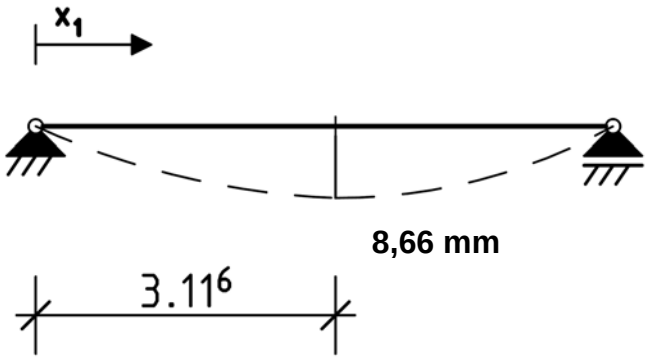
1) wegen der praktischeren Schreibweise hier: **EI = 5.850 kNm²**

a)



Bereich 1:

$$q_{(x)} = x$$

$$Q_{(x)} = -\frac{x^2}{2} + 6$$

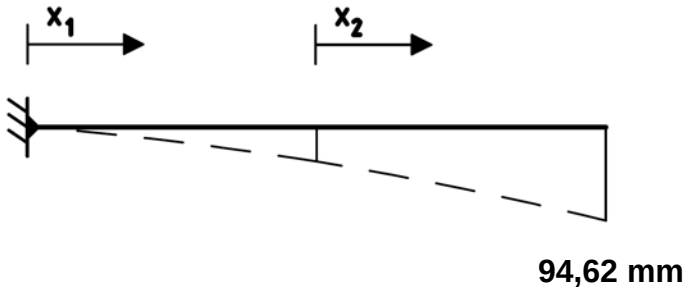
$$M_{(x)} = -\frac{x^3}{6} + 6x$$

$$w'_{(x)} = -\frac{1}{EI}\left(\frac{x^4}{24} - 3x^2 + 25{,}2\right)$$

$$w_{(x)} = -\frac{1}{EI}\left(\frac{x^5}{120} - x^3 + 25{,}2x\right)$$

wegen der praktischeren Schreibweise hier: **EI = 5.850 kNm²**

b)



Bereich 1:

$$q_{(x_1)} = 0$$

$$Q_{(x_1)} = 12$$

$$M_{(x_1)} = 12x - 54$$

$$w'_{(x_1)} = -\frac{1}{EI}\left(-6x^2 + 54x\right)$$

$$w_{(x_1)} = -\frac{1}{EI}\left(-2x^3 + 27x^2\right)$$

Bereich 2:

$$q_{(x_2)} = 4$$

$$Q_{(x_2)} = -4x + 12$$

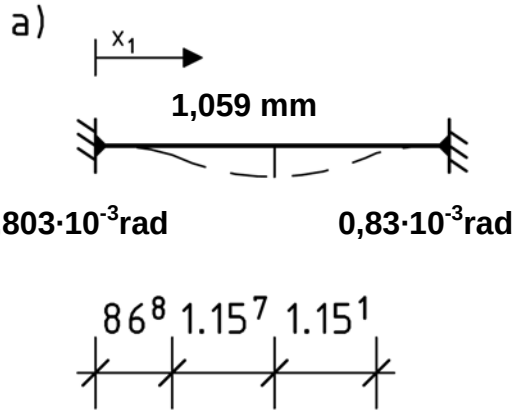
$$M_{(x_2)} = -2x^2 + 12x - 18$$

$$w'_{(x_2)} = -\frac{1}{EI}\left(\frac{2}{3}x^3 - 6x^2 + 18x + 108\right)$$

$$w_{(x_2)} = -\frac{1}{EI}\left(\frac{x^4}{6} - 2x^3 + 9x^2 + 108x + 189\right)$$

3) wegen der praktischeren Schreibweise hier: **EI = 2.520 kNm²**

a)



Bereich 1:

$$q_{(x)} = 0{,}5x + 3$$

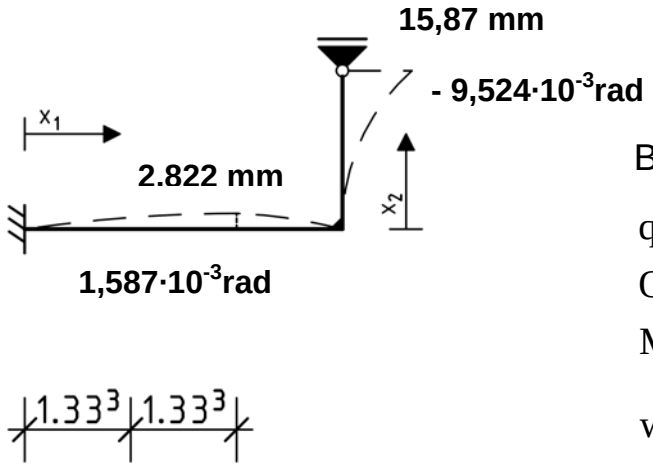
$$Q_{(x)} = -\frac{1}{4}x^2 - 3x + 7{,}2$$

$$M_{(x)} = -\frac{1}{12}x^3 - \frac{3}{2}x^2 + 7{,}2x - \frac{76}{15}$$

$$w'_{(x)} = -\frac{1}{EI}\left(-\frac{1}{48}x^4 - \frac{1}{2}x^3 + 3{,}6x^2 - \frac{76}{15}x\right)$$

$$w_{(x)} = -\frac{1}{EI}\left(-\frac{1}{240}x^5 - \frac{1}{8}x^4 + 1{,}2x^3 - \frac{38}{15}x^2\right)$$

b)



Bereich 1:

$$q_{(x_1)} = 0$$

$$Q_{(x_1)} = -4{,}5$$

$$M_{(x_1)} = -4{,}5x + 6$$

$$w'_{(x_1)} = -\frac{1}{EI}\left(-2{,}25x^2 + 6x\right)$$

$$w_{(x_1)} = -\frac{1}{EI}\left(-0{,}75x^3 + 3x^2\right)$$

Bereich 2:

$$q_{(x_2)} = 0$$

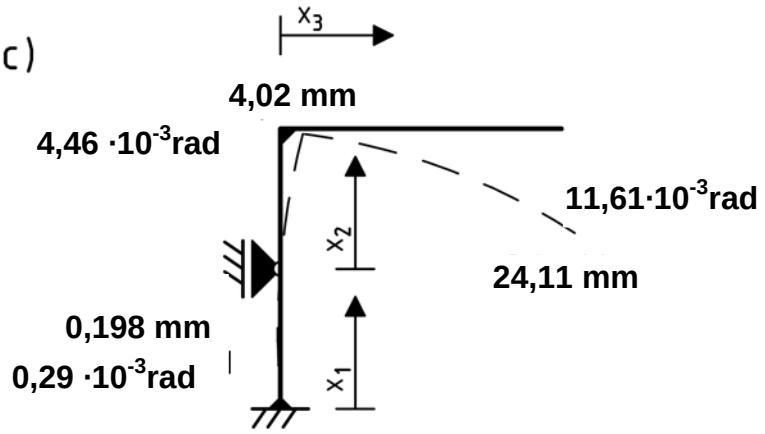
$$Q_{(x_2)} = 6$$

$$M_{(x_2)} = 6x - 12$$

$$w'_{(x_2)} = -\frac{1}{EI}\left(3x^2 - 12x - 12\right)$$

$$w_{(x_2)} = -\frac{1}{EI}\left(x^3 - 6x^2 - 12x\right)$$

c)



Bereich 1:

$$q_{(x_1)} = 0$$
$$Q_{(x_1)} = -6$$
$$M_{(x_1)} = -6x + 3$$
$$w'_{(x_1)} = -\frac{1}{EI}\left(-3x^2 + 3x\right)$$
$$w_{(x_1)} = -\frac{1}{EI}\left(-x^3 + \frac{3}{2}x^2\right)$$

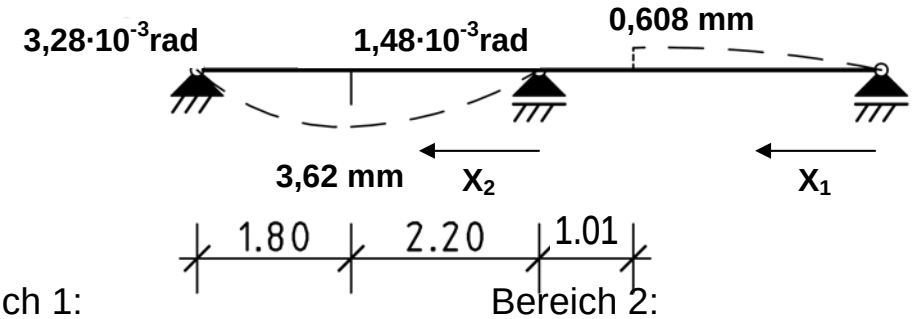
Bereich 2:

$$q_{(x_2)} = 0$$
$$Q_{(x_2)} = 0$$
$$M_{(x_2)} = -6$$
$$w'_{(x_2)} = -\frac{1}{EI}\left(-6x - 2{,}25\right)$$
$$w_{(x_2)} = -\frac{1}{EI}\left(-3x^2 - 2{,}25x\right)$$

Bereich 3:

$$q_{(x_3)} = 0$$
$$Q_{(x_3)} = 0$$
$$M_{(x_3)} = -6$$
$$w'_{(x_3)} = -\frac{1}{EI}\left(-6x - 11{,}25\right)$$
$$w_{(x_3)} = -\frac{1}{EI}\left(-3x^2 - 11{,}25x\right)$$

d)



Bereich 1:

$$q_{(x_1)} = \frac{3}{4}x$$
$$Q_{(x_1)} = -\frac{3}{8}x^2 + \frac{1}{2}$$
$$M_{(x_1)} = -\frac{1}{8}x^3 + \frac{1}{2}x - \frac{4}{15}$$
$$w'_{(x_1)} = -\frac{1}{EI}\left(\frac{1}{32}x^4 - \frac{1}{4}x^2 - \frac{4}{15}\right)$$

Bereich 2:

$$q_{(x_2)} = \frac{3}{4}x + 3$$
$$Q_{(x_2)} = -\frac{3}{8}x^2 - 3x + \frac{19}{2}$$
$$M_{(x_2)} = -\frac{1}{8}x^3 - \frac{3}{2}x^2 + \frac{19}{2}x - 6$$
$$w'_{(x_2)} = -\frac{1}{EI}\left(\frac{1}{32}x^4 + \frac{1}{2}x^3 - \frac{19}{4}x^2 + 6x + \frac{56}{15}\right)$$

$$w_{(x_1)} = -\frac{1}{EI}\left(\frac{1}{160}x^5 - \frac{1}{12}x^3 - \frac{4}{15}x\right) \qquad w_{(x_2)} = -\frac{1}{EI}\left(\frac{1}{160}x^5 + \frac{1}{8}x^4 - \frac{19}{12}x^3 + 3x^2 + \frac{56}{15}x\right)$$

Aufgabe 1

a)

Randbedingungen	Übergangsbedingungen
$M(x_1 = 0) = 0$	
$M(x_1 = l) = 0$	
$w(x_1 = 0) = 0$	
$w(x_1 = l) = 0$	

b)

Randbedingungen	Übergangsbedingungen
$Q(x_2 = l) = 0$	$Q(x_1 = l) = Q(x_2 = 0)$
$M(x_2 = l) = 0$	$M(x_1 = l) = M(x_2 = 0)$
$w(x_1 = 0) = 0$	$w'(x_1 = l) = w'(x_2 = 0)$
$w'(x_1 = 0) = 0$	$w(x_1 = l) = w(x_2 = 0)$

Aufgabe 2

a)

Randbedingungen	Übergangsbedingungen
$Q(x_3 = l) = 5$	$Q(x_1 = l) = Q(x_2 = 0) + 5$
$M(x_1 = 0) = 0$	$M(x_1 = l) = M(x_2 = 0)$
$M(x_3 = l) = 0$	$M(x_2 = l) = M(x_3 = 0)$
$w(x_1 = 0) = 0$	$w'(x_1 = l) = w'(x_2 = 0)$
$w(x_2 = l) = 0$	$w'(x_2 = l) = w'(x_3 = 0)$
$w(x_3 = 0) = \frac{N_1 \bullet l_1}{E_1 \bullet A_1} + \frac{N_2 \bullet l_2}{E_2 \bullet A_2}$	$w(x_1 = l) = w(x_2 = 0)$

b)

Randbedingungen	Übergangsbedingungen
$Q(x_2 = l) = 0$	$M(x_1 = l) = M(x_2 = 0)$
$M(x_1 = 0) = 0$	$w'(x_1 = l) = w'(x_2 = 0)$
$M(x_2 = l) = 0$	
$w(x_1 = 0) = 0$	
$w(x_1 = l) = 0$	
$w(x_2 = 0) = 0$	

Aufgabe 3

a)

Randbedingungen

$w'(x_1 = 0) = 0$

$w'(x_1 = l) = 0$

$w(x_1 = 0) = 0$

$w(x_1 = l) = 0$

Übergangsbedingungen

b)

Randbedingungen

$M(x_2 = l) = 0$

$w'(x_1 = 0) = 0$

$w(x_1 = 0) = 0$

$w(x_1 = l) = 0$

$w(x_2 = 0) = \frac{N_1 \bullet l_1}{E_1 \bullet A_1} = 0$ wegen $E \bullet A = \infty$

Übergangsbedingungen

$M(x_1 = l) = M(x_2 = 0)$

$w'(x_1 = l) = w'(x_2 = 0)$

c)

Randbedingungen

$M(x_2 = 0) = -6$

$M(x_3 = 0) = -6$

$M(x_3 = l) = -6$

$w'(x_1 = 0) = 0$

$w(x_1 = 0) = 0$

$w(x_1 = l) = 0$

$w(x_2 = 0) = 0$

$w(x_3 = 0) = \frac{N_1 \bullet l_1}{E_1 \bullet A_1} + \frac{N_2 \bullet l_2}{E_2 \bullet A_2} = 0$ wegen $E \bullet A = \infty$ bzw. wegen $N = 0$

Übergangsbedingungen

$M(x_1 = l) = M(x_2 = 0)$

$M(x_2 = l) = M(x_3 = 0)$

$w'(x_2 = l) = w'(x_3 = 0)$

$w'(x_1 = l) = w'(x_2 = 0)$

d)

Randbedingungen

$M(x_1 = 0) = 0$

$M(x_2 = l) = 0$

$w(x_1 = 0) = 0$

$w(x_1 = l) = 0$

$w(x_2 = 0) = 0$

$w(x_2 = l) = 0$

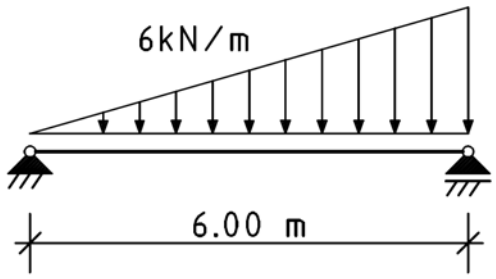
Übergangsbedingungen

$M(x_1 = l) = M(x_2 = 0)$

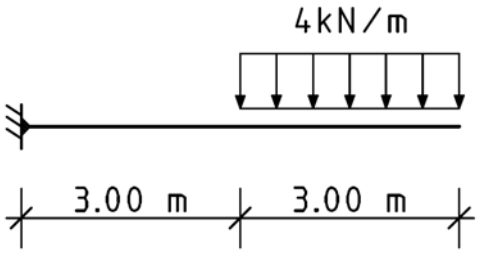
$w'(x_1 = l) = w'(x_2 = 0)$

1) Gegeben sind die nachfolgenden Systeme mit Belastung.
E = 30000 N/mm²; Querschnitt b/h = 15/25 cm. Berechnen Sie mit Hilfe der DGL die max. Durchbiegung!

a)

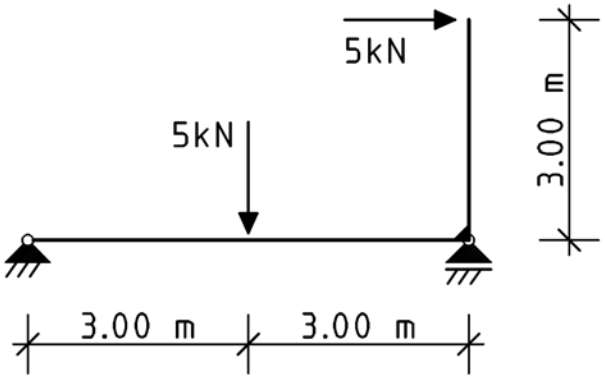


b)

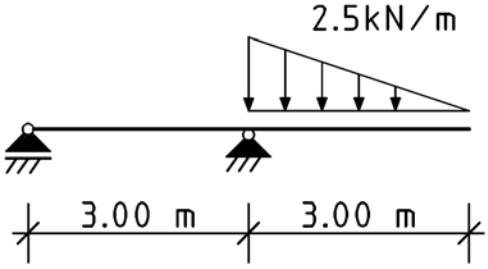


2) Gegeben sind die nachfolgenden Systeme mit Belastung.
E = 30000 N/mm²; Querschnitt b/h = 15/25 cm. Berechnen Sie mit Hilfe der DGL die Verdrehungen an den Stabenden sowie die max. und min. Durchbiegung!

a)



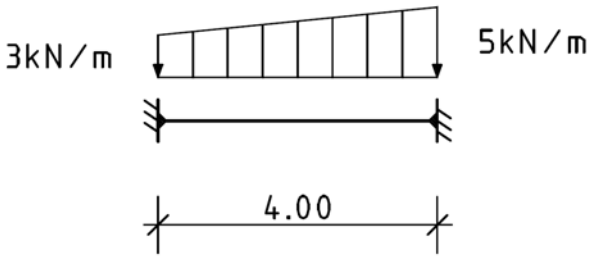
b)



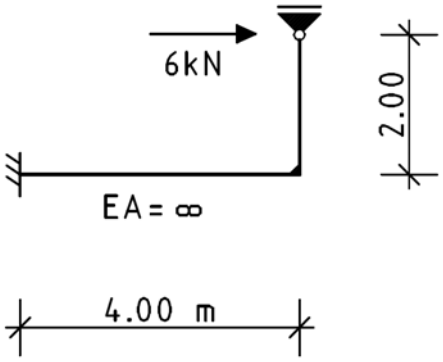
3) Gegeben sind die nachfolgenden Systeme mit Belastung. Berechnen Sie mit Hilfe der DGL der Biegelinie die maximalen Werte für die Durchbiegung und die Verdrehung.

E = 210.000 MN/m²
Querschnitt : Hohlprofil □ 100x200x4

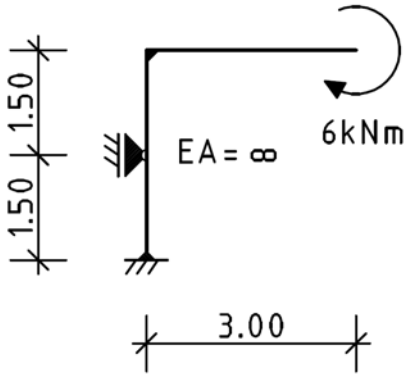
a)



b)



c)



d)