Deflection of Beams Using Beam Bending Tables

- Superposition
- Beam Tables

Example

$$0 < y < 2a$$

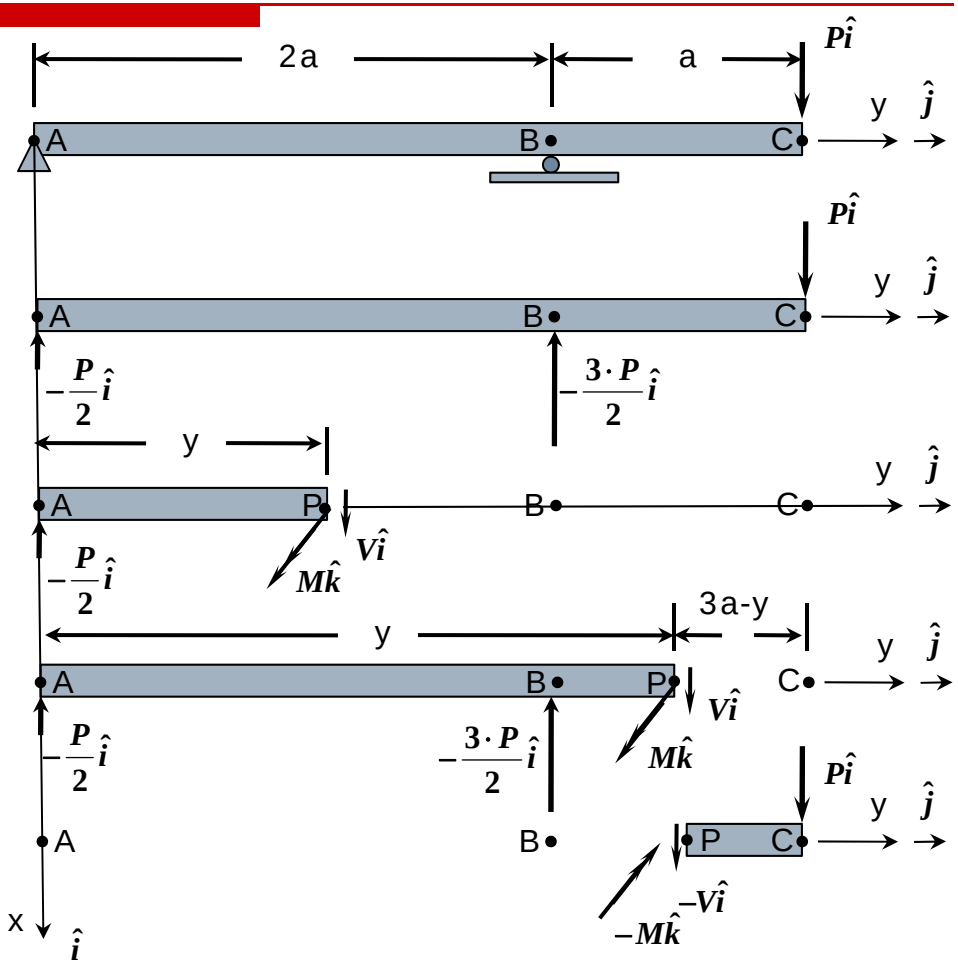
$$V = -\frac{P}{2}$$

$$M = -\frac{P \cdot y}{2}$$

$$2a < y < 3a$$

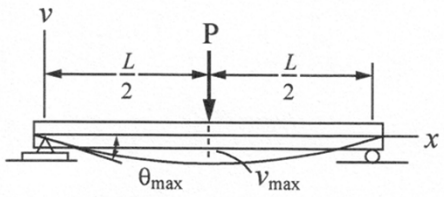
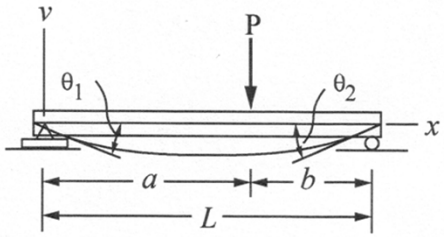
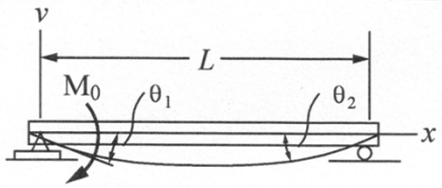
$$V = P$$

$$M = -(3 \cdot a - y) \cdot P$$

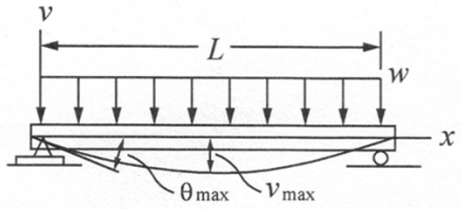
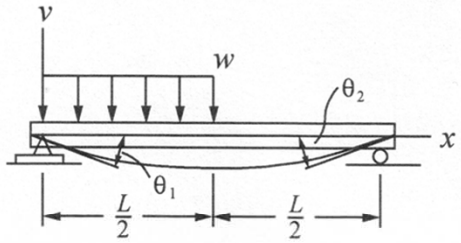
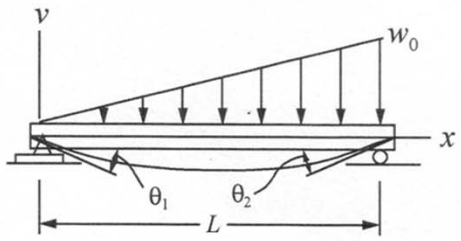


Beam Tables From FE Exam Equation Book: 1

Simply Supported Beam Slopes and Deflections

	BEAM	SLOPE	DEFLECTION	ELASTIC CURVE
(1)		$\theta_{max} = \frac{-PL^2}{16EI}$	$v_{max} = \frac{-PL^3}{48EI}$	$v = \frac{-Px}{48EI}(3L^2 - 4x^2)$ $0 \le x \le L/2$
(2)		$\theta_1 = \frac{-Pab(L+b)}{6EIL}$ $\theta_2 = \frac{Pab(L+a)}{6EIL}$	$v\Big\|_{x=a} = \frac{-Pba}{6EIL}(L^2 - b^2 - a^2)$	$v = \frac{-Pbx}{6EIL}(L^2 - b^2 - x^2)$ $0 \le x \le a$
(3)		$\theta_1 = \frac{-M_0 L}{3EI}$ $\theta_2 = \frac{M_0 L}{6EI}$	$v_{max} = \frac{-M_0 L^2}{\sqrt{243}EI}$	$v = \frac{-M_0 x}{6EIL}(x^2 - 3Lx + 2L^2)$

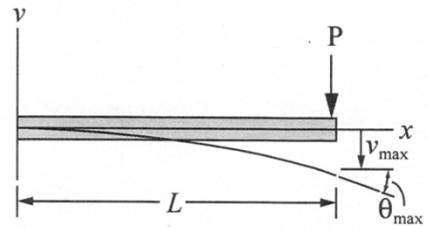
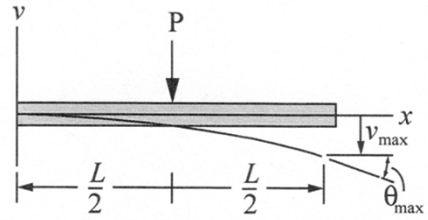
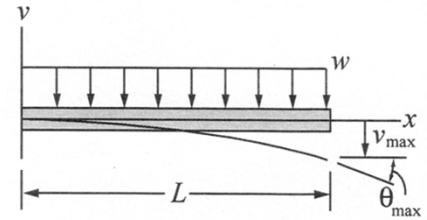
Beam Tables From FE Exam Equation Book: 2

(4)		$\theta_{max} = \frac{-wL^3}{24EI}$	$v_{max} = \frac{-5wL^4}{384EI}$	$v = \frac{-wx}{24EI}(x^3 - 3Lx^2 + L^3)$
(5)		$\theta_1 = \frac{-3wL^3}{128EI}$ $\theta_2 = \frac{7wL^3}{384EI}$	$v\Big\|_{x=L/2} = \frac{-5wL^4}{768EI}$ $v_{max} = -0.006563\frac{wL^4}{EI}$ at $x = 0.4598L$	$v = \frac{-wx}{384EI}(16x^3 - 24Lx^2 + 9L^3)$ $0 \le x \le L/2$ $v = \frac{-wL}{384EI}(8x^3 - 24Lx^2 + 17L^2x - L^3)$ $L/2 \le x < L$
(6)		$\theta_1 = \frac{-7w_0L^3}{360EI}$ $\theta_2 = \frac{w_0L^3}{45EI}$	$v_{max} = -0.00652\frac{w_0L^4}{EI}$ at $x = 0.5193$	$v = \frac{-w_0x}{360EIL}(3x^4 - 10L^2x^2 + 7L^4)$

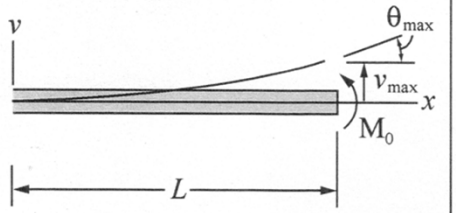
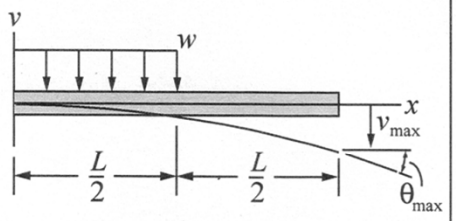
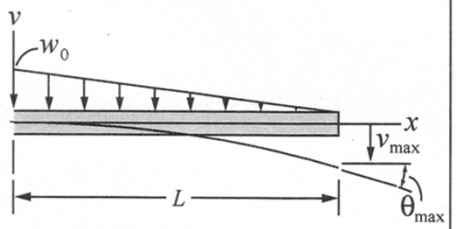
Hibbeler, R.C., *Mechanics of Materials*, 4th ed., Prentice Hall, 2000.

Beam Tables From FE Exam Equation Book: 3

Cantilevered Beam Slopes and Deflections

	BEAM	SLOPE	DEFLECTION	ELASTIC CURVE
(7)		$\theta_{max} = \frac{-PL^2}{2EI}$	$v_{max} = \frac{-PL^3}{3EI}$	$v = \frac{-Px^2}{6EI}(3L-x)$
(8)		$\theta_{max} = \frac{-PL^2}{8EI}$	$v_{max} = \frac{-5PL^3}{48EI}$	$v = \frac{-Px^2}{6EI}\left(\frac{3}{2}L-x\right) \quad 0 \le x \le L/2$ $v = \frac{-PL^2}{24EI}\left(3x-\frac{1}{2}L\right) \quad L/2 \le x \le L$
(9)		$\theta_{max} = \frac{-wL^3}{6EI}$	$v_{max} = \frac{-wL^4}{8EI}$	$v = \frac{-wx^2}{24EI}(x^2-4Lx+6L^2)$

Beam Tables From FE Exam Equation Book: 4

(10)		$\theta_{max} = \frac{M_0 L}{EI}$	$v_{max} = \frac{M_0 L^2}{2EI}$	$v = \frac{M_0 x^2}{2EI}$
(11)		$\theta_{max} = \frac{-wL^3}{48EI}$	$v_{max} = \frac{-7wL^4}{384EI}$	$v = \frac{-wx^2}{24EI}\left(x^2 - 2Lx + \frac{3}{2}L^2\right)$ $0 \le x \le L/2$ $v = \frac{-wL^3}{192EI}(4x - L/2)$ $L/2 \le x \le L$
(12)		$\theta_{max} = \frac{-w_0 L^3}{24EI}$	$v_{max} = \frac{-w_0 L^4}{30EI}$	$v = \frac{-w_0 x^2}{120EIL}(10L^3 - 10L^2 x + 5Lx^2 - x^3)$

Hibbeler, R.C., *Mechanics of Materials*, 4th ed., Prentice Hall, 2000.

Beams – Statically Indeterminate