Ryerson University

Dept. of Physics

PCS 211 – Fall 2021
Tutorial Report Cover Page

Group's Students Info

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Tutorial Number : ____5_____

Tutorial Date : ____Nov 9, 2021_____

Tutorial TA Name : _____Matt Bielecki_____

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1.

$I_1 = \frac{1}{2} m r^2$

$= \frac{1}{2}(2.0\,kg)(0.1\,m)^2$

$= 0.01\,kg \cdot m^2$

$I_0 = mr^2$

$I_0' = 2mr^2$

$I_2 = I_1 + I_0'$

$I_2 = I_1 + 2mr^2$

$I_2 = 0.01kg + 2(0.5kg)(0.1)^2$

$I_2 = 0.02\,kg \cdot m^2$

$I_1 \omega_1 = I_2 \omega_2$

$\omega_2 = \frac{I_1 \omega_1}{I_2}$

$= \frac{(0.01\,kg \cdot m^2)(100\,rpm)}{0.02\,kg \cdot m^2}$

$\boxed{\omega_2 = 50\,rpm}$

$\therefore$ angular velocity magnitude is 50 rpm

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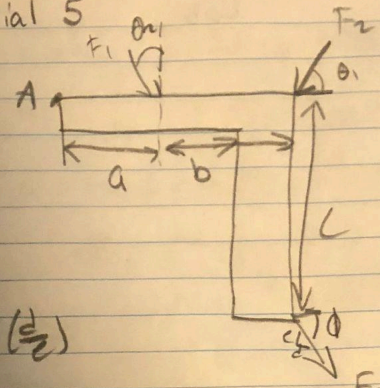
Tutorial 5

Q2.

a)



$\tan\phi = \frac{d}{e}$

$\phi = \tan^{-1}\left(\frac{d}{e}\right)$

$\text{Length} = (a+b-\frac{d}{e}c)\frac{e}{\sqrt{e^2+d^2}} = (2+3-3)\frac{4}{\sqrt{25}} = 2\cdot\frac{4}{5} = \frac{8}{5}$

$\text{Moment}_A = -F_1[a\cos\theta_1] - F_2(a+b)\sin\theta_1 + F_3 L$

$= -250[2\cos 30] - 300(2+3)(\sin 60) - 500\cdot\frac{8}{5}$

$= -433.0127 - 1299.0381 - 800$

$= -2532.0508\ \text{N·m}$

b) Solve using principle of moments

$\text{Moment}_A = -F_1(\cos\theta_1)a - F_2(\sin\theta_1)(a+b) + F_3\frac{d}{\sqrt{d^2+e^2}}L - F_3\frac{e}{\sqrt{d^2+e^2}}(a+b)$

$= -250(\cos 30)2 - 300(\sin 60)(5) + 500\frac{12}{5} - 500.4$

$= -433.0127 - 1299.0381 + 1200 - 2000$

$= -2532.0508\ \text{N·m}$

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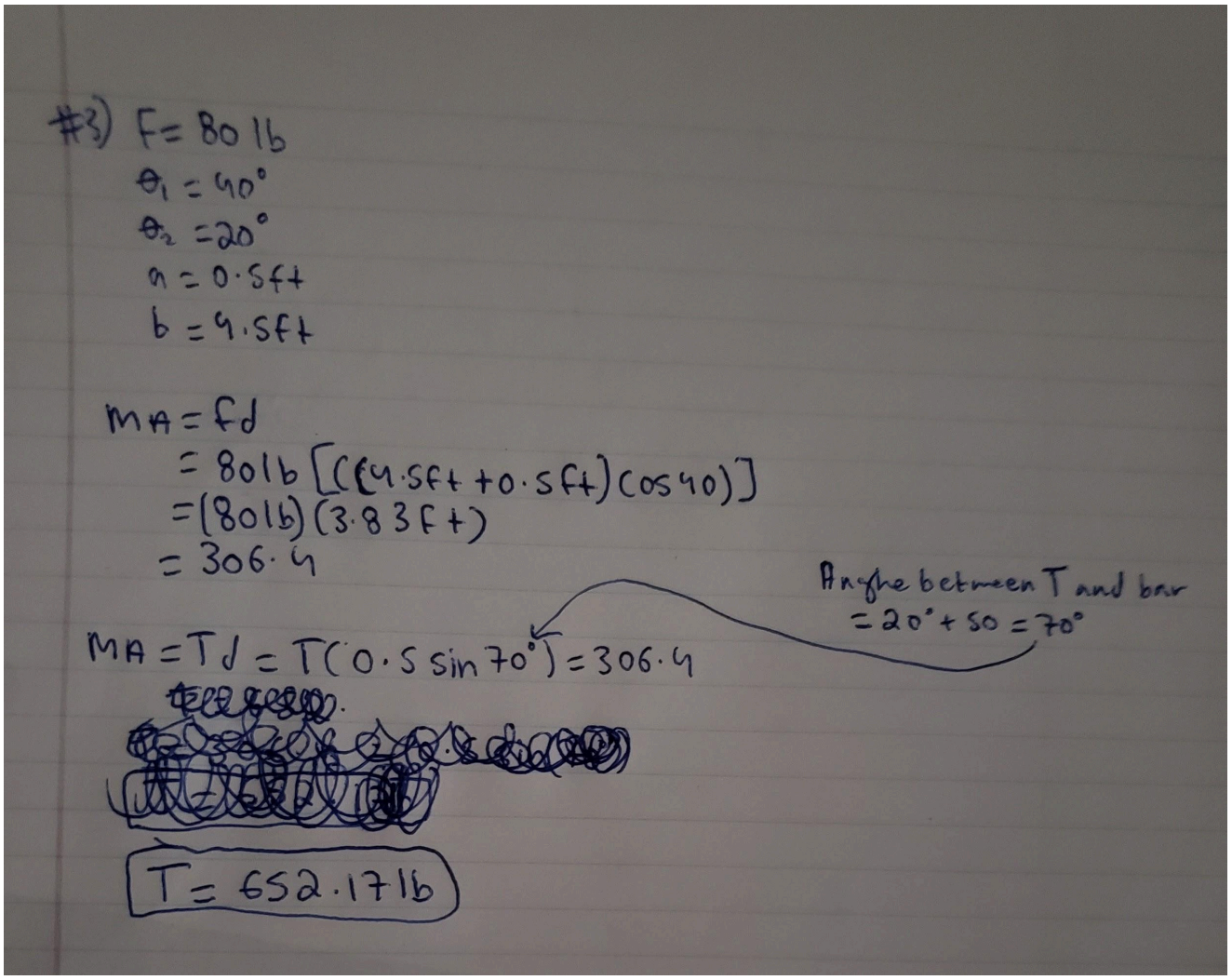

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4.

$\vec{A} = 0\hat{i} + 0\hat{j} + 0\hat{k}$

$\vec{C} = 0.55\hat{i} + 0.4\hat{j} - 0.22\hat{k}$

$\vec{D}_{AC} = (0.55 - 0)\hat{i} + (0.4 - 0)\hat{j} + (-0.2 - 0)\hat{k}$

$= 0.55\hat{i} + 0.4\hat{j} - 0.2\hat{k}$

$F' = 80\cos 30 = 69.28\ N$

$F_x = 69.28\sin 40 = 44.5\ N$

$F_y = 69.28\cos 40 = 53.1\ N$

$F_z = -80\sin 30 = -40\ N$

$F = 44.5\hat{i} + 53.1\hat{j} - 40\hat{k}$

$M_A = D_{AC} \times F$

$$= \begin{vmatrix} i & j & k \\ 0.55 & 0.4 & -0.2 \\ 44.5 & 53.1 & -40 \end{vmatrix} = \boxed{(-5.38\hat{i} + 13.1\hat{j} + 11.4\hat{k})\ N \cdot m}$$

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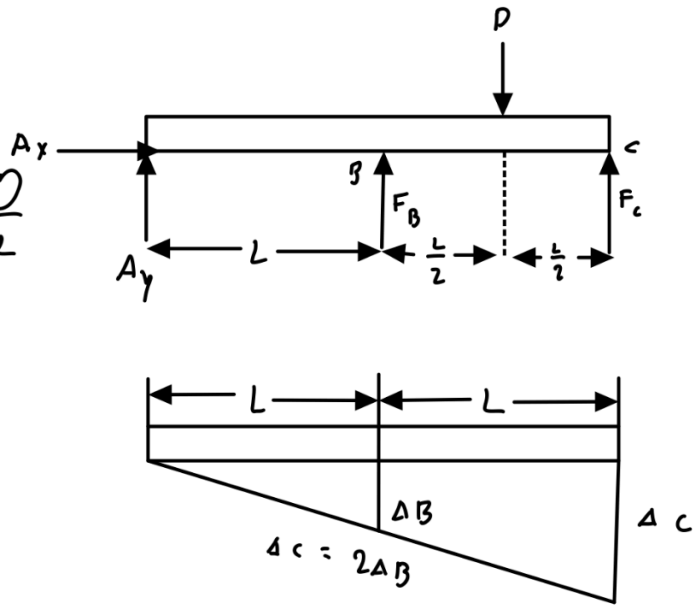
⑤

$\Sigma M_A = 0$



$$\frac{F_B k + F_c 2k - P\frac{3}{2}k}{k} = \frac{0}{2}$$

$$F_B + 2F_c - 1.5P = 0$$

$$F_B + 2F_c = 1.5P$$

$$\Delta_C = 2\Delta_B$$

$$\frac{F_C}{k} = \frac{2F_B}{k}$$

$$F_C = 2F_B$$

$$F_B + 2F_c = 1.5P$$

$$F_B + (2)(2F_B) = 1.5P$$

$$5F_B = 1.5P$$

$$\frac{5F_B}{5} = \frac{1.5P}{5}$$

$$F_B = 0.3P \quad //$$

$$F_C = 2F_B$$

$$= (2)(0.3P)$$

$$= 0.6P \quad //$$

$$\Delta_C = 2\Delta_B$$

$$\frac{F_C}{k} = \frac{2F_B}{k}$$

$$\Delta C = \frac{(2)(0.3P)}{k}$$

$$\Delta C = \frac{0.6P}{k}$$