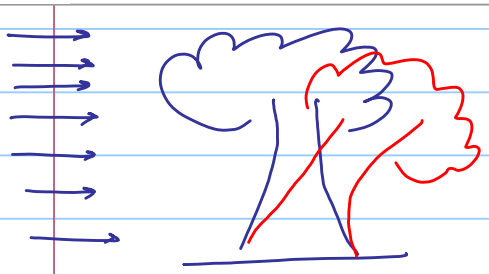
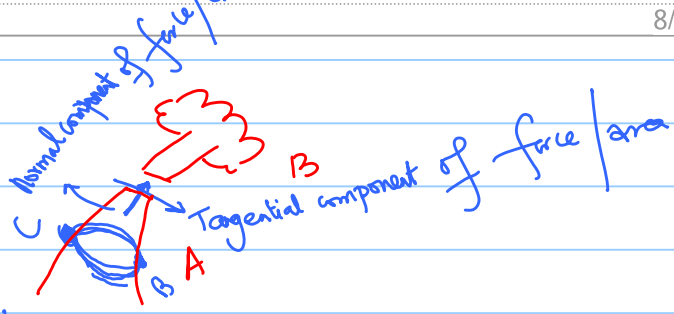
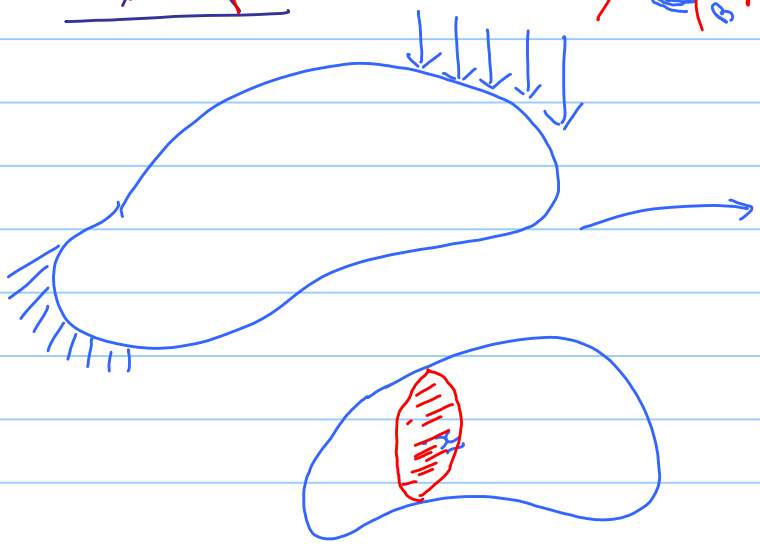
Lecture 4

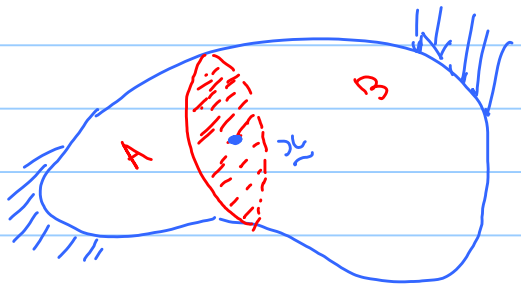
Concept of traction vector

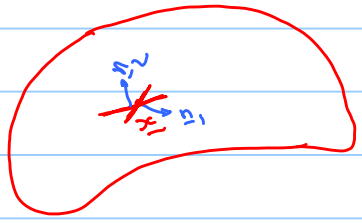
Note Title 8/10/2022

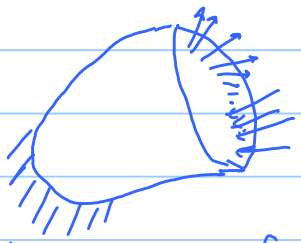






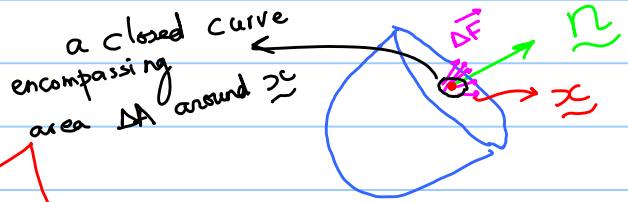




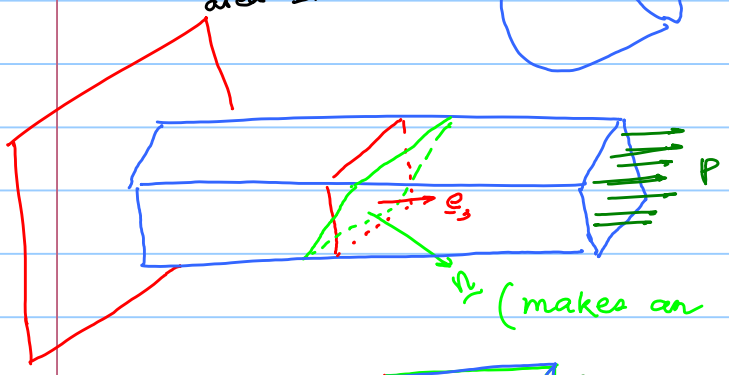


→ internal force/area varies from pt. to pt.
(traction vector)

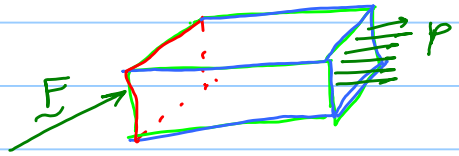
* Traction vector changes from pt. to pt. in the body
* " " need not be just perpendicular or tangential to the surface



$$\underset{\sim}{t}(\underset{\sim}{x},\underset{\sim}{n}) = \lim_{\Delta A \to 0} \frac{\Delta \underset{\sim}{F}}{\Delta A}$$



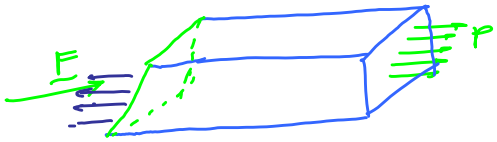
(makes an angle θ from $\underset{\sim}{e}_3$



$$pA\,\underset{\sim}{e}_3 + \underset{\sim}{F} = \underset{\sim}{0}$$

$$\Rightarrow \underset{\sim}{F} = -pA\,\underset{\sim}{e}_3$$

$$\Rightarrow F/A = -p\,\underset{\sim}{e}_3$$

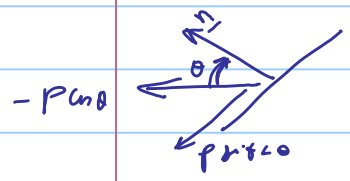


$$\underset{\sim}{p}A\underset{\sim}{e}_3 + \underset{\sim}{F} = \underset{\sim}{0}$$

$$\Rightarrow \underset{\sim}{F} = -pA\underset{\sim}{e}_3$$

$$\Rightarrow \frac{\underset{\sim}{F}}{A/\cos\theta} = \frac{-pA\underset{\sim}{e}_3}{A/\cos\theta} = -p\cos\theta\,\underset{\sim}{e}_3$$

$$\Rightarrow \underset{\sim}{t} = -p\cos\theta\,\underset{\sim}{e}_3$$



crack develops around 45° always!

→ With the information of traction vector on just three planes at a pt., one can find traction on any other plane at the same pt!