MEEG 2003 Quiz #1.m03 (2 pts each)

1. Determine the length of the side $\overline{AB}$ of the triangle shown.

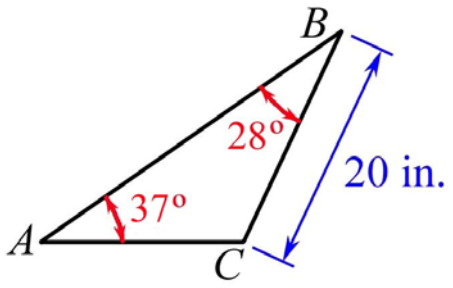

Fig. P1

2. Describe the rigid-body principle.

3. Describe Newton's third law.

4. The angle of twist (in radians) is given by $\theta = TL/(JG)$, where $T = Fd$, F = 400 lb, d = 2 in., L = 300 mm, $J = 10^4$ mm^4, and $G = 11.5 \times 10^6$ psi. Determine the value of θ in degrees.

5. Compute the value of the determinant D.

$$D = \begin{vmatrix} 5 & -7 & 9 \\ 4 & 0 & -3 \\ 6 & -4 & 1 \end{vmatrix}$$

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1. $\angle C = 180° - 37° - 28° = 115°$ $\quad \dfrac{\overline{AB}}{\sin 115°} = \dfrac{20}{\sin 37°}$ $\quad \therefore\ \overline{AB} = 30.1 \text{ in.}$

2. If two collinear forces with equal magnitudes but opposite directions are applied to a rigid body, the condition of rest or motion of the rigid body will remain unchanged.

3. To every action there is a collinear reaction having the same magnitude and being opposite in direction.

4. $$\theta = \frac{(Fd)L}{JG} = \frac{400 \text{ lb} \cdot 2 \text{ in.} \cdot 300 \text{ mm}}{10^4 \text{ mm}^4 \cdot 11.5 \times 10^6 \text{ psi}} \text{ rad} \cdot \frac{1 \text{ psi}}{1 \text{ lb/in}^2} \cdot \frac{1^3 \text{ ft}^3}{(12)^3 \text{ in}^3}$$
$$\cdot \frac{(0.3048)^3 \text{ m}^3}{1^3 \text{ ft}^3} \cdot \frac{(10^3)^3 \text{ mm}^3}{1^3 \text{ m}^3} \cdot \frac{180°}{\pi \text{ rad}} = 1.95946°$$
$$\therefore\ \theta = 1.959°$$

5. $$D = -4\begin{vmatrix} -7 & 9 \\ -4 & 1 \end{vmatrix} - (-3)\begin{vmatrix} 5 & -7 \\ 6 & -4 \end{vmatrix} = -4(-7+36) + 3(-20+42) = -50$$