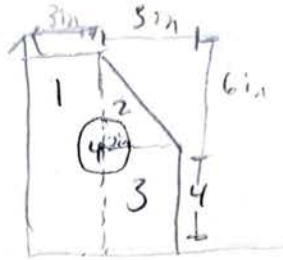


Test 3

Problem #1

Solution



Shape	$A (\text{in}^2)$	$\bar{x} \text{ in}$	$\bar{y} \text{ in}$	$A\bar{x} (\text{in}^3)$	$A\bar{y} (\text{in}^3)$
1	30	1.5	5	45	150
2	9	4	6	36	54
3	12	4.5	2	54	24
4	<u>-12.56637061</u>	3	4	<u>-37.6991183</u>	<u>-50.26548244</u>
$\Sigma A = 38.43362939$				$\Sigma A\bar{x} = 97.30088817$	$\Sigma A\bar{y} = 177.7345176$

$$\bar{X} = \frac{\Sigma A\bar{x}}{\Sigma A} = \frac{97.30088817}{38.43362939} = 2.531660156$$

$$\bar{Y} = \frac{\Sigma A\bar{y}}{\Sigma A} = \frac{177.7345176}{38.43362939} = 4.624453127$$

$$\bar{X} = 2.53 \text{ in}$$

$$\bar{Y} = 4.62 \text{ in}$$

Problem # 2

Solution

$$A(2, -3, 3)$$

$$B(0, 3, 0)$$

$$C(-2, 3, 5)$$

$$F_{AB} = 70\text{ N}$$

$$F_{AC} = 40\text{ N}$$

F_{AB} A to B B to A

$$B(0, 3, 0) \quad d = \sqrt{(-2)^2 + 6^2 + (-3)^2} = 7$$

$$\underline{-A(2, -3, 3)}$$

$$-2, 6, -3$$

$$F_{ABx} = \frac{-2}{7}(70) = -20\text{ N}$$

$$F_{AB_y} = \frac{6}{7}(70) = 60\text{ N}$$

$$F_{ABz} = \frac{-3}{7}(70) = -30\text{ N}$$

F_{AC} A to C C to A

$$C(-2, 3, 5) \quad d = \sqrt{(-4)^2 + 6^2 + 2^2} = \sqrt{56}$$

$$\underline{-A(2, -3, 3)}$$

$$-4, 6, 2$$

$$F_{ACx} = \frac{-4}{\sqrt{56}}(40) = -21.38089935$$

$$F_{AC_y} = \frac{6}{\sqrt{56}}(40) = 32.07134903$$

$$F_{ACz} = \frac{2}{\sqrt{56}}(40) = 10.69044968$$

$$R_x = \sum F_x = -20 - 21.38089935 = -41.38089935$$

$$R_y = \sum F_y = 60 + 32.07134903 = 92.07134903$$

$$R_z = \sum F_z = -30 + 10.69044968 = -19.30955032$$

$$R = \sqrt{(-41.38\dots)^2 + 92.07\dots^2 + (-19.309\dots)^2} = 102.7733958$$

$$\theta_x = \cos^{-1}\left(\frac{-41.38\dots}{102.7\dots}\right) = 113.7434552^\circ$$

$$\theta_y = \cos^{-1}\left(\frac{92.07\dots}{102.7\dots}\right) = 26.3799194^\circ$$

$$\theta_z = \cos^{-1}\left(\frac{-19.3\dots}{102.7\dots}\right) = 100.8293643^\circ$$

$$R = 103 \text{ N}$$

$$\theta_x = 114^\circ$$

$$\theta_y = 26.4^\circ$$

$$\theta_z = 101^\circ$$

Problem #3

Solution

$$v = 525$$

$$A(0, 0, 0)$$

$$B(-3, -6, 6)$$

$$C(-2, 3, 6)$$

$$D(5, 0, 0)$$

$$F_{AB} \quad A \text{ to } B \quad B - A$$

$$B(-3, -6, 6) \quad d = \sqrt{(-3)^2 + (-6)^2 + 6^2} = 9$$

$$\underline{-A(0 \ 0 \ 0)}$$

$$-3, -6, 6$$

$$F_{ABx} = \frac{-3}{9} T_{AB}$$

$$F_{ABy} = \frac{-6}{9} T_{AB}$$

$$F_{ABz} = \frac{6}{9} T_{AB}$$

$$F_{AC} \quad A \text{ to } C \quad C - A$$

$$C(-2, 3, 6)$$

$$d = \sqrt{(-2)^2 + 3^2 + 6^2} = 7$$

$$\underline{-A \ 0 \ 0 \ 0}$$

$$-2, 3, 6$$

$$F_{ACx} = \frac{-2}{7} T_{AC}$$

$$F_{ACz} = \frac{6}{7} T_{AC}$$

$$F_{ACy} = \frac{3}{7} T_{AC}$$

FAD A to D D-A

D (5, 0, 0)

$$d = \sqrt{5^2 + 0^2 + 0^2} = 5$$

-A (0, 0, 0)

5, 0, 0

$$F_{ADx} = T_{AD}$$

$$F_{ADy} = \frac{0}{5} T_{AD} = 0$$

$$F_{ADz} = \frac{0}{5} T_{AD} = 0$$

$$\sum F_x: -\frac{3}{9} T_{AB} - \frac{2}{7} T_{AC} + T_{AD} = 0$$

$$\sum F_y: -\frac{6}{9} T_{AB} + \frac{3}{7} T_{AC} + 0 = 0$$

$$\sum F_z: \frac{6}{9} T_{AB} + \frac{6}{7} T_{AC} + 0 - 525 = 0$$

$$A = \begin{bmatrix} \sum F_x & -\frac{3}{9} & -\frac{2}{7} & 1 \\ \sum F_y & -\frac{6}{9} & \frac{3}{7} & 0 \\ \sum F_z & \frac{6}{9} & \frac{6}{7} & 0 \end{bmatrix}$$

$$T_{AB} = 263 \text{ lb}$$

$$T_{AC} = 408 \text{ lb}$$

$$T_{AD} = 204 \text{ lb}$$

$$B = \begin{bmatrix} 0 \\ 0 \\ 525 \end{bmatrix}$$

$$A^{-1} \cdot B = \begin{bmatrix} 262.5 \\ 408.333 \\ 204.167 \end{bmatrix}$$