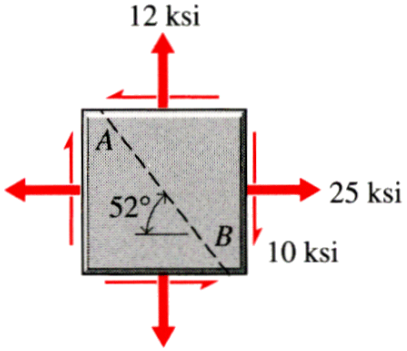
IDE 110 – Summer 2006 Quiz 13 **Name:** _____

Use the stress-transformation equations or Mohr's circle to determine the normal and shear stresses on inclined plane AB.

Show steps clearly. Put your answers on a properly oriented and labeled stress element.



Equations Method

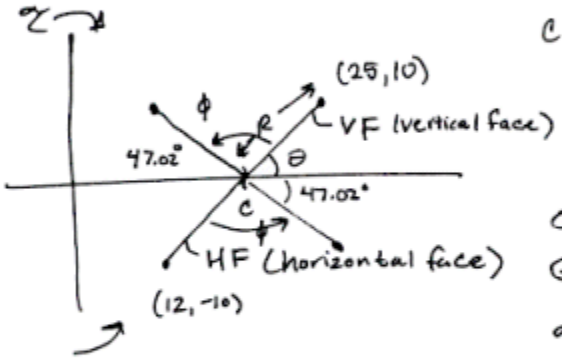
$\sigma_x = 25$ ksi $\quad \sigma_y = 12$ ksi $\quad \theta = 38°$ $\quad \tau_{xy} = -10$ ksi

$$\sigma_{x'} = \frac{25+12}{2} + \frac{25-12}{2}\cos(2\cdot 38) - 10\sin(2\cdot 38) = 10.37 \text{ ksi}$$

$$\sigma_{y'} = \frac{25+12}{2} - \frac{25-12}{2}\cos(2\cdot 38) + 10\sin(2\cdot 38) = 26.63 \text{ ksi}$$

$$\tau_{x'y'} = -\left(\frac{25-12}{2}\right)\sin(2\cdot 38) - 10\cos(2\cdot 38) = -8.73 \text{ ksi}$$

Mohr's Circle



$$C = \frac{25+12}{2} = 18.5 \qquad R = \sqrt{(25-18.5)^2 + 10^2} = 11.93$$

$$\phi = 2(38°) = 76°$$

$$\sigma_{x'} = C - R\cos(47.02) = 10.37 \text{ ksi}$$

$$\sigma_{y'} = C + R\cos(47.02) = 26.63 \text{ ksi}$$

$$\tau = \pm R\sin(47.02) = \pm 8.73 \text{ ksi}$$

$\sigma_{x'} \Rightarrow$ shear is + $\Rightarrow$ ↻

$\sigma_{y'} \Rightarrow$ shear is − $\Rightarrow$ ↺