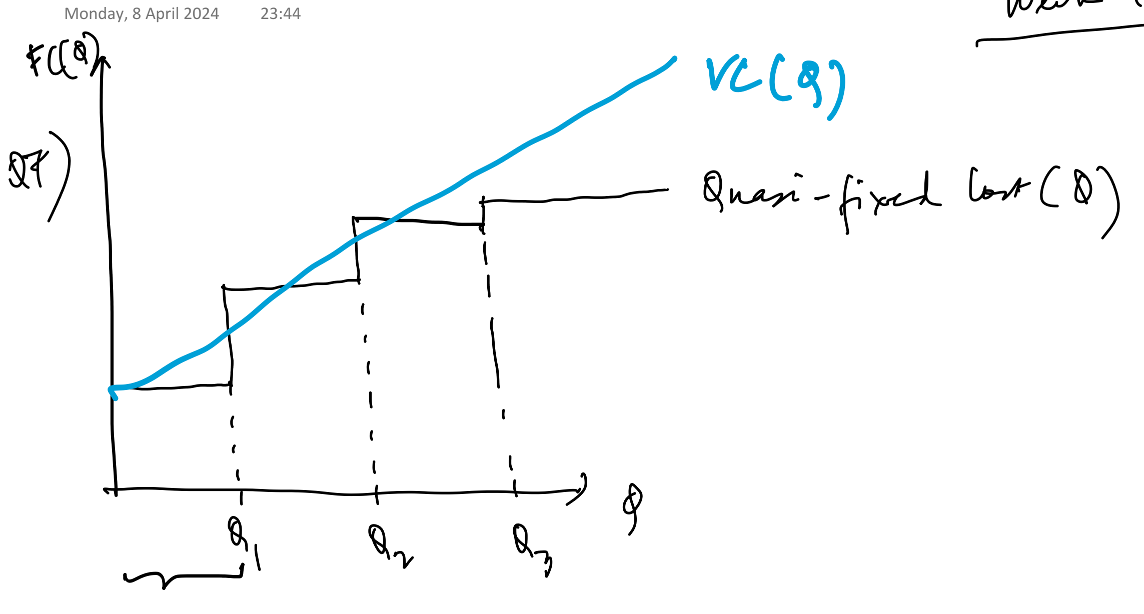
Week 11

Monday, 8 April 2024 23:44

Week 10

Q7)



$0 < Q < Q_1 \longrightarrow$ fixed.

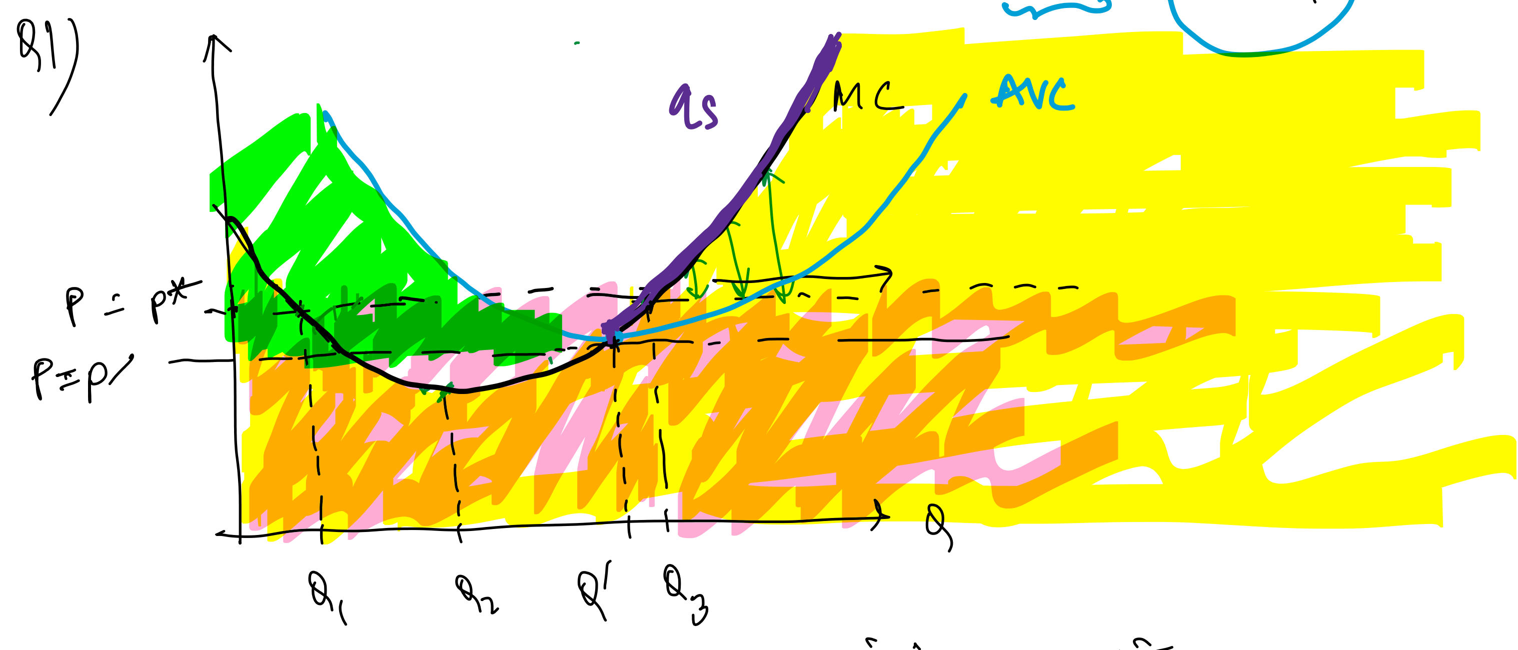
$\underbrace{\qquad\qquad}_{SR}$

Week 11

$\pi = TR - TC$

$\pi = p^* Q^* - \boxed{MC \times Q^*}$

Q1)



Beyond Q_3, firm cannot maximize profit, given $P = p^*$

To the left of Q', firm will not produce because it does not recover its variable cost also,

$\therefore P > AVC(Q_3)$ for profit maximization

$\underline{\underline{p' > AVC(Q')}}$ is condition for firm to produce.

Q4) $TC_1 = \underbrace{2q^3 - 4q^2 + 50q}_{VC} + \underbrace{100}_{FC}$

$MC_1 = \frac{d}{dq}(TC_1(q)) = 6q^2 - 8q + 50$

$MC_1 = 6\left(q^2 - \frac{8q}{6}\right) + 50$

$MC_1 = 6\left(q - \frac{4}{6}\right)^2 + 50 - 6 \times \left(\frac{2}{3}\right)^2$

$MC_1 = 6\left(q - \frac{2}{3}\right)^2 + 47.33$

$AVC_1 = \frac{VC_1(q)}{q}$

$AVC_1 = 2q^2 - 4q + 50$

$AVC_1 = 2(q^2 - 2q) + 50$

$AVC_1 = 2(q-1)^2 + (50-2)$

$AVC_1 = 2(q-1)^2 + 48$

AVC_1 has a minima at $q = 1$

$\therefore$ It will operate at $q_1 > 1$

At $q_1 = 1$, $AVC_1 = 48 = MC_1 = P$

It will operate at $P > 48$

For getting supply curve we get $MC_1 = P$

$P = 6\left(q_1 - \frac{2}{3}\right)^2 + 47.33$

$q_1 = \sqrt{\frac{P - 47.33}{6}} + \frac{2}{3}$

$TC_2 = \underbrace{2q^3 - 8q^2 + 20q}_{VC} + \underbrace{100}_{FC}$

$MC_2 = 6q^2 - 16q + 20$

$MC_2 = 6\left(q^2 - \frac{16}{6}q\right) + 20$

$MC_2 = 6\left(q_2 - \frac{8}{6}\right)^2 + \left(20 - \frac{8^2}{6}\right)$

Rough work

$(q-x)^2 = q^2 + x^2 - 2qx$

$2qx = \frac{16q}{6}$

$\therefore x = \frac{8}{6}$

$MC_2 = 6\left(q_2 - \frac{4}{3}\right)^2 + 20 - 10.667$

$MC_2 = 6\left(q_2 - \frac{4}{3}\right)^2 + 9.33$

$AVC_2 = 2q_2^2 - 8q_2 + 20$

$AVC_2 = 2(q_2^2 - 4q) + 20$

$AVC_2 = 2(q_2 - 2)^2 + 20 - 8$

$AVC_2 = 2(q_2 - 2)^2 + 12$

$\therefore$ Firm 2 operates if $q_2 > 2$, $P > 12$

$MC_2 = P = 6\left(q_2 - \frac{4}{3}\right)^2 + 9.33$

$\Rightarrow q_2 = \sqrt{\frac{P - 9.33}{6}} + \frac{4}{3}$

ii) At $p = 25$, only firm 2 operates.

At $p = 55$, both firm 1 & 2 operate

q_2 at $P = 25$

$q_2 = \sqrt{\frac{25 - 9.33}{6}} + \frac{4}{3}$

$q_2 = 2.94$

$Q_s = q_2 = 2.94$

At $p = 55$

$q_1 = \sqrt{\frac{55 - 47.33}{6}} + \frac{2}{3}$

$q_1 = 1.797$

$q_2 = \sqrt{\frac{55 - 9.33}{6}} + \frac{4}{3}$

$q_2 = 4.092$

$Q_s = q_1 + q_2$

$Q_s = 5.889$

At $p = 55$, calculate producer's surplus for firm 1

$PS_1 = (MC - AVC)\, q_1$

$AVC = 2(q-1)^2 + 48$

$AVC = 2[1.797 - 1]^2 + 48$

$AVC = 49.27$

$PS = (55 - 49.27) \times 1.797$

$PS = 10.297$

Q6) $f(z_1, z_2) = q = \sqrt{z_1 + z_2}$

If $w_2 < w_1$ firm uses only z_2, no z_1

$C = w_2 z_2$ —(1)

$q = \sqrt{z_2} \Rightarrow q^2 = z_2$ —(2)

$C = w_2 q^2$

$MC = 2w_2 q$

For profit max^n, $MC = P$

$P = 2w_2 q$ $\qquad P = 1$

$q = \frac{1}{2w_2}$ ✓

$\pi(p, w) = TR - TC$

$= pq - w_2 q^2$

$= \frac{1}{2w_2} - w_2\left[\frac{1}{2w_2}\right]^2$

$= \frac{1}{2w_2} - w_2\left(\frac{1}{4w_2^2}\right)$

$= \frac{1}{2w_2} - \frac{1}{4w_2}$

$\pi(p, w) = \frac{1}{4w_2}$

Q9) $C = 25 + q^2$

$MC = 2q$

$AVC = q$

$MC = AVC \Rightarrow q = 0$

$\therefore$ Firms produces at $q > 0$, $P > 0$

$Q_D = 120 - P$

$2q = P = MC$

$\therefore q = \frac{P}{2}$

$Q_S = 10q = \frac{10P}{2} = 5P$

In eqbm,

$Q_D = Q_S$

$\therefore 120 - P = 5P$

$\therefore P = \frac{120}{6} = 20$

$\therefore Q_S = 20 \times 5 = 100$

$q = \frac{100}{10} = 10$

$\pi(p, w) = pq - C$

$\pi(p, w) = p \cdot \left(\frac{p}{2}\right) - \left(25 + \frac{p^2}{4}\right)$

$= \frac{p^2}{2} - \frac{p^2}{4} - 25$

$\pi(p, w) = \frac{p^2}{4} - 25$

In eqbm, $P = 20$.

$\therefore$ For each firm,

$\pi = \frac{(20)^2}{4} - 25$

$\pi = 100 - 25 = 75$