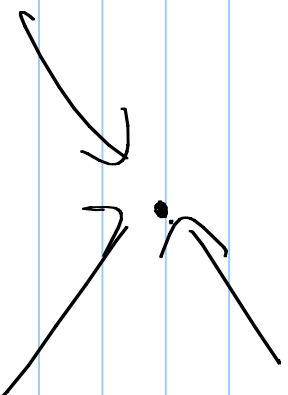


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Concurrent Force Systems

All forces pass through a single point
Particle



A vector is a quantity that has both a magnitude and a direction

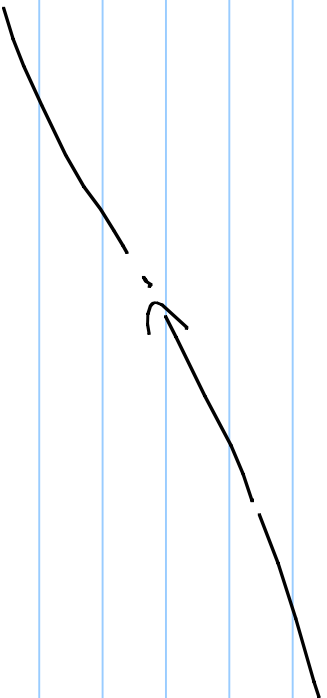
23.4 miles 15° E of N

Free - can be placed anywhere in space

Sliding - Moved along its line of action

Bound - Associated with a fixed point in space

Rigid Body - A body which does not deform due to the application of a force.



Forces - Vectors

Scalar

- 1 Velocity
- 2 Acceleration
- 3 Linear Momentum
- 4 Torque

Time

Mass

Length

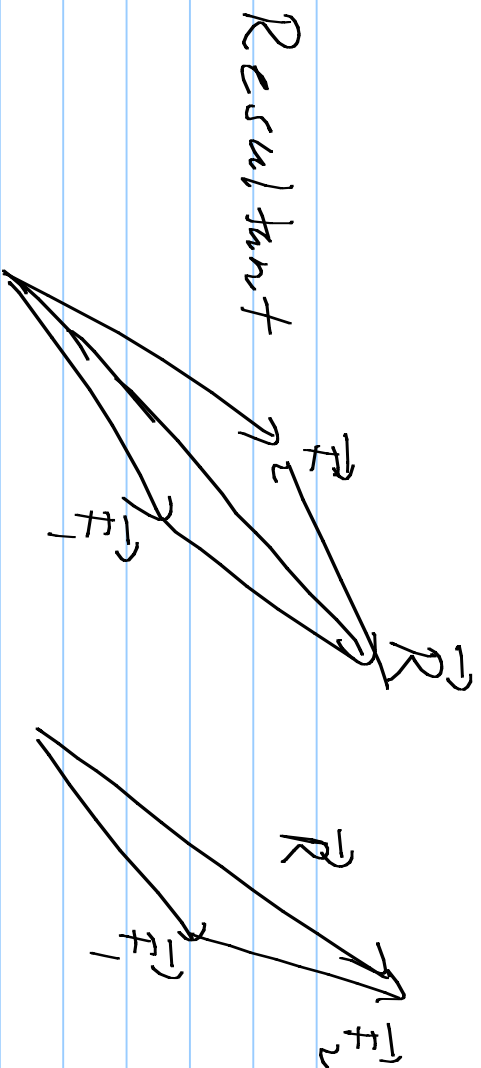
Area

Volume

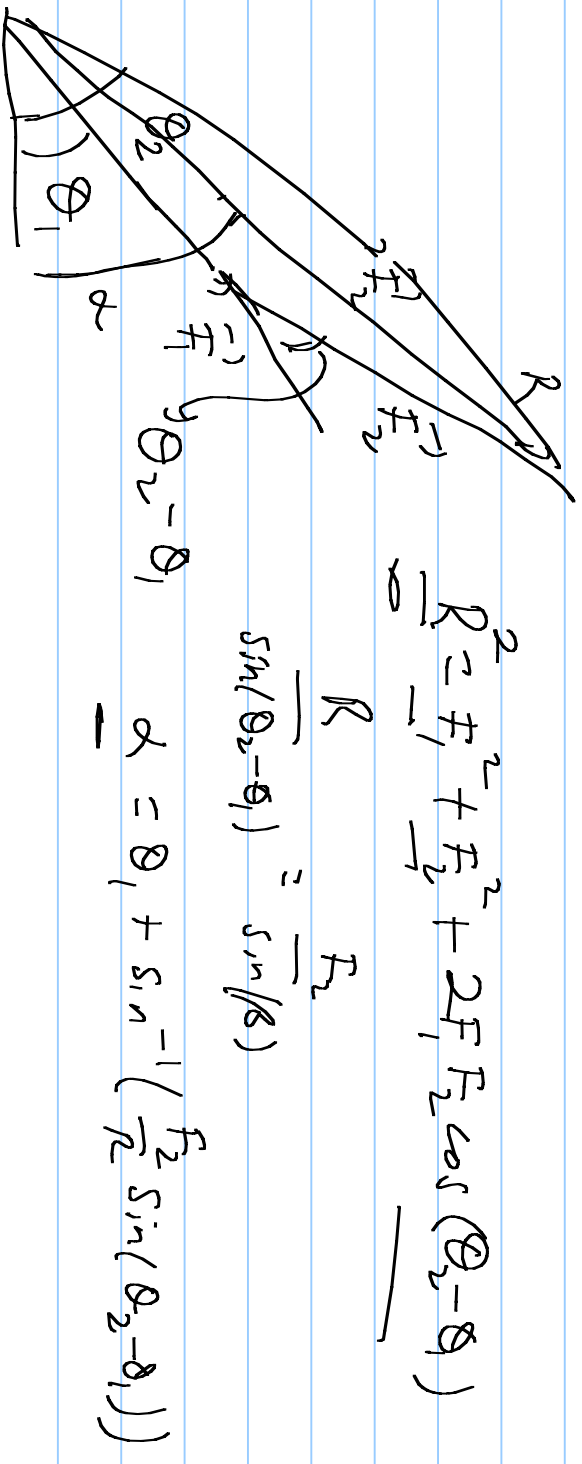
Inertia

Concurrent - pass through a single point
Coplanar - are in a plane
Parallel - are parallel
Collinear - on the same line

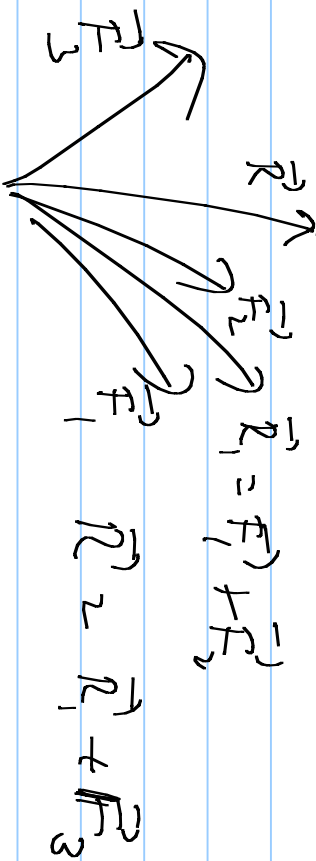




Resultant is the sum of two or more vectors



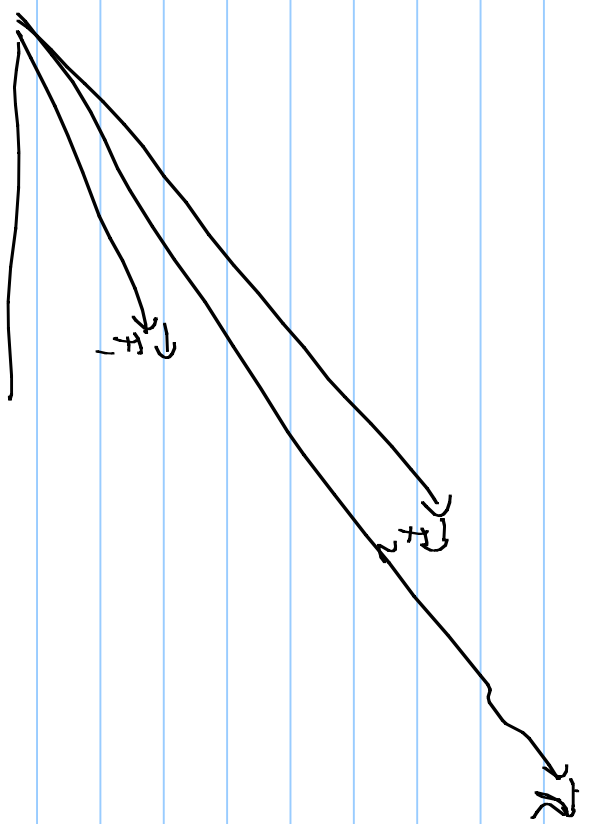
Resultant of 3 or more forces



$F_1 = 100\text{ N}$ @ 20° N of E
 $F_2 = 200\text{ N}$ @ 40° N of E

$$R = 100^2 + 200^2 + 2(100)(200)\cos(20^\circ)$$

$$R \approx 296\text{ N}$$



$$\alpha = 20^\circ + \sin^{-1}\left(\frac{200}{296} \sin(20^\circ)\right) = 33.4^\circ \text{ N of E}$$

$$F_1 = 100 \text{ N } 20^\circ \text{ N of E}$$

$$F_2 = 200 \text{ N } 40^\circ \text{ N of E}$$

$$F_3 = 150 \text{ N } 45^\circ \text{ N of W}$$

$$R_1 = 296 \text{ N } 33.4^\circ \text{ N of E}$$

$$R^2 = (296)^2 + (150)^2 + 2(296)(150) \cos(135 - 33.4)$$

$$R = 364 \text{ N}$$

$$\alpha \approx 33.4 + \sin^{-1} \left(\frac{150}{364} \sin(101.6) \right) \\ = 62.3^\circ$$

