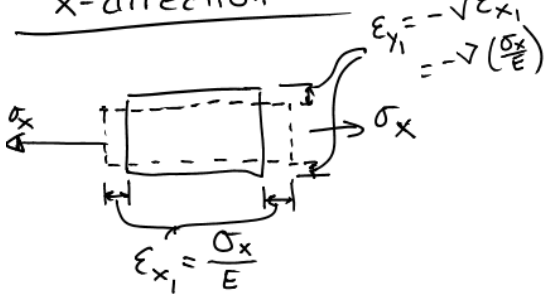
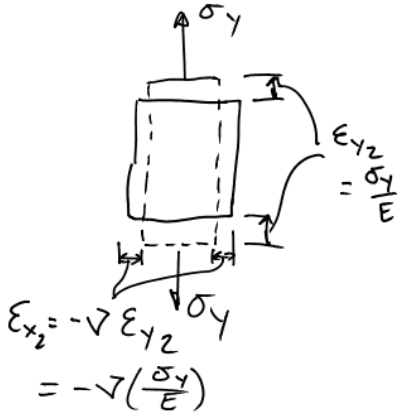
Hooke's Law for Plane Stress

$\sigma = E\varepsilon$ Poisson's Ratio => $\varepsilon' = -\nu\varepsilon$

x-direction



y-direction



$$\varepsilon_x = \varepsilon_{x_1} + \varepsilon_{x_2}$$
$$= \frac{\sigma_x}{E} - \nu\frac{\sigma_y}{E}$$
$$\boxed{\varepsilon_x = \frac{1}{E}(\sigma_x - \nu\sigma_y)}$$

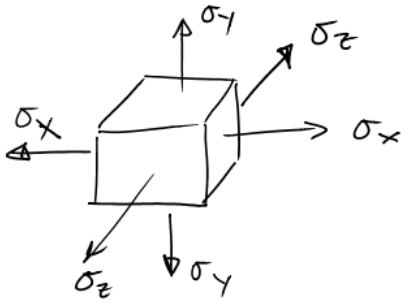
$$\varepsilon_y = \varepsilon_{y_1} + \varepsilon_{y_2}$$
$$= -\nu\left(\frac{\sigma_x}{E}\right) + \frac{\sigma_y}{E}$$
$$\boxed{\varepsilon_y = \frac{1}{E}(\sigma_y - \nu\sigma_x)}$$

$$\boxed{\gamma_{xy} = \frac{\tau_{xy}}{G}}$$

- Simplifying

$$\sigma_x = \frac{E}{1-\nu^2}(\varepsilon_x + \nu\varepsilon_y)$$
$$\sigma_y = \frac{E}{1-\nu^2}(\varepsilon_y + \nu\varepsilon_x)$$
$$\tau_{xy} = G\gamma_{xy}$$

Triaxial Stress



3 Mohr's Circles