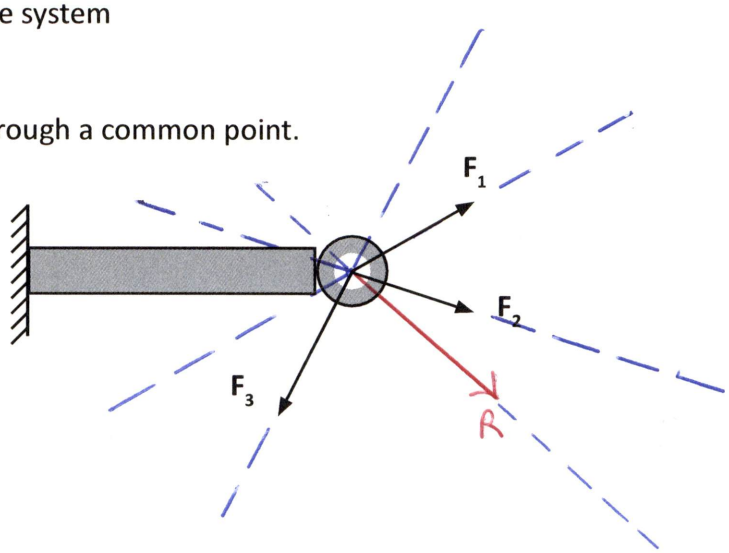
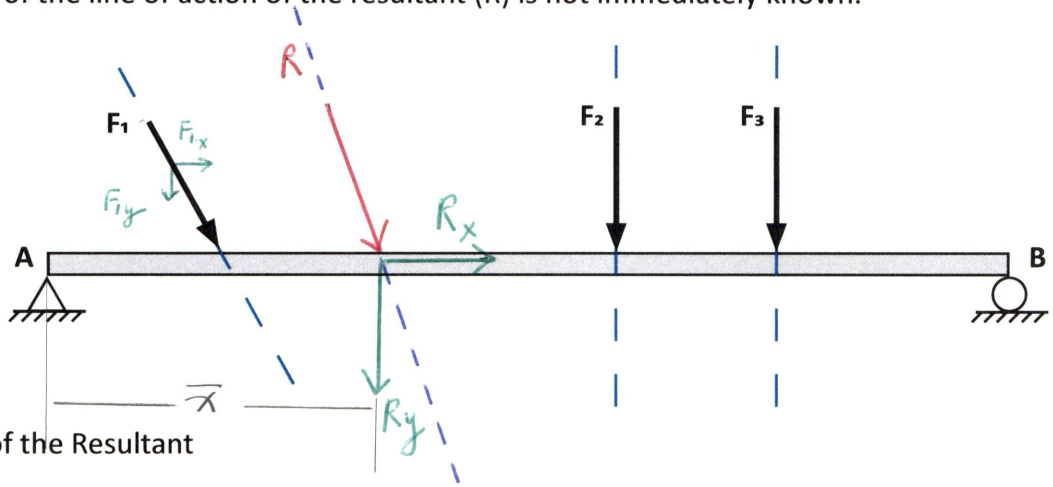
2-10
Resultant of a Nonconcurrent Coplanar Force system

Concurrent Coplanar Force System
The line of action of the Resultant passes through a common point.



Nonconcurrent Coplanar Force System
There is no point of concurrency.
The **location** of the line of action of the resultant (R) is not immediately known.



Magnitude of the Resultant

$R_x = \sum F_x$

$R_y = \sum F_y$

$R = \sqrt{R_x^2 + R_y^2}$

Direction of the Resultant

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

Θ is determined by which Quadrant the Resultant lies in.

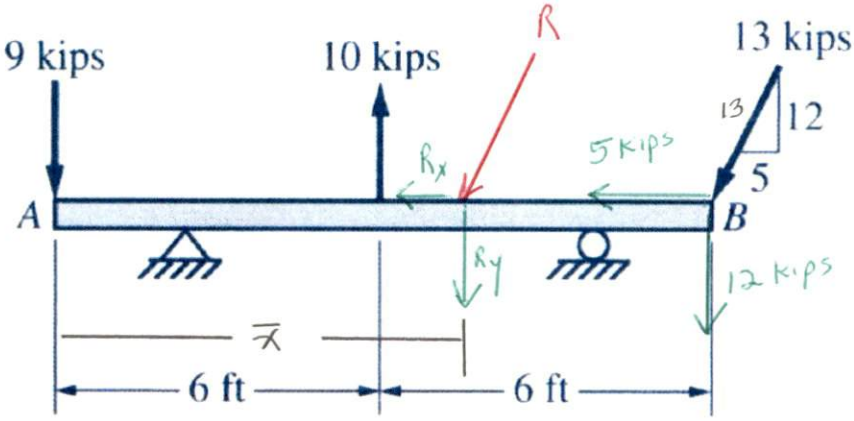
Location of the Resultant
The location of the line of action of the resultant can be determined by the requirement of the moments.
If two force systems are equivalent, the resultant moments of the two systems about an arbitrary point must be equal.

Resultant Force — Black Forces

$R_y \bar{x} = \sum M_A$

$\bar{x} = \frac{\sum M_A}{R_y}$ located to the right of point A

2-64 Find the magnitude, direction, and location of the resultant of the three forces acting on the beam.



Solution.

magnitude

$R_x = \Sigma F_x = -5 \text{ kips} = 5 \text{ kips} \leftarrow$

$R_y = \Sigma F_y = -9 \text{ kips} + 10 \text{ kips} - 12 \text{ kips} = -11 \text{ kips} = 11 \text{ kip} \downarrow$

} Resultant lies in Quad 3

$R = \sqrt{5 \text{ kips}^2 + 11 \text{ kips}^2} = 12 \text{ kips}$

Direction

$\alpha = \tan^{-1}\left|\frac{11}{5}\right| = 66°$

ccw +M ↻
cw −M

$\theta = 180° + \alpha = 180° + 66° = 246°$

Location

$R_y \bar{x} = M_A$

(cw) $-11 \text{ kips}\ \bar{x} = 10 \text{ kips}\,(6 \text{ ft}) - 12 \text{ kips}\,(12 \text{ ft}) = -84 \text{ kip·ft}$ ↺

$\bar{x} = \frac{84 \text{ kips·ft}}{11 \text{ kips}} = 7.6 \text{ ft}$ to the right of point A

$R = 12 \text{ kips}$ ↖ 246° located 7.6 ft to the right of point A