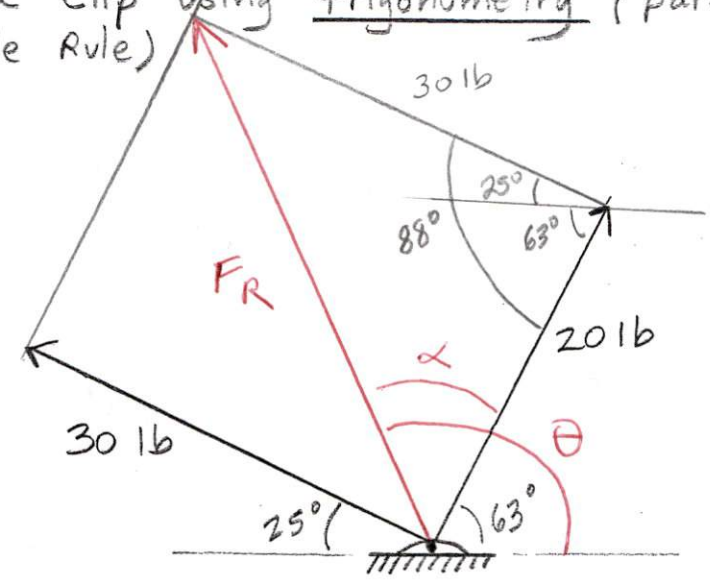
CMGT 340	Exam #1	Fall 2019

Show all work for full credit. All angles are to be measured ccw from the + x-axis. All vectors are to be positive scalar, True direction.

Name Solution

1. Determine the resultant of the two-forces acting on the clip using <u>trigonometry</u> (parallelogram Law or Triangle Rule)



<u>Law of Cosines</u>

$$F_R = \sqrt{30\,lb^2 + 20\,lb^2 - 2(30\,lb)(20\,lb)\cos 88°}$$

$$= 35.5\,lb \quad (36\,lb)$$

<u>Law of Sines</u>

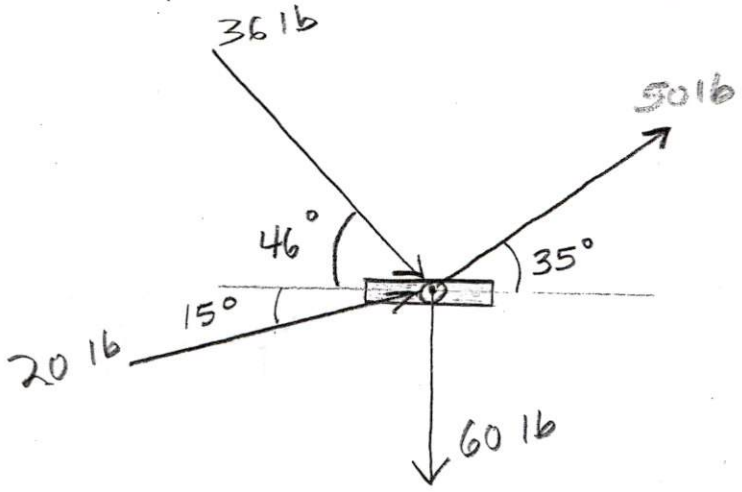
$$\frac{\sin\alpha}{30\,lb} = \frac{\sin 88°}{35.5\,lb}$$

$$\alpha = \sin^{-1}\left(\frac{30\,lb \sin 88°}{35.5\,lb}\right) = 57.6°$$

$$\theta = 63° + 57.6° = 120° \quad (121°)$$

$$F_R = 35.5\,lb \; \angle \; 120°$$

2. Determine the resultant of the forces acting on the bracket by completing the following



Force	Dir (θ)	$F_x = F\cos\theta$	$F_y = F\sin\theta$
50	35°	41	28.7
36	314°	25	−25.9
20	15°	19.3	5.2
60	270°	0	−60
		$\Sigma F_x = 85$	$\Sigma F_y = -52$

Magnitude

$R_x = \Sigma F_x =$ 85 lb →

$R_y = \Sigma F_y =$ 52 lb ↓

} Resultant lies in Quad 4

$R = \sqrt{85\text{lb}^2 + 52\text{lb}^2} = 99.6$ lb

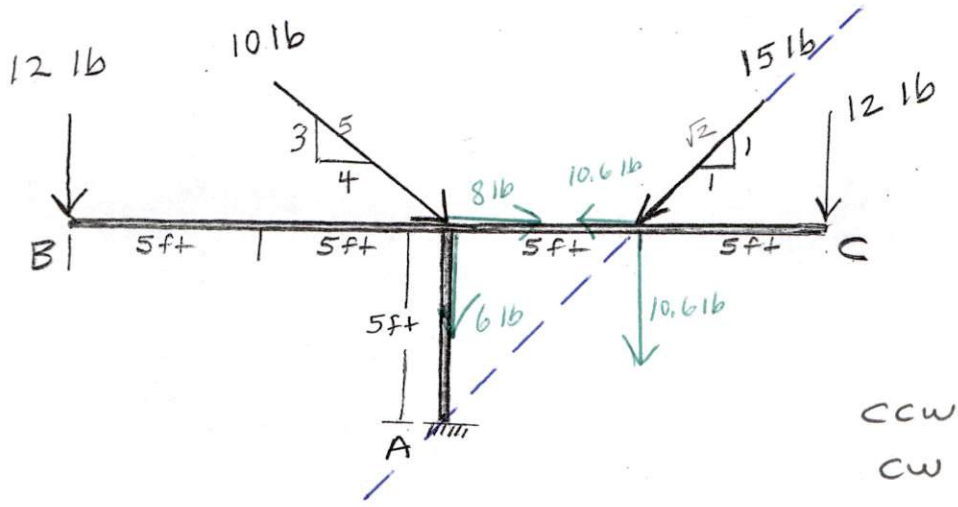
Direction

$\alpha = \tan^{-1}\left|\frac{52}{85}\right| = 31.5°$

$\theta = 360° - 31.5° = 328.5°$

ANS. $F_R = 99.6$ lb ∠ 328.5°

3. Determine the moment due to the forces acting on the bracket at:



ccw +M ↺
cw −M ↻

A. $M_B = -6\text{ lb}(10\text{ ft}) - 10.6\text{ lb}(15\text{ ft}) - 12\text{ lb}(20\text{ ft})$

$= -60\text{ lb.ft} - 159\text{ lb.ft} - 240\text{ lb.ft}$

$= -459\text{ lb.ft}$ ↻

also, Line of action of 15 lb force goes through the moment center

B. $M_A = 12\text{ lb}(10\text{ ft}) - 8\text{ lb}(5\text{ ft}) + 10.6\text{ lb}(5\text{ ft}) - 10.6\text{ lb}(5\text{ ft}) - 12\text{ lb}(10\text{ ft})$

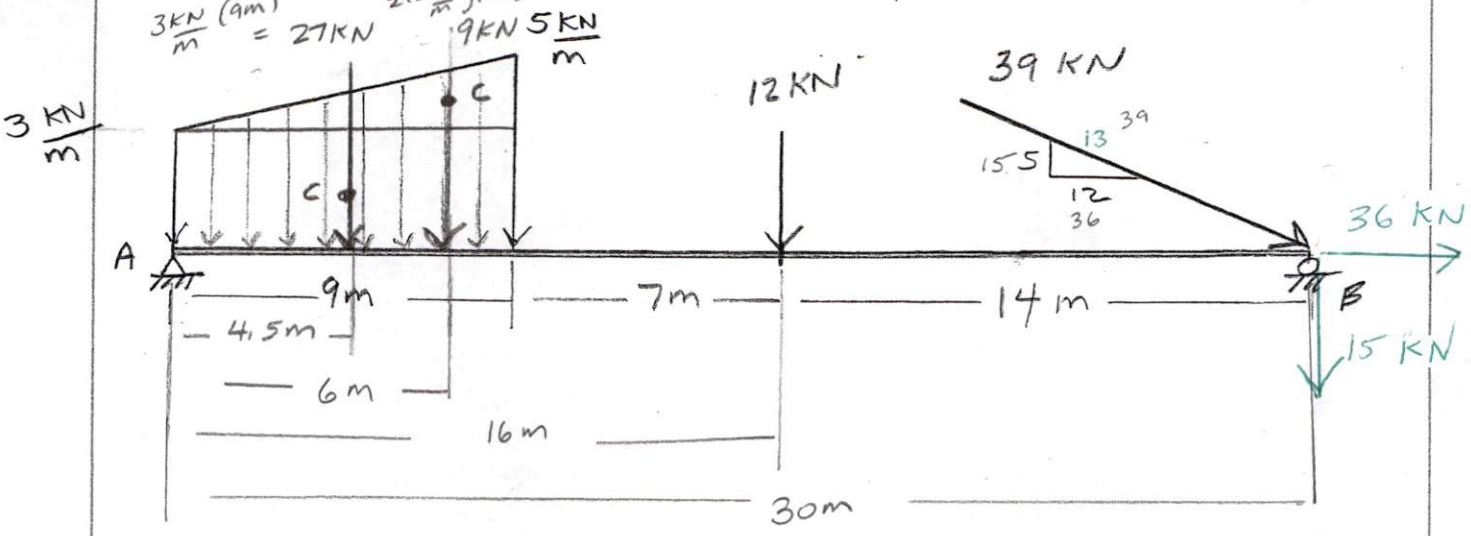
$= -40\text{ lb.ft}$ ↻

C. $M_C = 12\text{ lb}(20\text{ ft}) + 6\text{ lb}(10\text{ ft}) + 10.6\text{ lb}(5\text{ ft})$

$= 240\text{ lb.ft} + 60\text{ lb.ft} + 53\text{ lb ft}$

$= 353\text{ lb.ft}$ ↺

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



Magnitude

$R_x = \Sigma F_x = 36\ KN \rightarrow$

$R_y = \Sigma F_y = -27\ KN - 9\ KN - 12\ KN - 15\ KN = 63\ KN \downarrow$ } QUAD 4

$R = \sqrt{36\ KN^2 + 63\ KN^2} = 73\ KN$

Direction

$\alpha = \tan^{-1}\left|\frac{63}{36}\right| = 60°$

$\theta = 360° - 60° = 300°$

Location

6

$M_A = -27\ KN(4.5m) - 9\ KN(6m) - 12\ KN(16m) - 15\ KN(30m)$

$= -121.5\ KN\cdot m - 54\ KN\cdot m - 192\ KN\cdot m - 450\ KN\cdot m$

$= -817.5\ KN\cdot m$

$R_y \bar{x} = 817.5\ KN\cdot m$

$\bar{x} = \frac{817.5\ KN\cdot m}{63\ KN} = 13\ m$ to the right of A

$F_R = 73\ KN \measuredangle 300°$ located 13 m to the right of A