Jirot Phuakkund 6304641449

1.

firm 1 : $\pi_1 = TR_1 - TC_1$

$= (a - bQ_1 - bQ_2 - bQ_3)Q_1 - C_1$

$\frac{d\pi_1}{dQ_1} = a - bQ_2 - bQ_3 - c = 2bQ_1$

$Q_1 = \frac{a - bQ_2 - bQ_3 - c}{2b}$

from $\pi_1 = \pi_2 = \pi_3 = \pi_{All}$

$Q_2 = \frac{a - bQ_1 - bQ_3 - c}{2b}$

$Q_3 = \frac{a - bQ_1 - bQ_2 - c}{2b}$

Sub Q_2 into Q_1 : $Q_1 = \frac{a - b\left(\frac{a - bQ_1 - bQ_3 - c}{2b}\right) - bQ_3 - c}{2b}$

$Q_1 = \frac{a - bQ_3}{3b}$

Sub Q_1 into Q_2 : $Q_2 = \frac{a - b\left(\frac{a - bQ_2 - bQ_3 - c}{2b}\right) - bQ_3 - c}{2b}$

$Q_2 = \frac{a - bQ_3}{3b}$

Sub Q_1 and Q_2 into Q_3 $\quad Q_3 = \frac{a - b\left(\frac{a - bQ_3}{3b}\right) - b\left(\frac{a - bQ_3}{3b}\right) - c}{2b}$

$Q_3 = \frac{a + 2bQ_3}{6b} \qquad Q_3 = \frac{a}{4b}$

as $Q_1 = Q_2 = Q_3$

$P = a - bQ = a - bQ = a - 3b\left(\frac{a}{4b}\right) = \frac{a}{4}$

as $\pi_1 = \pi_2 = \pi_3 = \pi_{All}$

$\pi = (P - C)Q = \left(\frac{a}{4} - C\right) = \frac{a}{4b} = \frac{a^2}{16b} - c$

2. assume $Q_1 + Q_2 + Q_3 + \dots + Q_n = A$

$P = a - b(Q_1 + Q_2 + Q_3 + \dots + Q_n)$

$\pi_1 = a - b(Q_1 + Q_2 + Q_3 + \dots + Q_n)Q_1 - C_1$

$Q_1 - \frac{1}{2}Q_1 = \frac{a}{2b} - \frac{A}{2}$

$\frac{d\pi_1}{dQ_1} = a - 2bQ_1 + bQ_2 + bQ_3 + \dots + bQ_n = 0$

$Q_1 = \frac{a}{b} - A = Q_2 = Q_3 = \dots = Q_n$

$Q_1 = \frac{a}{2b} - \frac{1}{2}(Q_2 + Q_3 + \dots + Q_n)$

$Q_n = \frac{a}{2b} - \frac{1}{2}(Q_2 + Q_3 + \dots + Q_{n-1})$

As $A = Q_1 + Q_2 + Q_3 + \dots + Q_n$

$A = n\left(\frac{a}{b} - A\right)$

$A = \frac{na}{b} - nA$ $\quad$ $A + nA = \frac{na}{b}$ $\quad$ $A(1+n) = \frac{na}{b}$

$A = \frac{na}{(1+n)b}$

$P = a - bA = a - b\left(\frac{na}{(n+1)b}\right) = a - \frac{na}{n+1} = a - a\left(\frac{n}{n+1}\right)$

$= \frac{\cancel{a(n}+1) - \cancel{an}}{(n+1)} = \frac{a}{(n+1)}$

$\pi = P \cdot Q - C = \frac{a}{n+1} \cdot \frac{a}{(n+1)b} - C$

$= \frac{a^2}{(n+1)^2 b} - C$

3. If $n \to \infty$

$Q_1 = \frac{a}{(n+1)b} \to 0$, each firm will sell Q nearly 0 unit.

$Q = \frac{na}{(n+1)b} \to 0$, Q of firms combine will nearly ∞ units.

$P = \frac{a}{(n+1)} \to 0$, when supply increase, P will decrease nearly 0.

$\pi = \frac{a^2}{(n+1)^2 b} - C$, each firm will lose profit.

If $n = 2$

$Q_1 = \frac{a}{(n+1)b} = \frac{a}{2b}$, monopoly will sell less.

$Q = \frac{na}{(n+1)b} = \frac{a}{2b}$, firm will become monopolist.

$P = \frac{a}{(n+1)} = \frac{a}{2}$, monopoly will set higher price.

$\pi = \frac{a^2}{(n+1)^2 b} - C = \frac{a^2}{4b} - C$, monopolist will gain higher profit.