3.

(A) $MR_A = 100 - 2q_A$

$MR_B = 50 - 2q_B$

$MC = 20$

$\pi = 60 \times 40 + 50 \times 30 - 20 \cdot (40 + 30)$

$= 2500 = PS$

$TS = 1250 + 2500 = 3750$

$CS = CS_A + CS_B = 800 + 450 = 1250$

(B)

$Q = q_A + q_B = 180 - 2P$

$\begin{cases} P = 100 - q_A \\ P = 50 - q_B \end{cases}$

$\pi = TR - TC$

$= 190 - 0.5Q^2 - 2Q$

$Q^* = 70 \quad P^* = 55$

$\pi = 2450$

$CS_A = 10125$

$CS_B = 312.5$

(C)

$\pi = 2F + (P - 20)(q_A + q_B)$

$= -P^2 + 60P + 25r$

$P = 10 \quad F = 1200 \quad q = 120 \quad \pi = 3700$

$CS = CS_A + CS_B - 2F$

$= 1200$