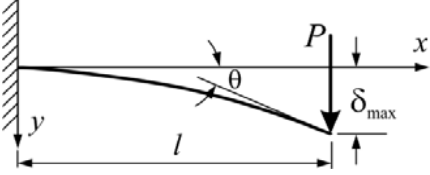
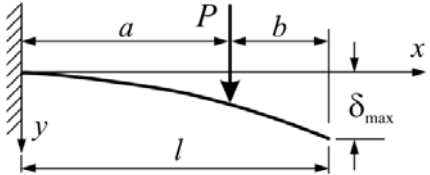
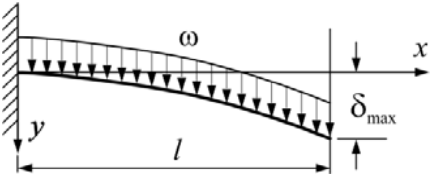
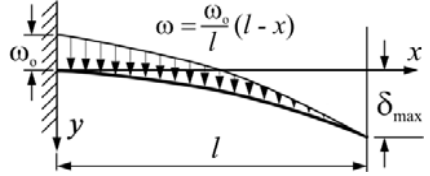
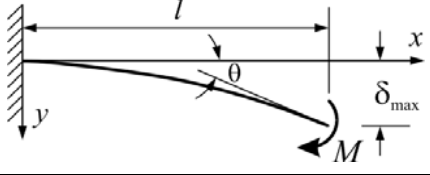
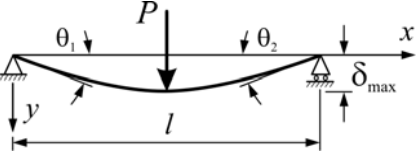
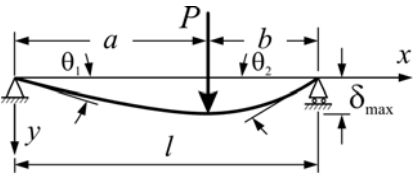
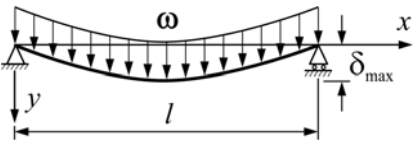
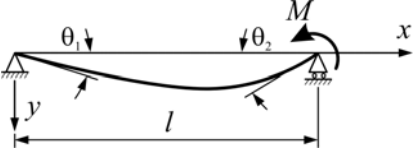
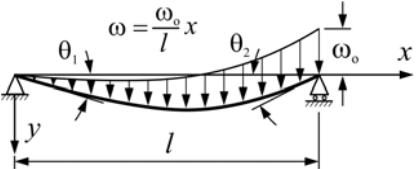


BEAM DEFLECTION FORMULAE

BEAM TYPE	SLOPE AT FREE END	DEFLECTION AT ANY SECTION IN TERMS OF x	MAXIMUM DEFLECTION
1. Cantilever Beam – Concentrated load P at the free end			
	$\theta = \frac{Pl^2}{2EI}$	$y = \frac{Px^2}{6EI}(3l - x)$	$\delta_{\max} = \frac{Pl^3}{3EI}$
2. Cantilever Beam – Concentrated load P at any point			
	$\theta = \frac{Pa^2}{2EI}$	$y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$	$\delta_{\max} = \frac{Pa^2}{6EI}(3l - a)$
3. Cantilever Beam – Uniformly distributed load ω (N/m)			
	$\theta = \frac{\omega l^3}{6EI}$	$y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$	$\delta_{\max} = \frac{\omega l^4}{8EI}$
4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m)			
	$\theta = \frac{\omega_o l^3}{24EI}$	$y = \frac{\omega_o x^2}{120EI}(10l^3 - 10l^2x + 5lx^2 - x^3)$	$\delta_{\max} = \frac{\omega_o l^4}{30EI}$
5. Cantilever Beam – Couple moment M at the free end			
	$\theta = \frac{Ml}{EI}$	$y = \frac{Mx^2}{2EI}$	$\delta_{\max} = \frac{Ml^2}{2EI}$

BEAM DEFLECTION FORMULAS

BEAM TYPE	SLOPE AT ENDS	DEFLECTION AT ANY SECTION IN TERMS OF x	MAXIMUM AND CENTER DEFLECTION
6. Beam Simply Supported at Ends – Concentrated load P at the center			
	$\theta_1 = \theta_2 = \frac{Pl^2}{16EI}$	$y = \frac{Px}{12EI} \left(\frac{3l^2}{4} - x^2 \right) \text{ for } 0 < x < \frac{l}{2}$	$\delta_{\max} = \frac{Pl^3}{48EI}$
7. Beam Simply Supported at Ends – Concentrated load P at any point			
	$\theta_1 = \frac{Pb(l^2 - b^2)}{6EI}$ $\theta_2 = \frac{Pab(2l - b)}{6EI}$	$y = \frac{Pbx}{6EI} (l^2 - x^2 - b^2) \text{ for } 0 < x < a$ $y = \frac{Pb}{6EI} \left[\frac{l}{b} (x - a)^3 + (l^2 - b^2)x - x^3 \right] \text{ for } a < x < l$	$\delta_{\max} = \frac{Pb(l^2 - b^2)^{3/2}}{9\sqrt{3}EI} \text{ at } x = \sqrt{(l^2 - b^2)}/3$ $\delta = \frac{Pb}{48EI} (3l^2 - 4b^2) \text{ at the center, if } a > b$
8. Beam Simply Supported at Ends – Uniformly distributed load ω (N/m)			
	$\theta_1 = \theta_2 = \frac{\omega l^3}{24EI}$	$y = \frac{\omega x}{24EI} (l^3 - 2lx^2 + x^3)$	$\delta_{\max} = \frac{5\omega l^4}{384EI}$
9. Beam Simply Supported at Ends – Couple moment M at the right end			
	$\theta_1 = \frac{Ml}{6EI}$ $\theta_2 = \frac{Ml}{3EI}$	$y = \frac{Mlx}{6EI} \left(1 - \frac{x^2}{l^2} \right)$	$\delta_{\max} = \frac{Ml^2}{9\sqrt{3}EI} \text{ at } x = \frac{l}{\sqrt{3}}$ $\delta = \frac{Ml^2}{16EI} \text{ at the center}$
10. Beam Simply Supported at Ends – Uniformly varying load: Maximum intensity ω_o (N/m)			
	$\theta_1 = \frac{7\omega_o l^3}{360EI}$ $\theta_2 = \frac{\omega_o l^3}{45EI}$	$y = \frac{\omega_o x}{360EI} (7l^4 - 10l^2x^2 + 3x^4)$	$\delta_{\max} = 0.00652 \frac{\omega_o l^4}{EI} \text{ at } x = 0.519l$ $\delta = 0.00651 \frac{\omega_o l^4}{EI} \text{ at the center}$