CMGT 340	Exam #1	Fall 2018

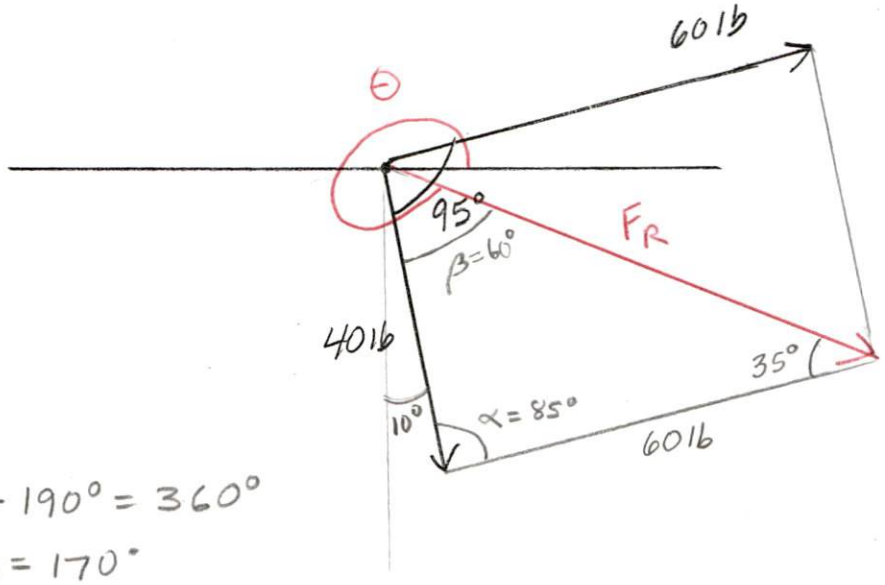
One page of notes (Front & Back) hand written by You.
Algebra & Trig cheat sheets
Show ALL work for full credit

NO CELL PHONES

All angles are to be measured ccw from the +x-axis

Name solution

1. Determine the magnitude and direction of the resultant force using the <u>parallelogram Law</u>



$2\alpha + 190^\circ = 360^\circ$

$2\alpha = 170^\circ$

$\alpha = \frac{170^\circ}{2} = 85^\circ$

$F_R = \sqrt{40lb^2 + 60lb^2 - 2(40lb)(60lb)\cos 85^\circ}$

$= 69\,lb$

$\frac{\sin\beta}{60lb} = \frac{\sin 85^\circ}{69\,lb}$

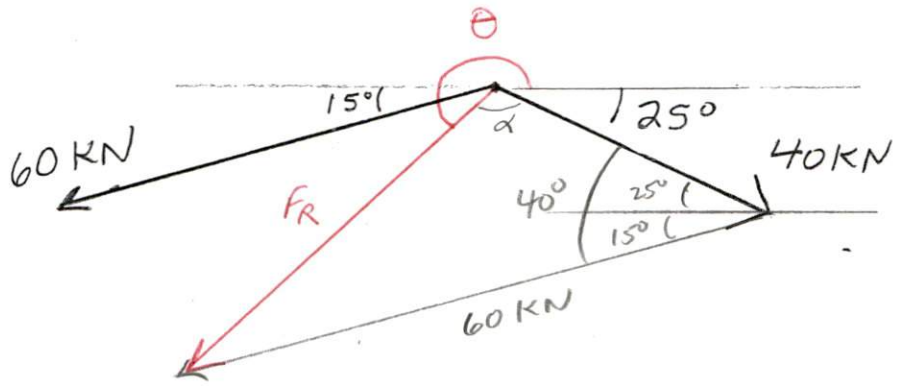
$\beta = \sin^{-1}\left(\frac{60lb \sin 85^\circ}{69\,lb}\right) = 60^\circ$

$\theta = 270^\circ + 10^\circ + 60^\circ$

$= 340^\circ$

$F_R = 69lb \measuredangle 340^\circ$

2. Determine the magnitude and direction of the resultant force using the Triangle Rule.



$$F_R = \sqrt{60KN^2 + 40KN^2 - 2(60KN)(40KN)\cos 40°}$$

$$= 39\,KN$$

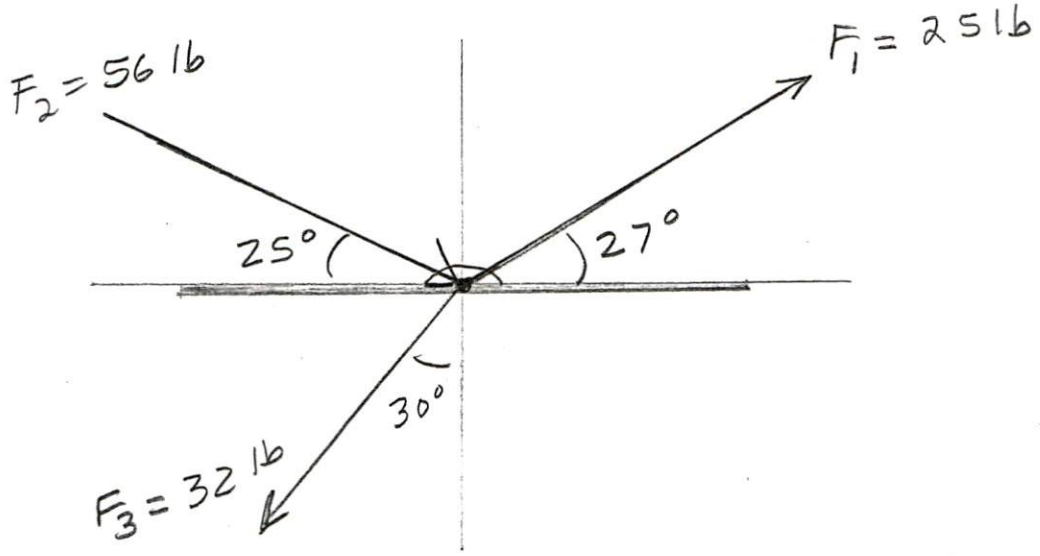
$$\frac{\sin\alpha}{60KN} = \frac{\sin 40°}{39KN}$$

$$\alpha = \sin^{-1}\left(\frac{60KN \sin 40°}{39KN}\right) = 81.5° \text{ or } 82°$$

$$\theta = 360° - 25° - 82° = 253°$$

$$F_R = 39\,KN \measuredangle 253°$$

3. Determine the magnitude and direction of the resultant force for the system shown.



Solution. use positive angles measured ccw from the + x-axis

Force (lb)	Direction (θ)	$F_x = F\cos\theta$ (lb)	$F_y = F\sin\theta$ (lb)
25	27°	22.3	11.3
56	335°	50.8	−24
32	240°	−16	−27.7
		$\Sigma F_x = 57$ lb	$\Sigma F_y = -40$

$R_x = \Sigma F_x =$ 57 lb →

$R_y = \Sigma F_y =$ 40 lb ↓

} the resultant lies in Quad 4

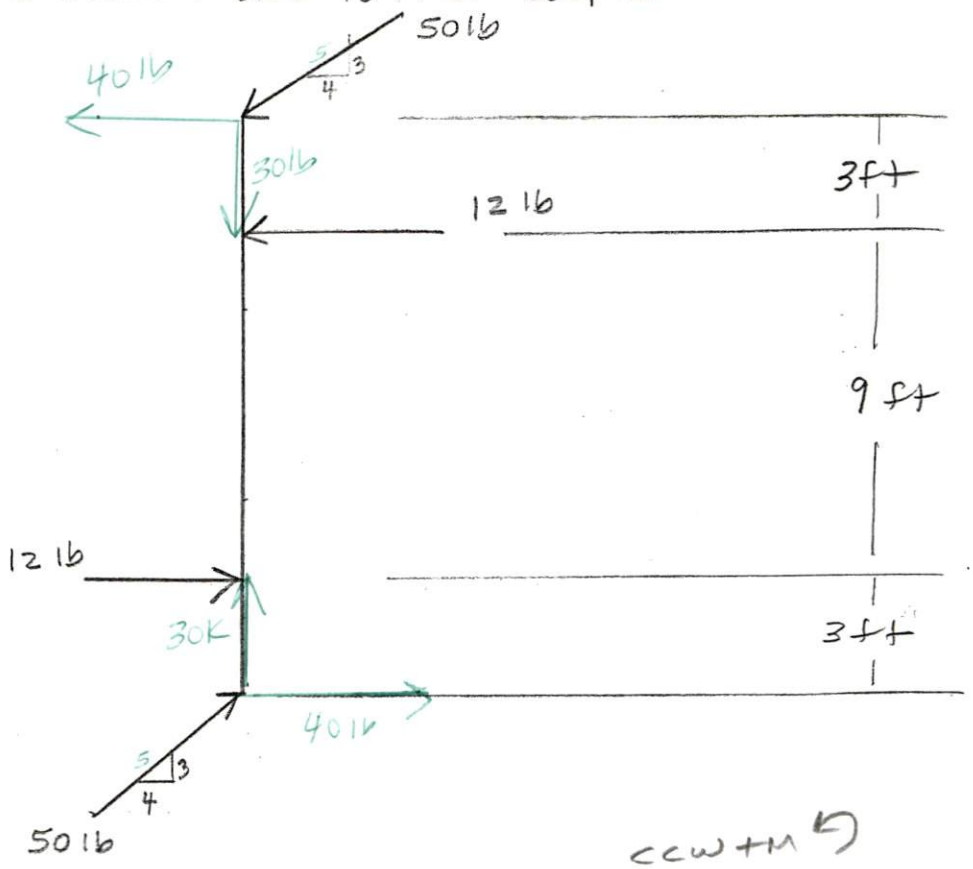
$R = \sqrt{57\text{ lb}^2 + 40\text{ lb}^2} = 70$ lb

$\alpha = \tan^{-1}\left|\frac{R_y}{R_x}\right| = \tan^{-1}\left|\frac{40}{57}\right| = 35°$

$\theta = 360° - 35° = 325°$

$R =$ 70 lb (magnitude) ↖ 325° (Direction (θ))

4. Determine the moment due to the couples.



ccw +M ↺
cw -M ↻

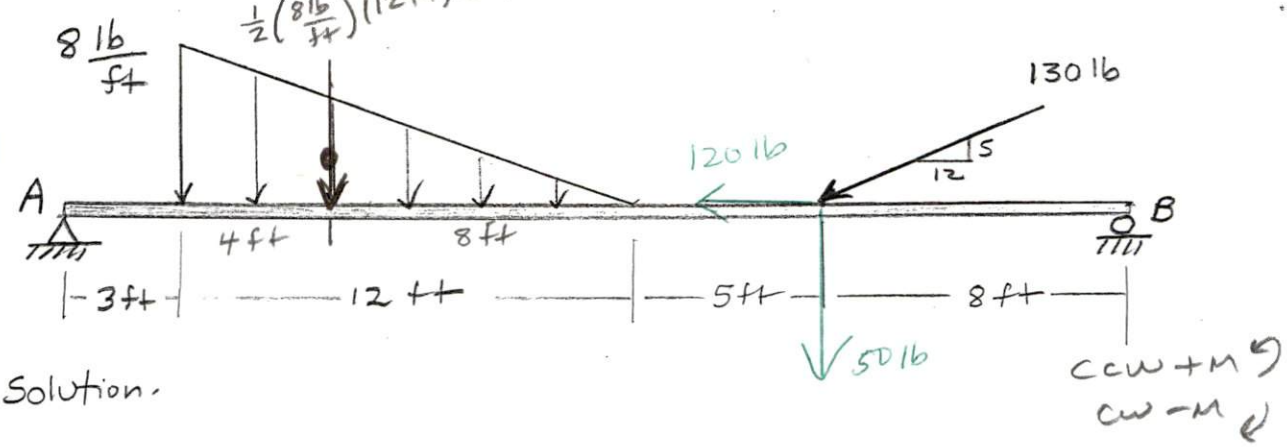
Solution.

$$M_{\not\perp} = 12\,lb(9\,ft) + 40\,lb(15\,ft)$$

$$= 108\,lb\cdot ft + 600\,lb\cdot ft$$

$$= 708\,lb\cdot ft \circlearrowleft$$

5. Determine the magnitude, direction, and location of the resultant force for the force system shown wrt point A.



Solution.

Magnitude

$R_x = \Sigma F_x = -120\,lb = 120\,lb \leftarrow$

$R_y = \Sigma F_y = -48\,lb - 50\,lb = 98\,lb \downarrow$

} Resultant lies in QUAD 3

$R = \sqrt{120\,lb^2 + 98\,lb^2} = 155\,lb$

Direction

$\alpha = \tan^{-1}\left|\frac{98}{120}\right| = 39°$

$\theta = 180° + \alpha = 180° + 39° = 219°$

Location

$M_A = -48\,lb(7\,ft) - 50\,lb(20\,ft) = -1336\,lb\cdot ft$ ↻

$R_y \bar{x} = 1336\,lb\cdot ft$

$\bar{x} = \frac{1336\,lb\cdot ft}{98\,lb} = 13.6\,ft$ to the right of point A

$F_R = 155\,lb \angle 219°$ located 13.6 ft to the right of A