Quiz #1

1. The critical load for the column shown is $P_{cr} = (\pi^2 EI)/(4L^2)$. For $E = 20\times10^6$ lb/in^2, $I = 1.5\times10^3$ mm^4, and $L = 4$ ft, 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 lbm = 0.4536 kg.) ②

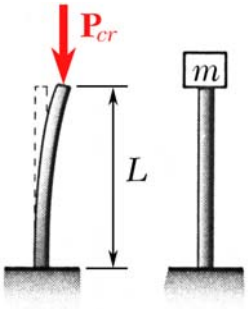

Fig. P1

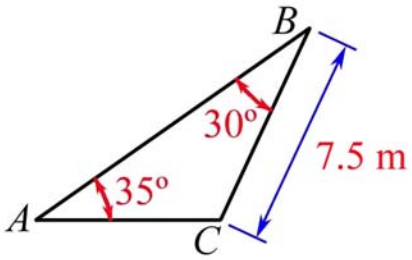

Fig. P2

$$D = \begin{vmatrix} 5 & -7 & 9 \\ 4 & 3 & -2 \\ 6 & -4 & -1 \end{vmatrix}$$

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 difference between *kinematics* and. *Kinetics*. ②

5. Describe *Newton's law of gravitation*. ②

1.

$$m = \frac{P_{cr}}{g} = \frac{\pi^2 EI}{4L^2 g} = \frac{\pi^2(20\times10^6 \text{lb/in}^2)(1.5\times10^3 \text{mm}^4)}{4(4^2\text{ft}^2)(9.81\text{ m/s}^2)} \cdot \frac{1\text{ lbm }(9.81\text{ m/s}^2)}{1\text{ lb}} \cdot \frac{0.4536\text{ kg}}{1\text{ lbm}}$$

$$\cdot \frac{(12)^2\text{ in}^2}{1^2\text{ ft}^2} \cdot \frac{1^4\text{ ft}^4}{(0.3048)^4\text{ m}^4} \cdot \frac{1^4\text{ m}^4}{(10^3)^4\text{ mm}^4} \qquad \therefore\ m = 35.0\text{ kg}$$

2. $\angle C = 180° - 35° - 30° = 115°$ $\qquad \dfrac{\overline{AB}}{\sin 115°} = \dfrac{7.5}{\sin 35°}$ $\qquad \therefore\ \overline{AB} = 11.85\text{ m}$

3. $D = 5\begin{vmatrix} 3 & -2 \\ -4 & -1 \end{vmatrix} - (-7)\begin{vmatrix} 4 & -2 \\ 6 & -1 \end{vmatrix} + 9\begin{vmatrix} 4 & 3 \\ 6 & -4 \end{vmatrix} = 5(-3-8) + 7(-4+12) + 9(-16-18) = \mathbf{-305}$

4. *Kinematics* deals with the mathematical study of motion of bodies without considering the cause of motion. *Kinetics* relates the motion of a body to the force system causing the motion; it usually contains some kinematics.

5. *Newton's law of gravitation* states that two particles are mutually attracted by a pair of opposite forces that are directed along the line joining the particles and have the same magnitude which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.