Chapter 5 : Equilibrium of a Rigid Body

External vs Internal Forces

External : Forces caused by phenomena outside of the body

Internal: Within the body

Newton's 3rd => Sum of internal forces = 0

Not shown on the FBD

External forces are shown.

Static Equilibrium

$$\sum \vec{F} = 0$$
$$\sum \vec{M} = 0$$

2-D

$$\sum F_x = 0$$
$$\sum F_y = 0$$
$$\sum M_z = 0$$

3-D

$$\sum F_x = 0$$
$$\sum F_y = 0$$
$$\sum F_z = 0$$
$$\sum M_x = 0$$
$$\sum M_y = 0$$
$$\sum M_z = 0$$

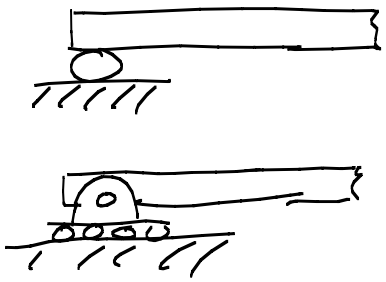
Support Reactions

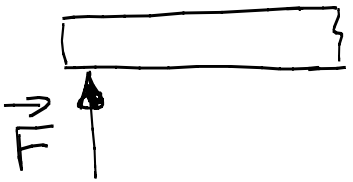
=> If the reaction prevents translation, then a force is developed in the opposite direction of the intended translation.

=> If the reaction prevents rotation, then a couple moment is developed.

2-D

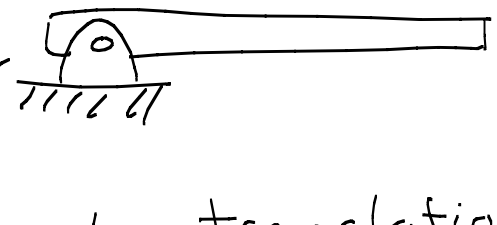
Roller



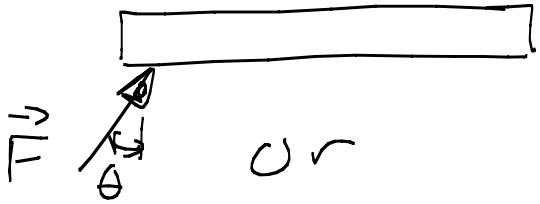


prevents downward translation

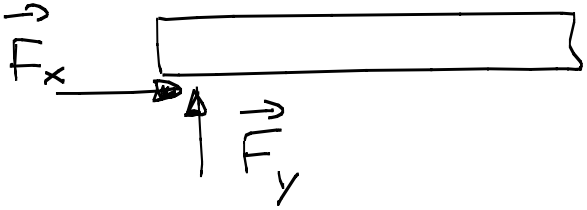
Pin



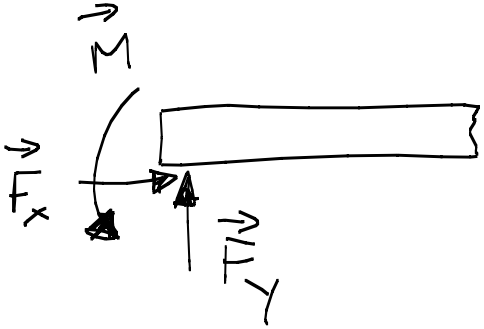
prevents translation in all directions



or



Fixed Support



No Rotation
No translation

Table 5-1, Other 2-D Support Conditions