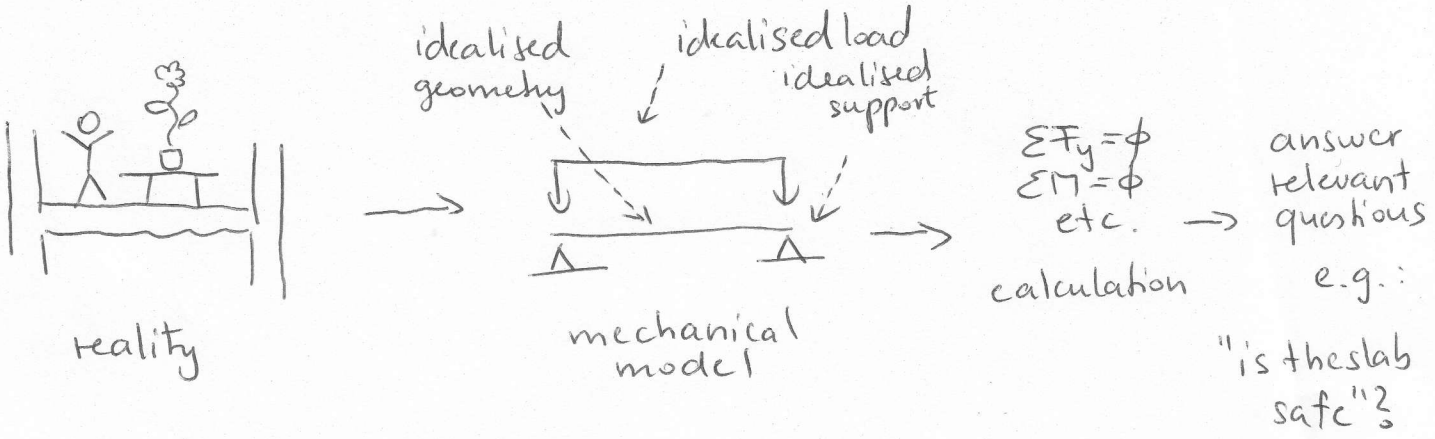
Lecture 3 Modeling structures: idealized supports

The typical steps of structural analysis



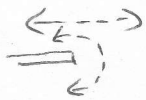
→ calculations: you will learn about it in all subjects of our department.

→ meaningful questions: you need to know more to ask and answer the relevant questions. One simple question will be discussed in the last class

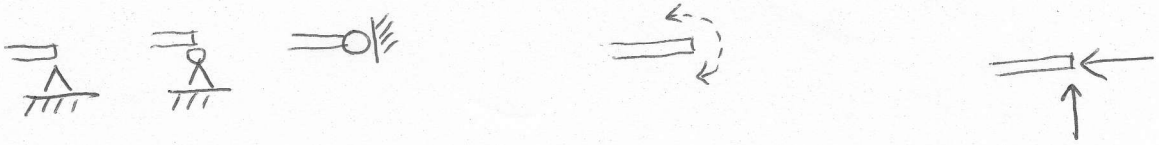
→ idealized loads: later during this course

→ idealized supports: today.

IDEALISED SUPPORTS

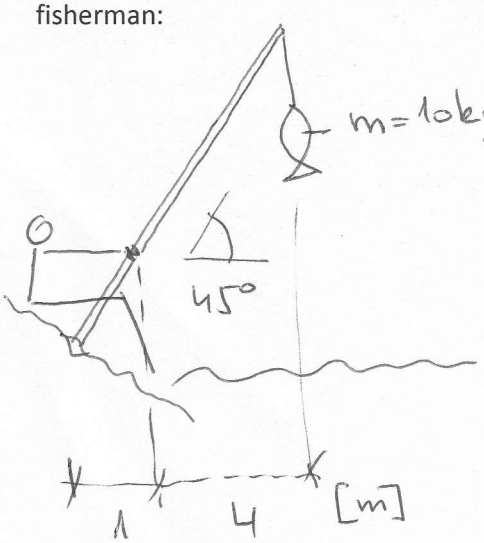
Name	Symbol	motion allowed	reaction forces
roller or slider			
			
or supporting bar			

reaction

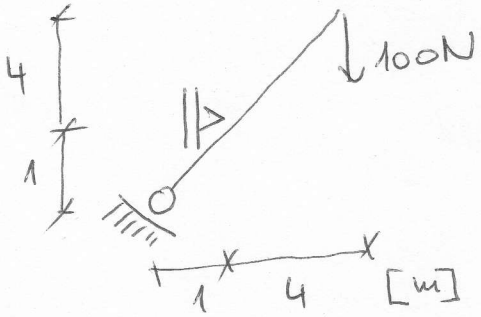
hinge 

fixed support 

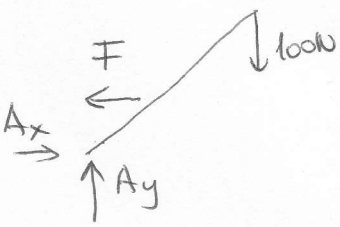
Excercise 1: build a mechanical model of the fishing pole and find the force in the arm of the fisherman:



mechanical model:



free body diagram:



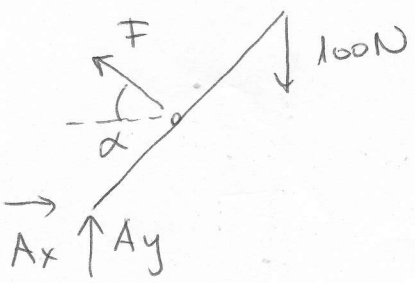
Calculation

$\Sigma M_A = F \cdot 1m - 100N \cdot 5m = \phi \rightarrow \boxed{F = 500N}$

(You can use $\Sigma F_x = \phi$ and $\Sigma F_y = \phi$ to find A_x and A_y if you want)

Excercise 2. Find the direction of force F int he previous excercise for which F is minimal. How big is F?

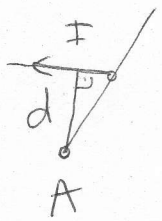
$\alpha = ?$



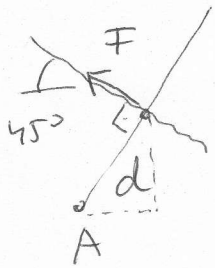
$$\sum M_A = F \cdot d - 100\text{kN}5\text{m} = 0$$

$$\downarrow$$

$F = \frac{500\text{Nm}}{d}$ where d is the distance of the line of action of F from A.



d is largest if $\alpha = 45°$:



$\rightarrow \quad d = \frac{1\text{m}}{\cos 45°} = 1{,}414\text{m}$

$$\boxed{F = \frac{500\text{Nm}}{1{,}414\text{m}} = 353{,}6\text{N}}$$