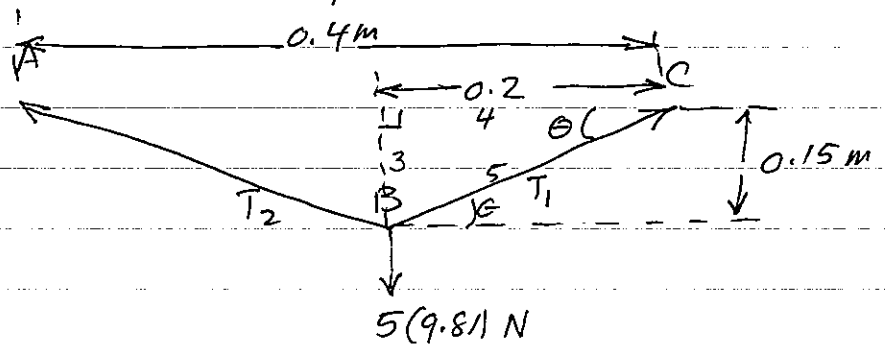
Homework(2) Solutions | M. Saeb

F 3.3 Due Dec. 03/2014

From Symmetry, point B will be in the middle of AC



$T_1 \cos\theta = T_2 \cos\theta \quad \therefore T_1 = T_2 = T$

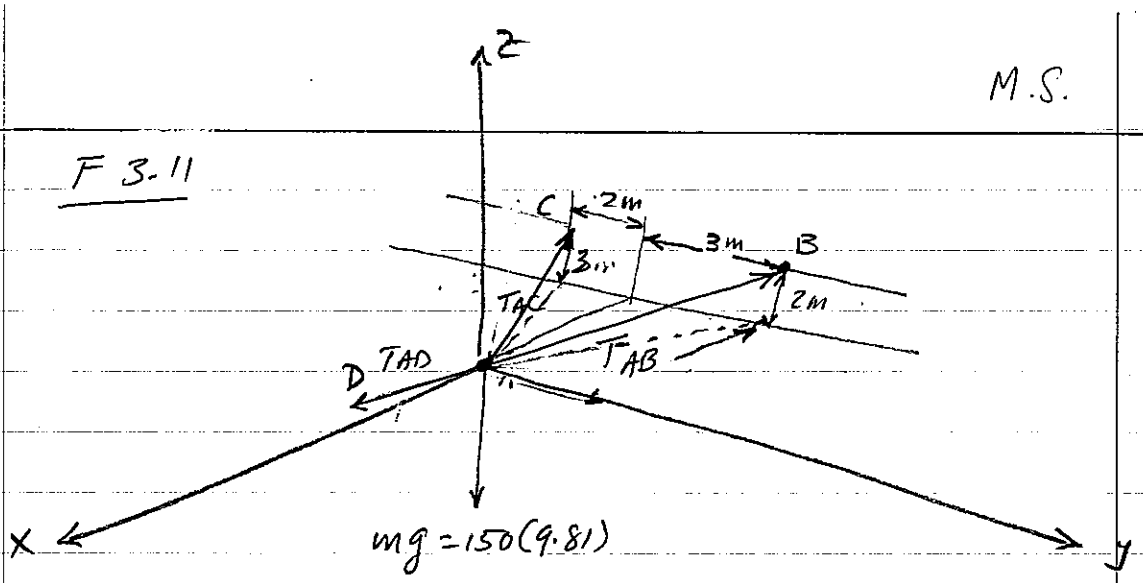
$2T \sin\theta = 5(9.81)$

$2T\left(\frac{3}{5}\right) = 5(9.81) = 49.05 \text{ N}$

$T = \frac{25}{6}(9.81) \text{ N}$

$\simeq 40.9 \text{ N}.$

F 3-11



$$\Sigma F_x = 0$$
$$\Sigma F_y = 0$$
$$\Sigma F_z = 0$$

$$\mathbb{F}_B = F_B \left(\frac{\mathbb{r}_{AB}}{r_{AB}}\right)$$
$$= F_B \left[\frac{-6\underline{i} + 3\underline{j} + 2\underline{k}}{\sqrt{(6)^2 + (3)^2 + (2)^2}}\right]$$
$$\mathbb{F}_B = -\frac{6}{7}F_B\,\underline{i} + \frac{3}{7}F_B\,\underline{j} + \frac{2}{7}F_B\,\underline{k}$$

$$\mathbb{F}_C = F_C \left(\frac{\mathbb{r}_{AC}}{r_{AC}}\right)$$
$$= F_C \left[\frac{-6\underline{i} - 2\underline{j} + 3\underline{k}}{\sqrt{(6)^2 + (2)^2 + (3)^2}}\right]$$
$$= -\frac{6}{7}F_C\,\underline{i} - \frac{2}{7}F_C\,\underline{j} + \frac{3}{7}F_C\,\underline{k}$$

$$\mathbb{F}_D = F_D\,\underline{i}$$

$$\mathbb{W} = -150\,\underline{k}$$

$$\therefore \Sigma F_x = 0: \quad -\frac{6}{7}F_B - \frac{6}{7}F_C + F_D = 0$$
$$\Sigma F_y = 0: \quad \frac{3}{7}F_B - \frac{2}{7}F_C = 0$$
$$\Sigma F_z = 0: \quad \frac{2}{7}F_B + \frac{3}{7}F_C - 150 = 0$$

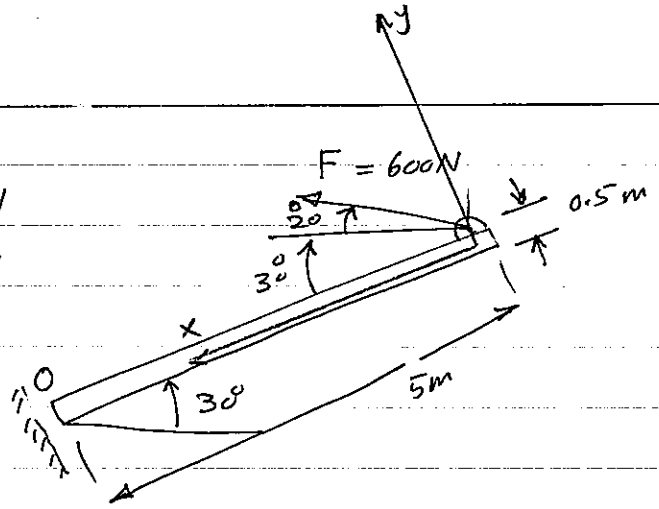
Solve and get

$F_B \cong 162\,N$ ◀

$F_C \cong 242\,N$ ◀

$F_D \cong 346\,N$ ◀

F 4.1



$$\underline{F} = -600\cos 50^\circ\ \underline{i} + 600\sin 50^\circ\ \underline{j}$$

$$= -385.7\ \underline{i} + 459.6\ \underline{j} \quad N$$

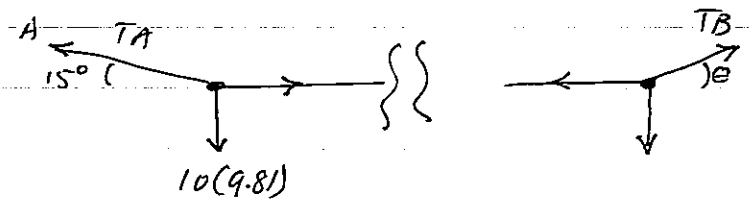
$$\underline{r}_O = 5\ \underline{i} + 0.5\ \underline{j} \quad m$$

$$\underline{M} = \underline{r}_O \times \underline{F} = \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ 5 & +0.5 & 0 \\ -385.7 & 459.6 & 0 \end{vmatrix}$$

$$= 0\ \underline{i} + 0\ \underline{j} + 2490.8\ \underline{k} \quad N.m$$

$$\simeq 2.49\ KN.m$$

F 3.6



$T_A \sin 15^\circ = 10(9.81)$

$T_A \cong 379 \text{ N}$

$T_B \sin\theta = 15(9.81)$

$T_B = 15(9.81)/\sin\theta$ (1)

but $T_A \cos 15^\circ = T_B \cos\theta$

$379 \cos 15^\circ = T_B \cos\theta = 366.1 \text{ N}$ (2) ✓

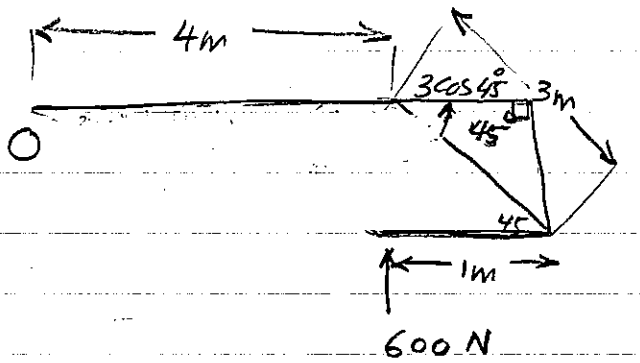
(1) ÷ (2) $\rightarrow$ $\dfrac{1}{\cos\theta} = \dfrac{15(9.81)/366.1}{\sin\theta}$

$\tan\theta = \dfrac{15(9.81)}{366.1}$

$\theta \cong 21.9^\circ$ ✓ ◀

$T_B = \dfrac{366.1}{\cos 21.9^\circ} \cong 394.6 \text{ N}$ ◀

F 4.4

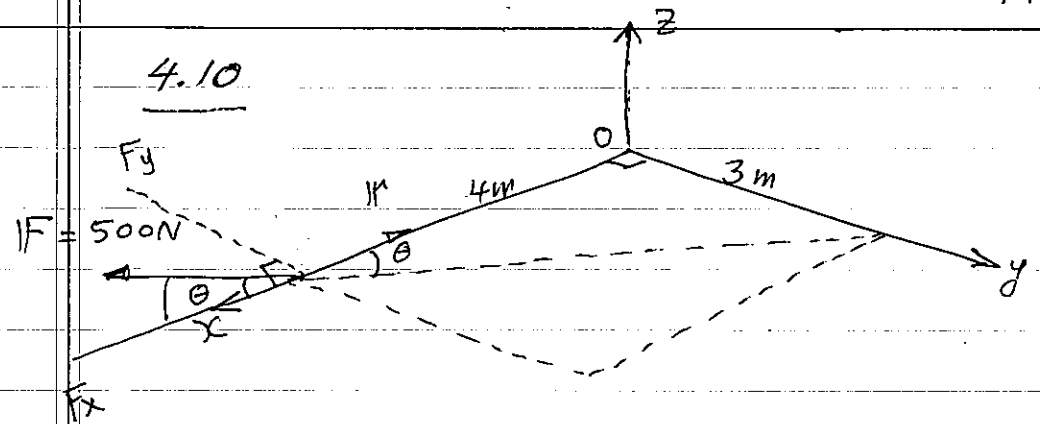


$d = (3\cos 45 + 4) - 1$

$= 5.12\ m$

$\therefore (M = 600\,(5.12) \cong 3.07\ KN.m$ ◀

4.10



$$\underline{F} = 500\cos\theta\,\underline{i} - 500\sin\theta\,\underline{j}$$

$$= 500\cdot\frac{4}{5}\,\underline{i} - 500\cdot\frac{3}{5}\,\underline{j} = 400\,\underline{i} - 300\,\underline{j}\ \text{N}$$

$$\underline{r}_O = -4\,\underline{i}$$

$$\underline{M}_O = \underline{r}_O \times \underline{F}$$

$$= \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ -4 & 0 & 0 \\ 400 & -300 & 0 \end{vmatrix} = 0\,\underline{i} + 0\,\underline{j} + (1200)\,\underline{k}$$

$$= 1200\,\underline{k}\ \text{N.m} \quad \blacktriangleleft$$

NOTE to the student:

Please neatly prepare your future homeworks. This will help you now and in the future.