

Opmerkingen: Zie §2.7, blz. 41 t/m 48

Antwoorden 2.50-1:

a. $N = +(0,48 \text{ kN/m}^2)x^2 - (2,4 \text{ kN/m})x + (2 \text{ kN})$

$$u = \left\{ +(0,08 \text{ m}^{-2})x^3 - (0,6 \text{ m}^{-1})x^2 + x \right\} \times 10^{-3}$$

b. Zie de figuren hiernaast

c. $N_A = N_B = +2 \text{ kN} \Rightarrow A_h = 2 \text{ kN} \leftarrow$

$$B_h = 2 \text{ kN} \rightarrow$$

Toelichting:

$$q = -\frac{2\hat{q}}{\ell}x + \hat{q}$$

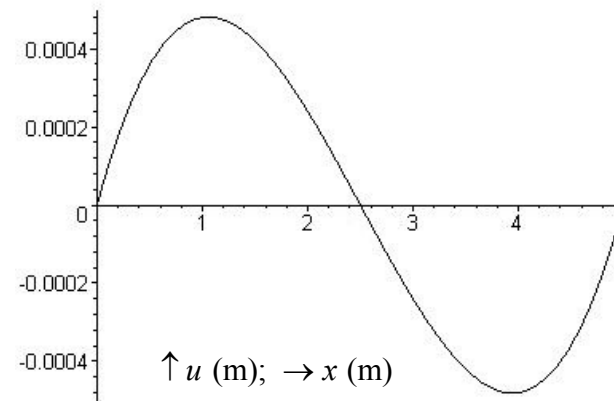
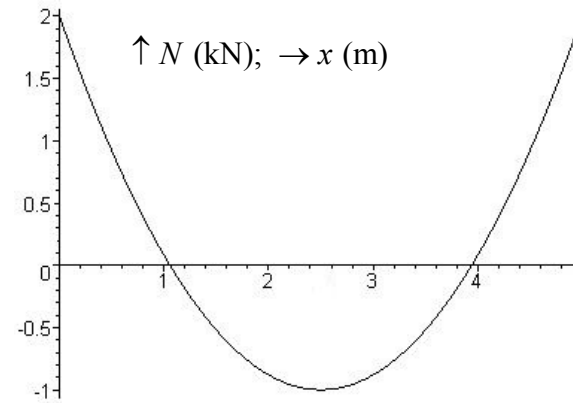
$$EAu'' = -q = +\frac{2\hat{q}}{\ell}x - \hat{q}$$

$$N = EAu' = +\frac{\hat{q}}{\ell}x^2 - \hat{q}x + C_1$$

$$EAu = +\frac{\hat{q}}{3\ell}x^3 - \frac{\hat{q}}{2}x^2 + C_1x + C_2$$

$$x = 0; u = 0 \Rightarrow C_2 = 0$$

$$x = \ell = 5 \text{ m}; u = 0 \Rightarrow C_1 = \frac{1}{6}\hat{q}\ell = 2 \text{ kN}$$



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Antwoorden 2.50-2:

a. $N = \left(-\frac{12}{\pi} \sin \frac{\pi x}{(5 \text{ m})} + \frac{24}{\pi^2} \right) \text{ kN}$

$$u = + \frac{30 \times 10^{-3}}{\pi^2} \left(\cos \frac{\pi x}{(5 \text{ m})} + \frac{2x}{(5 \text{ m})} - 1 \right) \text{ m}$$

b. Zie de figuren hiernaast

c. $N_A = N_B = \frac{24}{\pi^2} \text{ kN} \Rightarrow A_h = 2,43 \text{ kN} \leftarrow$
 $B_h = 2,43 \text{ kN} \rightarrow$

Toelichting:

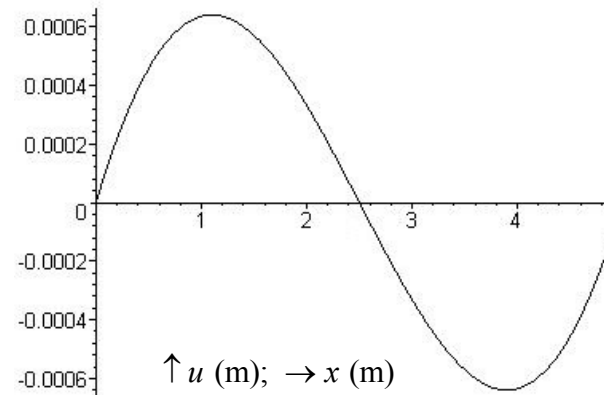
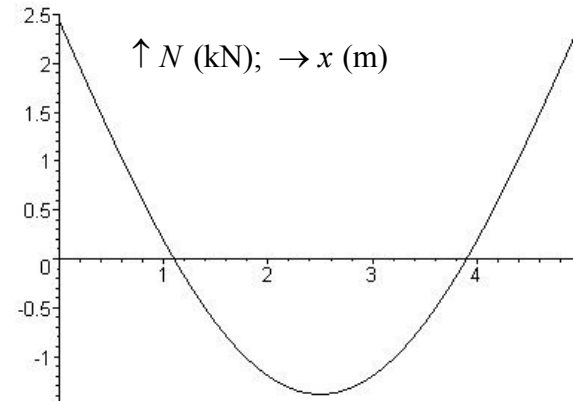
$$EAu'' = -q = -\hat{q} \cos \frac{\pi x}{\ell}$$

$$N = EAu' = -\frac{\hat{q}\ell}{\pi} \sin \frac{\pi x}{\ell} + C_1$$

$$EAu = +\frac{\hat{q}\ell^2}{\pi^2} \cos \frac{\pi x}{\ell} + C_1 x + C_2$$

$$x = 0; u = 0 \Rightarrow C_2 = -\frac{\hat{q}\ell^2}{\pi^2} = -\frac{60}{\pi^2} \text{ kNm}$$

$$x = \ell = 5 \text{ m}; u = 0 \Rightarrow C_1 = \frac{2\hat{q}\ell}{\pi^2} = \frac{24}{\pi^2} \text{ kN}$$



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Antwoorden 2.50-3:

a. $N = +(0,128 \text{ kN/m}^3)x^3 - (0,960 \text{ kN/m}^2)x^2 + (4 \text{ kN})$
 $u = \left\{ +(0,016 \text{ m}^{-3})x^4 - (0,16 \text{ m}^{-2})x^3 + 2x \right\} \times 10^{-3}$

b. Zie de figuren hiernaast

c. $N_A = +4 \text{ kN} \Rightarrow A_h = 4 \text{ kN} \leftarrow$
 $N_B = -4 \text{ kN} \Rightarrow B_h = 4 \text{ kN} \leftarrow$

Toelichting:

$$q = -\frac{4\hat{q}}{\ell^2}x^2 + \frac{4\hat{q}}{\ell}x$$

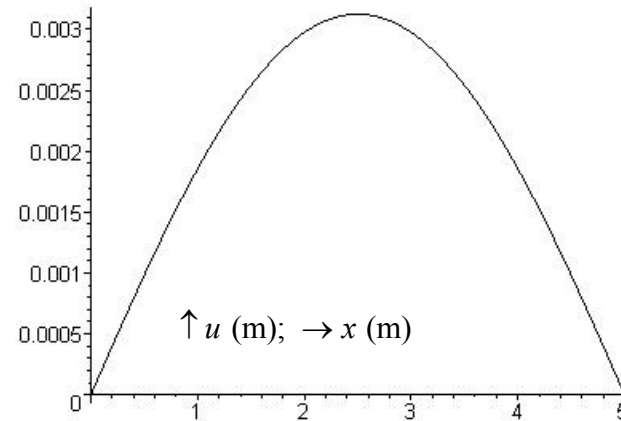
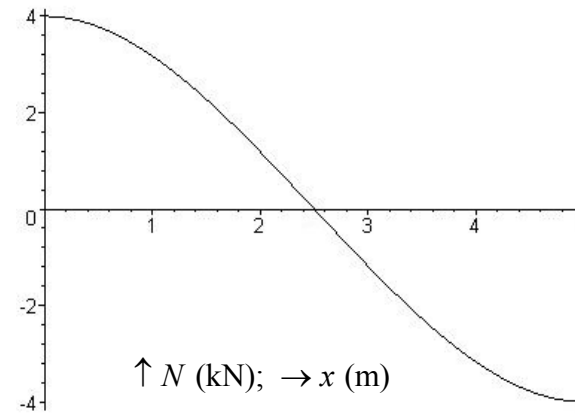
$$EAu'' = -q = +\frac{4\hat{q}}{\ell^2}x^2 - \frac{4\hat{q}}{\ell}x$$

$$N = EAu' = +\frac{4\hat{q}}{3\ell^2}x^3 - \frac{2\hat{q}}{\ell}x^2 + C_1$$

$$EAu = +\frac{\hat{q}}{3\ell^2}x^4 - \frac{2\hat{q}}{3\ell}x^3 + C_1x + C_2$$

$$x = 0; u = 0 \Rightarrow C_2 = 0$$

$$x = \ell = 5 \text{ m}; u = 0 \Rightarrow C_1 = \frac{1}{3}\hat{q}\ell = 4 \text{ kN}$$



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Antwoorden 2.50-4:

a. $N = \frac{12}{\pi} \cos \frac{\pi x}{(5 \text{ m})} \text{ kN}$

$$u = + \frac{30 \times 10^{-3}}{\pi^2} \sin \frac{\pi x}{(5 \text{ m})} \text{ m}$$

b. Zie de figuren hiernaast

c. $N_A = + \frac{12}{\pi} \text{ kN} \Rightarrow A_h = 3,82 \text{ kN} \leftarrow$

$$N_B = - \frac{12}{\pi} \text{ kN} \Rightarrow B_h = 3,82 \text{ kN} \leftarrow$$

Toelichting:

$$EAu'' = -q = -\hat{q} \sin \frac{\pi x}{\ell}$$

$$N = EAu' = + \frac{\hat{q}\ell}{\pi} \cos \frac{\pi x}{\ell} + C_1$$

$$EAu = + \frac{\hat{q}\ell^2}{\pi^2} \sin \frac{\pi x}{\ell} + C_1x + C_2$$

$$x = 0; u = 0 \Rightarrow C_2 = 0$$

$$x = \ell = 5 \text{ m}; u = 0 \Rightarrow C_1 = 0$$

