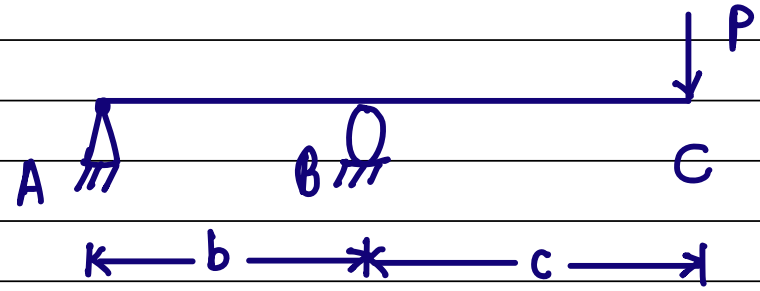
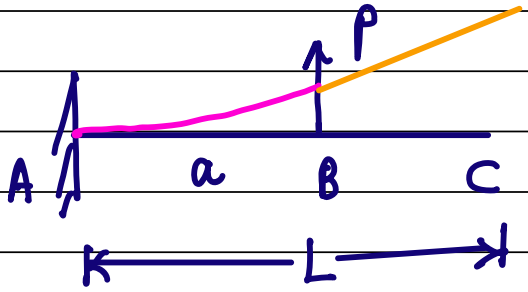
DNYANESH PAWASKAR

Tutorial 5

1.



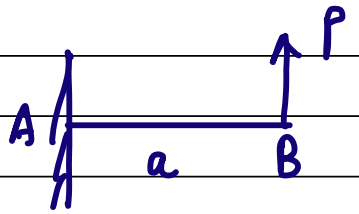
Trick:



$$u_B = \frac{Pa^3}{3EI}, \quad \theta_B = \frac{Pa^2}{2EI}$$

$$u_C = u_B + \theta_B (L-a)$$

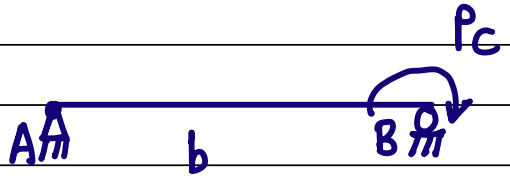
$$= \frac{Pa^3}{3EI} + \frac{Pa^2}{2EI}(L-a)$$

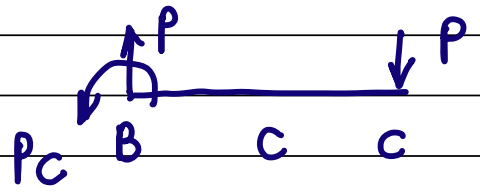


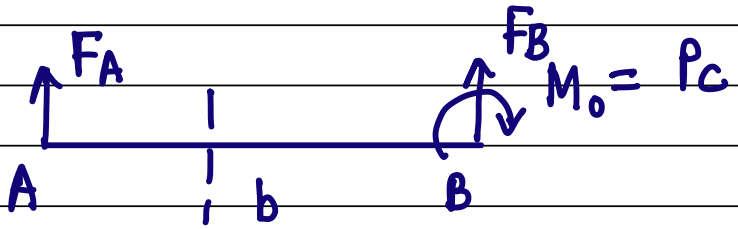
$$u(z) = \frac{P}{EI}\left(\frac{az^2}{2} - \frac{z^3}{6}\right)$$

$$u' = \frac{P}{EI}\left(az - \frac{z^2}{2}\right), \quad \theta_B = u'(a) = \frac{Pa^2}{2EI}$$

CT 1 Castigliano Thm 1 PMPE
CT 2 Castigliano Thm 2 PMCE







$$M(z) = -M_0 z/L$$

$$= EI u'' \quad \text{w/ BCs} \quad u(0) = 0, \; u(b) = 0$$

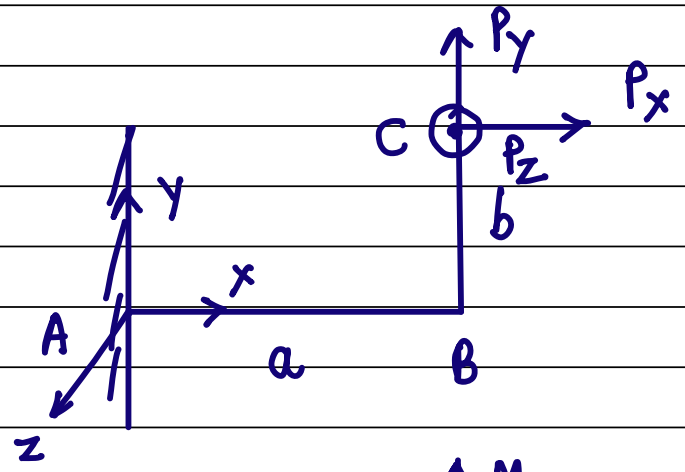
$$u(z) = \frac{-M_0}{bEI}\left(\frac{z^3}{6} - \frac{b^2 z}{6}\right)$$

$$u'(b) = \theta_B = \frac{-M_0 b}{3EI}$$

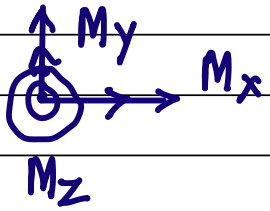
$$\downarrow \delta_C = \frac{P_C^3}{3EI} + \theta_B C$$

$$= \frac{P_C^2}{3EI}(b+c)$$ same as before.

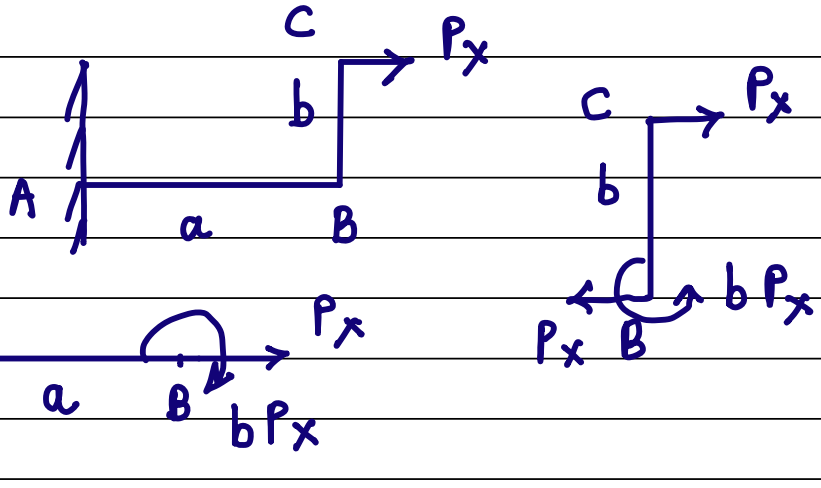
2.



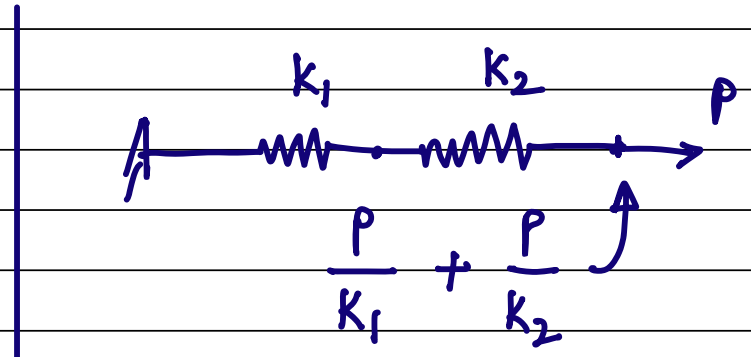
Homework At C



Only P_x



x-disp of C due to P_x

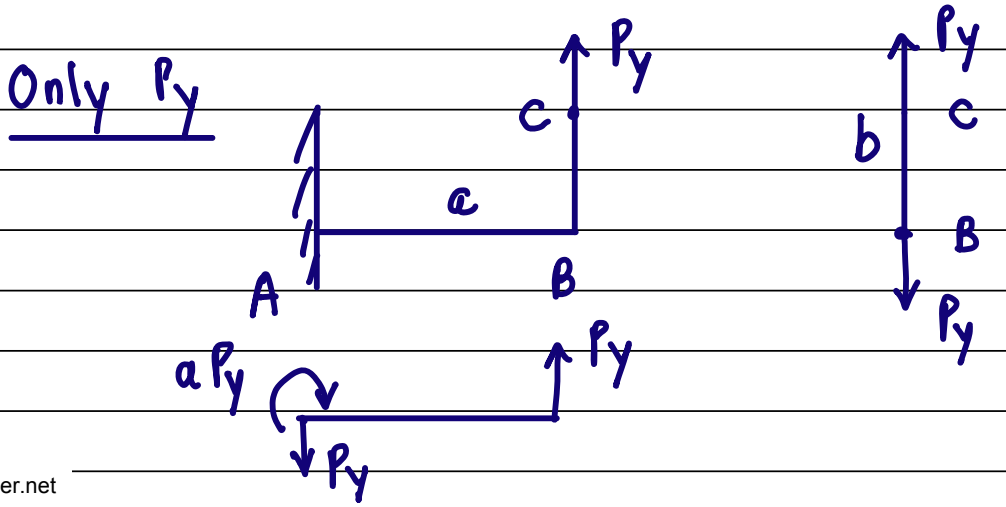


$$\frac{P_x b^3}{3EI} + \frac{P_x a}{AE} + \underbrace{\frac{b P_x a}{EI}}_{\theta_B} \cdot b$$

y-disp of C

$$= - \frac{b P_x a^2}{2EI}$$

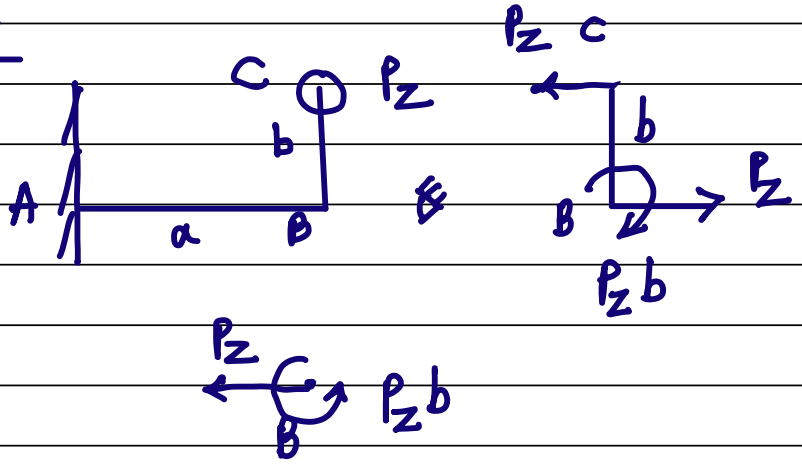
Only P_y



$$\text{x-disp of C} = -\frac{P_y a^2}{2EI} \cdot b$$

$$\text{y-disp of C} = \frac{P_y b}{AE} + \frac{P_y a^3}{3EI}$$

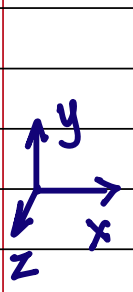
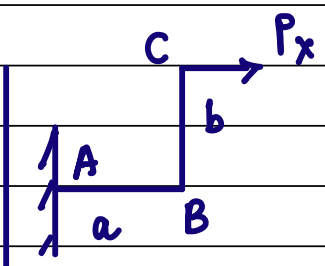
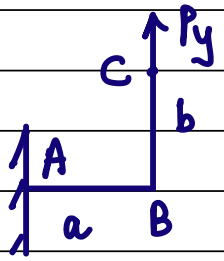
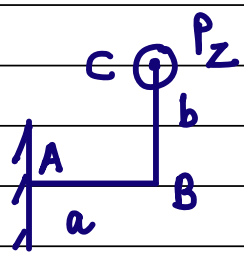
Only P_z



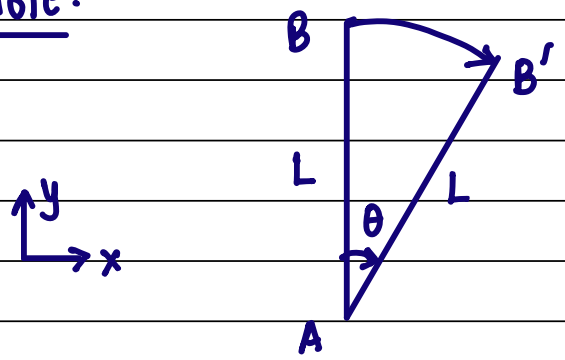
$$\text{z disp of C} = \frac{P_z a^3}{3EI} + \frac{(P_z b)a}{GJ} \cdot b + \frac{P_z b^3}{3EI}$$

x-disp of C = 0
y-disp of C = 0

Present results in tabular format in exams

				
x disp.		$\frac{P_x a}{AE} + \frac{P_x b^3}{3EI} + \frac{P_x b^2 a}{EI}$	$-\frac{P_y a^2 b}{2EI}$	0
y disp.		$-\frac{P_x b a^2}{2EI}$	$\frac{P_y b}{AE} + \frac{P_y a^3}{3EI}$	0
z disp.		0	0	$\frac{P_z b^3}{3EI} + \frac{P_z a^3}{3EI} + P_z b^2 a / GJ$

Note:



Say AB rotated cw @ A to AB'

For small angles, $\sin\theta \approx \theta$, $\cos\theta \approx 1$

x-disp of B = $L\sin\theta \approx L\theta$

y-disp of B = $L - L\cos\theta \approx 0$

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR

DNYANESH PAWASKAR