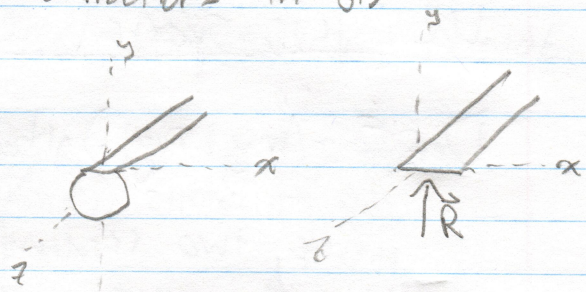
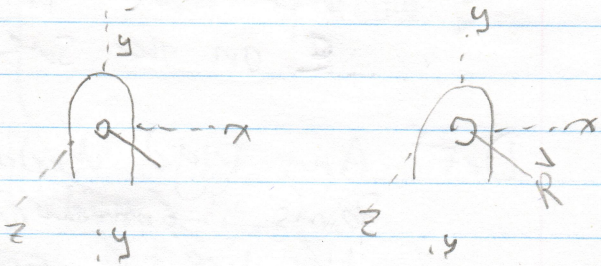
Reactions @ supports & connections in 3D

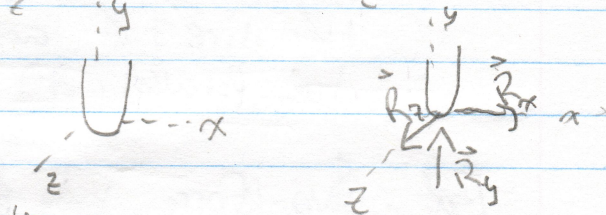
* ball
* frictionless surface



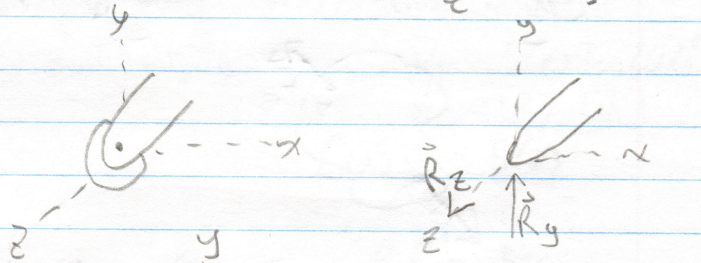
* Cable



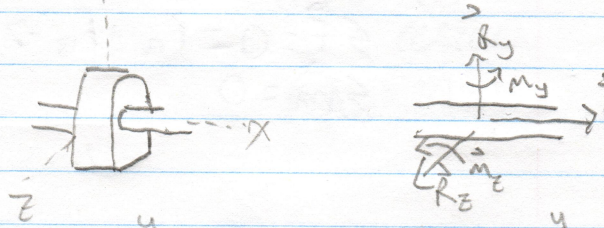
* Rough surface
* ball and socket



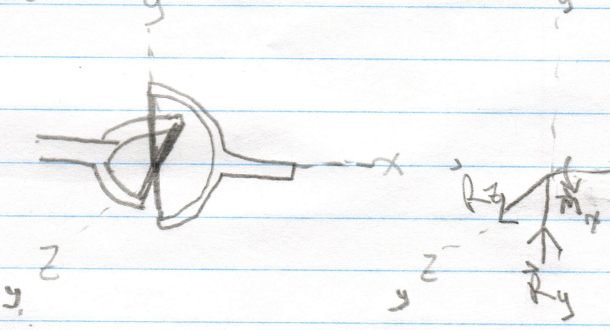
* roller
* wheel on rail



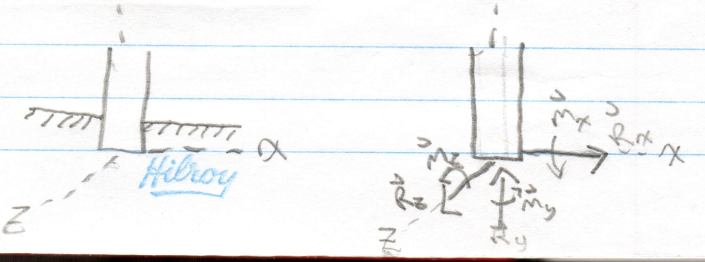
* hinge (bearing) (supports rigid bodies)



* universal joint



* fixed support

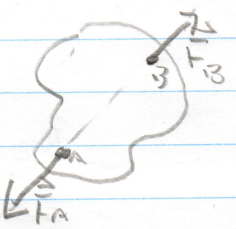


4.2 Two special cases

Def^n Any rigid body subject to forces acting @ only 2 points is called a two-force body; @ equilibrium the two resultants acting on a two force body are equal in magnitude, opposite in direction & on the same line of action

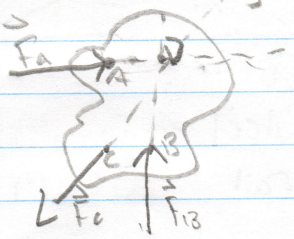
Def^n Any rigid body subject to forces acting @ only 3 points is called a three force body; @ equilibrium the lines of action of the three resultant must be parallel or concurrent

Eg Two-force body & three-force body



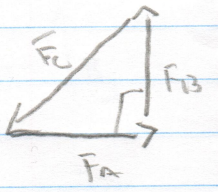
$\sum \vec{F} = 0 = \vec{F}_A + \vec{F}_B \rightarrow \vec{F}_A = -\vec{F}_B$

$\sum \vec{m} = 0$

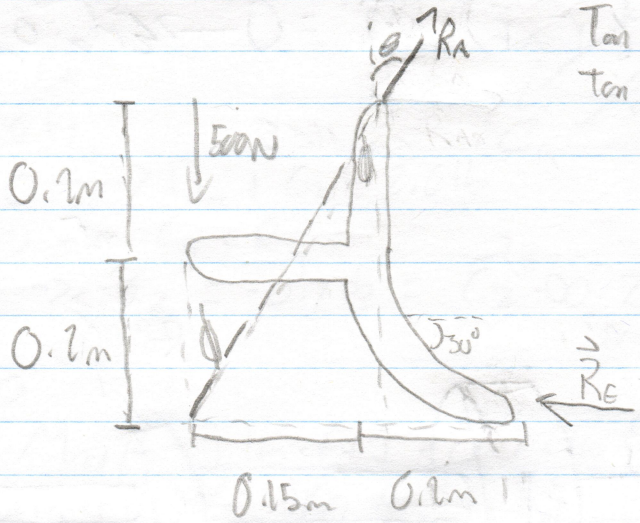


$\sum \vec{F} = 0$

$\sum \vec{m} = 0$



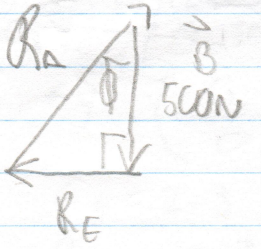
Ex 6.62 Determine the reactions at A and E when $\alpha = 0$



$\tan\phi = \frac{0}{a}$

$\tan\phi = \frac{0.15}{0.4}$

$\phi = 20.6°$



$\Sigma F = 0$

$0 = \vec{R}_A + \vec{R}_E + \vec{R}_B$

$\tan\phi = \frac{R_E}{500}$

$R_E = 500 \tan 20.6°$

$R_E = 187.5N$

$\cos\phi = \frac{500}{R_A}$

$R_A = \frac{500}{\cos 20.6°}$

$R_A = 534N$

$\vec{R}_A = 534N \angle 20.6°$

$\vec{R}_E = 187.5N \leftarrow$

Hibbeler