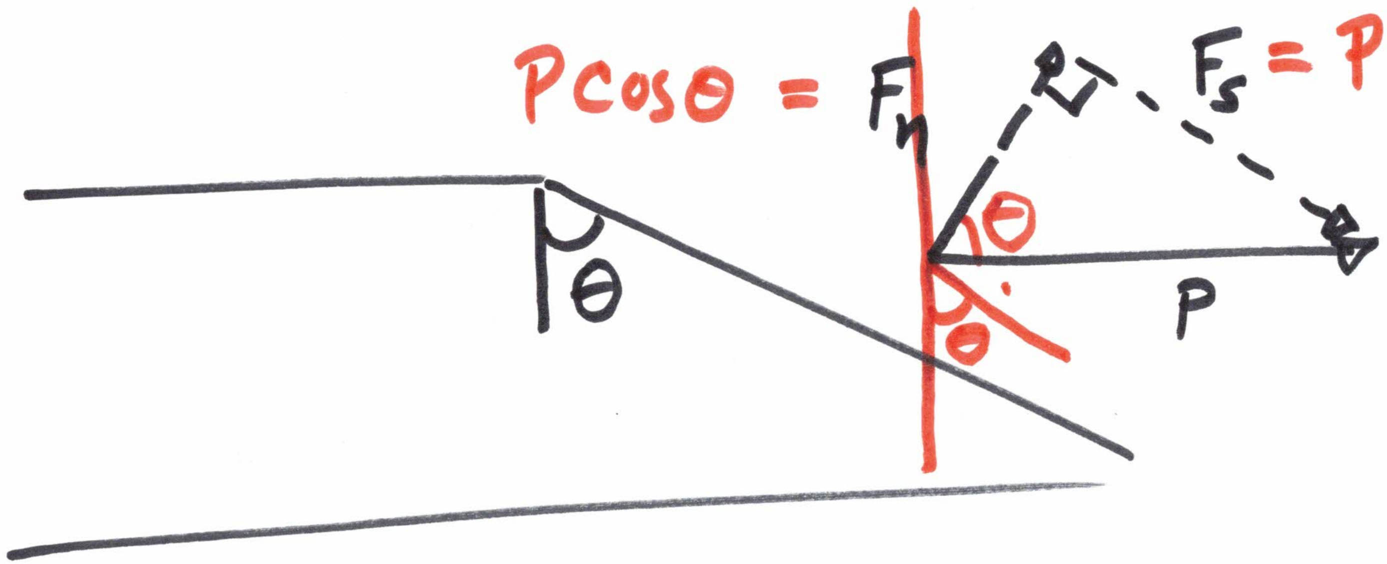
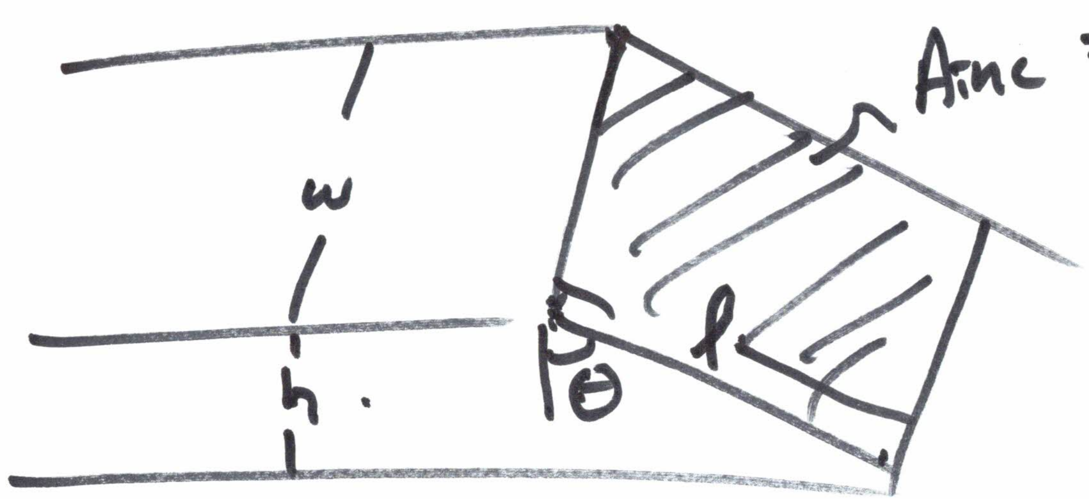
B. Stress on inclined plane

find θ in this triangle



$P\cos\theta = F_n$

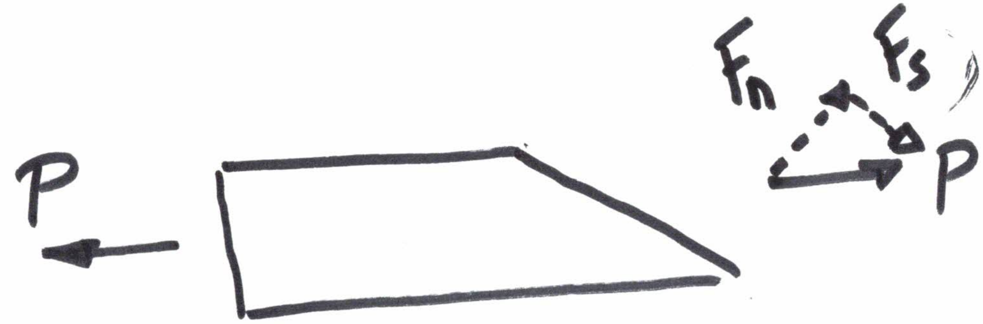
$F_s = P\sin\theta$

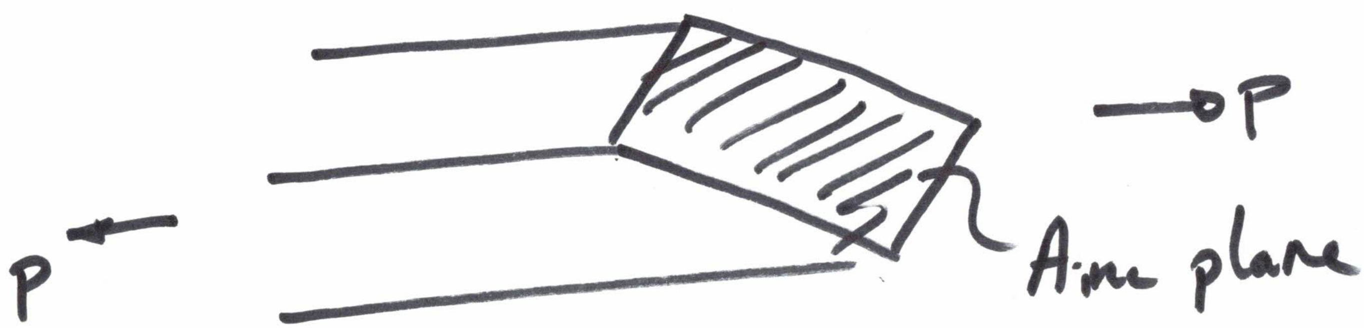


$A_{inc} = w \cdot \ell$

$\cos\theta = \frac{h}{\ell}$

$\ell = \frac{h}{\cos\theta}$





$$\sigma_{inc} = \frac{F_n}{A_{inc}} \qquad \tau_{inc} = \frac{F_s}{A_{inc}}$$

$$\sigma_{inc} = \frac{F_n}{A_{inc}} = \frac{P\cos\theta}{\frac{w \cdot h}{\cos\theta}} = \frac{P}{A_{xsection}} \cos^2\theta$$

$$\sigma_{inc} = \sigma_{axial} \cos^2\theta$$

$$\tau_{inc} = \frac{F_s}{A_{inc}} = \frac{P\sin\theta}{\frac{w \cdot h}{\cos\theta}} = \frac{P}{A_{xsection}} \sin\theta\cos\theta$$

$$\tau_{inc} = \sigma_{axial} \sin\theta\cos\theta$$

do not memorize these!

Normal & shear stress vary with angle.

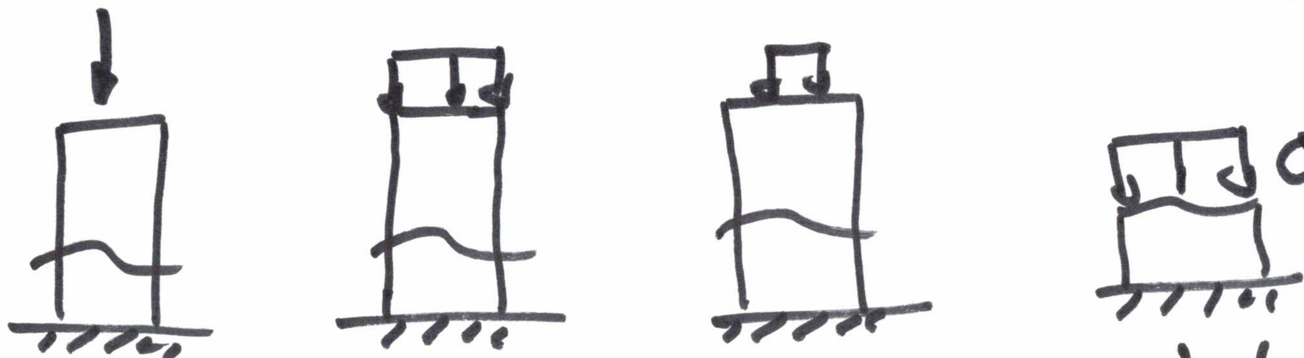
σ_{max} is at $\theta = 0^\circ$, $\tau = 0$

τ_{max} is at $\theta = \pm 45^\circ$, $\sigma = \dfrac{\sigma_{axial}}{2}$

See Figure 2.34 in book.

C. St. Venant's Principle

Many loading cases that do not look exactly like axial loading / tensile stress can be approximated by axial loading.

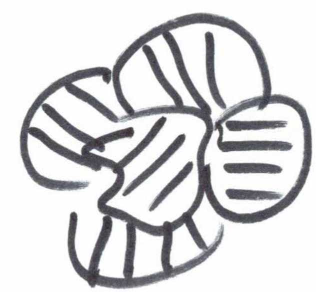


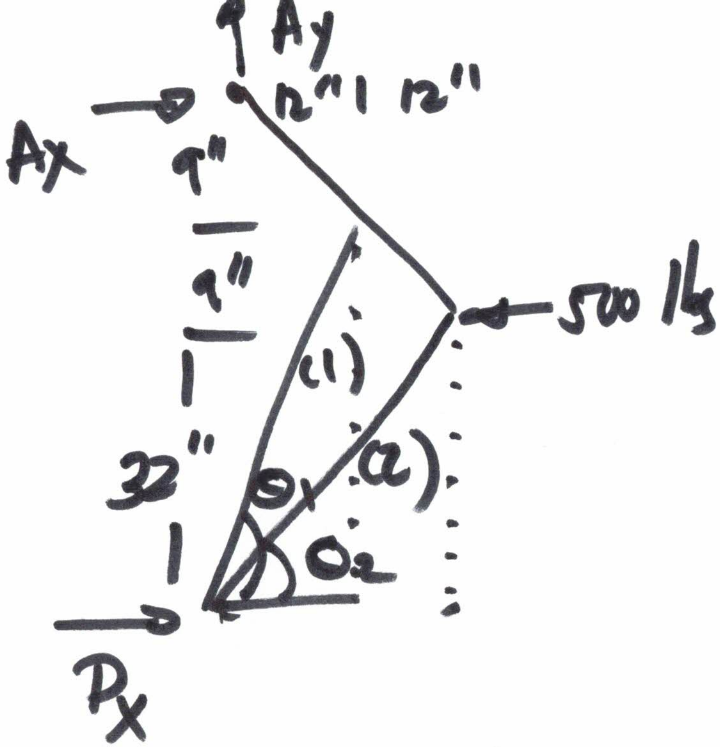
σ is the same a short distance from load

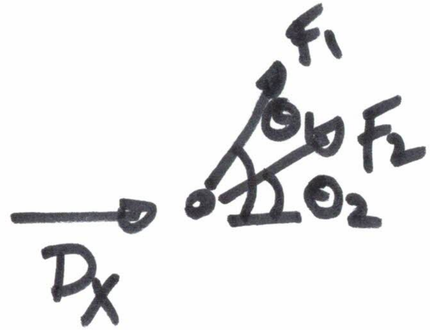
D. $E - G - \nu$ Relation

For isotropic materials, we have two independent constants.

$$G = \frac{E/2}{(1+\nu)}$$







$\circlearrowleft \Sigma M_A$ $\quad D_x(32+9+9) - 500(18) = 0$

$\Sigma F_y \uparrow + \quad A_y = 0$

$\xrightarrow{\Sigma F_x} \quad +A_x - 500 + D_x = 0$

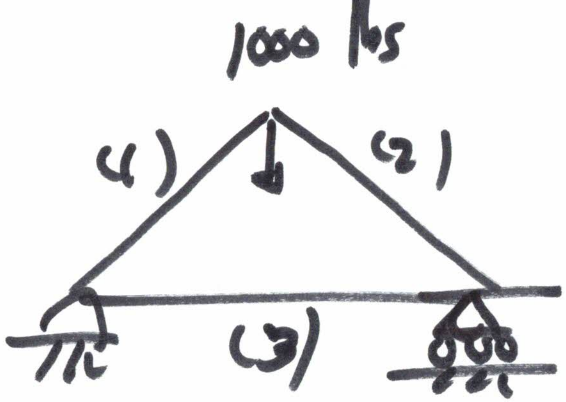
$\sigma_1 = \dfrac{F_1}{A_1}, \quad \sigma_2 = \dfrac{F_2}{A_2}$

$\tan\theta_2 = \dfrac{32}{24}$

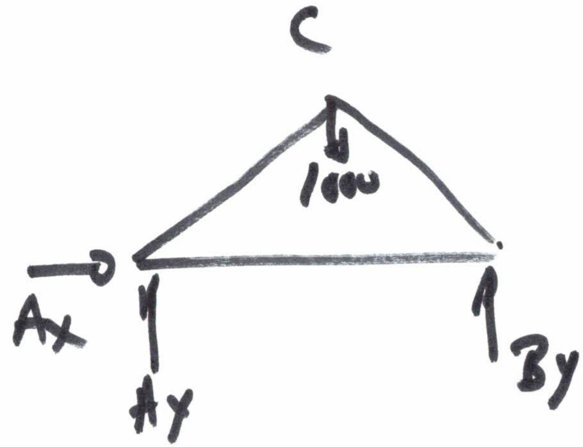
$\tan\theta_1 = \dfrac{41}{12}$

$\overrightarrow{\Sigma F_x}^{+}$ $D_x + F_1 \cos\theta_1 + F_2 \cos\theta_2 = 0$

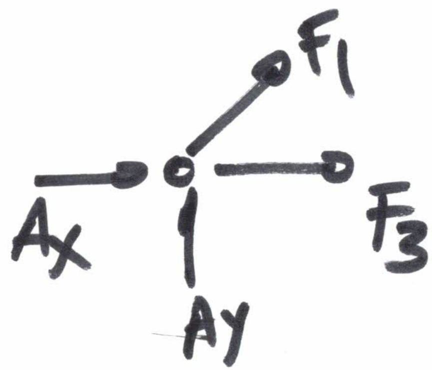
$\Sigma F_y \uparrow^{+}$ $F_1 \sin\theta_1 + F_2 \sin\theta_2 = 0$



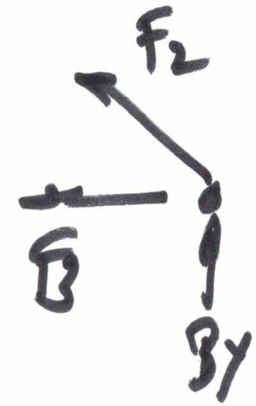
1000 lbs
(1)
(2)
(3)



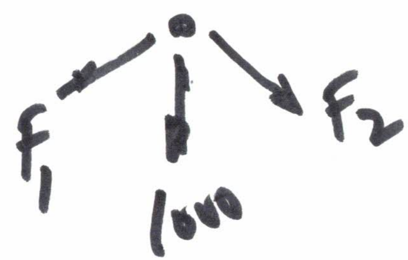
C
1000
Ax
Ay
By



F1
Ax
F3
Ay



F2
By



F1
1000
F2