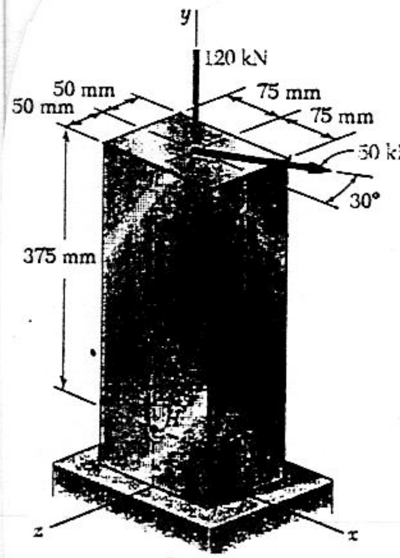
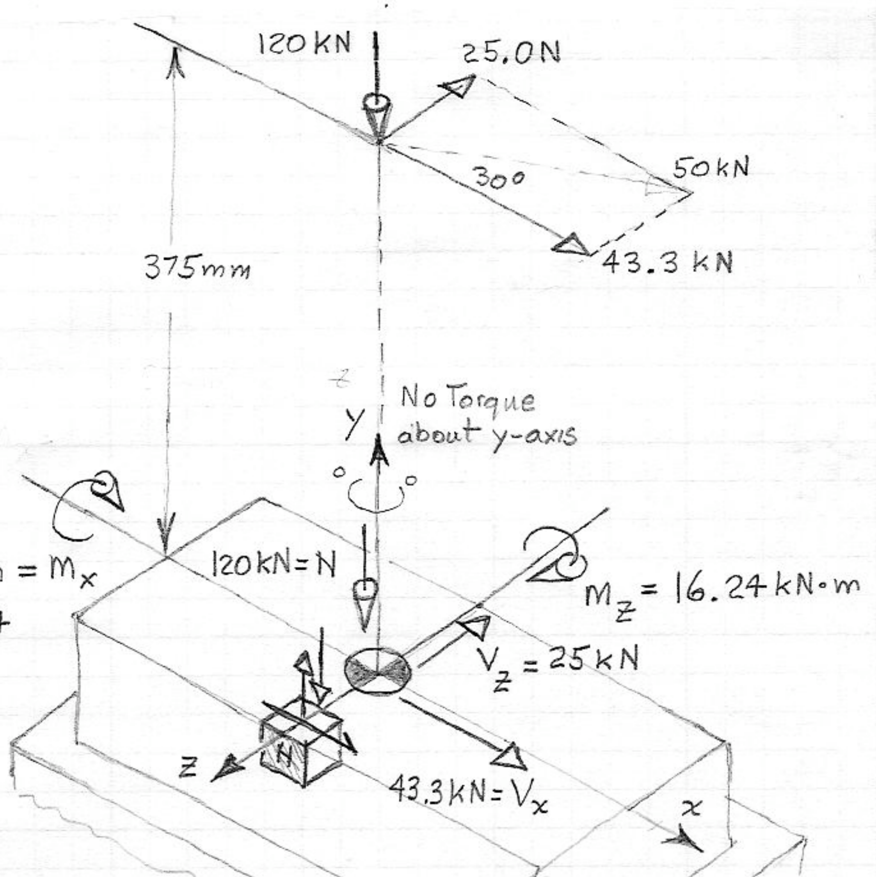
## Problem 8.49

**8.49** For the post and loading shown, determine the principal stresses, principal planes, and maximum shearing stress at point *H*.




$9.375 \text{ kN}\cdot\text{m} = M_x$

$I_x = \dfrac{150(100)^3}{12} = 12.5\times10^6 \text{ mm}^4$

$I_x = 12.5\times10^{-6} \text{ m}^4$

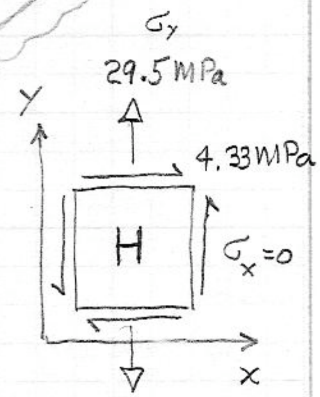
$A = (100)(150) = 15\times10^3 \text{ mm}^2$

$A = 15\times10^{-3} \text{ m}^2$

### Stresses at point H

$\sigma = -\dfrac{N}{A} + \dfrac{M_x Z}{I_x} = -\dfrac{120{,}000}{0.015} + \dfrac{9375(0.05)}{12.5\times10^{-6}}$

$\tau = \dfrac{3}{2}\dfrac{V_x}{A} = \dfrac{3}{2}\dfrac{43{,}300}{0.015}$ $\quad$ $\tau = 4.33$ MPa $\quad$ $\sigma = 29.5$ MPa




### Maximum stresses

$\sigma_{avg} = 29.5/2 = 14.75$ MPa, $\quad R = \sqrt{\left(\dfrac{29.5}{2}\right)^2 + (4.33)^2}$

$R = 15.37$ MPa

$\sigma_{max} = \sigma_{avg} + R$,

$\sigma_{min} = \sigma_{avg} - R$,

$\sigma_{max} = 30.1$ MPa

$\sigma_{min} = -0.62$ MPa

Because max(+) min(−) $\quad \tau_{max}^{\text{in-plane}} = R$

$\tau_{max} = 15.37$ MPa

$\tan 2\theta_p = \dfrac{2\tau_{xy}}{(\sigma_x - \sigma_y)} = -0.2936$ $\quad$ $\theta_p = -8.2°$