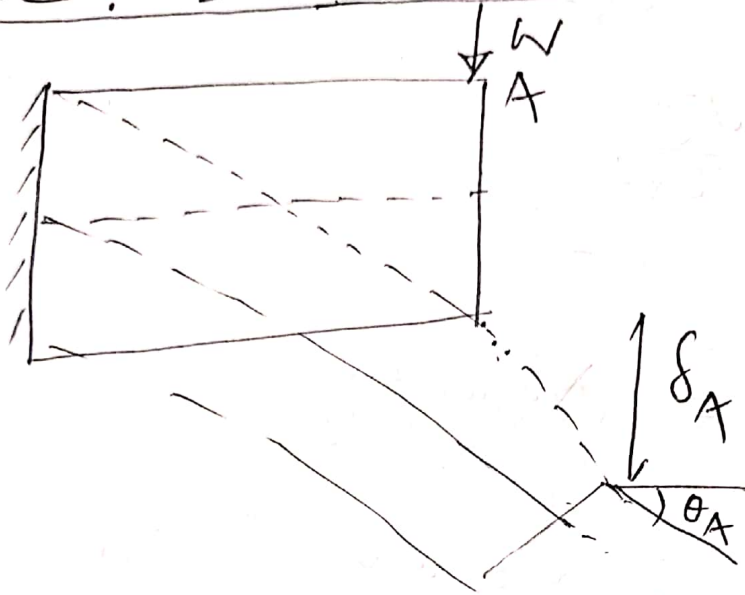


Subject: Introduction to Solid Mechanics

Topic: Deflection of Beam

Instructor: Prof. RASHID MUSTAFA

Lecture: 01



$\delta_A \rightarrow$  Deflection at Point A due to the point load W

$\theta_A \rightarrow$  Slope at A due to the point load W

A/c to Elastic curve (Differential Equation)

$$\frac{1}{R} = \frac{\frac{d^2y}{dx^2}}{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}$$

$$\text{If } \theta = \frac{dy}{dx} = 0$$

$$\frac{1}{R} = \frac{d^2y}{dx^2}$$

A/c to Bending Equation

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

$$\frac{1}{R} = \frac{M}{EI}$$

$$\frac{1}{R} = \frac{d^2y}{dx^2} = \frac{M}{EI}$$

$$EI \frac{d^2y}{dx^2} = M$$

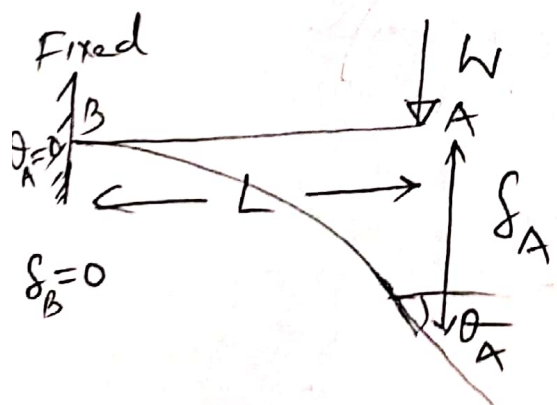
M → Moment

$$EI \frac{d^2y}{dx^2} = \text{Moment}$$

$$EI \frac{d^3y}{dx^3} = V = \frac{dM}{dx} = \text{Shear force}$$

$$EI \frac{d^4y}{dx^4} = L = -\frac{dV}{dx} = \text{load intensity}$$

⇒ Some Important formula



Slope (θ) at A

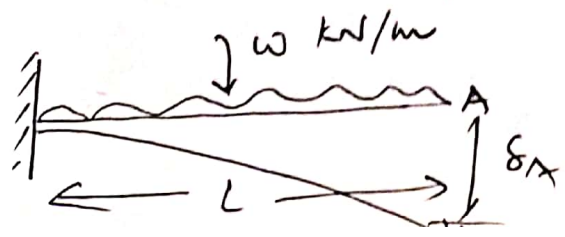
Deflection (δ) at A

$$\frac{WL^2}{2EI}$$

$$\frac{WL^3}{3EI}$$

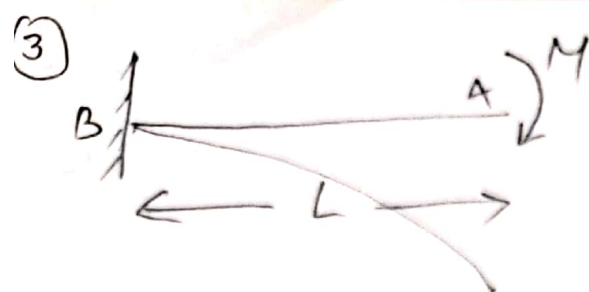
Max<sup>m</sup> slope

Max<sup>m</sup> deflection



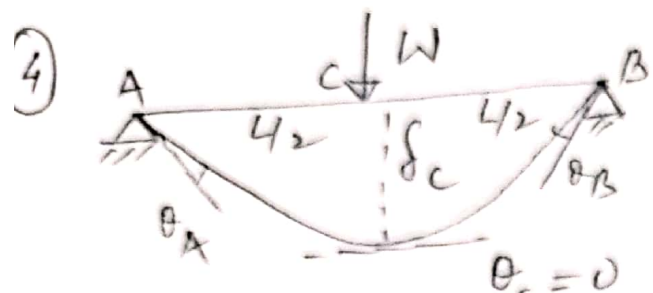
$$\frac{wL^3}{6EI}$$

$$\frac{wL^4}{8EI}$$



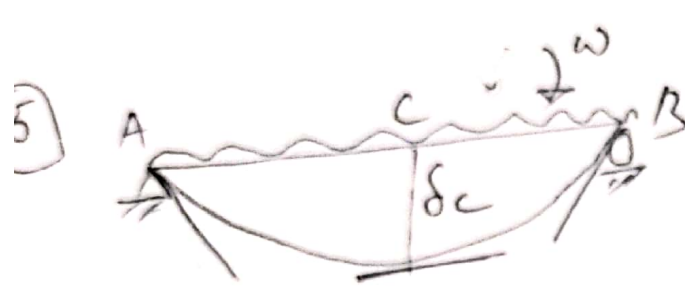
$$\theta_A = \frac{ML}{EI}$$

3)  $\delta_A = \frac{ML^2}{2EI}$



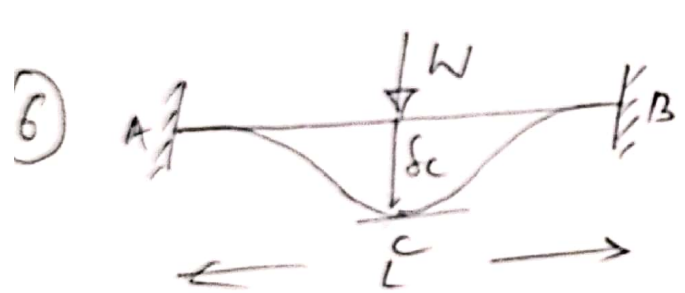
$$\theta_A = \theta_B = \frac{WL^2}{16EI}$$

$$\delta_c = \delta_{max} = \frac{WL^3}{48EI}$$



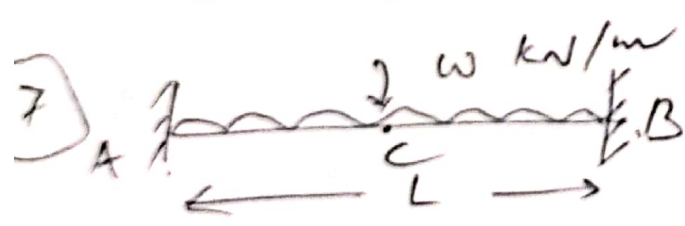
$$\theta_A = \theta_B = \frac{wL^3}{24EI}$$

$$\delta_c = \delta_{max} = \frac{5}{384} \frac{wL^4}{EI}$$



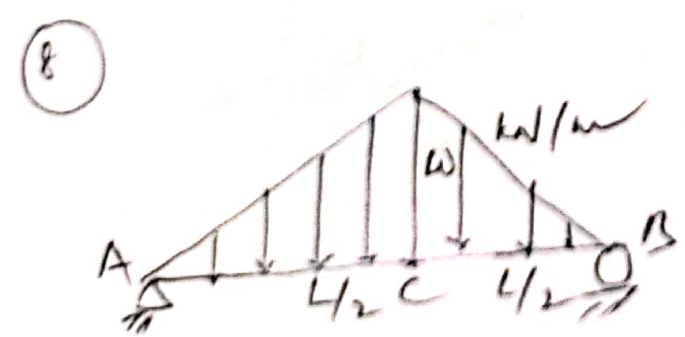
$$\theta_A = \theta_B = \theta_c = 0$$

$$\delta_c = \delta_{max} = \frac{1}{4} \left( \frac{WL^3}{48EI} \right)$$



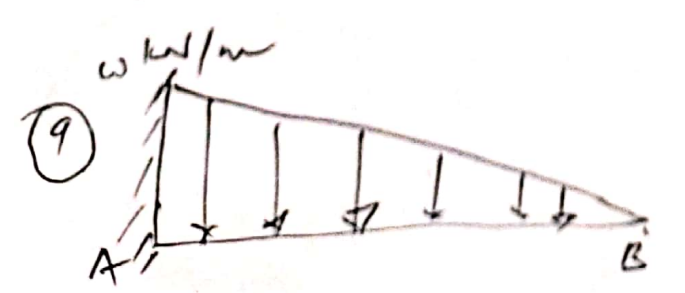
$$\theta_A = \theta_B = \theta_c = 0$$

$$\delta_c = \delta_{max} = \frac{1}{5} \left( \frac{5}{384} \frac{wL^4}{EI} \right)$$



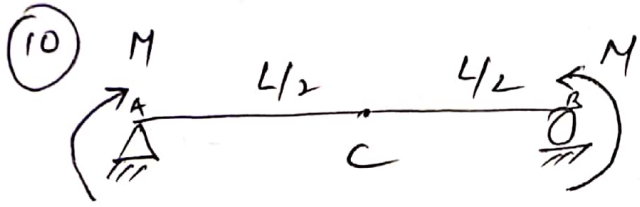
$$\theta_A = \theta_B = \frac{5}{192} \frac{wL^3}{EI}$$

$$\delta_c = \frac{wL^4}{120EI}$$



$$\theta_B = \theta_{max} = \frac{wL^3}{24EI}$$

$$\delta_B = \delta_{max} = \frac{wL^4}{30EI}$$



$$\theta_A = \theta_B = \frac{ML}{2EI}$$

(4)

$$\delta_C = \delta_{max} = \frac{ML^2}{8EI}$$

Happy Learning