

Quiz #1

1. The critical load for the column shown is $P_{cr} = (\pi^2 EI)/(4L^2)$. For $E = 20 \times 10^6 \text{ lb/in}^2$, $I = 1.5 \times 10^3 \text{ mm}^4$, and $L = 1.5 \text{ m}$, determine the largest mass m (in kg) of a block which may be placed on the top of the column without causing the column to buckle. (Use $1 \text{ lbm} = 0.4536 \text{ kg}$.) ②

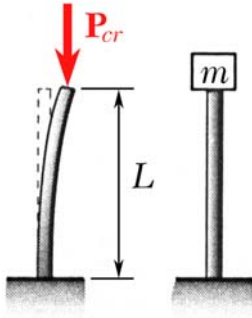


Fig. P1

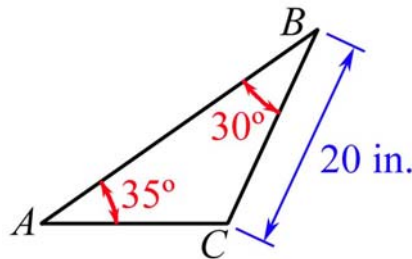


Fig. P2

$$D = \begin{vmatrix} 5 & -7 & 9 \\ 4 & 0 & -2 \\ 6 & -4 & 1 \end{vmatrix}$$

2. Determine the length of the side \overline{AB} of the triangle shown. ②
3. Compute the value of the determinant D shown. ②
4. Describe the rigid-body principle. ②
5. Describe the principle of transmissibility. ②

1.

$$m = \frac{P_{cr}}{g} = \frac{\pi^2 EI}{4L^2 g} = \frac{\pi^2 (20 \times 10^6 \text{ lb/in}^2)(1.5 \times 10^3 \text{ mm}^4)}{4[(1.5)^2 \text{ m}^2](9.81 \text{ m/s}^2)} \cdot \frac{1 \text{ lbm} (9.81 \text{ m/s}^2)}{1 \text{ lb}} \cdot \frac{0.4536 \text{ kg}}{1 \text{ lbm}}$$

$$\cdot \frac{(12)^2 \text{ in}^2}{1^2 \text{ ft}^2} \cdot \frac{1^2 \text{ ft}^2}{(0.3048)^2 \text{ m}^2} \cdot \frac{1^4 \text{ m}^4}{(10^3)^4 \text{ mm}^4} \quad \therefore m = 23.1 \text{ kg}$$

2. $\angle C = 180^\circ - 35^\circ - 30^\circ = 115^\circ$ $\frac{\overline{AB}}{\sin 115^\circ} = \frac{20}{\sin 35^\circ}$ $\therefore \overline{AB} = 31.6 \text{ in.}$

3. $D = -4 \begin{vmatrix} -7 & 9 \\ -4 & 1 \end{vmatrix} - (-2) \begin{vmatrix} 5 & -7 \\ 6 & -4 \end{vmatrix} = -4(-7 + 36) + 2(-20 + 42)$ $\therefore D = -72$

4. If two collinear forces with equal magnitudes but opposite directions are applied to a rigid body, the condition of rest or motion of this body will remain unchanged.
5. If a force acting on a rigid body is transmitted to another point on its line of action, the condition of rest or motion of this body will remain unchanged.