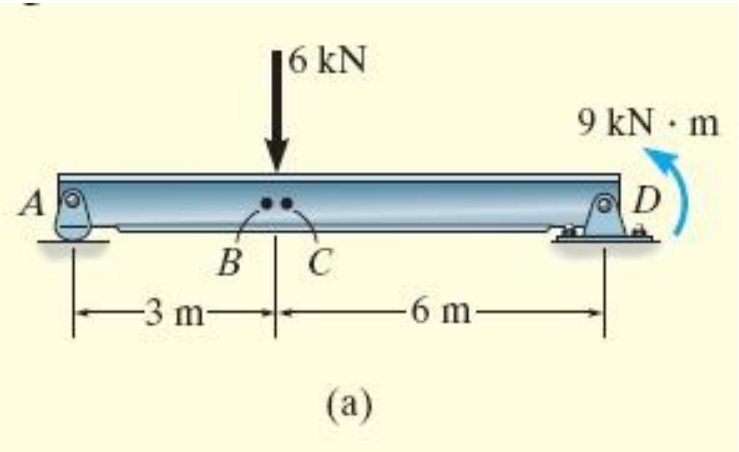
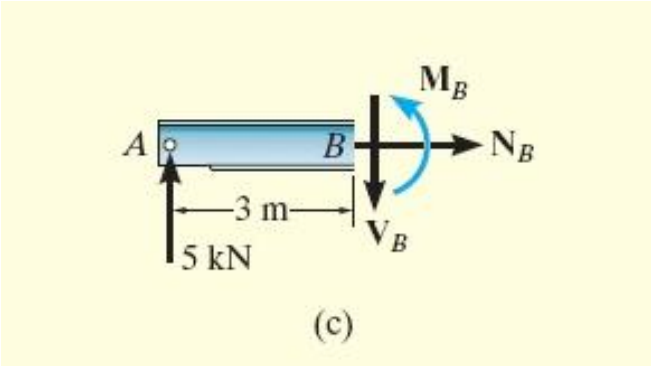
Statica(WB/MT) college 11
Internal forces Ch.7.2-7.3

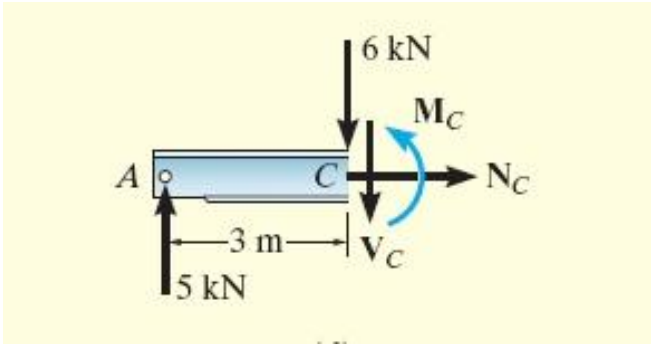
Guido Janssen
G.c.a.m.janssen@tudelft.nl

Vorige keer:





$N_B = 0$
$V_B = 5$ kN
$M_B = 15$ kN.m



$N_C = 0$
$V_C = -1$ kN (werkt dus de andere kant op dan getekend)
$M_C = 15$ kN.m

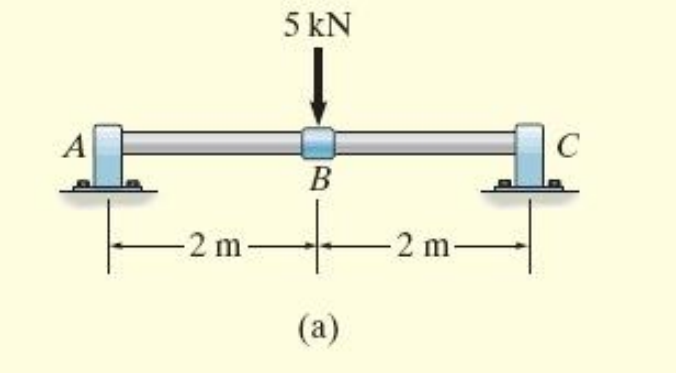
Tussen B en C vindt er een sprong in de schuikracht plaats van 6 kN.

Vandaag:

Momenten en schuifkrachten op alle posities.

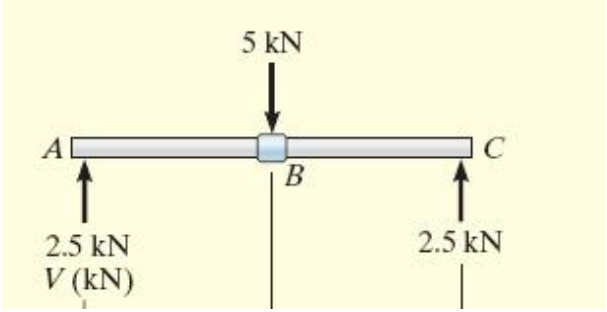
Mathematisch verband tussen belastingen, schuifspanning en buigend moment

Example 7.6



Bepaal voor ieder punt tussen A en C de schuifkracht en het buigend moment. A is een taatslager (thrust bearing) en C is een glijlager (journal bearing)

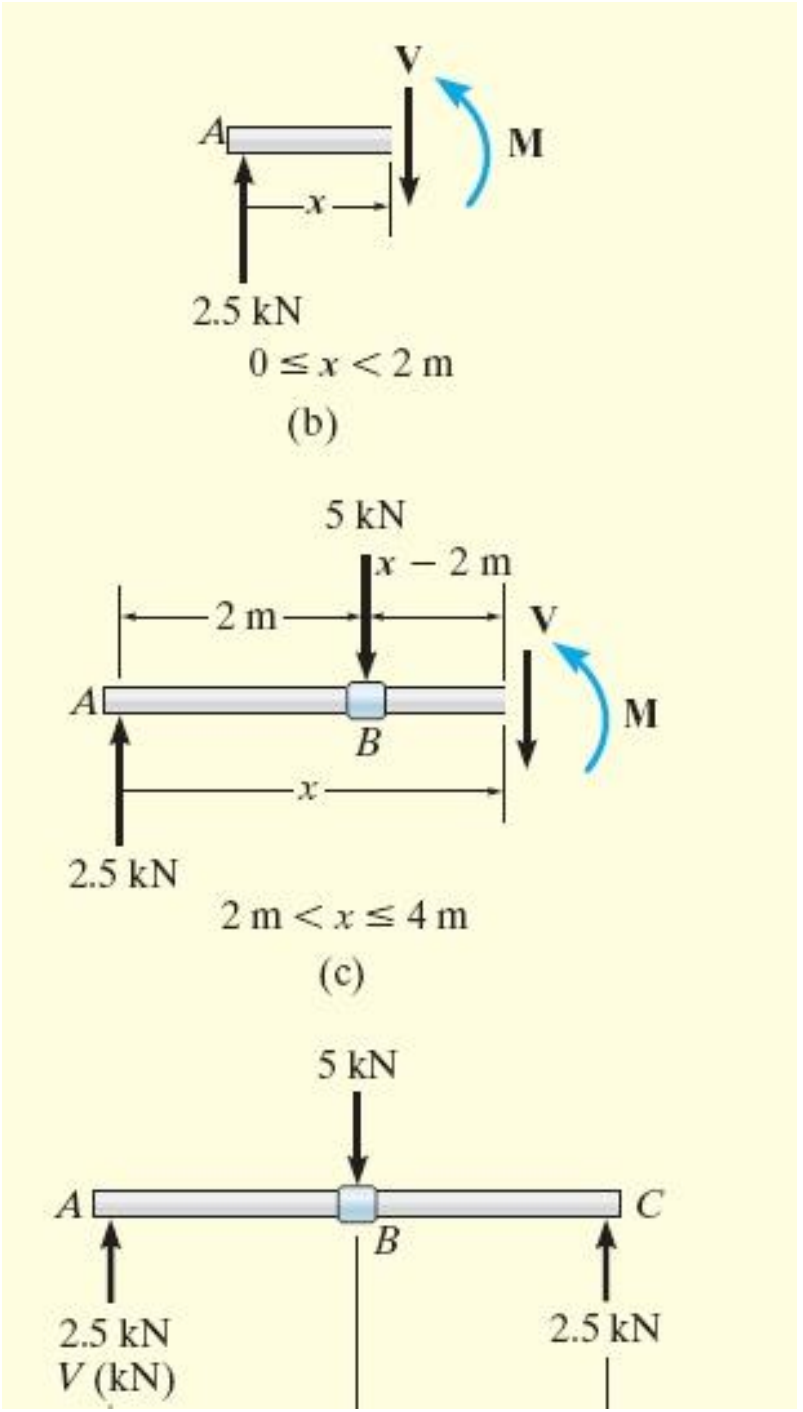
Wat doen we het eerst?



Twee FBD's, voor verschillende doorsnijdingen, één links van B, één rechts van B.

Wat doen we nu?

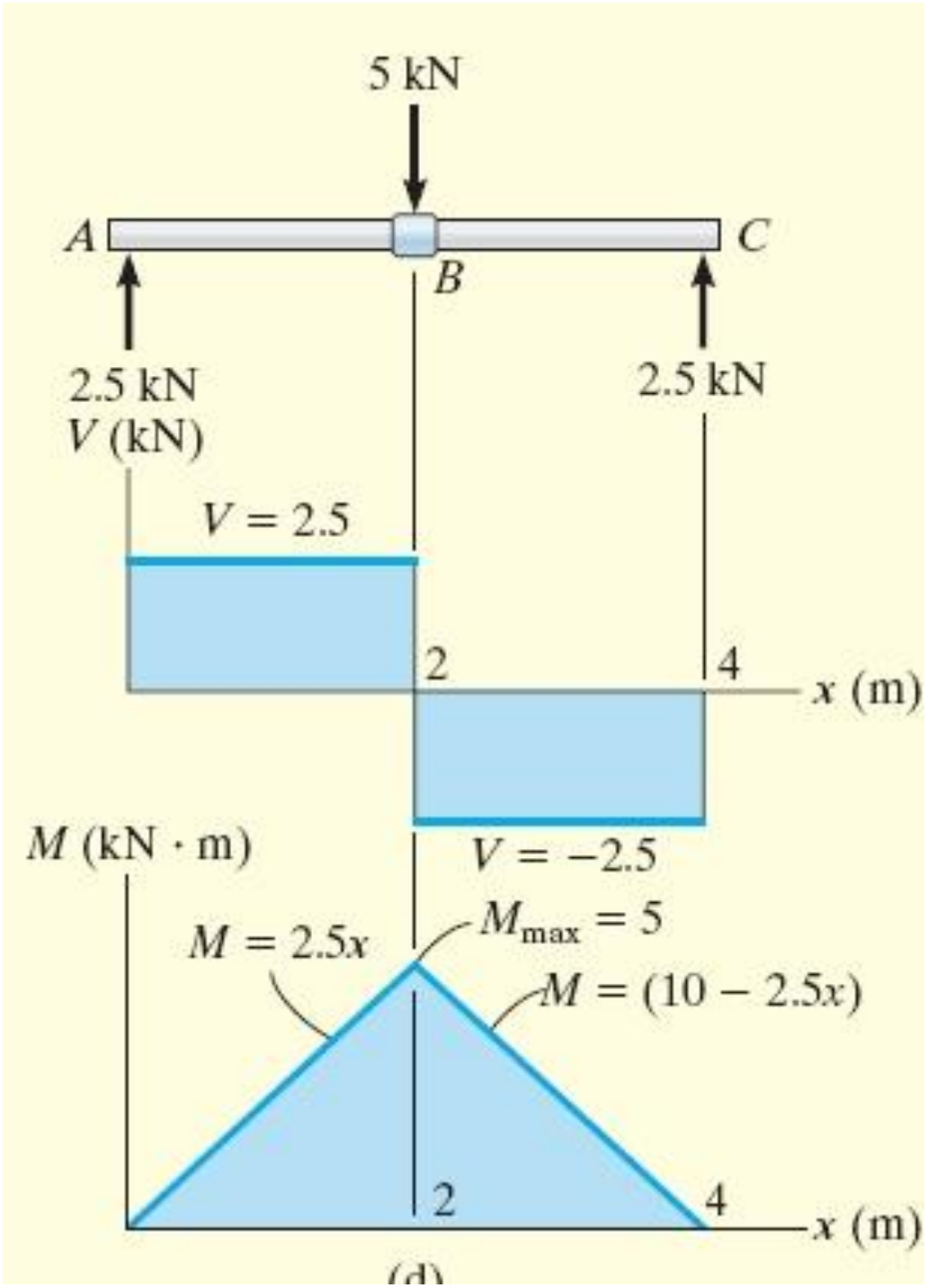
Example 7.6b


V
M
A
x
2.5 kN
0 ≤ x < 2 m
(b)
5 kN
x − 2 m
2 m
V
M
A
B
x
2.5 kN
2 m < x ≤ 4 m
(c)
5 kN
A
B
C
2.5 kN
V (kN)
2.5 kN

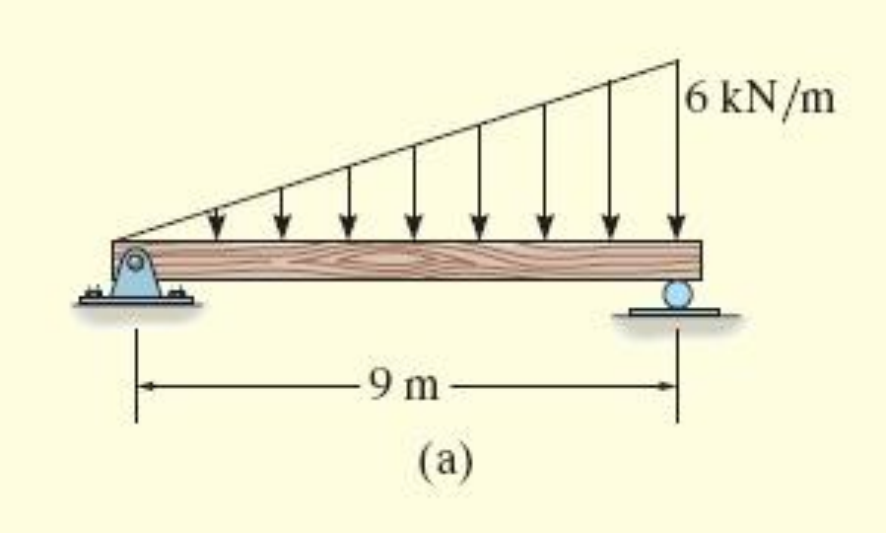
Example 7.6c

Merk op: $\frac{dM(x)}{dx} = V(x)$

$$M(x) = \int_0^x V(u)\,du$$



Example 7.7

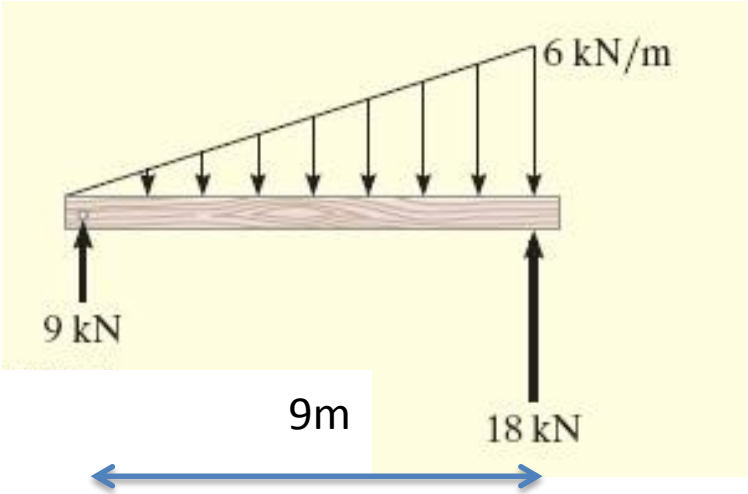


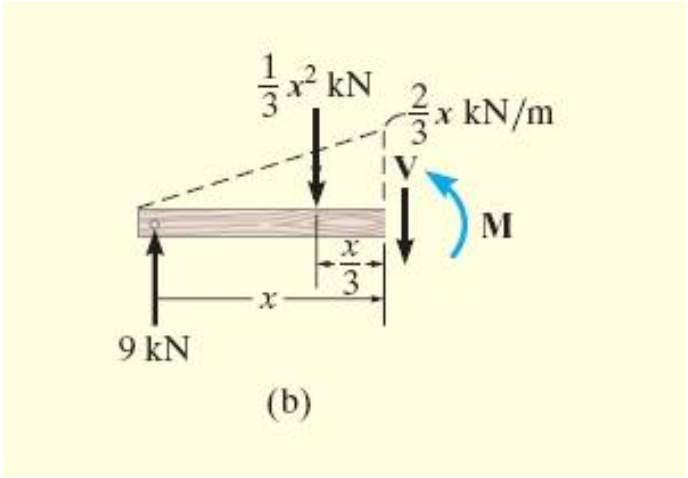
Teken de schuifkracht en moment diagrammen voor de balk.

Plan van aanpak?

FBD van geheel.
Steunpunt reacties.
FBD van deel.
Interne reacties op deel.

Example 7.7b

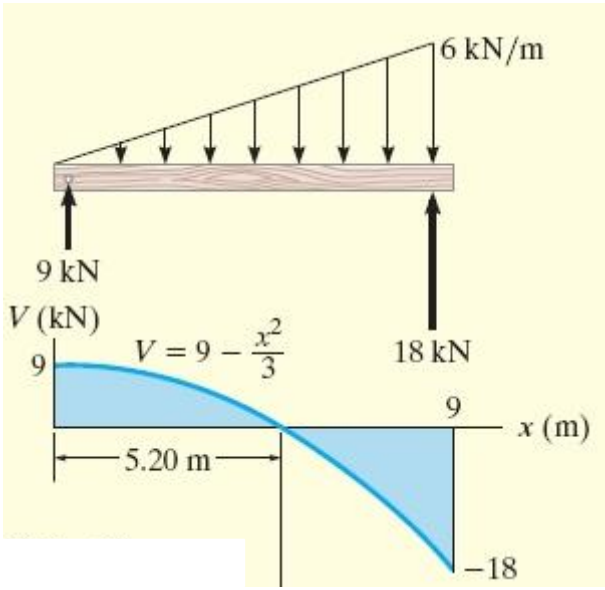




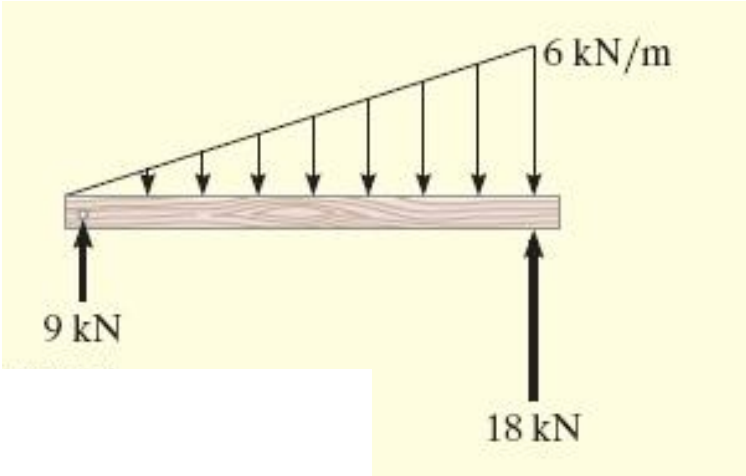
$$+\text{-}\ \text{å}\ F_y = 0$$

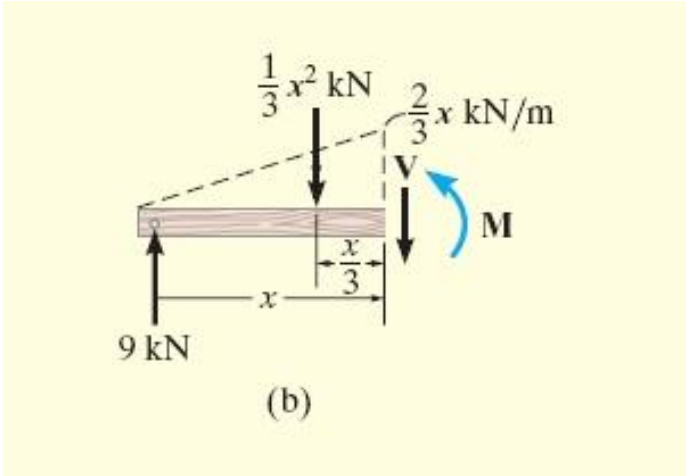
$$9 - \frac{1}{3}x^2 - V = 0$$

$$V = \text{æ}\ 9 - \frac{x^2}{3}\ \text{ö}\ kN$$



Example 7.7c

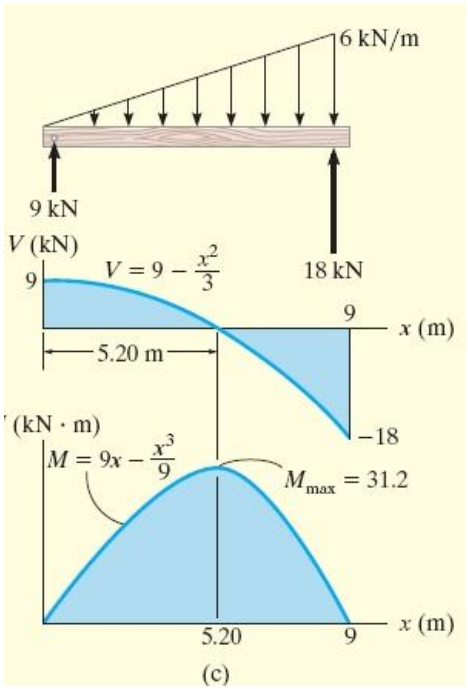




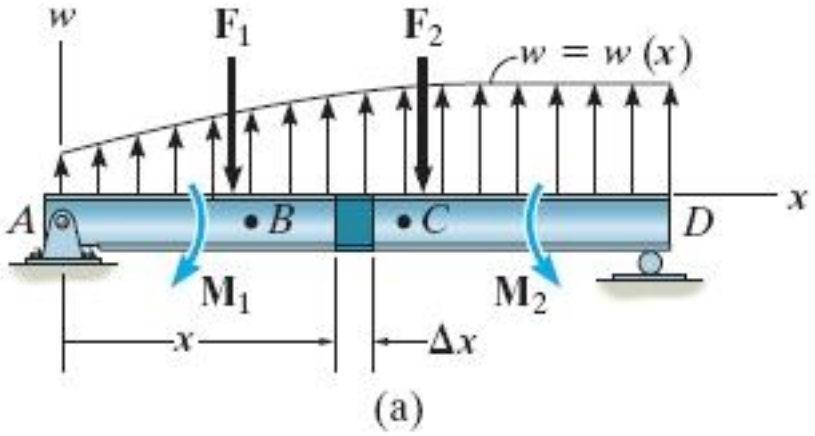
$$\text{linksom} + \sum M = 0$$

$$M + \frac{1}{3}x^2\left(\frac{x}{3}\right) - 9x = 0$$

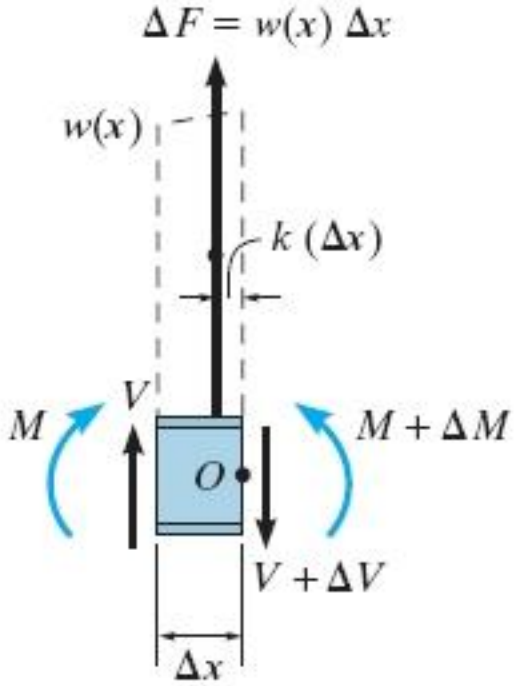
$$M = \left(9x - \frac{x^3}{9}\right) kN \times m$$



7.3 Verdeelde belasting, Schuifkracht en Moment



(a)



(b)

7.3 b verdeelde belasting - schuifkracht

$$+\uparrow \sum F_y = 0$$

$$V + w(x)\Delta x - (V + \Delta V) = 0$$

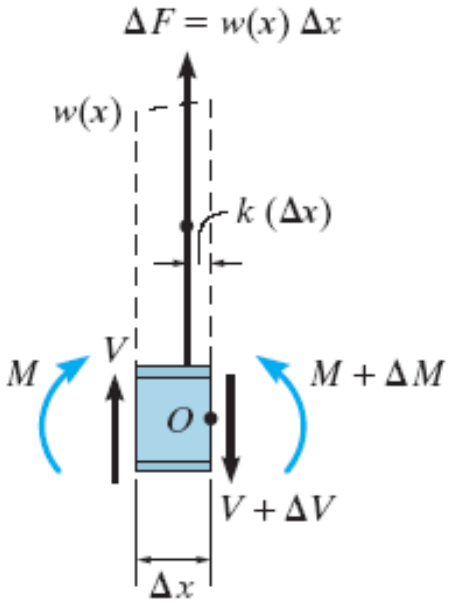
$$\Delta V = w(x)\Delta x$$

$$\frac{\Delta V}{\Delta x} = w(x)$$

$$\frac{dV}{dx} = w(x)$$

$$dV = w(x)\,dx$$

$$\Delta V = \int dV = \int w(x)dx$$



7.3c schuifkracht - moment

$$linksom + \sum M_O = 0$$

$$(M + \Delta M) - [w(x)\,\Delta x]\,k\Delta x - V\Delta x - M = 0$$

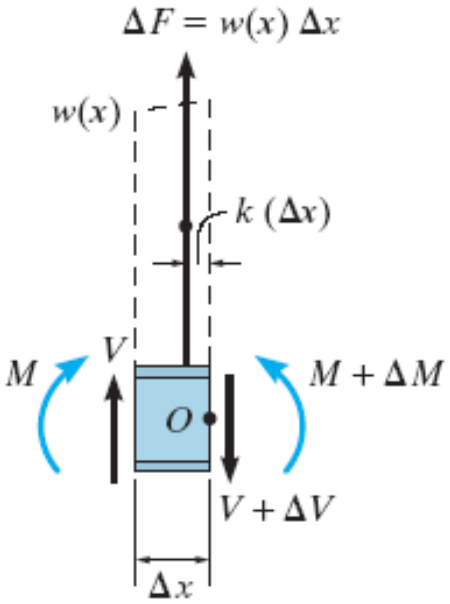
$$\Delta M = V\Delta x + kw(x)(\Delta x)^2$$

$$\frac{\Delta M}{\Delta x} = V + kw(x)\,\Delta x$$

$$\frac{dM}{dx} = V$$

$$dM = V dx$$

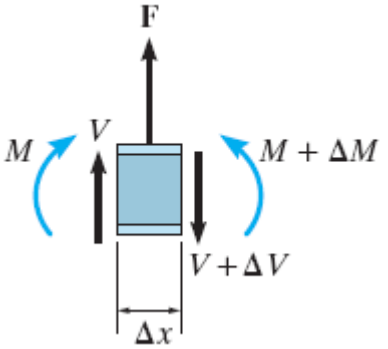
$$\Delta M = \int V\,dx$$



7.3d Externe “punt”krachten

$$+\uparrow \sum F_y = 0$$

$$\Delta V = F$$

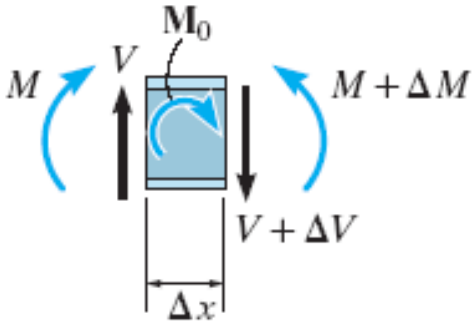


Tengevolge van een externe kracht “springt” de schuifkracht.

7.3e Externe koppels

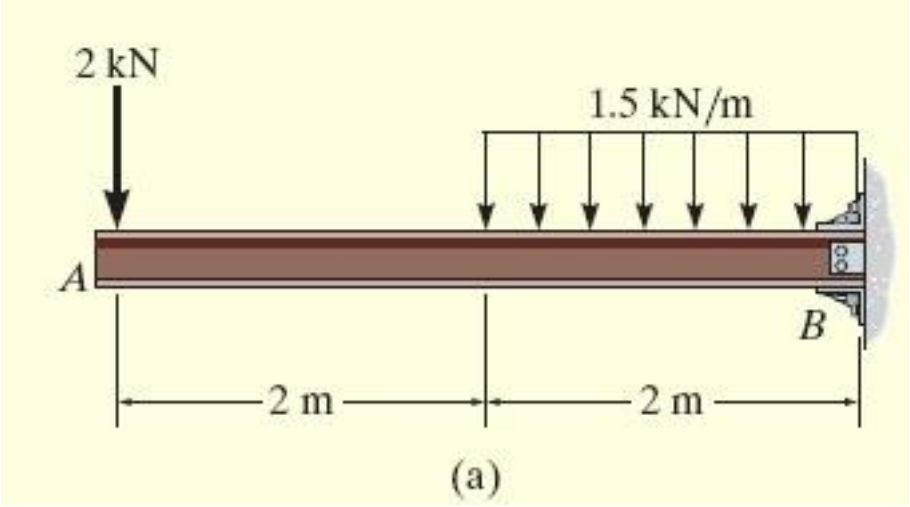
$$linksom + \sum M = 0$$

$$\Delta M = M_0$$



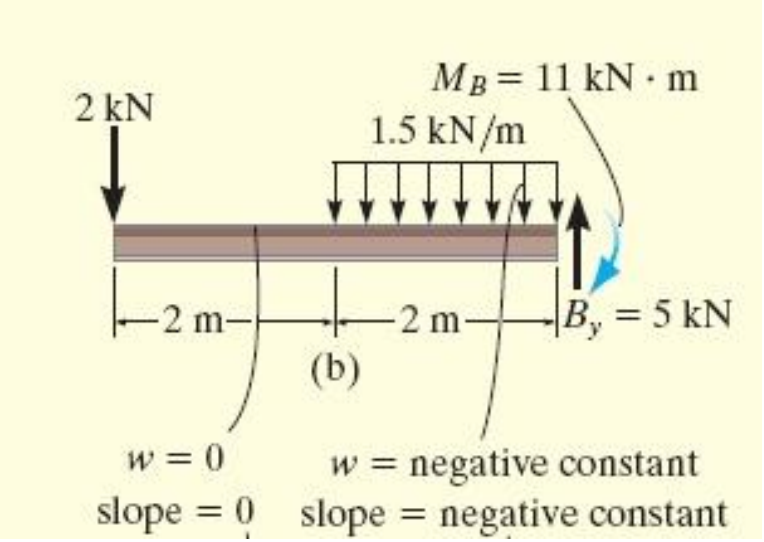
Tengevolge van een extern koppel “springt” de momentenlijn.

Example 7.8



Bepaal de schuifkrachtlijn en de momentenlijn van de balk.

Plan van aanpak?



Example 7.8b

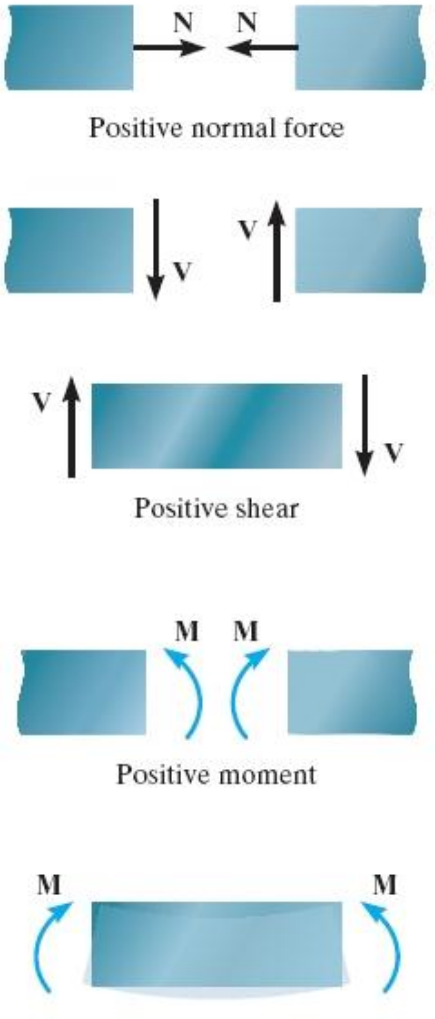
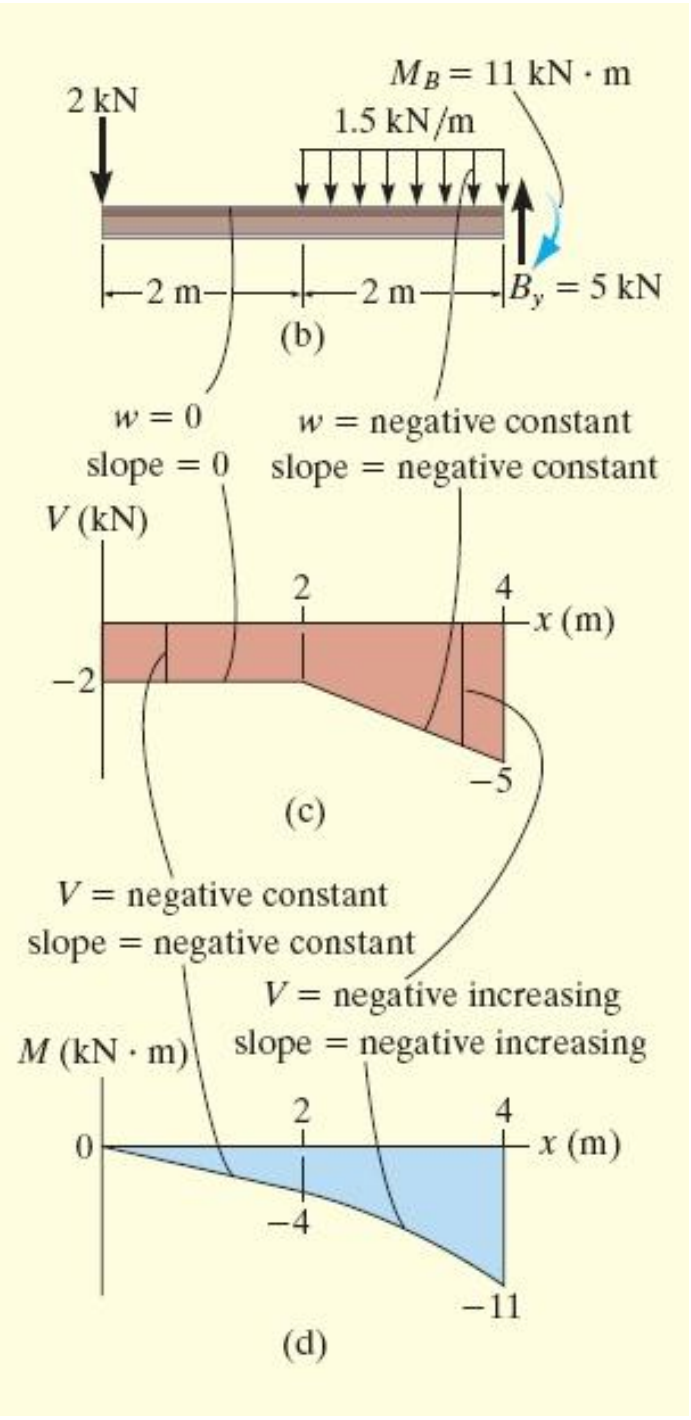
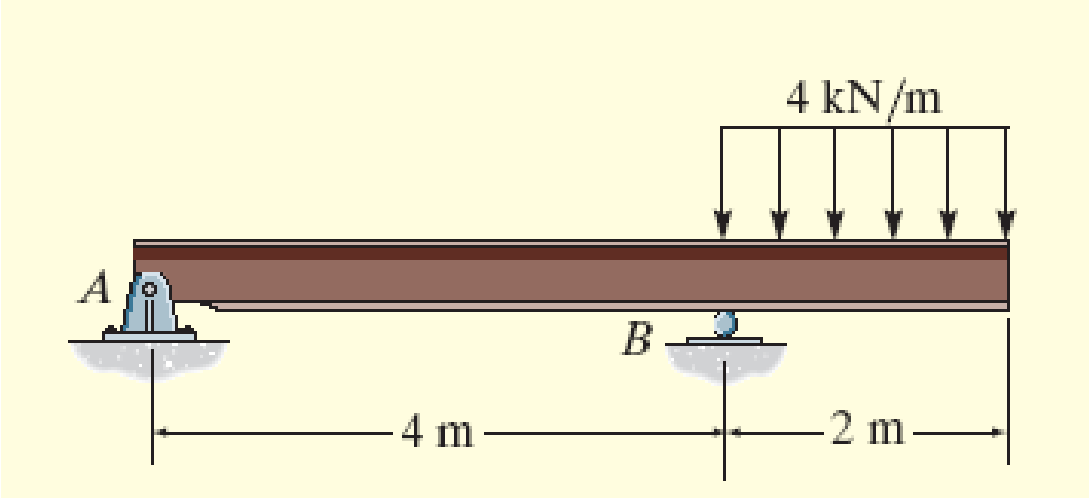


Fig. 7.3

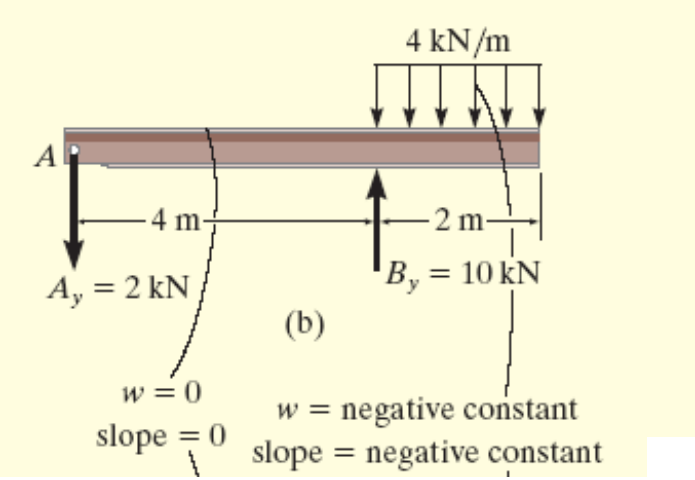


Example 7.9



Bepaal de dwarskrachtlijn en de momentenlijn voor de balk.

Plan van aanpak?



Example 7.9b

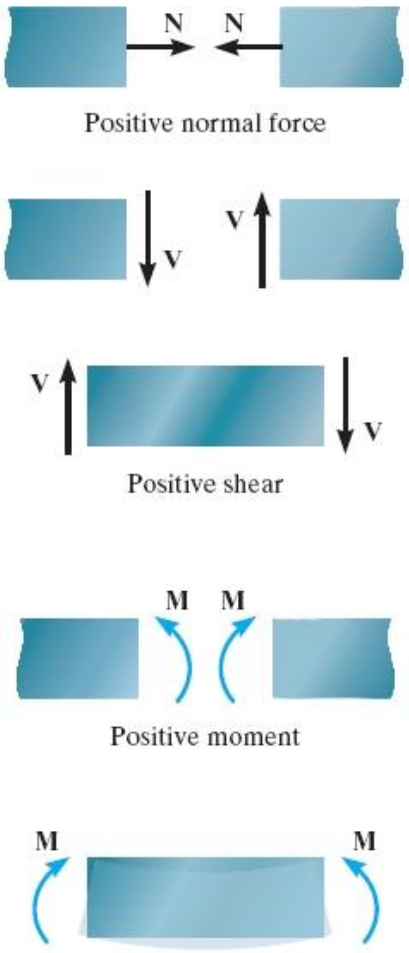
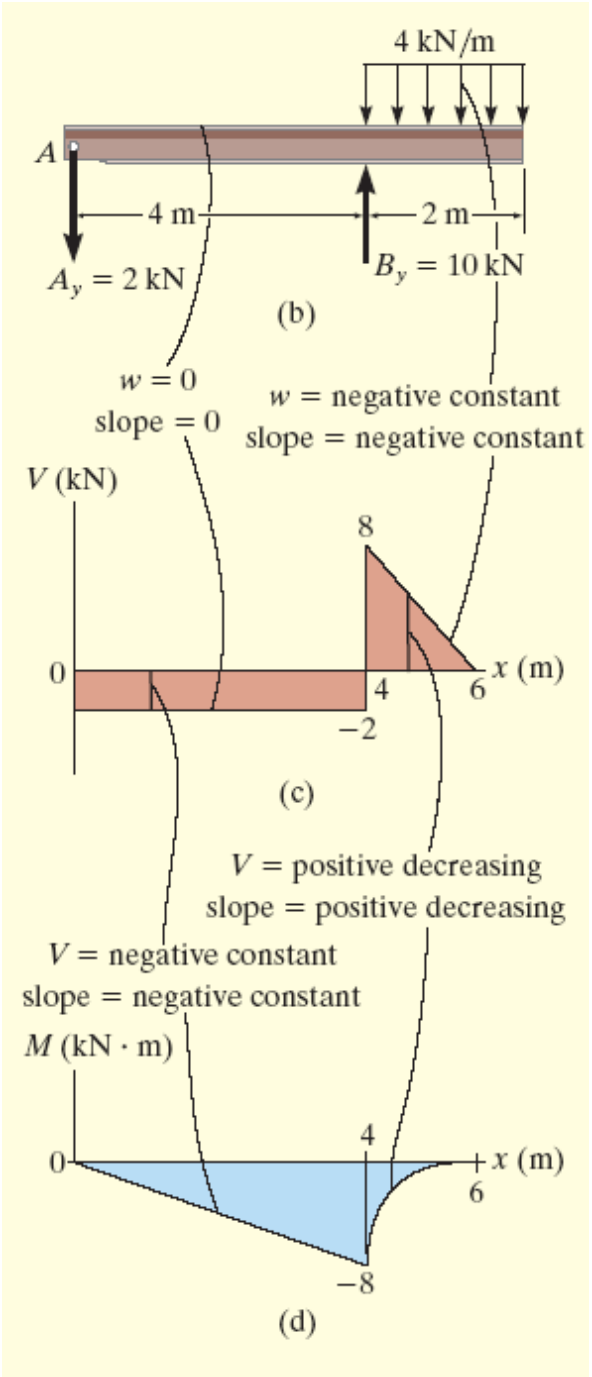
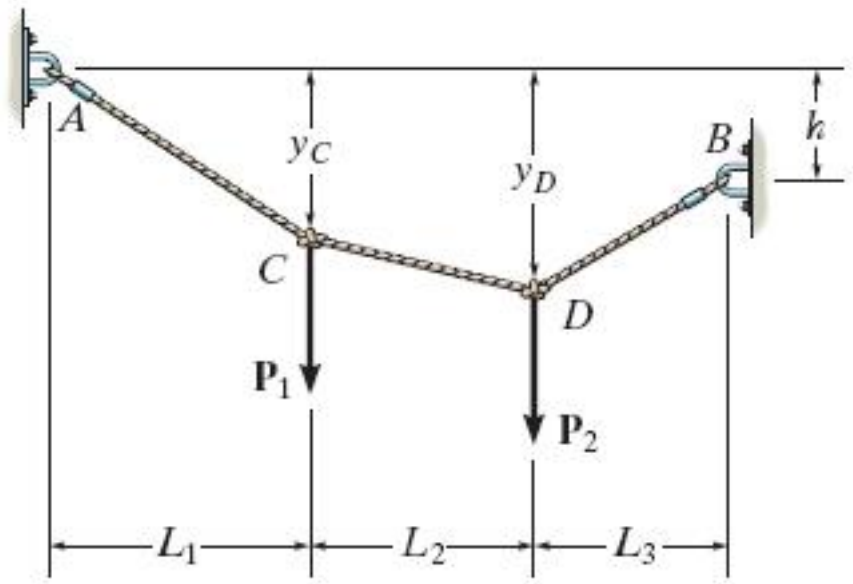


Fig. 7.3



Massaloze kabels



Hoeveel onbekenden?

$F_{Ax}, F_{Ay}, F_{Bx}, F_{By}$

S_{AC}, S_{CD}, S_{DB}

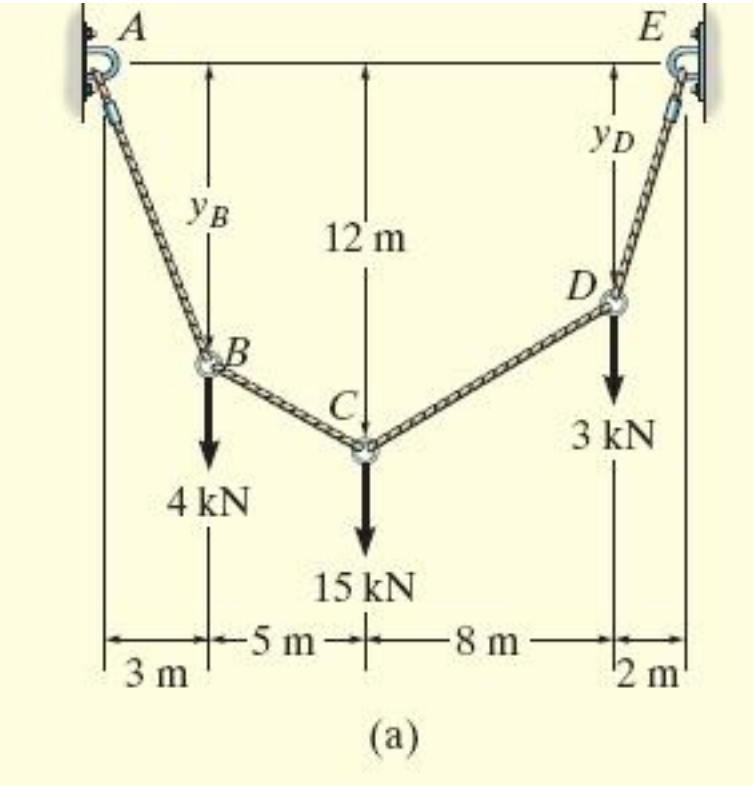
Y_C, Y_D

Hoeveel vergelijkingen?

Twee vergelijkingen per punt A,B,C,D.

9 onbekenden, 8 vergelijkingen. Je hebt nog iets nodig: b.v. de lengte van de kabel of één van de zakkingen Y.

Example 7.11



Bepaal de spanning in de segmenten AB, BC, CD, DE.

Huiswerk

Example 7.11 napluizen:	0.5 uur
Kennis nemen van Toets 11:	0.5 uur
Terugkijken op paragraaf 7.2 en 7.3:	0.5 uur
Toets 11 maken*:	4.0 uur
Voorbereiden paragrafen 8.1 t/m 8.4	1.0 uur
	_____ +
Totaal:	6.5 uur

* Als je niet uit de sommen van Toets 11 komt, of geen toegang hebt, begin dan met de “fundamental problems” uit het boek en doe vervolgens wat gewone opgaven of de sommen op “Mastering Engineering”(zie announcement Bb). Ook in schrift, ook meenemen naar werkcollege.