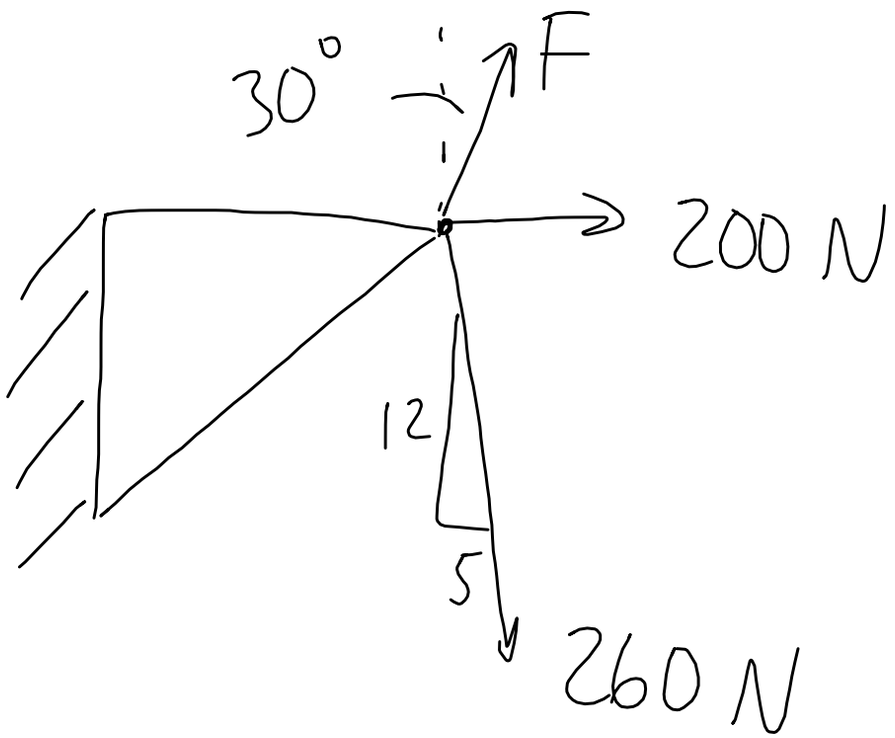


Find F that minimizes

F_R

$$F_R = \left(200 + \frac{F}{2} + \frac{5}{13}\,260\right)\hat{i} + \left(\frac{\sqrt{3}}{2}F - \frac{12}{13}(260)\right)\hat{j}$$

$$= \left(300 + \frac{F}{2}\right)\hat{i} + \left(\frac{\sqrt{3}}{2}F - 240\right)\hat{j}$$

$$F_R^2 = \left(300 + \frac{F}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}F - 240\right)^2$$

$$\frac{F^2}{4} + 300F + 90000$$

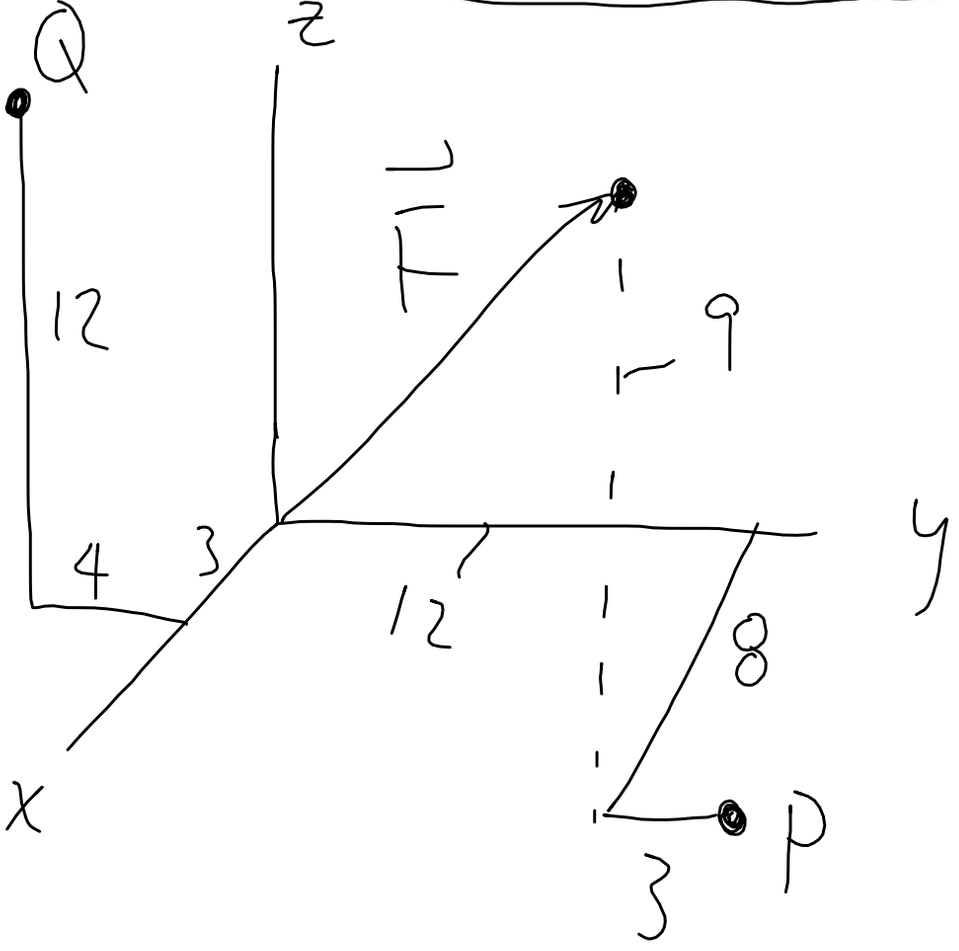
$$+ \frac{3}{4}F^2 - \sqrt{3}(240)F + 57600$$

$$= F^2 + F\left(300 - \sqrt{3}\,240\right) + 147600$$

$$2F_R \frac{dF_R}{dF} = 2F \times 300 - \sqrt{3}\,240$$

Set $2F + 300 - \sqrt{3}\,240 = 0$

$F = 57.8\ N$



$F = 170\ lbs$

Replace w/ forces:

$\| \overrightarrow{OP}$

$\| \overrightarrow{OQ}$

$\| \hat{j}$

$$\hat{u}_F = \frac{8\hat{i} + 12\hat{j} + 9\hat{k}}{17}$$

$$\hat{u}_{OP} = \frac{8\hat{i} + 15\hat{j}}{17}$$

$$\hat{u}_{OQ} = \frac{3\hat{i} - 4\hat{j} + 12\hat{k}}{13}$$

$$\vec{F} = 80\hat{i} + 120\hat{j} + 90\hat{k} = F_{OP}\,\hat{u}_{OP} + F_{OQ}\,\hat{u}_{OQ} + F_y\,\hat{j}$$

$$\hat{i}: \quad 80 = \frac{8}{17} F_{OP} + \frac{3}{13} F_{OQ}$$

$$\hat{j}: \quad 120 = \frac{15}{17} F_{OP} - \frac{4}{13} F_{OQ} + F_y$$

$$\hat{k}: \quad 90 = \frac{12}{13} F_{OQ}$$