CMGT 350	Exam #1	F 2021

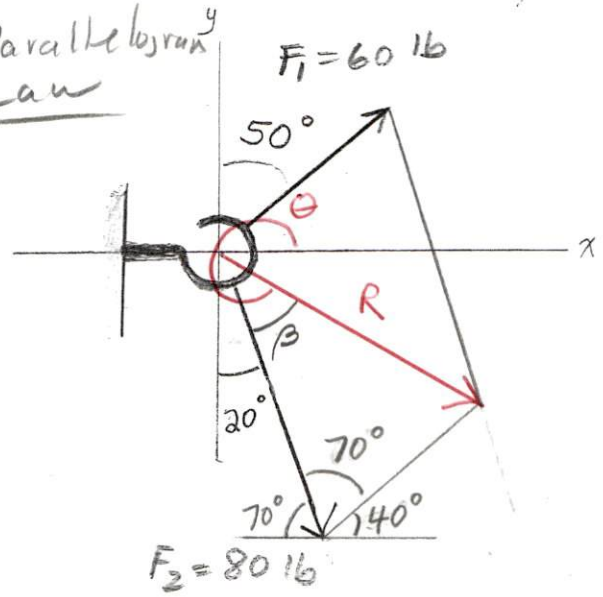
Show all work for full credit
All angles are to be measured ccw from +Le + x-axis
All vector answers are to be positive scalar, true direction

One page of notes, Front & Back, Hand written by You
Algebra & Trig cheat sheets

Name Solution

1. Determine the magnitude of the resultant force and its direction for the forces acting on the hook using the parallelogram Law OR Triangle Rule.

Parallelogram Law



Law of Cosines

$$R = \sqrt{80\text{ lb}^2 + 60\text{ lb}^2 - 2(80\text{ lb})(60\text{ lb})\cos 70^\circ} = 82\text{ lb}$$

Law of Sines

$$\frac{\sin\beta}{60\text{ lb}} = \frac{\sin 70^\circ}{82\text{ lb}}$$

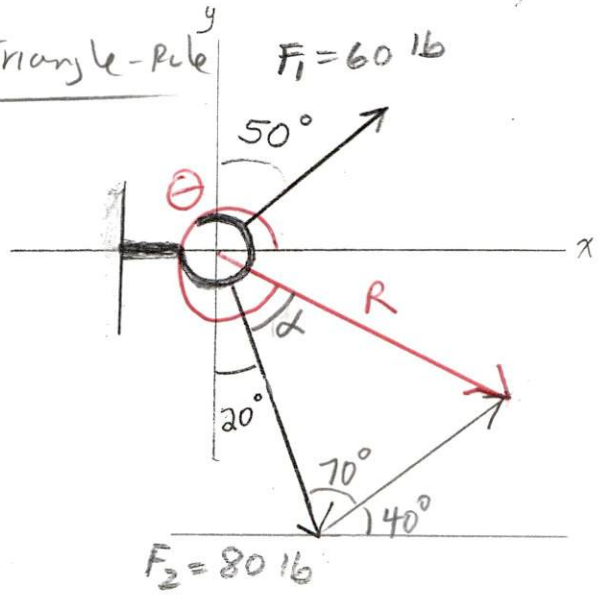
$$\beta = \sin^{-1}\left(\frac{60\text{ lb}\sin 70^\circ}{82\text{ lb}}\right) = 43^\circ$$

$$\theta = 270^\circ + 20^\circ + \beta = 290^\circ + 43^\circ = 333^\circ$$

$$R = 82\text{ lb} \measuredangle 333^\circ$$

1. Determine the magnitude of the resultant force and its direction for the forces acting on the hook using the parallelogram Law OR Triangle Rule.

Triangle-Rule



Law of Cosines

$$R = \sqrt{80\text{lb}^2 + 60\text{lb}^2 - 2(80\text{lb})(60\text{lb})\cos 70^\circ}$$

$$= 82 \text{ lb}$$

Law of Sines

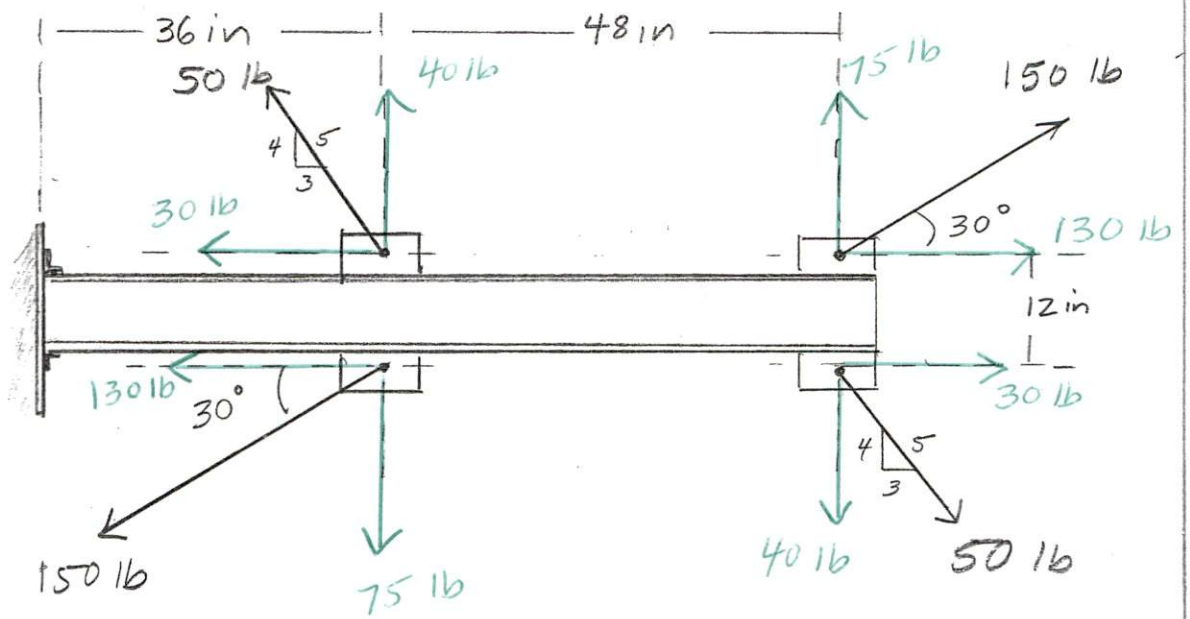
$$\frac{\sin\alpha}{60\text{lb}} = \frac{\sin 70^\circ}{82\text{lb}}$$

$$\alpha = \sin^{-1}\left(\frac{60\text{lb}(\sin 70^\circ)}{82\text{lb}}\right) = 43^\circ$$

$$\theta = 270^\circ + 20^\circ + 43^\circ = 333^\circ$$

$$R = 82 \text{ lb} \measuredangle 333^\circ$$

2. Determine the moment couple for the forces acting on the cantilever beam.



ccw +M ↺

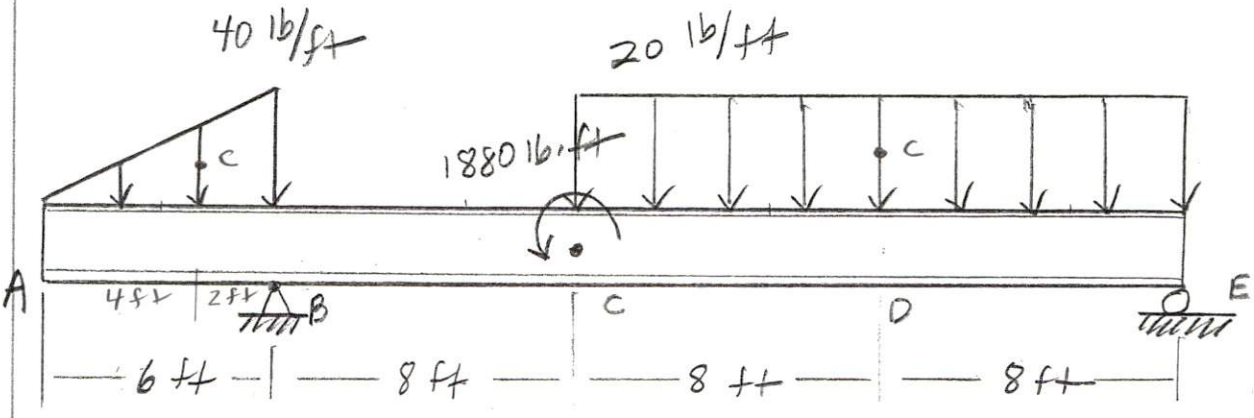
cw −M ↻

$M_{\not\phi} = +30\,lb(12\,in) - 40\,lb(48\,in) - 130\,lb(12\,in) + 75\,lb(48\,in)$

$= 480\ lb \cdot in$ ↺

or $40\ lb \cdot ft$ ↺

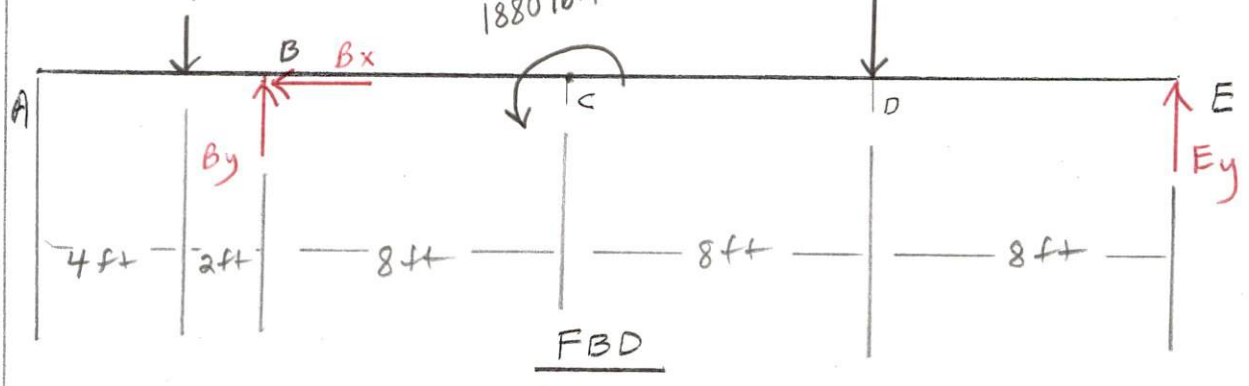
3. A simply supported beam supports the applied loads and moments as shown. Determine the reactions at the supports.



Solution

$\frac{1}{2}\left(\frac{40\text{ lb}}{\text{ft}}\right)(6\text{ ft}) = 120\text{ lb}$

$\frac{20\text{ lb}}{\text{ft}}(16\text{ ft}) = 320\text{ lb}$



FBD

Equilibrium Equations

ccw +M ↺
cw −M ↻

$[\Sigma F_x = 0] \quad B_x = 0$

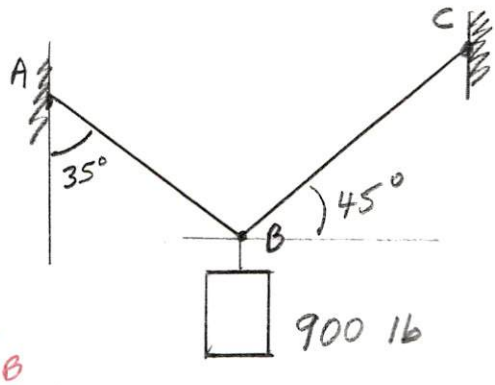
$[\Sigma M_B = 0] \quad +120\text{ lb}(2\text{ ft}) + 1880\text{ lb·ft} - 320\text{ lb}(16\text{ ft}) + E_y(24\text{ ft}) = 0$

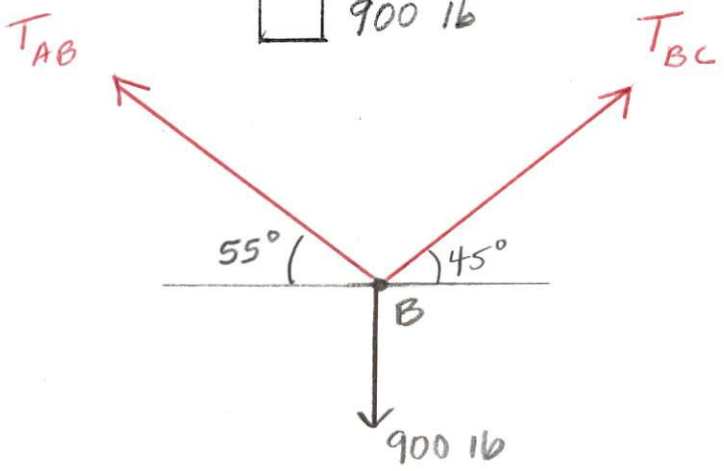
$E_y = \frac{3000\text{ lb·ft}}{24\text{ ft}} = \underline{125\text{ lb}}\ \uparrow$

$[\Sigma F_y = 0] \quad -120\text{ lb} + B_y - 320\text{ lb} + E_y = 0$

$B_y = 440\text{ lb} - 125\text{ lb} = \underline{315\text{ lb}}\ \uparrow$

4. Determine the tension in each cable using the Force Triangle method.





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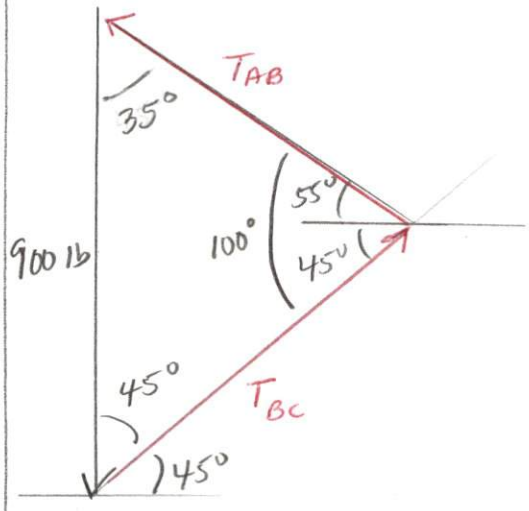

Force – Triangle

$$\frac{T_{AB}}{\sin 45^\circ} = \frac{T_{BC}}{\sin 35^\circ} = \frac{900\ lb}{\sin 100^\circ}$$

$$T_{AB} = \frac{\sin 45^\circ (900\ lb)}{\sin 100^\circ} = \underline{646\ lb}$$

$$T_{BC} = \frac{\sin 35^\circ (900\ lb)}{\sin 100^\circ} = \underline{524\ lb}$$