

Quantitative Fundamentals

Procedures:

1. Draw a picture of the problem.
2. Label the picture.
3. Determine what is known.
4. Determine what is wanted.
5. Select the appropriate equation.
6. Replace the symbols with knowns.
7. Solve for the unknown.

Equations:

$$\bar{v} = \Delta p / \Delta t$$

$$\bar{a} = \Delta v / \Delta t$$

$$v_f = v_i + a \cdot t$$

$$d = v_i \cdot t + 1/2 a \cdot t^2$$

$$v_f^2 = v_i^2 + 2a \cdot d$$

$$\bar{\omega} = \Delta \theta / \Delta t$$

$$\bar{\alpha} = \Delta \omega / \Delta t$$

$$v_t = \omega \cdot r$$

$$F = m \cdot a$$

$$wt = m \cdot g$$

$$M = m \cdot v$$

$$F \cdot t = m \cdot v_2 - m \cdot v_1$$

$$F \cdot d = m \cdot g \cdot h + 1/2 m \cdot v^2$$

$$W = F \cdot d$$

$$P = W/t = F \cdot v$$

$$\tau = F \cdot d$$

$$\tau = I \cdot \alpha$$

$$H = I \cdot \omega$$

$$\tau \cdot t = I_2 \cdot \omega_2 - I_1 \cdot \omega_1$$

$$\sum \tau = \tau \sum$$

$$\sum F = 0 \quad \text{in equilibrium}$$

$$\sum \tau = 0 \quad \text{in equilibrium}$$

Hints:

1. It may be necessary to make intermediate calculations for unrequested unknowns.
2. Make sure variables are in the appropriate units.
3. Check to see that the answer is in the correct units.

Identities:

$$1 \text{ radian} = 57.3^\circ$$

$$360^\circ = 2\pi \text{ radians}$$

$$\pi = 3.14$$

$$1 \text{ meter} = 3.28 \text{ ft}$$

$$1 \text{ mile/hr} = 1.467 \text{ ft/sec}$$

$$1 \text{ Newton} = 1 \text{ kg} \cdot \text{m/sec}^2$$

$$1 \text{ Joule} = 1 \text{ N} \cdot \text{m}$$

$$1 \text{ Watt} = 1 \text{ N} \cdot \text{m/sec}$$

$$1 \text{ Newton} = .225 \text{ lb}$$

$$1 \text{ slug} = 1 \text{ lb} \cdot \text{sec}^2/\text{ft}$$

Conversions at sea level:

$$g = 32.2 \text{ ft/sec}^2 = 9.8 \text{ m/sec}^2$$

$$1 \text{ kg} = 2.2 \text{ lb}$$

$$1 \text{ slug} = 32.2 \text{ lb}$$

Trigonometric relationships:

$$\sin \theta = \text{opposite/hypotenuse}$$

$$\cos \theta = \text{adjacent/hypotenuse}$$

$$\tan \theta = \text{opposite/adjacent}$$

$$v_v = v_r \cdot \sin \theta$$

$$v_h = v_r \cdot \cos \theta$$