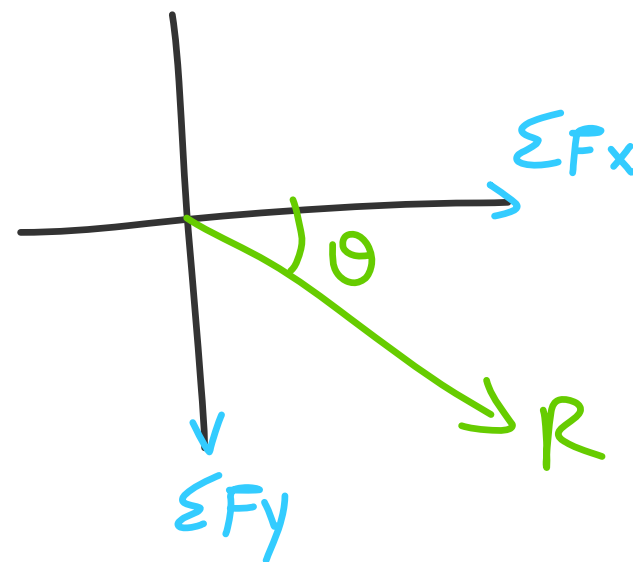1)

$$\Sigma F_x = 40 - 30 \cos 30°$$
$$+ 10 \sin 20° + 50 \sin 45°$$

$$\boxed{\Sigma F_x = 52.79 \text{ KN}} \quad (\longrightarrow)$$

$$\Sigma F_y = +30 \sin 30° + 10 \cos 20°$$
$$- 50 \cos 45°$$

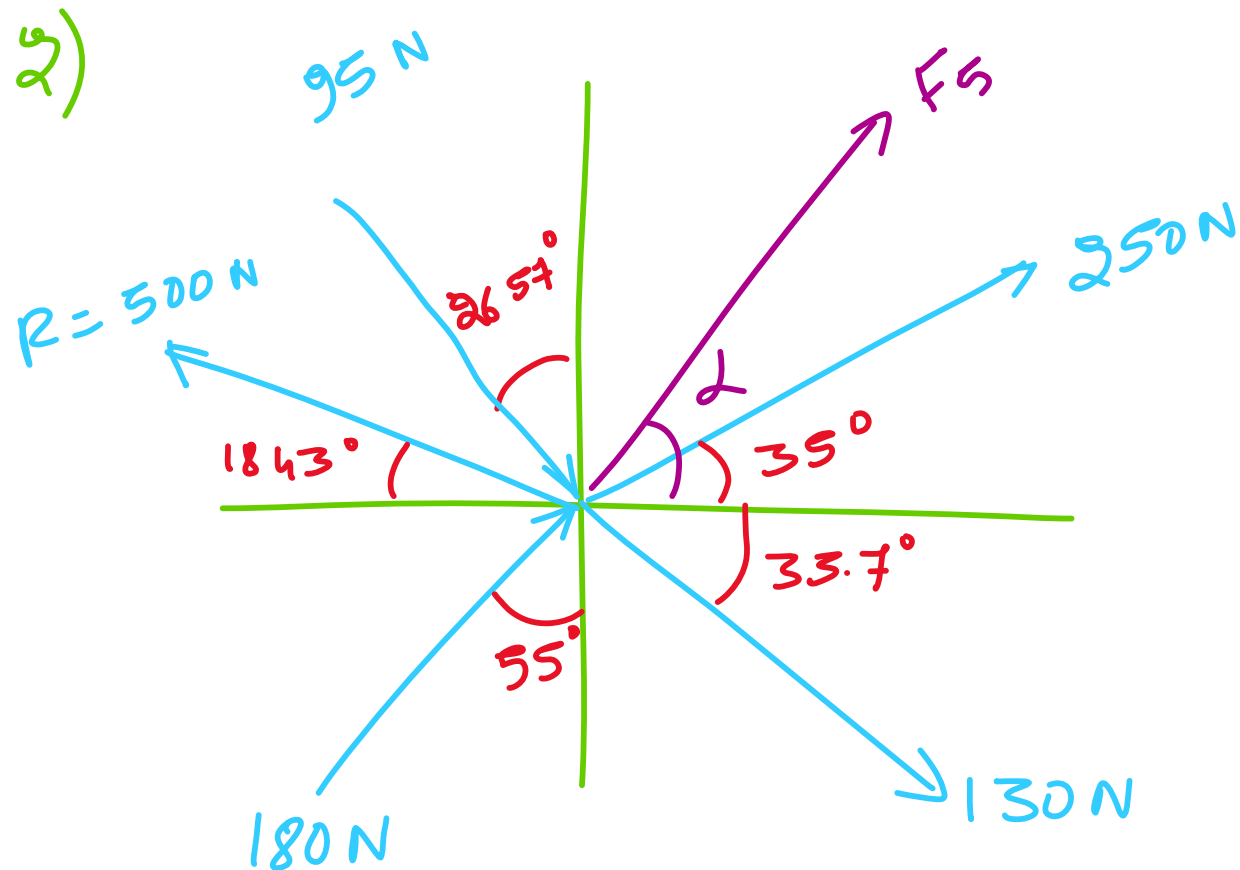$$\boxed{\Sigma F_y = -10.95 \text{ KN}} \quad (\downarrow)$$

$$R = \sqrt{\Sigma F_x{}^2 + \Sigma F_y{}^2}$$

$$= \sqrt{52.79^2 + (-10.95)^2}$$
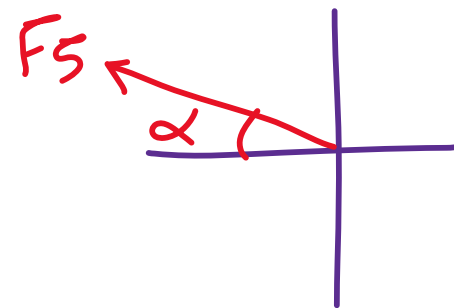
$$\boxed{R = 53.91 \text{ KN}}$$

$$\theta = \tan^{-1}\left|\frac{\Sigma F_y}{\Sigma F_x}\right|$$

$$\boxed{\theta = 11.73°}$$

2)

$\Sigma_{Fx} =$

$-500 \cos 18.43° = 250 \cos 35°$
$+ F_5 \cos \alpha$
$+ 95 \sin 26.57°$
$+ 180 \sin 55°$
$+ 130 \cos 33.7°$

$$\boxed{F_5 \cos \alpha = -977.23 \, N} \quad -(1)$$

$\Sigma_{Fy} =$
$500 \sin 18.43° = 250 \sin 35° + F_5 \sin \alpha - 95 \cos 26.57° + 180 \cos 55°$
$\qquad - 130 \sin 33.7°$

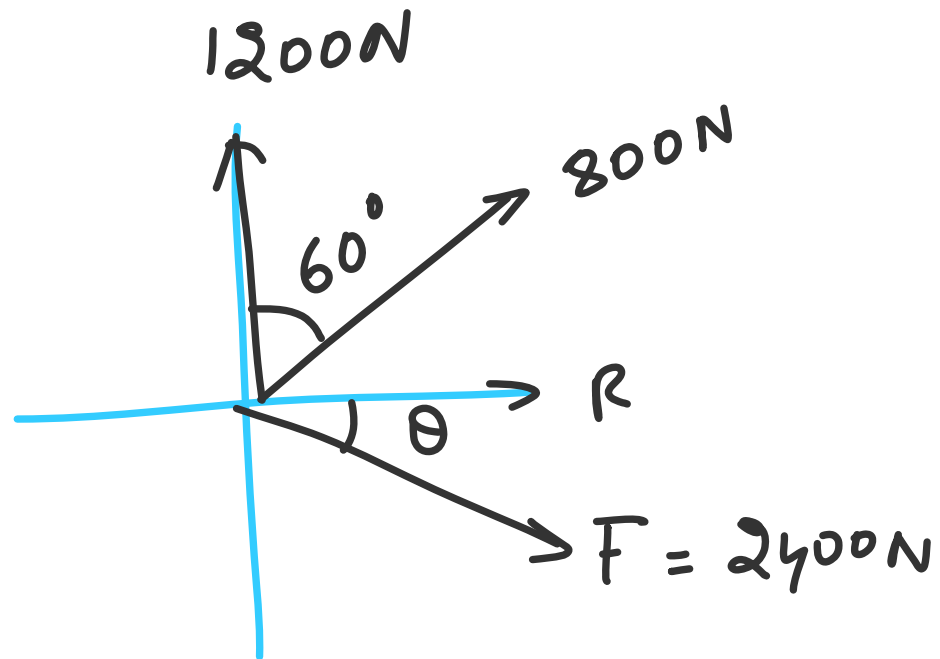$$\boxed{F_5 \sin \alpha = 68.53 \, N} \quad -(2)$$

$$\boxed{F_5 = 979.72 \, N}$$

$\dfrac{(2)}{(1)} = \dfrac{\cancel{F_5} \sin \alpha}{\cancel{F_5} \cos \alpha} = \dfrac{68.53}{977.2}$
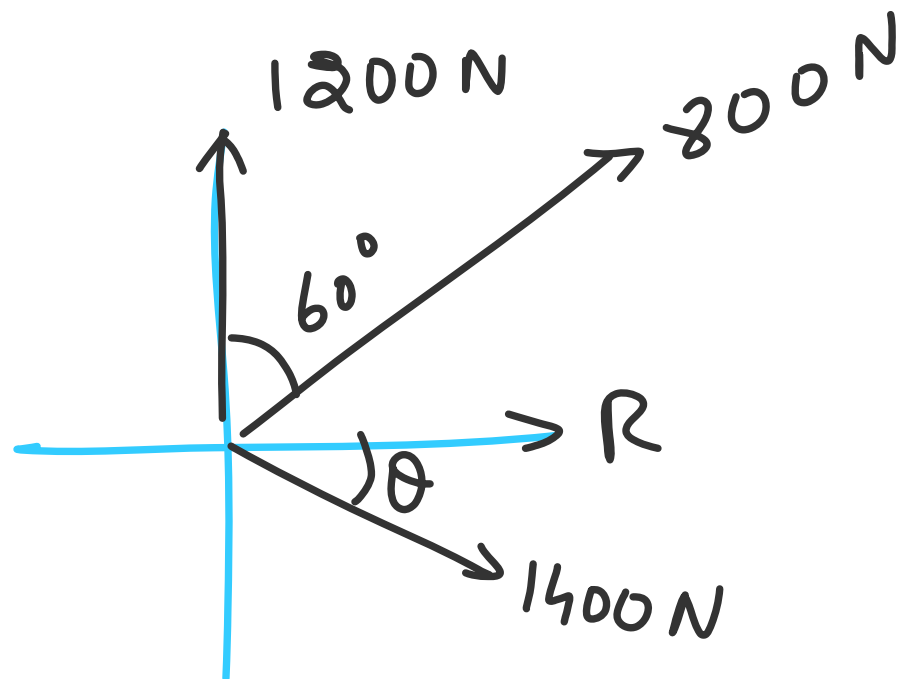
$$\boxed{\alpha = 4.01°}$$

3)

a)

$$\Sigma F_y = 0 = 1200 + 800 \cos 60^0$$
$$- 2400 \sin \theta$$

$$\boxed{\theta = 41\ 81^0}$$

b)

$$\Sigma F_y = 0 = 1200 + 800 \cos 60^0$$
$$- 1400 \sin \theta$$

$$\boxed{\sin \theta = 1.143} \quad \text{Not possible}$$

* Resultant cannot be horizontal
  or
* Force 'F' should be equal to or greater than 1600 N

4)
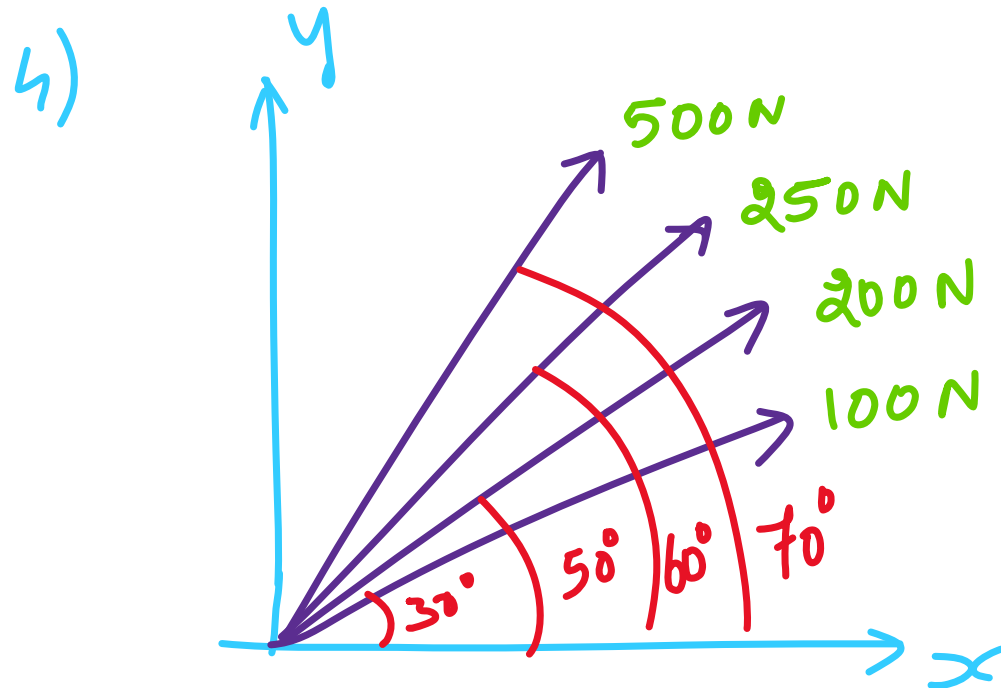
$$\Sigma_{Fx} = 100 \cos 30° + 200 \cos 50° + 250 \cos 60°$$

$$+ 500 \cos 70°$$

$$\boxed{\Sigma_{Fx} = 511.17 \text{ N}}$$

$$\Sigma_{Fy} = 100 \sin 30° + 200 \sin 50° + 250 \sin 60°$$

$$+ 500 \sin 70°$$

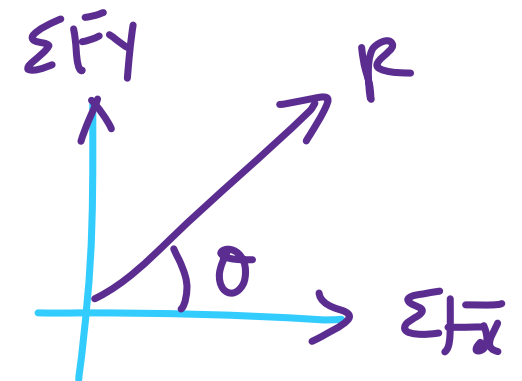$$\boxed{\Sigma_{Fy} = 889.56 \text{ N}}$$

$$R = \sqrt{511.17^2 + 889.56^2}$$
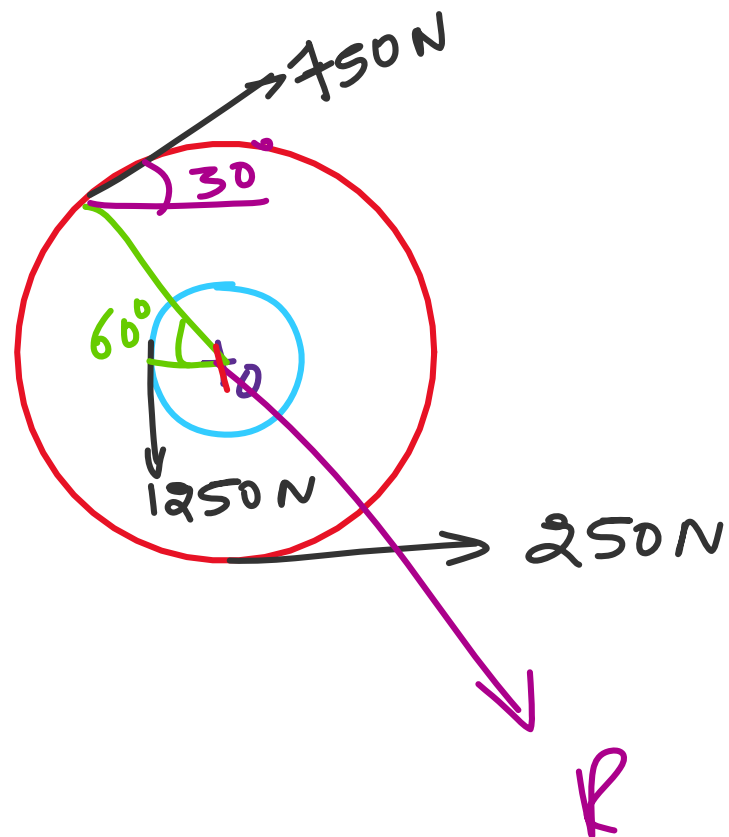
$$\boxed{R = 1025.96 \text{ N}}$$

$$\theta = \tan^{-1} \frac{\Sigma_{Fy}}{\Sigma_{Fx}}$$

$$= \tan^{-1} \frac{889.56}{511.17}$$

$$\boxed{\theta = 60.11°}$$

5)

$$\Sigma F_x = 250 + 750 \cos 30°$$

$$\boxed{\Sigma F_x = 899.51 N}$$

$$\Sigma F_y = -1250 + 750 \sin 30°$$
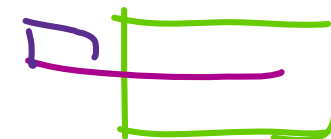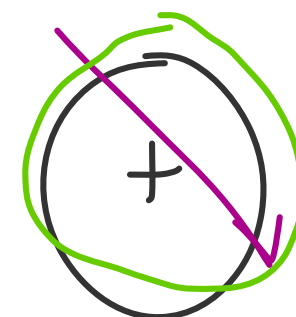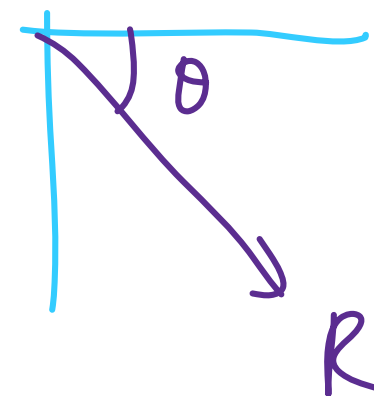
$$\boxed{\Sigma F_y = -875 N}$$

$$\boxed{R = 1254.88 N}$$

$$\boxed{\theta = 44.21°}$$

$$R \times d = (250 \times 1.25)$$
$$+ (1250 \times 0.5)$$
$$- (750 \times 1.25)$$

$$R \times d = 0$$

$$\boxed{d = 0}$$

6)

$$\theta = \tan^{-1} \frac{3}{6}$$

$$\boxed{\theta = 26.56^\circ}$$

$$\Sigma M_A = -2240 \times 3 \sec 26.56^\circ$$

$$-1120 \times 6 \sec 26.56^\circ$$

$$-2000 \times 3 \tan 26.56^\circ$$

$$-1000 \times 9$$

$$-2000 \times 6$$

$$-3000 \times 3$$

$$\boxed{\Sigma M_A = -48026.37 \ N-m}$$

$$\Sigma F_x = 2000 + \left(1120 + 2240 + 1120\right) \sin 26.56^\circ$$

$$\boxed{\Sigma F_x = 4003.16 \ N}$$

$$\Sigma F_y = -3000 - 2000 - 1000$$

$$-\left(2240 + 1120 + 1120\right) \cos 26.56^\circ$$

$$\boxed{\Sigma F_y = -10007.02 \ N}$$
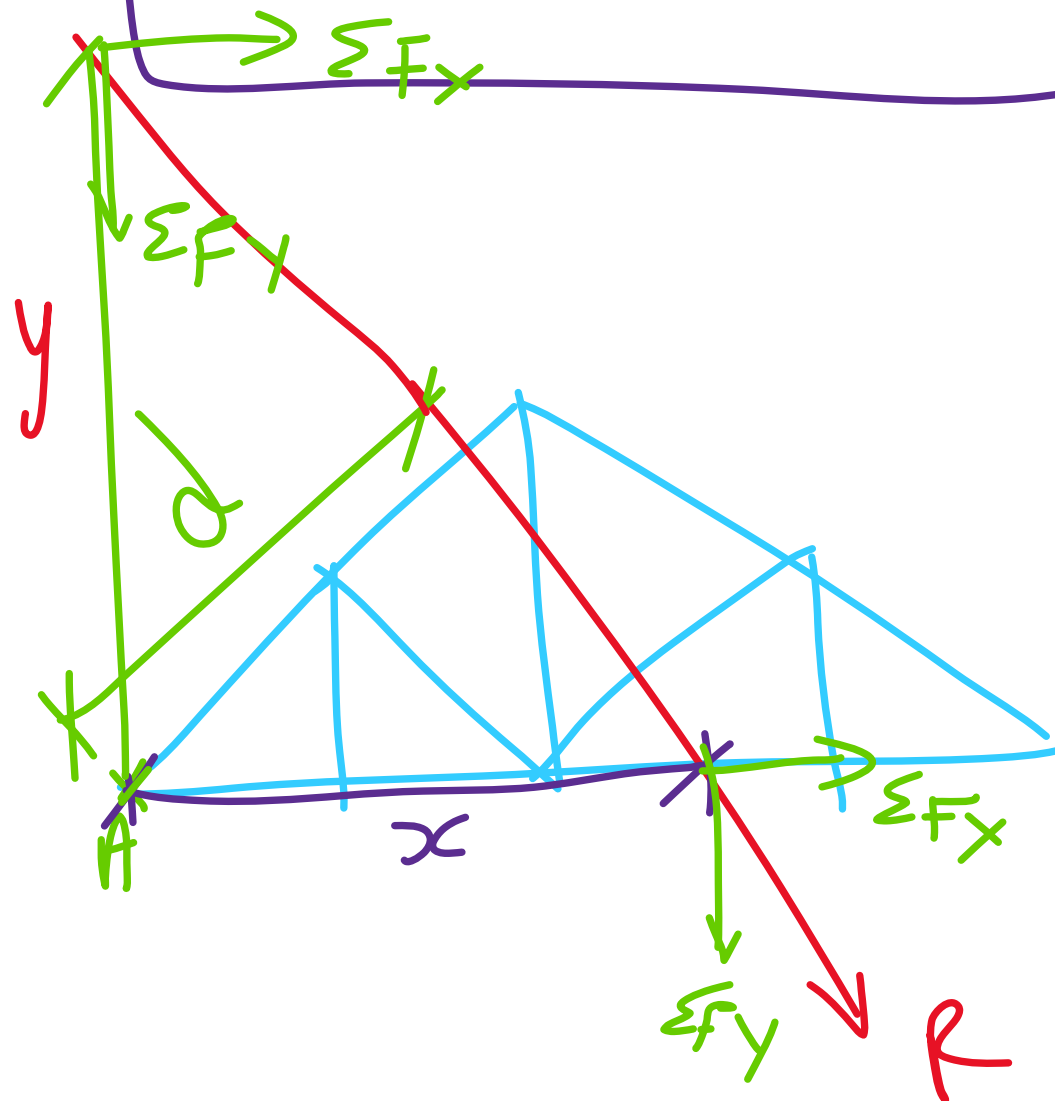
$$\boxed{R = 10778.19 \ N}$$

$$\boxed{\alpha = 68.19^\circ}$$
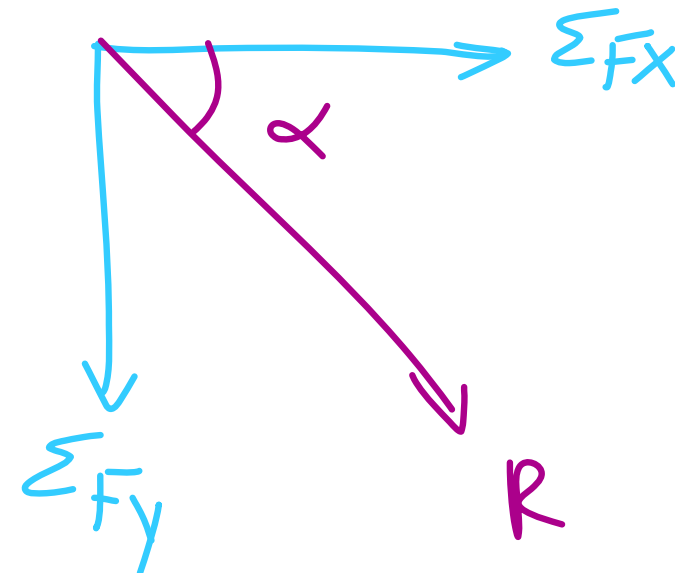
$$R \times d = \Sigma M_A$$

$$d = \frac{48026\ 37}{10778\ 19}$$

$$\boxed{d = 4\ 45\ m}$$

$$x = \frac{\Sigma M_A}{\Sigma F_y}$$

$$= \frac{48026.37}{10007.29}$$

$$\boxed{x = 4.8\ m\ \text{from 'A'}}$$

$$y = \frac{\Sigma M_A}{\Sigma F_x}$$

$$= \frac{48026\ 37}{4003\ 52}$$

$$\boxed{y = 11\ 9\ m}$$

7)

$R = 0$, $\Sigma F_x = \Sigma F_y = 0$

$\theta = \tan^{-1} \dfrac{4}{3}$

$\boxed{\theta = 53.13^\circ}$

$\Sigma F_x = 0 = 110 + 150 \cos 53.13^\circ + F_4 x$

$\boxed{F_4 x = -200 \text{ N}}$

$\Sigma F_y = 0 = -120 + 150 \sin 53.13^\circ + F_4 y$

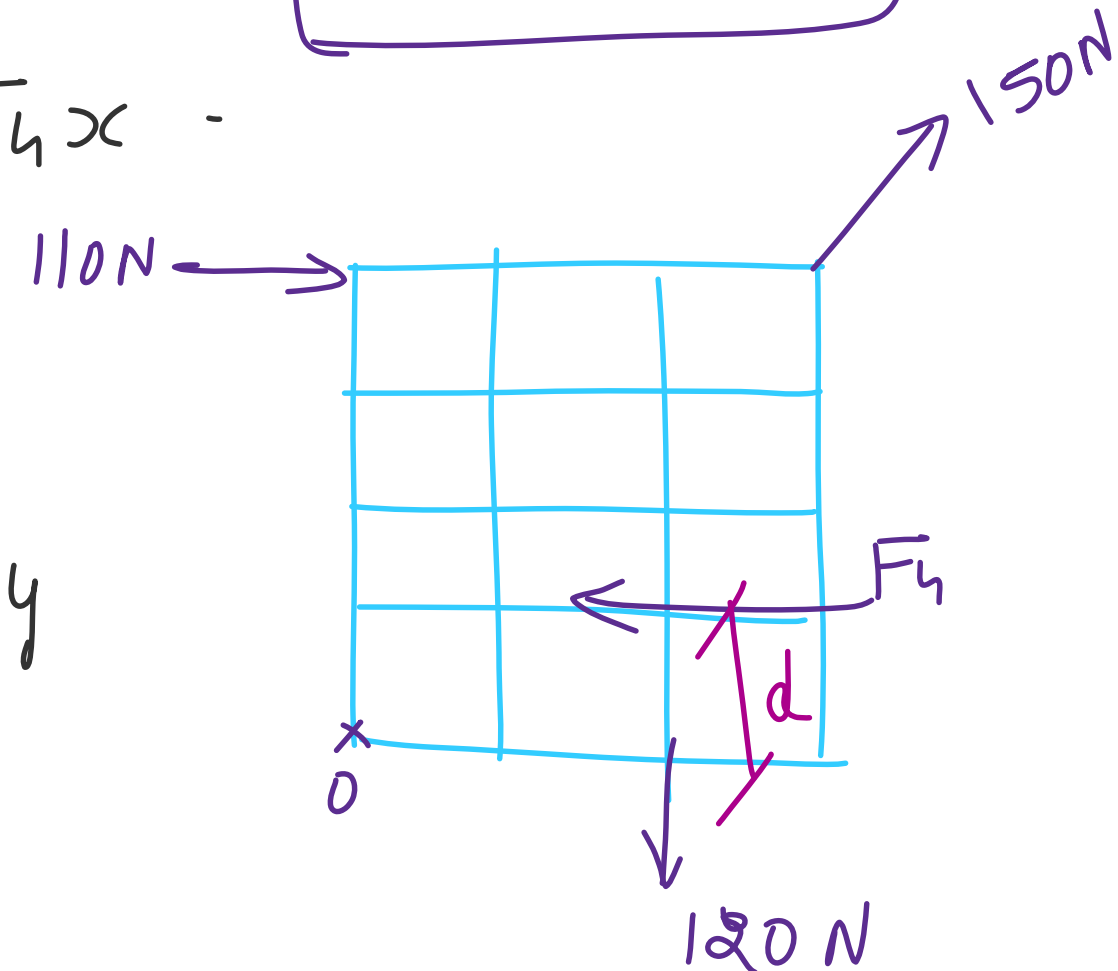$\boxed{F_4 y = 0}$

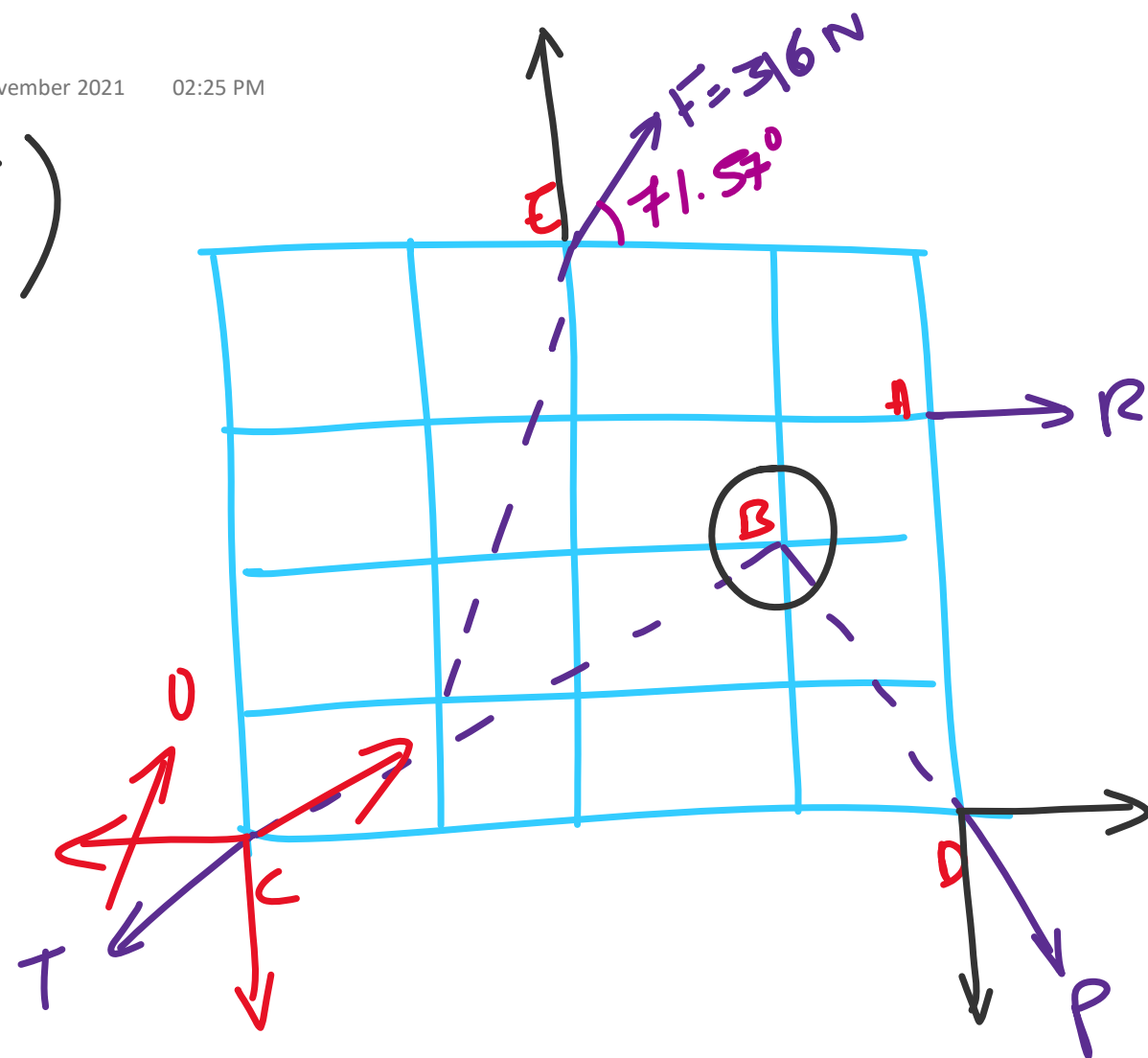$\boxed{F_4 = -200 \text{ N}}$

$\Sigma M_0 = -480$

$-110 \times 4 - 120 \times 2 + 200 \times d = -480$

$\boxed{d = 1 \text{ m}}$ The assumption is correct

T_1)

To Find 'R' (Moment Center 'B')

$$\Sigma M_B = M_R$$

$$-316 \times \sin 71.57° \times 1 - 316 \times \cos 71.57° \times 2$$

$$= -R \times 1$$

$$\boxed{R = 499.65 \text{ N}}$$

To find 'P' (Moment Center 'C')

$$\Sigma M_C = M_R$$

$$316 \times \sin 71.57° \times 2 - 316 \times \cos 71.57° \times 4$$

$$- P \cos 26.57° \times 4 = -499.65 \times 3$$

$$\boxed{P = 474.82 \text{ N}}$$

To find 'T' (moment center 'D')

$$\Sigma M_D = M_R$$

$$-316 \times \cos 71.57° \times 4 - 316 \times \sin 71.57° \times 2 + T \cos 56.31° \times 4 =$$

$$-499.65 \times 3$$

$$\boxed{T = -225.1 \quad N}$$