6 $\gamma_o = (240/80)^2 = 9$ - closed, so $\sigma_a = \bar{\sigma}$ ($\sigma_F = 0$).
from (2) $\bar{\sigma} = (60 - 9\times 20)/8 = -15$ MPa ; $\tilde{\sigma} = (60-20)9/8 = 45$ MPa.
from (3) $\sigma_t = -15 + 45/\gamma$ $\quad \sigma_a = -15 \quad \sigma_r = -15 - 45/\gamma$; $\gamma = (D/80)^2$.

eg. $D = D_i = 80$	$\gamma = 1$	$\sigma_t = 30$	$\sigma_a = -15$	$\sigma_r = -60$ ($= p_i$ ✓)
$D = D_m = 160$	4	-4	-15	-26
$D = D_o = 240$	9	-10	-15	-20 ($= -p_o$ ✓)

The shape of the stress plot is identical to that shown in Notes - a factor of exactly 2 applies.
σ^* at bore $= \hat{\sigma} - \check{\sigma} = 30 - (-60) = 90$ MPa.

7 Basic equations:

$$\bar{\sigma} = (p_i - \gamma_o p_o)/(\gamma_o - 1) \; ; \; \tilde{\sigma} = \frac{(p_i - p_o)\gamma_o}{\gamma_o - 1}$$

at critical bore:

$$\sigma_t = \bar{\sigma} + \tilde{\sigma} = \frac{(\gamma_o + 1)p_i - 2\gamma_o p_o}{(\gamma_o - 1)}$$

$$\sigma_r = \bar{\sigma} - \tilde{\sigma} = -p_i \text{ always}$$

$$\sigma_a = 0 \text{ since open}$$

& $\sigma_e = \hat{\sigma} - \check{\sigma}$ - max. shear stress thing.
Consider p_i fixed and examine what happens as p_o increases from an initial value of zero.

Initially $p_o = 0$ so $\hat{\sigma} = \sigma_t = \frac{\gamma_o + 1}{\gamma_o - 1} p_i$; $\check{\sigma} = \sigma_r = -p_i$
$\therefore \sigma_e = \hat{\sigma} - \check{\sigma} = \frac{2\gamma_o}{\gamma_o - 1} \cdot p_i$

As p_o increases from 0, the tensile σ_t tends to become compressive. However σ_t remains $\hat{\sigma}$ provided $(\gamma_o + 1)p_i \geq 2\gamma_o p_o$
So in this range $0 \leq p_o/p_i \leq (\gamma_o + 1)/2\gamma_o$

$$\sigma_e = \hat{\sigma} - \check{\sigma} = \sigma_t - \sigma_r = 2\gamma_o(p_i - p_o)/(\gamma_o - 1)$$

When p_o increases beyond $\frac{\gamma_o + 1}{2\gamma_o} \cdot p_i$, σ_t does become compressive, i.e. $< \sigma_a$.
So $\hat{\sigma} = \sigma_a = 0$ and
$\check{\sigma} = \sigma_r = -p_i$ still, provided $\sigma_t > \sigma_r$
i.e. provided $p_o \leq p_i$
In the range $\frac{\gamma_o + 1}{2\gamma} \leq p_o/p_i \leq 1$ therefore,

$$\sigma_e = \hat{\sigma} - \check{\sigma} = \sigma_a - \sigma_r = p_i$$

Finally when $p_o \geq p_i$, σ_t replaces σ_r as the minimum and

$$\sigma_e = \hat{\sigma} - \check{\sigma} = \sigma_a - \sigma_t = \frac{2\gamma_o p_o - (\gamma_o + 1)p_i}{\gamma_o - 1}$$

Q.E.D.