BEAM DEFLECTION FORMULAE

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Cantilever Beam — Concentrated load P at the free end 1. Cantilever Beam — Concentrated load P at the free end 2. Cantilever Beam — Concentrated load P at any point 2. Cantilever Beam — Concentrated load P at any point 3. Cantilever Beam — Uniformly distributed load o (N/m) 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_a (N/m) 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_a (N/m) 5. Cantilever Beam — Couple moment M at the free end 5. Cantilever Beam — Couple moment M at the free end	BEAM TYPE I. Cantilever Beam — Concentrated load P at the free end 1. Cantilever Beam — Concentrated load P at the free end 2. Cantilever Beam — Concentrated load P at the free end 2. Cantilever Beam — Concentrated load P at any point 3. Cantilever Beam — Uniformly distributed load P at any point 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_a (N/m) 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_a (N/m) 5. Cantilever Beam — Uniformly varying load: Maximum intensity ω_a (N/m) 5. Cantilever Beam — Couple moment M at the free end 5. Cantilever Beam — Couple moment M at the free end	BEAM TYPE I. Cantilever Beam — Concentrated load P at the free end 1. Cantilever Beam — Concentrated load P at the free end 2. Cantilever Beam — Concentrated load P at the free end 2. Cantilever Beam — Concentrated load P at any point 3. Cantilever Beam — Uniformly distributed load P at any point 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_b (N/m) 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_b (N/m) $\theta = \frac{\omega_b l^2}{24EI}$ $y = \frac{\rho x^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\rho x^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\rho x^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{\omega x^2}{24EI}(10l^3 - 10l^2 x + 5lx^2 - x^3)$
BEAM TYPE SLOPE AT FREE END DEFLECTION AT ANY SECTION IN TERMS OF x 1. Cantilever Beam — Concentrated load P at the free end $y = \frac{Px^2}{6EI}(3I - x)$ 2. 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Cantilever Beam — Uniformly varying load: Maximum intensity o_o (N/m) $0 = \frac{o_o}{I}(I - x)$ $y = \frac{o_o x^2}{24EI}$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$ $y = \frac{o_o x^2}{24EI}(3x - a) \text{ for } a < x < I$	BEAM TYPE SLOPE AT FREE END DEFLECTION AT ANY SECTION IN TERMS OF x 1. Cantilever Beam — Concentrated load P at the free end $ y = \frac{Px^2}{6EI}(3t - x) $ 2. Cantilever Beam — Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3a - x) \text{ for } a < x < I $ 3. Cantilever Beam — Uniformly distributed load a (N/m) $ y = \frac{Gx^2}{6EI}(3x - a) \text{ for } a < x < I $ 4. Cantilever Beam — Uniformly varying load: Maximum intensity a a b a a a b a	BEAM TYPE SLOPE AT FREE END DEFLECTION AT ANY SECTION IN TERMS OF x 1. Cantilever Beam — Concentrated load P at the free end $ y = \frac{Px^2}{6EI}(3t - x) $ $ y = \frac{Px^2}{6EI}(3t - x) $ 3. Cantilever Beam — Uniformly distributed load o (N/m) 4. Cantilever Beam — Uniformly varying load: Maximum intensity o ₀ , (N/m) 5. Cantilever Beam — Couple moment M at the free end 5. Cantilever Beam — Couple moment M at the free end	BEAM TYPE SLOPE AT FREE END DEFLECTION AT ANY SECTION IN TERMS OF x 1. 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Cantilever Beam — Concentrated load P at any point $y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } a < x < l$ $y = \frac{Px^2}{24EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{Px^2}{24EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{Px^2}{24EI}(x^2 + 6l^2 - 4lx)$
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Cantilever Beam — Uniformly varying load: Maximum intensity ω_{α} (N/m) $\omega = \frac{\omega_{\alpha} l(l-x)}{l}$ $\omega = \frac{\omega_{\alpha} l^{2}}{l}$ $\omega = \frac{\omega_{\alpha} l}{l}$ $\omega = \frac{\omega_{\alpha} l}{$	1. Cantilever Beam — Concentrated load P at the free end $y = \frac{Px^2}{6EI}(3l - x)$ 2. Cantilever Beam — Concentrated load P at any point $y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ 3. Cantilever Beam — Uniformly distributed load ω (N/m) $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_a (N/m) $y = \frac{\omega_a x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{\omega_a x^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3)$
$\theta = \frac{Pl^2}{2EI}$ $\frac{\partial}{\partial x} = \frac{P}{\partial EI} (3l - x)$ $\frac{\partial}{\partial EI} = \frac{\partial}{\partial EI} (3l - x$	2. Cantilever Beam — Concentrated load P at any point $y = \frac{Px^2}{6EI}(3I - x)$ $\theta = \frac{Pa^2}{2EI}$ $y = \frac{Px^2}{6EI}(3I - x)$ $y = \frac{Px^2}{6EI}(3I - x)$ $y = \frac{Px^2}{6EI}(3I - x)$ for $0 < x < a$ $y = \frac{Pa^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < l$ $y = \frac{Px^2}{6EI}(3x - a)$ for $a < x < $	2. Cantilever Beam — Concentrated load P at any point $y = \frac{Px^2}{6EI}(3I-x)$ $y = \frac{Px^2}{6$	2. Cantilever Beam — Concentrated load P at any point $y = \frac{Px^2}{6EI}(3I - x)$ $y = \frac{Px^2}{6EI}(3I - x)$ 3. Cantilever Beam — Uniformly distributed load ω (N/m) $y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $y = \frac{Px^2}{6EI}(3x - a) \text{ for } a < x < I$ $y = \frac{Px^2}{6EI}(3x - a) \text{ for } a < x < I$ $y = \frac{Px^2}{6EI}(3x - a) \text{ for } a < x < I$ $y = \frac{Gx^2}{6EI}(3x - a) \text{ for } a < x < I$ $y = \frac{Gx^2}{24EI}(x^2 + 6I^2 - 4Ix)$	2. Cantilever Beam — Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3I - x) $ 3. Cantilever Beam — Uniformly distributed load ω (N/m) 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_{α} (N/m) 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_{α} (N/m) $ \psi = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Px^2}{6EI}(3x - a) \text{ for } a < x < l $ $ y = \frac{Gx^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ y = \frac{Gx^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ y = \frac{Gx^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ y = \frac{Gx^2}{24EI}(x^2 + 6l^2 - 4lx) $	2. Cantilever Beam — Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3I - x) $ 2. Cantilever Beam — Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Px^2}{6EI}(3x - a) \text{ for } a < x < I $ 3. Cantilever Beam — Uniformly distributed load o (N/m) $ y = \frac{ox^2}{6EI}(3x - a) \text{ for } a < x < I $ 4. Cantilever Beam — Uniformly varying load: Maximum intensity o_o (N/m) $ y = \frac{ox^2}{24EI}(x^2 + 6I^2 - 4Ix) $ $ y = \frac{ox^2}{24EI}(x^2 + 6I^2 - 4Ix) $ $ y = \frac{ox^2}{24EI}(10I^3 - 10I^2x + 5Ix^2 - x^3) $ 5. Cantilever Beam — Courle moment M of the free and
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2. Cantilever Beam – Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3l - x) $ 2. Cantilever Beam – Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 3. Cantilever Beam – Uniformly distributed load a (N/m) $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity a (N/m) $ y = \frac{a - a^2}{6EI}(x^2 + 6l^2 - 4lx) $ $ y = \frac{a - a^2}{24EI}(x^2 + 6l^2 - 4lx) $ 5. Cantilever Beam – Couple moment M at the free end	2. 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$\theta = \frac{2EI}{2EI}$ $y = \frac{1}{6EI}(3l-x)$ 2. Cantilever Beam - Concentrated load P at any point $y = \frac{Px^2}{6EI}(3a-x) \text{ for } 0 < x < a$ $y = \frac{Pa^2}{6EI}(3x-a) \text{ for } 0 < x < a$ $y = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < l$ 3. Cantilever Beam - Uniformly distributed load ω (N/m) $\frac{\omega}{\delta} = \frac{\omega d^3}{6EI}$ $\psi = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\psi = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\psi = \frac{\omega x^2}{120lEI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam - Couple moment M at the free end	$\theta = \frac{2EI}{2EI}$ $y = \frac{1}{6EI}(3l-x)$ 2. Cantilever Beam - Concentrated load P at any point $\theta = \frac{Pa^2}{2EI}$ $y = \frac{Px^2}{6EI}(3x-x) \text{ for } 0 < x < a$ $y = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < l$ 3. Cantilever Beam - Uniformly distributed load ω (N/m) $\theta = \frac{\omega_0 l^3}{6EI}$ $y = \frac{\omega_0 x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{\omega_0 x^2}{120lEI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam - Couple moment M at the free end	2. Cantilever Beam — Concentrated load P at any point $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2. Cantilever Beam – Concentrated load P at any point $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2. Cantilever Beam – Concentrated load P at any point $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2. Cantilever Beam – Concentrated load P at any point $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
2. Cantilever Beam — Concentrated load P at any point $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2. Cantilever Beam – Concentrated load P at any point $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2. Cantilever Beam – Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < I $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < I $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_{ω} (N/m) $ \psi = \frac{\omega_0 x^2}{24EI}(x^2 + 6I^2 - 4Ix) $ 5. Cantilever Beam – Couple moment M at the free end $ \psi = \frac{\omega_0 x^2}{120IEI}(10I^3 - 10I^2x + 5Ix^2 - x^3) $	2. Cantilever Beam – Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $ \omega = \frac{\omega_0 l^3}{l^2(l - x)} \qquad \omega = \frac{\omega_0 l^3}{24EI} \qquad \omega = \frac{\omega_0 x^2}{24EI} (10l^3 - 10l^2x + 5lx^2 - x^3) $ 5. Cantilever Beam — Couple moment M at the free end	2. Cantilever Beam — Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < I $ 3. Cantilever Beam — Uniformly distributed load ω (N/m) $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < I $ 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_0 (N/m) $ y = \frac{\omega x^2}{24EI}(x^2 + 6I^2 - 4Ix) $ $ y = \frac{\omega_0 x^2}{24EI}(10I^3 - 10I^2x + 5Ix^2 - x^3) $ $ y = \frac{\omega_0 x^2}{120IEI}(10I^3 - 10I^2x + 5Ix^2 - x^3) $	2. Cantilever Beam - Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 3. Cantilever Beam - Uniformly distributed load $o(N/m)$ $ y = \frac{Oo^3}{6EI}(3x - a) \text{ for } a < x < l $ 4. Cantilever Beam - Uniformly varying load: Maximum intensity $o_o(N/m)$ $ y = \frac{oox^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ y = \frac{oox^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3) $ $ y = \frac{oox^2}{120lEI}(10l^3 - 10l^2x + 5lx^2 - x^3) $
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2. Cantilever Beam — Concentrated load P at any point	2. Cantilever Beam – Concentrated load P at any point	2. Cantilever Beam – Concentrated load P at any point $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2. Cantilever Beam – Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $ \omega = \frac{\omega_o}{l}(l - x) $ $ \psi = \frac{\omega_o l^3}{4EI} $ $ \psi = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2x + 5k^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	2. Cantilever Beam — Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 3. Cantilever Beam — Uniformly distributed load ω (N/m) $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_o (N/m) $ \omega = \frac{\omega_o x^2}{I}(I - x) + x $ $ \omega = \frac{\omega_o l^3}{I} + x $ $ \theta = \frac{\omega_o l^3}{24EI} + y = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3) $ 5. Cantilever Beam — Counle moment M at the free and	2. Cantilever Beam – Concentrated load P at any point $ y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a $ $ y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $ \psi = \frac{\omega_o x^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ \psi = \frac{\omega_o x^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ \psi = \frac{\omega_o x^2}{120IEI}(10l^3 - 10l^2 x + 5k^2 - x^3) $ $ \psi = \frac{\omega_o x^2}{120IEI}(10l^3 - 10l^2 x + 5k^2 - x^3) $
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Cantilever Beam — Concentrated load P at any point $y = \frac{Px^2}{6EI}(3a - x) \text{ for } 0 < x < a$ $\theta = \frac{Pa^2}{2EI}$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3$
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a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$
$\theta = \frac{Pa^2}{2EI}$ $\theta = \frac{Pa^2}{2EI}$ $\theta = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{24EI}(1x - a)$	3. Cantilever Beam — Uniformly distributed load ω (N/m) $ \theta = \frac{Pa^2}{2EI} \qquad y = \frac{Pa^2}{6EI} (3x - a) \text{ for } a < x < l \\ y = \frac{Pa^2}{6EI} (3x - a) \text{ for } a < x < l \\ y = \frac{Pa^2}{6EI} (3x - a) \text{ for } a < x < l \\ y = \frac{Constilever}{6EI} \qquad y = \frac{Constilever}{24EI} (x^2 + 6l^2 - 4lx) $ 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_o (N/m) $ \theta = \frac{\omega_o l^3}{24EI} \qquad y = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3) $ 5. Cantilever Beam — Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \theta = \frac{Pa^2}{2EI} \qquad y = \frac{Pa^2}{6EI} (3x - a) \text{ for } a < x < l $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ y = \frac{Ga}{6EI} (3x - a) \text{ for } a < x < l $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $ \phi = \frac{\omega_o x^2}{24EI} (10l^3 - 10l^2 x + 5lx^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < d \\ y = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < d \\ y = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < d \\ y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $ \psi = \frac{\omega_0 x^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < a < a < a < a < a < a < a < a <$	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < a < a < a < a < a < a < a < a <$
3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{Pa^2}{2EI}$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{6EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\omega = \frac{\omega_0}{l}(l - x)$ $\psi = \frac{\omega_0 x^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 l^3}{24EI} \qquad y = \frac{\omega_0 x^2}{120lEI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\frac{\partial}{\partial x} = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\frac{\partial}{\partial x} = \frac{\omega x^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \theta = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ y = \frac{\omega x^2}{6EI}(x^2 + 6l^2 - 4lx) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $ \phi = \frac{\omega_0}{l}(l - x) $ $ \theta = \frac{\omega_0 l^3}{24EI} $ $ \theta = \frac{\omega_0 l^3}{24EI} $ $ \theta = \frac{\omega_0 l^3}{24EI} $ $ y = \frac{\omega_0 x^2}{120IEI}(10l^3 - 10l^2x + 5lx^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{Pa^2}{2EI}$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\theta = \frac{\omega_l^3}{6EI}$ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\psi = \frac{\omega_v^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\psi = \frac{\omega_v^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ $\psi = \frac{\omega_v x^2}{120lEI}(10l^3 - 10l^2x + 5lx^2 - x^3)$	3. Cantilever Beam – Uniformly distributed load ω (N/m) 3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{Pa^2}{2EI}$ $y = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < I$ $y = \frac{\omega x^2}{24EI}(x^2 + 6I^2 - 4Ix)$ $0 = \frac{\omega}{I}(I-x)$
3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{DI}{2EI}$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{Oux^2}{6EI}(x^2 + 6l^2 - 4lx)$ $\theta = \frac{\omega_0 l^3}{6EI}$ $\phi = \frac{\omega_0 e^2}{l}(l - x)$ $\theta = \frac{\omega_0 l^3}{24EI}$ $\theta = \frac{\omega_0 v^2}{120IEI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < l $ $ \psi = \frac{Cax^2}{24EI}(x^2 + 6l^2 - 4lx) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $ \psi = \frac{\omega_o x^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ \psi = \frac{\omega_o x^2}{120IEI}(10l^3 - 10l^2x + 5lx^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{\Delta EI}{2EI}$ $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{6EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\phi = \frac{\omega_0}{l}(l - x)$ $\psi = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\phi = \frac{\omega_0}{l}(l - x)$ $\phi = \frac{\omega_0 l^3}{24EI}$ $\theta = \frac{\omega_0 l^3}{24EI}$ $\theta = \frac{\omega_0 l^3}{24EI} $	3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{\alpha I^{3}}{2EI}$ $\psi = \frac{Pa^{2}}{6EI}(3x-a) \text{ for } a < x < l$ $\psi = \frac{\omega X^{2}}{6EI}(x^{2}+6l^{2}-4lx)$ $\psi = \frac{\omega X^{2}}{24EI}(x^{2}+6l^{2}-4lx)$	3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{\omega I^3}{2EI}$ $\theta = \frac{\omega I^3}{6EI}(3x-a) \text{ for } a < x < I$ $\psi = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < I$ $\psi = \frac{\omega x^2}{24EI}(x^2 + 6I^2 - 4Ix)$ $\psi = \frac{\omega x^2}{24EI}(x^2 + 6I^2 - 4Ix)$ $\psi = \frac{\omega x^2}{24EI}(10I^3 - 10I^2x + 5Ix^2 - x^3)$ $\psi = \frac{\omega_0 I^3}{24EI}$ $\psi = \frac{\omega_0 I^3}{120IEI}(10I^3 - 10I^2x + 5Ix^2 - x^3)$	3. Cantilever Beam – Uniformly distributed load ω (N/m) $\theta = \frac{\omega I^3}{2EI}$ $\theta = \frac{\omega I^3}{6EI}(3x - a) \text{ for } a < x < I$ $\psi = \frac{\omega x^2}{6EI}(x^2 + 6I^2 - 4Ix)$ $\phi = \frac{\omega_0 I^3}{I}(I - x)$ $\psi = \frac{\omega_0 I^3}{24EI}$ $\psi = \frac{\omega_0 x^2}{120IEI}(10I^3 - 10I^2x + 5Ix^2 - x^3)$
3. Cantilever Beam — Uniformly distributed load ω (N/m) $\theta = \frac{\omega t^3}{6EI}$ $\psi = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < l$ $\psi = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$	3. Cantilever Beam — Uniformly distributed load ω (N/m) $\theta = \frac{\omega I^3}{6EI} \qquad y = \frac{Pa^2}{6EI} (3x-a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{6EI} (x^2 + 6l^2 - 4lx)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6l^2 - 4lx)$ 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o I^3}{24EI} \qquad y = \frac{\omega_o x^2}{120IEI} (10I^3 - 10I^2x + 5lx^2 - x^3)$ 5. Cantilever Beam — Couple moment M at the free end	3. Cantilever Beam — Uniformly distributed load ω (N/m) $\theta = \frac{\omega I^3}{6EI} \qquad y = \frac{Pa^2}{6EI} (3x-a) \text{ for } a < x < I$ $y = \frac{Pa^2}{6EI} (3x-a) \text{ for } a < x < I$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$ $y = \frac{\omega x^2}{24EI} (x^2 + 6I^2 - 4Ix)$	3. Cantilever Beam — Uniformly distributed load ω (N/m) $\theta = \frac{\omega I^3}{6EI}$ $\theta = \frac{\omega I^3}{6EI}$ $\theta = \frac{\omega I^3}{24EI}$	3. Cantilever Beam — Uniformly distributed load ω (N/m) $y = \frac{Pa^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{6EI}(3x - a) \text{ for } a < x < l$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $y = \frac{\omega x^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3)$ $y = \frac{\omega_0 x^2}{120lEI}(10l^3 - 10l^2x + 5lx^2 - x^3)$	3. Cantilever Beam — Uniformly distributed load ω (N/m) $y = \frac{Pa^2}{6EI}(3x-a) \text{ for } a < x < l$ $\theta = \frac{\omega l^3}{6EI}$ $y = \frac{\omega x^2}{24EI}(x^2 + 6l^2 - 4lx)$ $\theta = \frac{\omega_0}{24EI}(l-x)$ $\theta = \frac{\omega_0 l^3}{24EI}$ $\theta = \frac{\omega_0 l^3}{24EI}$ $\theta = \frac{\omega_0 l^3}{24EI}$ $\theta = \frac{\omega_0 x^2}{24EI}(10l^3 - 10l^2x + 5lx^2 - x^3)$
3. Cantilever Beam – Uniformly distributed load ω (N/m) $y = \frac{Pa^{-}}{6EI}(3x-a) \text{ for } a < x < I$ $y = \frac{\omega x^{2}}{6EI}(3x-a) \text{ for } a < x < I$ $y = \frac{\omega x^{2}}{6EI}(x^{2}+6I^{2}-4Ix)$ $y = \frac{\omega x^{2}}{24EI}(x^{2}+6I^{2}-4Ix)$ $y = \frac{\omega x^{2}}{24EI}(x^{2}+6I^{2}-4Ix)$ $y = \frac{\omega x^{2}}{24EI}(x^{2}+6I^{2}-4Ix)$ $y = \frac{\omega x^{2}}{24EI}(x^{2}+6I^{2}-4Ix)$ $y = \frac{\omega x^{2}}{24EI}(10I^{3}-10I^{2}x+5Ix^{2}-x^{3})$ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam — Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^{-}}{6EI}(3x-a) \text{ for } a < x < I $ 3. Cantilever Beam — Uniformly distributed load ω (N/m) $ \psi = \frac{\omega x^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ 4. Cantilever Beam — Uniformly varying load: Maximum intensity ω_{o} (N/m) $ \psi = \frac{\omega_{o}x^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ $ \psi = \frac{\omega_{o}x^{2}}{24EI}(10I^{3} - 10I^{2}x + 5Ix^{2} - x^{3}) $ 5. Cantilever Beam — Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \theta = \frac{\omega I^3}{6EI} $ $ \theta = \frac{\omega I^3}{24EI} $ $ \theta = \frac{\omega I^3}{24EI} $ $ \phi = \frac{\omega X^2}{24EI} $ $ \phi = \frac{\omega X^2}$	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^{T}}{6EI}(3x - a) \text{ for } a < x < I $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{\omega x^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω _o (N/m) $ \psi = \frac{\omega x^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ $ \psi = \omega x^{2$	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^{2}}{6EI}(3x-a) \text{ for } a < x < I $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{\omega x^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_{o} (N/m) $ \psi = \frac{\omega x^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ $ \psi = \frac{\omega_{o}^{2}}{24EI}(1-x) $ $ \psi = \frac{\omega_{o}^{2}}{24EI}(1-x) $ $ \psi = \frac{\omega_{o}^{2}}{24EI}(10I^{3} - 10I^{2}x + 5Ix^{2} - x^{3}) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{Pa^{2}}{6EI}(3x-a) \text{ for } a < x < I $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{\omega x^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_{o} (N/m) $ \psi = \frac{\omega_{o}^{2}}{24EI}(x^{2} + 6I^{2} - 4Ix) $ $ \psi = \frac{\omega_{o}^{2}}{24EI}(1-x) $ $ \psi = \frac{\omega_{o}x^{2}}{24EI}(10I^{3} - 10I^{2}x + 5Ix^{2} - x^{3}) $ $ \psi = \frac{\omega_{o}x^{2}}{120IEI}(10I^{3} - 10I^{2}x + 5Ix^{2} - x^{3}) $
3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{(N/m)}{6EI} \text{(N/m)} $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $ \omega = \frac{\omega_0}{I}(I - x) \text{(N/m)} $ $ \omega = \frac{\omega_0}{I}(I - x) \text{(N/m)} $ $ \theta = \frac{\omega_0 I^3}{24EI} \text{(10I}^3 - 10I^2x + 5Ix^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{1}{6EI}(3x - a) \text{ for } a < x < t $ $ \theta = \frac{\omega l^3}{6EI} $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $ \omega = \frac{\omega_o}{l}(l - x) $ $ \psi = \frac{\omega_o x^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ \psi = \frac{\omega_o x^2}{24EI}(x^2 + 6l^2 - 4lx) $ $ \psi = \frac{\omega_o x^2}{24EI}(10l^3 - 10l^2 x + 5lx^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{1}{6EI}(3x - a) \text{ for } a < x < t $ $ \psi = \frac{\omega x^{2}}{24EI}(x^{2} + 6t^{2} - 4tx) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_{o} (N/m) $ \psi = \frac{\omega_{o}x^{2}}{24EI}(x^{2} + 6t^{2} - 4tx) $ $ \psi = \frac{\omega_{o}x^{2}}{24EI}(10t^{3} - 10t^{2}x + 5tx^{2} - x^{3}) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{(3x - a) \text{ for } a < x < t}{6EI} $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ y = \frac{\omega x^2}{24EI} (x^2 + 6t^2 - 4tx) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $ \psi = \frac{\omega_o x^2}{24EI} (x^2 + 6t^2 - 4tx) $ $ \psi = \frac{\omega_o x^2}{24EI} (10t^3 - 10t^2 x + 5tx^2 - x^3) $ 5. Cantilever Beam – Couple moment M at the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{(3x - a) \text{ for } a < x < t}{6EI} $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $ \psi = \frac{\omega x^2}{24EI} (x^2 + 6t^2 - 4tx) $ $ \psi = \frac{\omega_o x^2}{24EI} (x^2 + 6t^2 - 4tx) $ $ \psi = \frac{\omega_o x^2}{24EI} (10t^3 - 10t^2 x + 5tx^2 - x^3) $ 5. Cantilever Beam – Couple moment Mat the free end	3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{(3x - a) \text{ for } a < x < t}{6EI} $ 3. Cantilever Beam – Uniformly distributed load ω (N/m) $ \psi = \frac{\omega x^2}{24EI} (x^2 + 6t^2 - 4tx) $ 4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $ \psi = \frac{\omega_0 x^2}{24EI} (10t^3 - 10t^2 x + 5tx^2 - x^3) $ $ \psi = \frac{\omega_0 x^2}{120tEI} (10t^3 - 10t^2 x + 5tx^2 - x^3) $
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4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\theta = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\theta = \frac{\omega_o l^3}{24EI}$ $\theta = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\theta = \frac{\omega_o l^3}{24EI}$ $y = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3)$ 5. Cantilever Beam – Couple moment M at the free end	4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o I^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120IEI} (10I^3 - 10I^2x + 5Ix^2 - x^3)$ S. Cantilever Beam – Couple moment Mat the free and	4. Cantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o I^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120IEI} \left(10I^3 - 10I^2x + 5Ix^2 - x^3\right)$
Santilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 l^3}{24EI}$ $\psi = \frac{\omega_0 x^2}{120lEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Santilever Beam – Couple moment M at the free end	Antilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 I^3}{24EI}$ $\psi = \frac{\omega_0 x^2}{120IEI} \left(10I^3 - 10I^2 x + 5Ix^2 - x^3\right)$ Antilever Beam – Couple moment M at the free end	Antilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120lEI} \left(10l^3 - 10l^2 x + 5lx^2 - x^3\right)$ Antilever Beam – Couple moment M at the free end	Figure 3. Santilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\theta = \frac{\omega_o l^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120lEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Figure 3. Santilever Beam – Couple moment M at the free end	2antilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ antilever Ream – Couple moment M at the free end	2antilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ 2antilever Ream – Couple moment M at the free end
Antilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o I^3}{24EI}$ $y = \frac{\omega_o x^2}{120IEI} (10I^3 - 10I^2 x + 5Ix^2 - x^3)$ Antilever Beam – Couple moment M at the free end	Santilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $y = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Santilever Beam – Couple moment M at the free end	Pantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 l^3}{24EI}$ $\psi = \frac{\omega_0 x^2}{120lEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Pantilever Beam – Couple moment M at the free end	Fantilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 l^3}{24EI}$ $\psi = \frac{\omega_0 x^2}{120lEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Fantilever Beam – Couple moment M at the free end	Santilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 l^3}{24EI}$ $y = \frac{\omega_0 x^2}{120/EI} \left(10l^3 - 10l^2 x + 5lx^2 - x^3\right)$ Santilever Ream – Couple moment M at the free end	Santilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 I^3}{24EI}$ $y = \frac{\omega_0 x^2}{120/EI} \left(10I^3 - 10I^2 x + 5Ix^2 - x^3\right)$ Solution of the free and
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Pantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120lEI} \left(10l^3 - 10l^2 x + 5lx^2 - x^3 \right)$ Fantilever Beam – Couple moment M at the free end	Santilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $y = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Santilever Beam – Couple moment M at the free end	Pantilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o l^3}{24EI}$ $y = \frac{\omega_o x^2}{120/EI} \left(10l^3 - 10l^2 x + 5lx^2 - x^3\right)$ Pantilever Beam – Couple moment M at the free end	Antilever Beam – Uniformly varying load: Maximum intensity ω_0 (N/m) $\theta = \frac{\omega_0 l^3}{24EI}$ $y = \frac{\omega_0 x^2}{120lEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Antilever Beam – Couple moment M at the free end	Antilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o I^3}{24EI}$ $y = \frac{\omega_o x^2}{120/EI} \left(10I^3 - 10I^2 x + 5Ix^2 - x^3\right)$ Antilever Ream – Couple moment M at the free end	Antilever Beam – Uniformly varying load: Maximum intensity ω_o (N/m) $\theta = \frac{\omega_o I^3}{24EI}$ $y = \frac{\omega_o x^2}{120IEI} \left(10I^3 - 10I^2 x + 5Ix^2 - x^3\right)$ Antilever Ream – Couple moment M at the free end
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$\theta = \frac{\omega_0 I^3}{24EI}$ $y = \frac{\omega_0 x^2}{120IEI} \left(10I^3 - 10I^2 x + 5Ix^2 - x^3\right)$ Eantilever Beam – Couple moment M at the free end	$\delta_{\text{max}} \qquad \theta = \frac{\omega_0 I^3}{24EI} \qquad \qquad y = \frac{\omega_0 x^2}{120IEI} \left(10I^3 - 10I^2 x + 5Ix^2 - x^3 \right)$ antilever Beam – Couple moment M at the free end	$\theta = \frac{\omega_0 l^3}{24EI}$ $y = \frac{\omega_0 x^2}{120lEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ The literary Beam – Couple moment M at the free end	$\theta = \frac{\omega_o l^3}{24EI}$ $\psi = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Finally, while ver Beam – Couple moment M at the free end	$\theta = \frac{\omega_o l^3}{24EI}$ $y = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Antilever Ream - Couple moment M at the free end	$\theta = \frac{\omega_o l^3}{24EI}$ $y = \frac{\omega_o x^2}{120IEI} (10l^3 - 10l^2 x + 5lx^2 - x^3)$ Fartilever Ream - Couple moment Mat the free and
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$\delta_{\text{max}} = \frac{\delta_{\text{max}}}{\frac{1}{24EI}} \qquad y = \frac{120IEI}{120IEI} (10I^3 - 10I^2x + 5Ix^2 - x^3)$ Cantilever Beam – Couple moment M at the free end	$ \frac{\delta_{\text{max}}}{\uparrow} \qquad \qquad \delta = \frac{\delta_{\text{max}}}{24EI} \qquad \qquad y = \frac{\delta_{\text{max}}}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3) $ Cantilever Beam – Couple moment M at the free end	$\delta_{\text{max}} = \frac{\delta_{\text{max}}}{\frac{1}{24EI}} \qquad y = \frac{120IEI}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3)$ Cantilever Beam – Couple moment M at the free end	$\theta = \frac{\delta_{\text{max}}}{24EI}$ $v = \frac{\delta_{\text{max}}}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3)$ Cantilever Beam – Couple moment M at the free end	$\delta_{\text{max}} = \frac{\delta_{\text{max}}}{\frac{1}{24EI}} \qquad y = \frac{1}{120IEI} (10l^3 - 10l^2x + 5lx^2 - x^3)$ Captilever Ream – Couple moment Mat the free end	$\delta_{\text{max}} = \frac{\delta_{\text{max}}}{120 \text{ IEI}} \left(\frac{10l^3 - 10l^2 x + 5lx^2 - x^3}{120 \text{ IEI}} \right)$ Continuous Ream – Couple moment Mat the free and
$ \begin{array}{c c} \hline \delta_{\text{max}} & \overline{\delta} = \overline{24EI} \\ \hline \hline \bullet & 120IEI \\ \hline Cantilever Beam - Couple moment M at the free end \end{array} $	$\frac{\delta_{\text{max}}}{\uparrow} \qquad \frac{\delta = \frac{\delta}{24EI}}{120IEI} (10i - 10i x + 5ix - x)$ Cantilever Beam – Couple moment M at the free end	$\frac{\delta_{\text{max}}}{\uparrow}$ $\frac{\delta_{\text{max}}}{\uparrow}$ Cantilever Beam – Couple moment M at the free end	$\delta_{\text{max}} = \frac{\delta_{\text{max}}}{\frac{1}{24EI}} = \frac{\delta_{\text{max}}}{24EI} = \frac{\delta_{\text{max}}}{120IEI} = \frac{\delta_{\text{max}}}$	$\delta_{\text{max}} = \frac{\delta_{\text{max}}}{\frac{1}{24EI}} = \frac{\delta_{\text{max}}}{24EI} = \frac{\delta_{\text{max}}}{24EI} = \frac{\delta_{\text{max}}}{120IEI} = \frac{\delta_{\text{max}}}{1$	$\delta_{\text{max}} = \frac{\delta_{\text{max}}}{120IEI} \left(\frac{10i}{10i} - \frac{10i}{10i} \frac{x + 5ix}{1} - x \right)$ Captilever Ream - Couple moment Mat the free and
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$\theta = \frac{MI}{EI} \qquad \qquad y = \frac{Mx^2}{2EI}$	$\theta = \frac{MI}{EI} \qquad \qquad y = \frac{Mx^2}{2EI}$	$\theta = \frac{Ml}{EI} \qquad \qquad \mathcal{V} = \frac{Mx^2}{2EI}$	$\theta = \frac{Ml}{EI} \qquad \qquad y = \frac{Mx^2}{2EI}$	$\theta = \frac{Ml}{EI} \qquad \qquad y = \frac{Mx^2}{2EI}$	$y = \frac{Mx^2}{2ET}$
$\theta = \frac{Ml}{r}$ $y = \frac{Mx^2}{r}$	$\theta = \frac{Ml}{2x}$ $y = \frac{Mx^2}{2x}$	$\theta = \frac{Ml}{2\pi}$ $y = \frac{Mx^2}{2\pi}$	$\theta = \frac{Ml}{r}$ $y = \frac{Mx^2}{r}$	$\theta = \frac{Ml}{rr}$ $y = \frac{Mx^2}{rr}$	$y = \frac{Mx^2}{2}$
$\theta = \frac{Ml}{V}$ $V = \frac{Mx^2}{l}$	$\theta = \frac{Ml}{l}$ $V = \frac{Mx^2}{l}$	$\theta = \frac{Ml}{l}$ $V = \frac{Mx^2}{l}$	$\theta = \frac{Ml}{l}$ $v = \frac{Mx^2}{l}$	$\theta = \frac{Ml}{l}$ $v = \frac{Mx^2}{l}$	$v = \frac{Mx^2}{}$
$\theta = \frac{M}{2}$ $v = \frac{Mx^2}{2}$	$\theta = \frac{M}{2}$ $v = \frac{Mx^2}{2}$	$\theta = \frac{M}{2}$ $v = \frac{Mx^2}{2}$	$\theta = \frac{Ml}{l}$ $v = \frac{Mx^2}{l}$	$\theta = \frac{Ml}{l}$ $v = \frac{Mx^2}{l}$	$v = \frac{Mx^2}{}$
A = M	A = M	$\Theta = M$	A = M	A = M	Mx^2
$O_{-}MI$ Mx^{2}	$O = MI$ Mx^2	$O = MI$ Mx^2	$O = MI$ Mx^2	$O M$ Mx^2	Mx^2
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5. Cantilever Beam – Couple moment M at the free end	5. Cantilever Beam – Couple moment M at the free end	5. Cantilever Beam – Couple moment M at the free end	5. Cantilever Beam – Couple moment M at the free end) (antiever Ream = Coline moment // at the tree end	
5. Cantilever Beam – Couple moment M at the free end	5. Cantilever Beam – Couple moment M at the free end	5. Cantilever Beam – Couple moment M at the free end	5. Cantilever Beam – Couple moment M at the free end	5 Cantilever Ream – Counle moment Mat the free end	S Cantilever Ream - Countermoment Mat the free and
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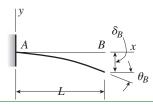
BEAM DEFLECTION FORMULAS

$0 = \frac{\omega_0}{l} x \qquad 0 = \frac{\omega_0}{\omega_0} x \qquad 0 = \frac{\omega_0}{l} x \qquad 0 $	9. Beam Simply S $ \begin{array}{ccccccccccccccccccccccccccccccccccc$	0 0 0 0 0 0 0 0 0 0	$ \begin{array}{c c} & P \\ & \theta_{1} \downarrow a \\ \hline & \theta_{2} \downarrow b \\ \hline & \theta_{max} \end{array} $ 8. Beam Simply S	θ_1 θ_2 δ_{max}	BEAM TYPE 6. Beam Simply S
10. Beam Simply Supported at Ends – Unifor $\theta_1 = \frac{7\omega_o l^3}{360EI}$ $\theta_2 = \frac{\omega_o l^3}{45EI}$	9. Beam Simply Supported at Ends – Couple moment M at the right end $\theta_1 = \frac{MI}{6EI}$ $\theta_2 = \frac{MI}{3EI}$ $y = \frac{1}{3EI}$	$\theta_1 = \theta_2 = \frac{\omega l^3}{24EI}$	$\theta_{1} = \frac{Pb(l^{2} - b^{2})}{6lEI}$ $\theta_{2} = \frac{Pab(2l - b)}{6lEI}$ 8. Beam Simply Supported at Ends – Uniform	$\theta_1 = \theta_2 = \frac{Pl^2}{16EI}$ $y = \frac{Px}{12EI} \left(\frac{3}{12EI} \right)$ Ream Simply Supported at Ends – Concentrated load P at any point	SLOPE AT ENDS DEFLECTION AT A 6. Beam Simply Supported at Ends – Concentrated load P at the center
Uniformly varying load: Maximum intensity ω_o (N/m) $y = \frac{\omega_o x}{360 lEI} \left(7l^4 - 10l^2 x^2 + 3x^4\right)$	moment M at the right end $y = \frac{Mlx}{6EI} \left(1 - \frac{x^2}{l^2} \right)$	$y = \frac{\omega x}{24EI} \left(l^3 - 2lx^2 + x^3 \right)$	$y = \frac{Pbx}{6lEI} (l^2 - x^2 - b^2) \text{ for } 0 < x < a$ $b) \qquad y = \frac{Pb}{6lEI} \left[\frac{l}{b} (x - a)^3 + (l^2 - b^2) x - x^3 \right]$ $\text{For } a < x < l$ Uniformly distributed load ω (N/m)	$y = \frac{Px}{12EI} \left(\frac{3l^2}{4} - x^2 \right) \text{ for } 0 < x < \frac{l}{2}$	DEFLECTION AT ANY SECTION IN TERMS OF x trated load P at the center
$\delta_{\text{max}} = 0.00652 \frac{\omega_{\text{o}} l^4}{EI} \text{ at } x = 0.519 I$ $\delta = 0.00651 \frac{\omega_{\text{o}} l^4}{EI} \text{ at the center}$	$\delta_{\text{max}} = \frac{Ml^2}{9\sqrt{3} El} \text{ at } x = \frac{l}{\sqrt{3}}$ $\delta = \frac{Ml^2}{16El} \text{ at the center}$	$\delta_{\max} = \frac{5\omega I^4}{384EI}$	$\delta_{\text{max}} = \frac{Pb(l^2 - b^2)^{3/2}}{9\sqrt{3} lEI} \text{ at } x = \sqrt{(l^2 - b^2)/3}$ $\delta = \frac{Pb}{48EI} (3l^2 - 4b^2) \text{ at the center, if } a > b$	$\delta_{\text{max}} = \frac{Pl^3}{48EI}$	MAXIMUM AND CENTER DEFLECTION



Deflections and Slopes of Beams

DEFLECTIONS AND SLOPES OF CANTILEVER BEAMS TABLE H-1



v = deflection in the y direction (positive upward)

v' = dv/dx = slope of the deflection curve

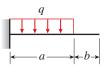
 $\delta_B = -v(L) = \text{deflection at end } B \text{ of the beam (positive downward)}$ $\theta_B = -v'(L) = \text{angle of rotation at end } B \text{ of the beam (positive clockwise)}$

$$v = -\frac{qx^2}{24EI}(6L^2 - 4Lx + x^2) \qquad v' = -\frac{qx}{6EI}(3L^2 - 3Lx + x^2)$$

$$v' = -\frac{qx}{6FI}(3L^2 - 3Lx + x^2)$$

$$\delta_B = \frac{qL^4}{8EI} \qquad \theta_B = \frac{qL^3}{6EI}$$

2



$$v = -\frac{qx^2}{24EI}(6a^2 - 4ax + x^2) \qquad (0 \le x \le a)$$

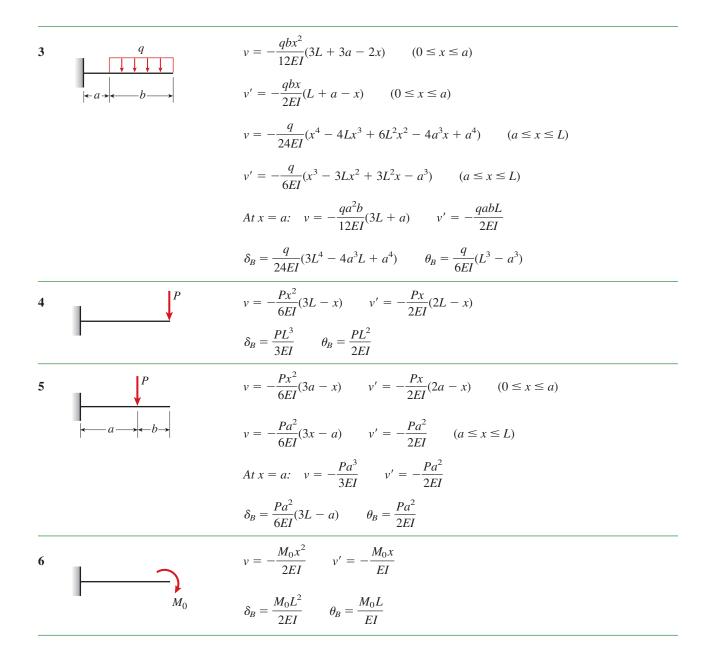
$$v' = -\frac{qx}{6EI}(3a^2 - 3ax + x^2) \qquad (0 \le x \le a)$$

$$v = -\frac{qa^3}{24EI}(4x - a)$$
 $v' = -\frac{qa^3}{6EI}$ $(a \le x \le L)$

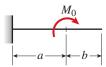
$$At x = a$$
: $v = -\frac{qa^4}{8EI}$ $v' = -\frac{qa^3}{6EI}$

$$\delta_B = \frac{qa^3}{24EI}(4L - a) \qquad \theta_B = \frac{qa^3}{6EI}$$

(Continued)



7



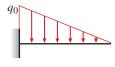
$$v = -\frac{M_0 x^2}{2EI}$$
 $v' = -\frac{M_0 x}{EI}$ $(0 \le x \le a)$

$$v = -\frac{M_0 a}{2EI}(2x - a)$$
 $v' = -\frac{M_0 a}{EI}$ $(a \le x \le L)$

$$At \ x = a$$
: $v = -\frac{M_0 a^2}{2EI}$ $v' = -\frac{M_0 a}{EI}$

$$\delta_B = \frac{M_0 a}{2EI} (2L - a) \qquad \theta_B = \frac{M_0 a}{EI}$$

8



$$v = -\frac{q_0 x^2}{120LEI} (10L^3 - 10L^2 x + 5Lx^2 - x^3)$$

$$v' = -\frac{q_0 x}{24 LEI} (4L^3 - 6L^2 x + 4Lx^2 - x^3)$$

$$\delta_B = \frac{q_0 L^4}{30EI} \qquad \theta_B = \frac{q_0 L^3}{24EI}$$

9

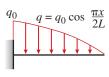


$$v = -\frac{q_0 x^2}{120 L EI} (20 L^3 - 10 L^2 x + x^3)$$

$$v' = -\frac{q_0 x}{24 LEI} (8L^3 - 6L^2 x + x^3)$$

$$\delta_B = \frac{11q_0L^4}{120EI} \qquad \theta_B = \frac{q_0L^3}{8EI}$$

10



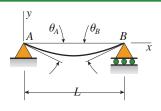
$$v = -\frac{q_0 L}{3\pi^4 E I} \left(48L^3 \cos \frac{\pi x}{2L} - 48L^3 + 3\pi^3 L x^2 - \pi^3 x^3 \right)$$

$$v' = -\frac{q_0 L}{\pi^3 EI} \left(2\pi^2 Lx - \pi^2 x^2 - 8L^2 \sin \frac{\pi x}{2L} \right)$$

$$\delta_B = \frac{2q_0L^4}{3\pi^4 EI}(\pi^3 - 24)$$
 $\theta_B = \frac{q_0L^3}{\pi^3 EI}(\pi^2 - 8)$

(Continued)

TABLE H-2 DEFLECTIONS AND SLOPES OF SIMPLE BEAMS



EI = constant

v = deflection in the y direction (positive upward)

v' = dv/dx = slope of the deflection curve

 $\delta_C = -v(L/2) = \text{deflection at midpoint } C \text{ of the beam (positive downward)}$

 x_1 = distance from support A to point of maximum deflection

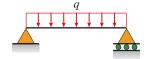
 $\delta_{\text{max}} = -v_{\text{max}} = \text{maximum deflection (positive downward)}$

 $\theta_A = -v'(0)$ = angle of rotation at left-hand end of the beam

(positive clockwise)

 $\theta_B = v'(L)$ = angle of rotation at right-hand end of the beam (positive counterclockwise)

1

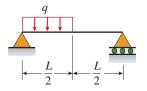


$$v = -\frac{qx}{24EI}(L^3 - 2Lx^2 + x^3)$$

$$v' = -\frac{q}{24EI}(L^3 - 6Lx^2 + 4x^3)$$

$$\delta_C = \delta_{\text{max}} = \frac{5qL^4}{384EI}$$
 $\theta_A = \theta_B = \frac{qL^3}{24EI}$

2



$$v = -\frac{qx}{384EI}(9L^3 - 24Lx^2 + 16x^3) \qquad \left(0 \le x \le \frac{L}{2}\right)$$

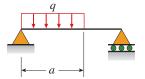
$$v' = -\frac{q}{384EI}(9L^3 - 72Lx^2 + 64x^3) \qquad \left(0 \le x \le \frac{L}{2}\right)$$

$$v = -\frac{qL}{384EI}(8x^3 - 24Lx^2 + 17L^2x - L^3) \qquad \left(\frac{L}{2} \le x \le L\right)$$

$$v' = -\frac{qL}{384EI}(24x^2 - 48Lx + 17L^2)$$
 $\left(\frac{L}{2} \le x \le L\right)$

$$\delta_C = \frac{5qL^4}{768EI} \qquad \theta_A = \frac{3qL^3}{128EI} \qquad \theta_B = \frac{7qL^3}{384EI}$$

3



$$v = -\frac{qx}{24LEI}(a^4 - 4a^3L + 4a^2L^2 + 2a^2x^2 - 4aLx^2 + Lx^3) \qquad (0 \le x \le a)$$

$$v' = -\frac{q}{24LEI}(a^4 - 4a^3L + 4a^2L^2 + 6a^2x^2 - 12aLx^2 + 4Lx^3) \qquad (0 \le x \le a)$$

$$v = -\frac{qa^2}{24LEI}(-a^2L + 4L^2x + a^2x - 6Lx^2 + 2x^3) \qquad (a \le x \le L)$$

$$v' = -\frac{qa^2}{2AIEI}(4L^2 + a^2 - 12Lx + 6x^2) \qquad (a \le x \le L)$$

$$\theta_A = \frac{qa^2}{24LEI}(2L - a)^2$$
 $\theta_B = \frac{qa^2}{24LEI}(2L^2 - a^2)$

4
$$\frac{L}{2} \rightarrow \frac{L}{2} \rightarrow \frac{$$

$$v = -\frac{Px}{48EI}(3L^2 - 4x^2) \qquad v' = -\frac{P}{16EI}(L^2 - 4x^2) \qquad \left(0 \le x \le \frac{L}{2}\right)$$
$$\delta_C = \delta_{\text{max}} = \frac{PL^3}{48EI} \qquad \theta_A = \theta_B = \frac{PL^2}{16EI}$$

$$v = -\frac{Pbx}{6LEI}(L^2 - b^2 - x^2) \qquad v' = -\frac{Pb}{6LEI}(L^2 - b^2 - 3x^2) \qquad (0 \le x \le a)$$

$$\theta_A = \frac{Pab(L+b)}{6LEI} \qquad \theta_B = \frac{Pab(L+a)}{6LEI}$$
If $a \ge b$, $\delta_C = \frac{Pb(3L^2 - 4b^2)}{48EI}$ If $a \le b$, $\delta_C = \frac{Pa(3L^2 - 4a^2)}{48EI}$

$$e^{-a}$$

$$v = -\frac{Px}{6EI}(3aL - 3a^2 - x^2) \qquad v' = -\frac{P}{2EI}(aL - a^2 - x^2) \qquad (0 \le x \le a)$$
$$v = -\frac{Pa}{6EI}(3Lx - 3x^2 - a^2) \qquad v' = -\frac{Pa}{2EI}(L - 2x) \qquad (a \le x \le L - a)$$

$$\delta_C = \delta_{\text{max}} = \frac{Pa}{24FI}(3L^2 - 4a^2)$$
 $\theta_A = \theta_B = \frac{Pa(L - a)}{2FI}$

If $a \ge b$, $x_1 = \sqrt{\frac{L^2 - b^2}{3}}$ and $\delta_{\text{max}} = \frac{Pb(L^2 - b^2)^{3/2}}{9\sqrt{3} LEI}$

$$v = -\frac{M_0 x}{6LEI} (2L^2 - 3Lx + x^2) \qquad v' = -\frac{M_0}{6LEI} (2L^2 - 6Lx + 3x^2)$$

$$\delta_C = \frac{M_0 L^2}{16EI} \qquad \theta_A = \frac{M_0 L}{3EI} \qquad \theta_B = \frac{M_0 L}{6EI}$$

$$x_1 = L \left(1 - \frac{\sqrt{3}}{3}\right) \quad \text{and} \quad \delta_{\text{max}} = \frac{M_0 L^2}{9\sqrt{3}EI}$$

(Continued)

8
$$M_0$$

$$v = -\frac{M_0 x}{24LEI}(L^2 - 4x^2) \qquad v' = -\frac{M_0}{24LEI}(L^2 - 12x^2) \qquad \left(0 \le x \le \frac{L}{2}\right)$$
$$\delta_C = 0 \qquad \theta_A = \frac{M_0 L}{24EI} \qquad \theta_B = -\frac{M_0 L}{24EI}$$

9
$$M_0$$

$$v = -\frac{M_0 x}{6LEI} (6aL - 3a^2 - 2L^2 - x^2) \qquad (0 \le x \le a)$$

$$v' = -\frac{M_0}{6LEI} (6aL - 3a^2 - 2L^2 - 3x^2) \qquad (0 \le x \le a)$$
At $x = a$: $v = -\frac{M_0 ab}{3LEI} (2a - L) \qquad v' = -\frac{M_0}{3LEI} (3aL - 3a^2 - L^2)$

At
$$x = a$$
: $v = -\frac{1}{3LEI}(2a - L)$ $v' = -\frac{1}{3LEI}(3aL - 3a^2 - L)$

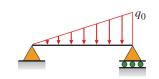
$$\theta_A = \frac{M_0}{6LEI}(6aL - 3a^2 - 2L^2)$$
 $\theta_B = \frac{M_0}{6LEI}(3a^2 - L^2)$

10
$$M_0$$
 M_0

11

$$v = -\frac{M_0 x}{2EI}(L - x)$$
 $v' = -\frac{M_0}{2EI}(L - 2x)$

$$\delta_C = \delta_{\text{max}} = \frac{M_0 L^2}{8EI}$$
 $\theta_A = \theta_B = \frac{M_0 L}{2EI}$

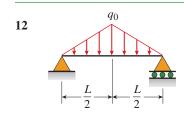


$$v = -\frac{q_0 x}{360 LEI} (7L^4 - 10L^2 x^2 + 3x^4)$$

$$v' = -\frac{q_0}{360LEI}(7L^4 - 30L^2x^2 + 15x^4)$$

$$\delta_C = \frac{5q_0L^4}{768EI}$$
 $\theta_A = \frac{7q_0L^3}{360EI}$ $\theta_B = \frac{q_0L^3}{45EI}$

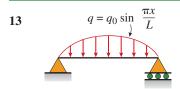
$$x_1 = 0.5193L$$
 $\delta_{\text{max}} = 0.00652 \frac{q_0 L^4}{EI}$



$$v = -\frac{q_0 x}{960 LEI} (5L^2 - 4x^2)^2 \qquad \left(0 \le x \le \frac{L}{2}\right)$$

$$v' = -\frac{q_0}{192LEI}(5L^2 - 4x^2)(L^2 - 4x^2) \qquad \left(0 \le x \le \frac{L}{2}\right)$$

$$\delta_C = \delta_{\text{max}} = \frac{q_0 L^4}{120EI} \qquad \theta_A = \theta_B = \frac{5q_0 L^3}{192EI}$$



$$v = -\frac{q_0 L^4}{\pi^4 E I} \sin \frac{\pi x}{L} \qquad v' = -\frac{q_0 L^3}{\pi^3 E I} \cos \frac{\pi x}{L}$$

$$\delta_C = \delta_{\text{max}} = \frac{q_0 L^4}{\pi^4 E I}$$
 $\theta_A = \theta_B = \frac{q_0 L^3}{\pi^3 E I}$