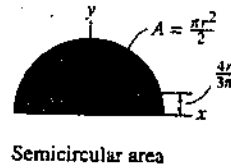
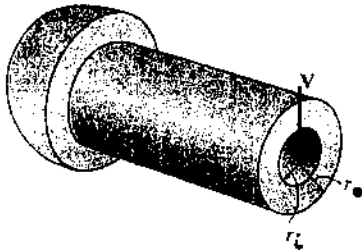


1. What is the maximum shear stress in the rivet? Also, show that if $r_i \rightarrow r_o$ then $\tau_{\max} = 2(V/A)$. (20%)

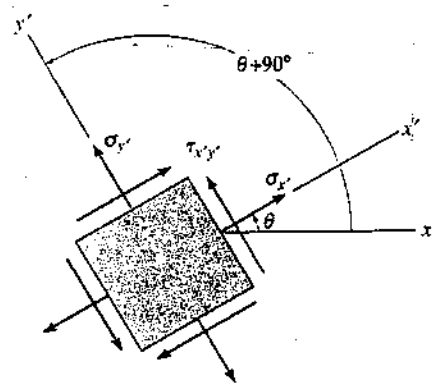
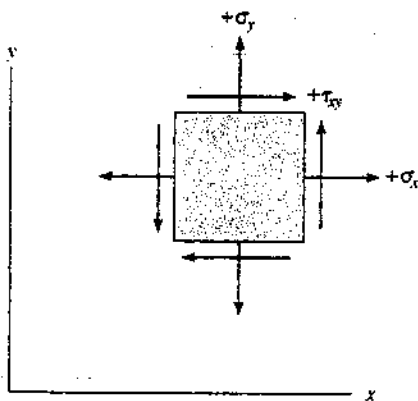


$$I_x = \frac{1}{8} \pi r^4$$

$$I_y = \frac{1}{8} \pi r^4$$

Semicircular area

2. Given the state of plane stress shown in the figure, please use force equilibrium equation to derive the stress transformation formula $\sigma_{x'}$, $\tau_{x'y'}$ in term of σ_x , σ_y , τ_{xy} and θ . (18%)



3. Plot the Mohr's circle for following stress states:

- (a) $\sigma_x = 10 \text{ Pa}$, $\sigma_y = \tau_{xy} = 0$,
- (b) $\sigma_x = 10 \text{ Pa}$, $\sigma_y = -10 \text{ Pa}$, $\tau_{xy} = 10 \text{ Pa}$,
- (c) $\sigma_x = 10 \text{ Pa}$, $\sigma_y = 10 \text{ Pa}$, $\tau_{xy} = 10 \text{ Pa}$,
- (d) $\sigma_x = 10 \text{ Pa}$, $\sigma_y = 10 \text{ Pa}$, $\tau_{xy} = 0$.

Mark the given stress state point in the Mohr's circle. (12%)

(背面仍有題目 請繼續作答)

4. 考慮如圖 4(a)之樑問題，該樑截面是由二個長方形(長寬各為 $2a$ 及 a)材料接合而成(如圖 4(b))。假設材料之楊氏係數為 E ，請回答下列各子題：
- (1) 使用所附之參考資料，以重疊法(Superposition method)求兩端點的反作用力(10%)；
 - (2) 使用能量法(Energy method)求兩端點的反作用力(10%)；
 - (3) 繪剪力圖及彎矩圖(10%)；
 - (4) 求結構樑中最大拉應力(Maximum tensile stress)(10%)；
 - (5) 如果材料是脆性行爲時，請問當本結構無法承受外力時，將先在哪處斷裂？請說明原因(5%)。
 - (6) 如果材料是韌性行爲時，請問當本結構無法承受外力時，將先在哪處產生永久變形？請說明原因(5%)。

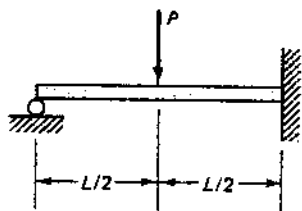


圖 4(a)

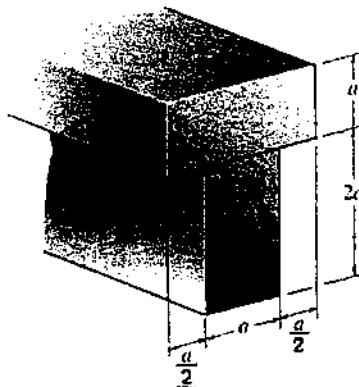


圖 4(b)

參考資料

Beam	Slope	Deflection
	$\theta_{max} = \frac{-PL^2}{2EI}$	$v_{max} = \frac{-PL^3}{3EI}$
	$\theta_{max} = \frac{-PL^2}{8EI}$	$v_{max} = \frac{-5PL^3}{48EI}$