

1. (A)

$$60 - 2Q = 30 \Rightarrow Q = 15, P = 45$$

$$CS = \frac{15 \times 45}{2} = 337.5$$

$$DWL = 112.5$$

$$\pi = 45 \times 15 - 30 \times 15 = 225 - 450$$

$$TS = 225 + 112.5 = 337.5$$

(B)

$$60 - Q = 30 \Rightarrow Q = 30$$

$$CS = 0$$

$$DWL = 0$$

$$\pi = \frac{30 \times 30}{2} = 450$$

$$TS = 0 + 450 = 450$$

(C)

$$\pi = P(Q_1)Q_1 + P(Q_2)(Q_1 - Q_2) - TC(Q_2)$$

$$CS = \frac{6 \times 20}{2} + \frac{4 \times 20}{2} = 100$$

$$= (100 - Q_1)Q_1 + (60 - Q_2)(Q_1 - Q_2) - 30Q_2$$

$$TS = 100 + 300 = 400$$

$$= -Q_1^2 - Q_2^2 + 30Q_1 + Q_1Q_2$$

$$DWL = 450 - 400 = 50$$

$$f' = -2Q_1 + Q_2 = 0, -2Q_2 + Q_1 = 0$$

$$\pi = 50 \times 10 + 40(20 - 10) - 30 \times 20 = 300$$

$$\Rightarrow Q_1 = 10, Q_2 = 20, P_1 = 50, P_2 = 40$$

(D)

$$\pi = P(Q_1)Q_1 + P(Q_2)(Q_2 - Q_1) + P(Q_3)(Q_1 - Q_2) - TC(Q_3)$$

$$= (60 - Q_1)Q_1 + (60 - Q_2)(Q_2 - Q_1) + (60 - Q_3)(Q_1 - Q_2) - 30Q_3$$

$$= -Q_1^2 - Q_2^2 - Q_3^2 + 30Q_1 + Q_1Q_2 + Q_2Q_1$$

$$f' = -2Q_1 + Q_2 = 0, -2Q_2 + Q_1 + Q_3 = 0, -2Q_3 + 30 + Q_2 = 0$$

$$\Rightarrow Q_1 = 7.5, Q_2 = 15, Q_3 = 22.5, P_1 = 52.5, P_2 = 45, P_3 = 52.5$$

$$\pi = 52.5 \times 7.5 + 45(15 - 7.5) + 37.5(22.5 \times 13) - 30 \times 22.5 = 337.5$$

$$CS = \frac{7.5 \times 7.5}{2} + \frac{7.5 \times 7.5}{2} + \frac{7.5 \times 7.5}{2} = 84.375$$

$$TS = 84.375 + 337.5 = 421.875$$

$$DWL = 450 - 421.875 = 28.125$$