}{3}\bar{i} + \frac{1}{3}\bar{j} - \frac{2}{3}\bar{k}\}$

$= \{80\bar{i} + 40\bar{j} - 80\bar{k}\}\text{N}$

$R_x = \Sigma F_x = 70.71 + 80 = 150.71\text{ N}$

$R_y = \Sigma F_y = 0 + 40 = 40\text{N}$

$R_z = \Sigma F_z = -70.71 - 80 = -150.71\text{N}$

$R = \sqrt{(150.7)^2 + (40)^2 + (-150.7)^2} = \boxed{216.9\text{N}}$

$\alpha = \cos^{-1}\frac{150.71\text{ N}}{216.9\text{ N}} = \boxed{46° = \alpha}$

$\beta = \cos^{-1}\frac{40\text{ N}}{216.9\text{ N}} = \boxed{79° = \beta}$

$\gamma = \cos^{-1}\frac{-150.71\text{N}}{216.9\text{N}} = \boxed{134° = \gamma}$