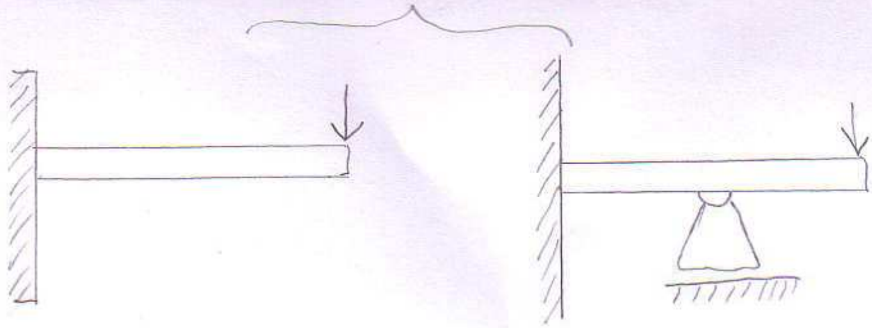
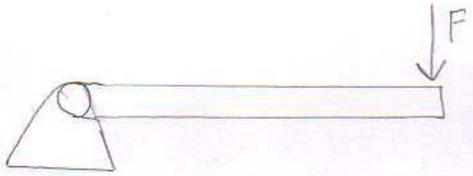
Mechanik

11.11.10

(1/4)

keine Fachwerke

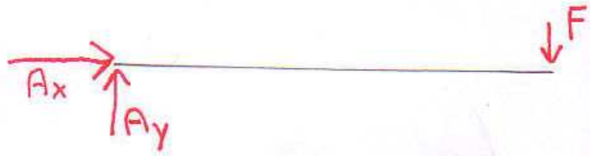




$k=1$ $\quad 2\cdot 1 \neq 1+2$

$s=1$

$r=2$



$\sum F_{ix} = A_x = 0$

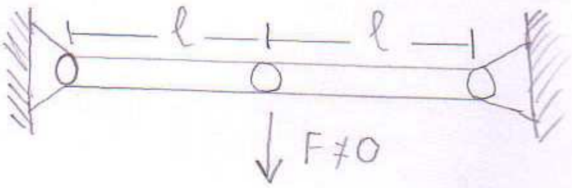
$\sum F_{iy} = A_y - F = 0$

$A_y = F$

$\sum M_i^{(A)} = -\ell F = 0$ $\Rightarrow$ kinem. unbest.

$\Rightarrow \underline{F=0}$ ↯

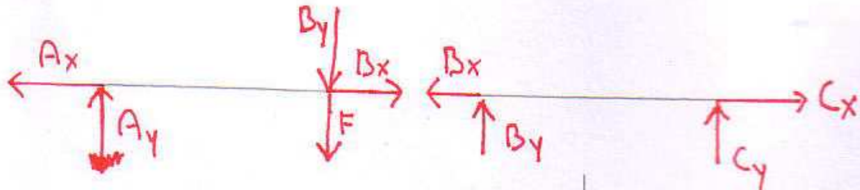
Bsp. 5



$k=3$

$s=2$ $\quad 2\cdot 3 = 2+4$

$r=4$



$\sum F_{ix} = -A_x + B_x = 0$

$\sum F_{iy} = A_y - B_y - F = 0$

$\sum M_i^{(B)} = -\ell A_y = 0$

$A_x = B_x$

$\sum F_{ix} = -B_x + C_x = 0$

$\sum F_{iy} = B_y + C_y = 0$

$\sum M_i^{(B)} = \ell C_y = 0$

$C_y = 0,\ B_y = 0 \Rightarrow F = 0$ ↯

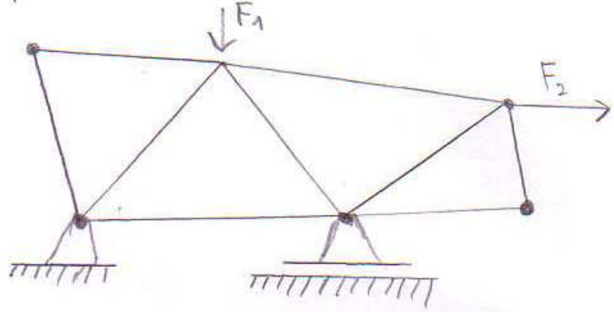
$\Rightarrow$ kinemat. unbestimmt, stat. unbestimmt

$A_x = B_x = C_x$

eine der Kräfte frei wählbar

Beispiel 2.6: Fachwerke

Gerade Stäbe, die an Knoten gelenkig verbunden sind.
Äußere Kräfte wirken nur an den Knoten.



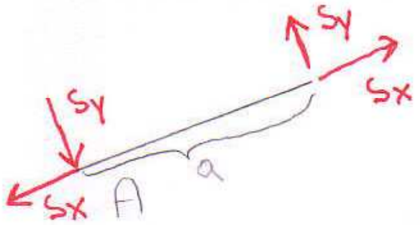
$k = 6$

$s = 9$

$r = 3$

freischneiden:

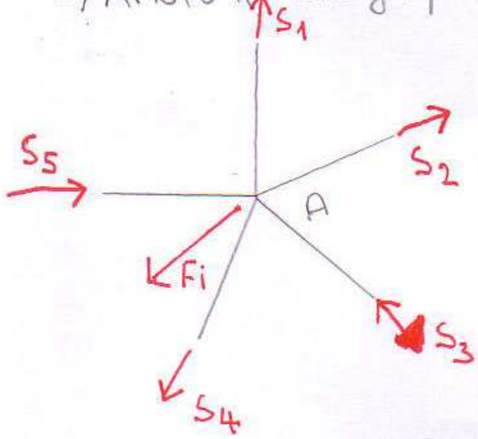
a) einzelner Stab



$\sum M_i^{(A)} = a\,S_y = 0 \Rightarrow S_y = 0$

$\|$ Stäbe übertragen Kräfte in Längsrichtung $\|$

b) Knoten (Auflager)



$\sum M_i^{(A)} = 0$ stets erfüllt

$\sum F_{ix} = 0$, $\sum F_{iy} = 0$

2 Gleichgewichtsbedingungen pro Knoten

k: Anzahl der Knoten (und Auflager)

s: Anzahl der Stäbe

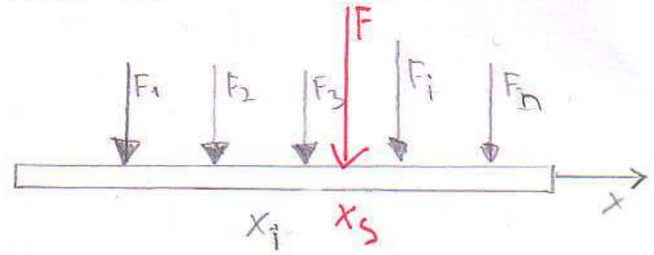
r: Anzahl der Lagerreaktionen

Gleichungen: $2k$

Unbekannte: $s + r$

$\boxed{2k = s + r}$ Notwendige Bestimmung für stat. Bestimmtheit

2.5 Verteilte Kräfte - Schwerpunkt



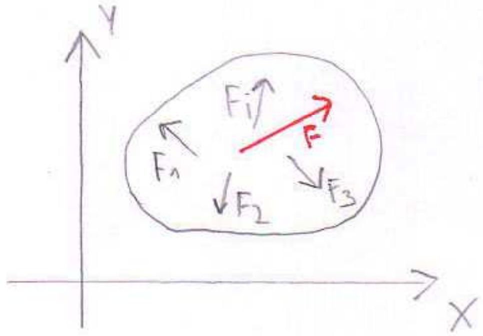
stat. äquivalente Einzelkraft

$$\sum F_i = F$$

$$\sum M_i^{(0)} = -\sum x_i F_i = -x_S F$$

$$x_S = \frac{1}{F}\sum x_i F_i$$

$$x_S = \frac{\sum x F_i}{\sum F_i}$$

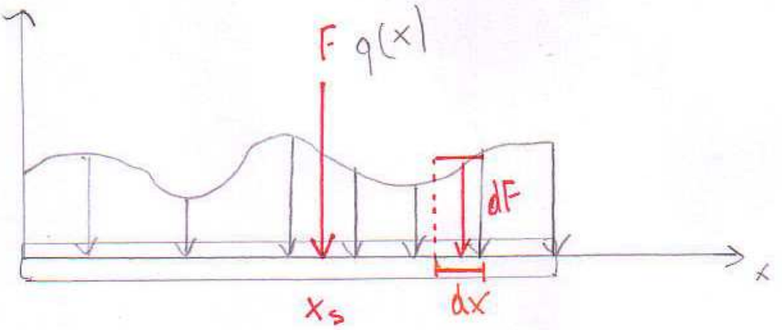


$$\underline{F} = \sum \underline{F}_i$$

$$M_F^{(A)} = \sum M_i^{(A)}$$

$$r_{sx} F_y - r_{sy} F_x = \sum (r_{ix} F_{iy} - r_{iy} F_{ix})$$

$$\boxed{r_{sx} = \frac{\sum r_{ix} F_{iy}}{\sum F_{iy}} \qquad r_{sy} = \frac{\sum r_{iy} F_{ix}}{\sum F_{ix}}}$$



Linienkraft $\left[\frac{N}{m}\right]$

Kraft auf Linienmoment dx: $dF = q(x)\,dx$

$$dM = -x\,dF = -x\,q(x)\,dx$$

Mechanik
11.11.10
(4|4)

$$F = \int_0^l dF = \int_0^l q(x)\,dx$$

$$M = \int_0^l dM = -\int_0^l x q(x)\,dx$$

$$= -x_s F$$

$$\boxed{x_s = \frac{\int_0^l x\,q(x)\,dx}{\int_0^l q(x)\,dx}}$$