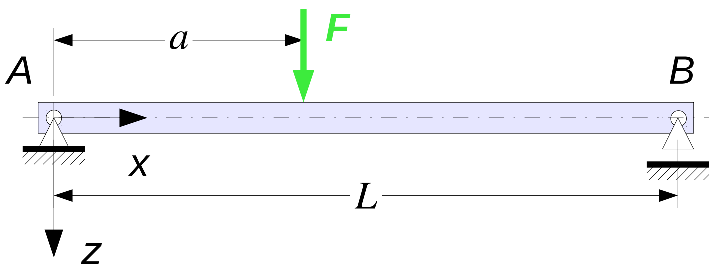
Biegelinien und Schnittlasten

Biegelinie: w positiv in Richtung z

Biegewinkel : $\phi = -\dfrac{dw}{dx}$ positiv im Gegenuhrzeigersinn ↺



$$w(a) = \frac{F L^3}{3 E I_y} \left(1 - \frac{a}{L}\right)^2 \left(\frac{a}{L}\right)^2$$

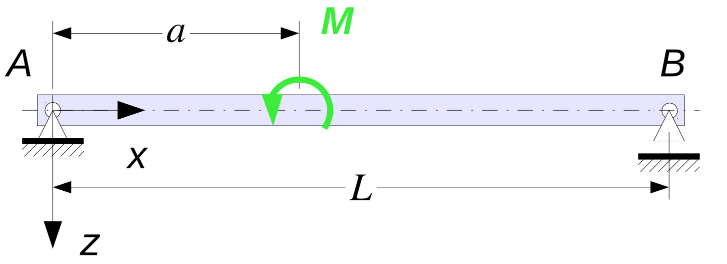
$$\phi_A = -\frac{F L^2}{6 E I_y} \frac{a}{L} \left(1 - \frac{a}{L}\right)\left(2 - \frac{a}{L}\right) \quad , \quad \phi_B = \frac{F L^2}{6 E I_y} \frac{a}{L} \left(1 - \left(\frac{a}{L}\right)^2\right)$$

$$w(x) = \frac{F L^3}{6 E I_y} \left[\left(1 - \frac{a}{L}\right)\left(\frac{a}{L}\left(2 - \frac{a}{L}\right)\frac{x}{L} - \left(\frac{x}{L}\right)^3 \right) + \left\langle \frac{x}{L} - \frac{a}{L} \right\rangle^3 \right]$$

$$\phi(x) = -\frac{F L^2}{6 E I_y} \left[\left(1 - \frac{a}{L}\right)\left(\frac{a}{L}\left(2 - \frac{a}{L}\right) - 3\left(\frac{x}{L}\right)^2 \right) + 3\left\langle \frac{x}{L} - \frac{a}{L} \right\rangle^2 \right]$$

$$M_y(x) = F L \left[\left(1 - \frac{a}{L}\right)\frac{x}{L} - \left\langle \frac{x}{L} - \frac{a}{L} \right\rangle \right]$$

$$Q_z(x) = F \left[1 - \frac{a}{L} - \left\langle \frac{x}{L} - \frac{a}{L} \right\rangle^0 \right]$$



$$w(a)=-\frac{ML^2}{3EI_y}\frac{a}{L}\left[2\left(\frac{a}{L}\right)^2-3\frac{a}{L}+1\right]$$

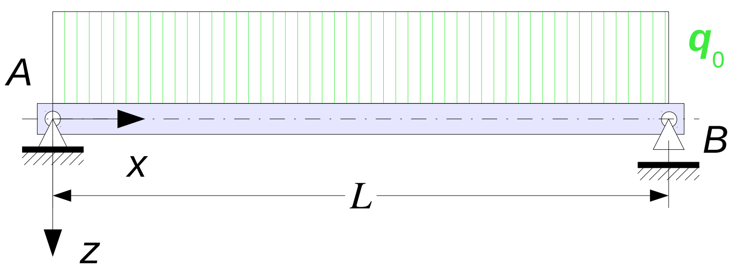
$$\phi_A=\frac{ML}{6EI_y}\left[3\left(\frac{a}{L}\right)^2-6\frac{a}{L}+2\right]\quad,\quad \phi_B=\frac{ML}{6EI_y}\left[3\left(\frac{a}{L}\right)^2-1\right]$$

$$w(x)=-\frac{ML^2}{6EI_y}\left[\left(\frac{x}{L}\right)^3-3\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^2+\left(2-6\frac{a}{L}+3\left(\frac{a}{L}\right)^2\right)\frac{x}{L}\right]$$

$$\phi(x)=\frac{ML}{6EI_y}\left[3\left(\frac{x}{L}\right)^2-6\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle+2-6\frac{a}{L}+3\left(\frac{a}{L}\right)^2\right]$$

$$M_y(x)=M\left(\frac{x}{L}-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^0\right)$$

$$Q_z(x)=\frac{M}{L}$$



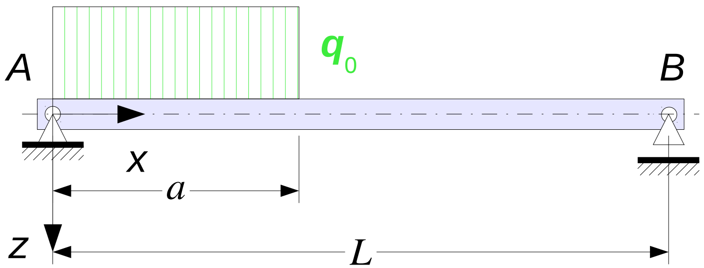
$$w_{max}=w\left(\frac{L}{2}\right)=\frac{5q_0L^4}{384EI_y}\quad,\quad \phi_A=-\frac{q_0L^3}{24EI_y}\quad,\quad \phi_B=\frac{q_0L^3}{24EI_y}$$

$$w(x)=\frac{q_0L^4}{24EI_y}\left[\left(\frac{x}{L}\right)^4-2\left(\frac{x}{L}\right)^3+\frac{x}{L}\right]$$

$$\phi(x)=-\frac{q_0L^3}{24EI_y}\left[4\left(\frac{x}{L}\right)^3-6\left(\frac{x}{L}\right)^2+1\right]$$

$$M_y(x)=-\frac{q_0L^2}{2}\left[\left(\frac{x}{L}\right)^2-\frac{x}{L}\right]$$

$$Q_z(x)=-\frac{q_0L}{2}\left(2\frac{x}{L}-1\right)$$



$$\phi_A = -\frac{q_0 L^3}{24\, E\, I_y} \left(\frac{a}{L}\right)^2 \left[\left(\frac{a}{L}\right)^2 - 4\frac{a}{L} + 4 \right]$$

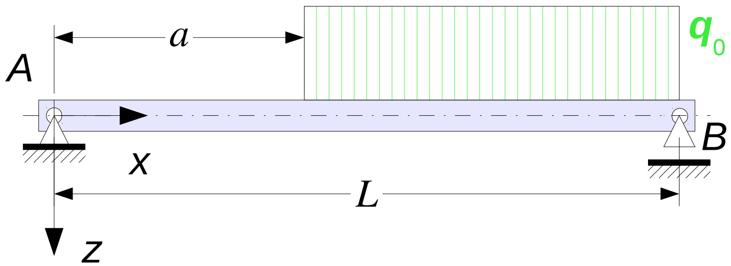
$$\phi_B = \frac{q_0 L^3}{24\, E\, I_y} \left(\frac{a}{L}\right)^2 \left[2 - \left(\frac{a}{L}\right)^2 \right]$$

$$w(x) = \frac{q_0 L^4}{24\, E\, I_y} \left[\left(\frac{x}{L}\right)^4 - \left\langle \frac{x}{L} - \frac{a}{L} \right\rangle^4 + 2\frac{a}{L}\left(\frac{a}{L} - 2\right)\left(\frac{x}{L}\right)^3 + \left(\frac{a}{L}\right)^2 \left(\left(\frac{a}{L}\right)^2 - 4\frac{a}{L} + 4 \right) \frac{x}{L} \right]$$

$$\phi(x) = -\frac{q_0 L^3}{24\, E\, I_y} \left[4\left(\frac{x}{L}\right)^3 - 4\left\langle \frac{x}{L} - \frac{a}{L} \right\rangle^3 + 6\frac{a}{L}\left(\frac{a}{L} - 2\right)\left(\frac{x}{L}\right)^2 + \left(\frac{a}{L}\right)^2 \left(\left(\frac{a}{L}\right)^2 - 4\frac{a}{L} + 4 \right) \right]$$

$$M_y(x) = -\frac{q_0 L^2}{2} \left[\left(\frac{x}{L}\right)^2 - \left\langle \frac{x}{L} - \frac{a}{L} \right\rangle^2 + \frac{a}{L}\left(\frac{a}{L} - 2\right)\frac{x}{L} \right]$$

$$Q_z(x) = -\frac{q_0 L}{2} \left[2\frac{x}{L} - 2\left\langle \frac{x}{L} - \frac{a}{L} \right\rangle + \frac{a}{L}\left(\frac{a}{L} - 2\right) \right]$$



$$w(x) = \frac{q_0 L^4}{24\, E\, I_y} \left[\left\langle \frac{x}{L} - \frac{a}{L} \right\rangle^4 - 2\left(1 - \frac{a}{L}\right)^2 \left(\frac{x}{L}\right)^3 - \left(1 - \frac{a}{L}\right)^2 \left(\left(\frac{a}{L}\right)^2 - 2\frac{a}{L} - 1 \right) \frac{x}{L} \right]$$

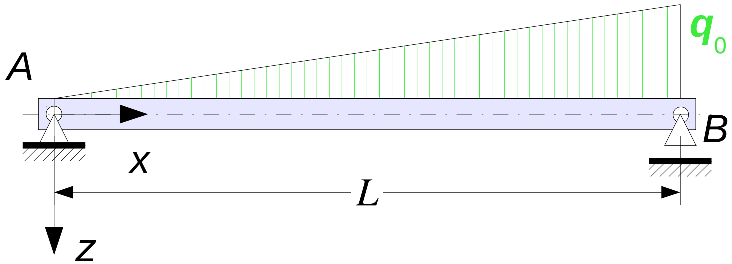
$$\phi_A = \frac{q_0 L^3}{24 E I_y}\left(1-\frac{a}{L}\right)^2\left(\left(\frac{a}{L}\right)^2 - 2\frac{a}{L} - 1\right)$$

$$\phi_B = \frac{q_0 L^3}{24 E I_y}\left(1-\frac{a}{L}\right)^2\left(\left(\frac{a}{L}\right)^2 + 2\frac{a}{L} + 1\right)$$

$$\phi(x) = -\frac{q_0 L^3}{24 E I_y}\left[4\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^3 - 6\left(1-\frac{a}{L}\right)^2\left(\frac{x}{L}\right)^2 - \left(1-\frac{a}{L}\right)^2\left(\left(\frac{a}{L}\right)^2 - 2\frac{a}{L} - 1\right)\right]$$

$$M_y = -\frac{q_0 L^2}{2}\left[\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^2 - \left(1-\frac{a}{L}\right)^2\frac{x}{L}\right]$$

$$Q_z(x) = -\frac{q_0 L}{2}\left[2\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle - \left(1-\frac{a}{L}\right)^2\right]$$



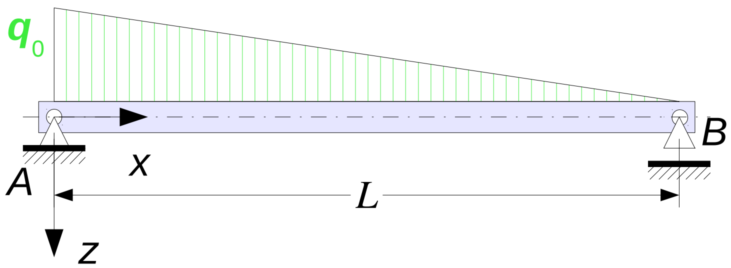
$$\phi_A = -\frac{7 q_0 L^3}{360 E I_y}\quad,\quad \phi_B = \frac{q_0 L^3}{45 E I_y}$$

$$w(x) = \frac{q_0 L^4}{360 E I_y}\left[3\left(\frac{x}{L}\right)^5 - 10\left(\frac{x}{L}\right)^3 + 7\frac{x}{L}\right]$$

$$\phi(x) = -\frac{q_0 L^3}{360 E I_y}\left[15\left(\frac{x}{L}\right)^4 - 30\left(\frac{x}{L}\right)^2 + 7\right]$$

$$M_y(x) = -\frac{q_0 L^2}{6}\left[\left(\frac{x}{L}\right)^3 - \frac{x}{L}\right]$$

$$Q_z(x) = -\frac{q_0 L}{6}\left[3\left(\frac{x}{L}\right)^2 - 1\right]$$



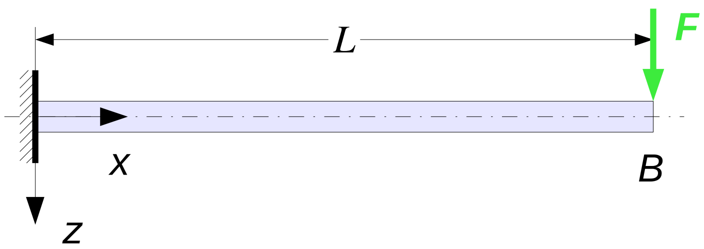
$$\phi_A = -\frac{q_0 L^3}{45\, E\, I_y} \quad , \quad \phi_B = \frac{7 q_0 L^3}{360\, E\, I_y}$$

$$w(x) = -\frac{q_0 L^4}{360\, E\, I_y}\left[3\left(\frac{x}{L}\right)^5 - 15\left(\frac{x}{L}\right)^4 + 20\left(\frac{x}{L}\right)^3 - 8\frac{x}{L}\right]$$

$$\phi(x) = \frac{q_0 L^3}{360\, E\, I_y}\left[15\left(\frac{x}{L}\right)^4 - 60\left(\frac{x}{L}\right)^3 + 60\left(\frac{x}{L}\right)^2 - 8\right]$$

$$M_y = \frac{q_0 L^2}{6}\left[\left(\frac{x}{L}\right)^3 - 3\left(\frac{x}{L}\right)^2 + 2\frac{x}{L}\right]$$

$$Q_z = \frac{q_0 L}{6}\left[3\left(\frac{x}{L}\right)^2 - 6\frac{x}{L} + 2\right]$$



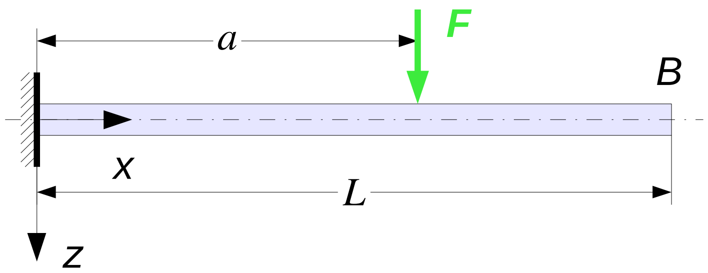
$$w_B = \frac{F L^3}{3\, E\, I_y} \quad , \quad \phi_B = -\frac{F L^2}{2\, E\, I_y}$$

$$w(x) = \frac{F L^3}{6\, E\, I_y}\left[3\left(\frac{x}{L}\right)^2 - \left(\frac{x}{L}\right)^3\right]$$

$$\phi(x) = -\frac{F L^2}{2\, E\, I_y}\left[2\left(\frac{x}{L}\right) - \left(\frac{x}{L}\right)^2\right]$$

$$M_y(x) = F L\left(\frac{x}{L} - 1\right)$$

$$Q_z(x) = F$$



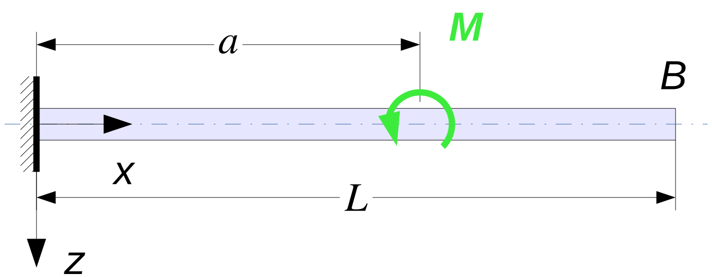
$$w_B=\frac{F\,L^3}{6\,E\,I_y}\left[3\left(\frac{a}{L}\right)^2-\left(\frac{a}{L}\right)^3\right]\quad,\quad \phi_B=-\frac{F\,a^2}{2\,E\,I_y}$$

$$w(x)=\frac{F\,L^3}{6\,E\,I_y}\left[3\frac{a}{L}\left(\frac{x}{L}\right)^2-\left(\frac{x}{L}\right)^3+\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^3\right]$$

$$\phi(x)=-\frac{F\,L^2}{2\,E\,I_y}\left[2\frac{a}{L}\frac{x}{L}-\left(\frac{x}{L}\right)^2+\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^2\right]$$

$$M_y(x)=F\,L\left[\frac{x}{L}-\frac{a}{L}-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle\right]$$

$$Q_z(x)=F\left[1-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^0\right]$$



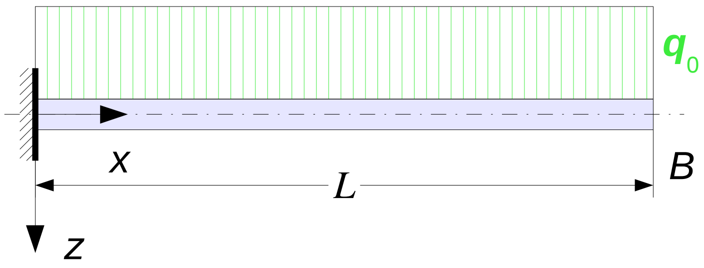
$$w_B=\frac{M\,L^2}{2\,E\,I_y}\frac{a}{L}\left(\frac{a}{L}-2\right)\quad,\quad \phi_B=\frac{M\,a}{E\,I_y}$$

$$w(x)=\frac{M\,L^2}{2\,E\,I_y}\left[\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^2-\left(\frac{x}{L}\right)^2\right]$$

$$\phi(x)=\frac{M\,L}{E\,I_y}\left[\frac{x}{L}-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle\right]$$

$$M_y(x)=M\left(1-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^0\right)$$

$$Q_z(x)=0$$



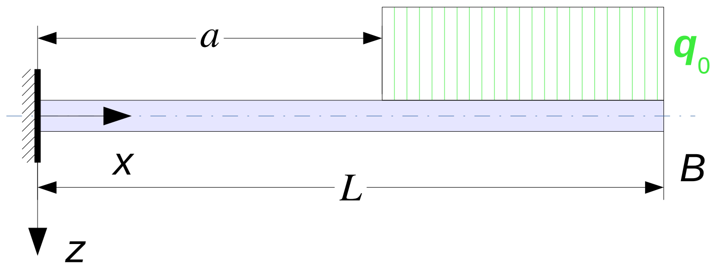
$$w_B=\frac{q_0 L^4}{8 E I_y} \quad , \quad \phi_B=-\frac{q_0 L^3}{6 E I_y}$$

$$w(x)=\frac{q_0 L^4}{24 E I_y}\left[6\left(\frac{x}{L}\right)^2-4\left(\frac{x}{L}\right)^3+\left(\frac{x}{L}\right)^4\right]$$

$$\phi(x)=-\frac{q_0 L^3}{6 E I_y}\left[3\frac{x}{L}-3\left(\frac{x}{L}\right)^2+\left(\frac{x}{L}\right)^3\right]$$

$$M_y(x)=-\frac{q_0 L^2}{2}\left[1-2\frac{x}{L}+\left(\frac{x}{L}\right)^2\right]$$

$$Q_z(x)=q_0 L\left(1-\frac{x}{L}\right)$$



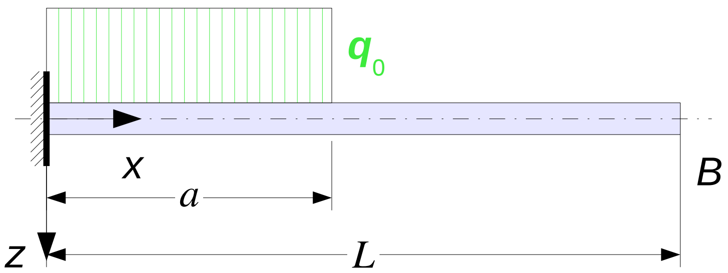
$$w_B=\frac{q_0 L^4}{24 E I_y}\left[3-4\left(\frac{a}{L}\right)^3+\left(\frac{a}{L}\right)^4\right] \quad , \quad \phi_B=-\frac{q_0 L^3}{6 E I_y}\left[1-\left(\frac{a}{L}\right)^3\right]$$

$$w(x)=\frac{q_0 L^4}{24 E I_y}\left[6\left(1-\left(\frac{a}{L}\right)^2\right)\left(\frac{x}{L}\right)^2+\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^4-4\left(1-\frac{a}{L}\right)\left(\frac{x}{L}\right)^3\right]$$

$$\phi(x)=-\frac{q_0 L^3}{6 E I_y}\left[3\left(1-\left(\frac{a}{L}\right)^2\right)\left(\frac{x}{L}\right)-3\left(1-\frac{a}{L}\right)\left(\frac{x}{L}\right)^2+\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^3\right]$$

$$M_y(x)=-\frac{q_0 L^2}{2}\left[1-\left(\frac{a}{L}\right)^2-2\left(1-\frac{a}{L}\right)\frac{x}{L}+\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^2\right]$$

$$Q_z(x)=q_0 L\left(1-\frac{a}{L}-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle\right)$$



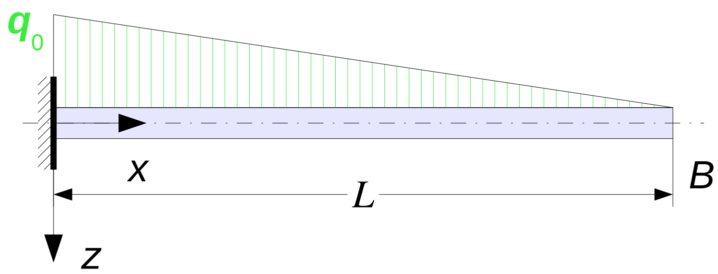
$$w_B=\frac{q_0 L^4}{24\,E\,I_y}\left(\frac{a}{L}\right)^3\left(4-\frac{a}{L}\right)\quad,\quad \phi_B=-\frac{q_0 a^3}{6\,E\,I_y}$$

$$w(x)=\frac{q_0 L^4}{24\,E\,I_y}\left[\left(\frac{x}{L}-\frac{a}{L}\right)^4-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^4+4\left(\frac{a}{L}\right)^3\frac{x}{L}-\left(\frac{a}{L}\right)^4\right]$$

$$\phi(x)=-\frac{q_0 L^3}{6\,E\,I_y}\left[\left(\frac{x}{L}-\frac{a}{L}\right)^3-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^3+\left(\frac{a}{L}\right)^3\right]$$

$$M_y=-\frac{q_0 L^2}{2\,E\,I_y}\left[\left(\frac{x}{L}-\frac{a}{L}\right)^2-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle^2\right]$$

$$Q_z(x)=-q_0 L\left(\frac{x}{L}-\frac{a}{L}-\left\langle\frac{x}{L}-\frac{a}{L}\right\rangle\right)$$



$$w_B=\frac{q_0 L^4}{30\,E\,I_y}\quad,\quad \phi_B=-\frac{q_0 L^3}{24\,E\,I_y}$$

$$w(x)=-\frac{q_0 L^4}{120\,E\,I_y}\left[\left(\frac{x}{L}-1\right)^5-5\frac{x}{L}+1\right]$$

$$\phi(x)=\frac{q_0 L^3}{24\,E\,I_y}\left[\left(\frac{x}{L}-1\right)^4-1\right]$$

$$M_y(x)=\frac{q_0 L^2}{6}\left(\frac{x}{L}-1\right)^3$$

$$Q_z(x)=\frac{q_0 L}{2}\left(\frac{x}{L}-1\right)^2$$