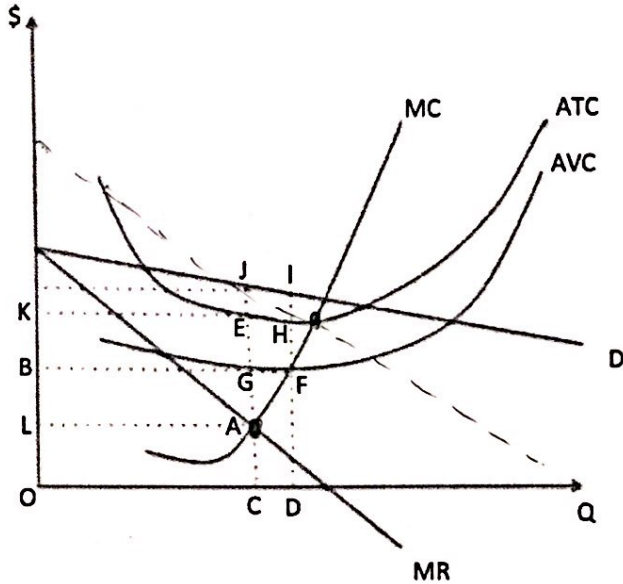*You can use the formula sheet that is given in the last page.*

Multiple Choice Questions (5 points each): +20

1. For a firm whose cost and revenue structure are represented in the above diagram, which of the following is not correct?

    A. The product whose demand is represented by D has close substitutes. ✓ price sensitive
    B. Total Fixed Cost cannot be zero. ✓
    C. D is higher than the profit maximizing level of quantity. ✓
    D. Marginal cost (MC) crosses ATC at its minimum point. ✓
    E. As Q goes up, for each unit, addition to total revenue is higher than the price.
       MR

2. For a firm whose cost and revenue structure are represented in the above diagram, which of the following represents per unit fixed cost at the profit maximizing level of output?

    A. |AJ|
    B. |JE|
    C. |AE|
    D. |EG|
    E. It cannot be determined with the given information.

$P = ax + b$

$(ax^2 + bx)' = 2ax + b$

$2ax + b = ax + b$

① $a = 0$
② $x = 0$

3. Which of the following is correct?

(handwritten: B crossed out)

A. In a perfectly competitive market, industry supply is obtained by vertically adding individual firm supplies. ✓

B. For both monopoly and monopolistic competition, a firm maximizes its profit taking into account the firm's cost structure and industry's demand curve.

C. A firm operating in perfect competition and making zero economic profit must move to another industry. ✗

D. Price and quantity demanded are inversely related in all markets. ✗

Ⓔ None of the above

4. If a monopolist has zero economic profit at its optimal production level, which of the following does not have to be correct?

(handwritten: C)

A. Demand is tangent to ATC at optimal Q. ✓ *(handwritten ✗ above)*

B. If demand is linear, P and MR are equal at only Q=0. ✓

C. AFC is below AVC. ✗

D. All of the above.

E. None of the above.

5. If a firm chooses to produce a positive quantity,

(handwritten: D)

A. Firm has to be in the short run. ✗

B. Firm has to be in the long run. ✗

C. The firm will increase its profit if it increases its scale. ✗

D. Price should be higher than AVC at the chosen quantity. *(handwritten: cover fixed cost)*

E. None of the above

6. (30 points) A perfectly competitive firm, operating in the <u>long run</u>, has the following total variable cost function depending on production level Q: $TVC(Q)=10Q^2+5Q^4$

If the firm has a fixed cost of 20,000, what is its optimal production level (Q*)?

(handwritten: +30)

(handwritten work, left column:)

(con'd)

$20Q^2 + 20Q^4 = 10Q^2 + 5Q^4 + 20000$

$\therefore 15Q^4 + 10Q^2 - 20000 = 0$ ✓

let $x = Q^2$

$\therefore 15x^2 + 10x - 20000 = 0$

$x = \dfrac{-10 \pm \sqrt{100 + 4\times15\times20000}}{30}$

$\therefore x_1 = 36.18 \qquad x_2 < 0 \ (\text{discard})$

$\therefore Q_1 = 6.02 \qquad Q_2 < 0 \ (\text{discard})$

$\therefore Q^* = 6.02$ ✓

(handwritten work, right column:)

$\therefore$ perfectly competitive:

$\therefore P = MR$

$\therefore$ optimal production level

$\therefore MR = MC$ at Q^*

$\odot \ MC = 20Q + 20Q^3 = P$

$\because$ in the long run:

$\therefore TR = TC$

$TR = PQ = 20Q^2 + 20Q^4$

$TC = TVC + TFC = 10Q^2 + 5Q^4 + 20000$

(to the left)

7. A monopolist has the following cost function 1000+30Q+50Q² and faces an industry demand given by 3,000-80Q.

a) (20 points) How many units this monopolist would produce and what would be the price that it would charge per unit?

45

$$MC = 100Q + 30$$
$$MR = (PQ)' = (3000Q - 80Q^2)' = -160Q + 3000$$

$$\therefore P = 3000 - 80Q^*$$
$$= 2086.4$$
$$\uparrow$$

$$\therefore MC = MR \Rightarrow 100Q + 30 = -160Q + 3000 \Rightarrow 260Q = 2970 \Rightarrow Q^* = 11.42$$

b) (20 points) If the demand stays the same in this industry but instead of a monopolist, the product is produced by 1,000 perfectly competitive firms, each having a total cost function of 50,000Q²+30Q+1 how many units would be sold by each firm and what would be the per unit price?

$$MC = 100,000Q + 30$$

$\therefore$ perfectly competitive

$\therefore MC = P = MR$ at Q^*

let Q^* be the optimal output for each firm

$1000\ Q^*$ add up to Q^*_{total} in market

$\therefore 100,000\ Q^* + 30 = 3000 - 80\ Q^*_{total} = 3000 - 80,000\ Q^*$

$\therefore 180,000\ Q^* = 2970$

$\therefore Q^* = 0.0165$

$\therefore$ 0.0165 units should be sold by each firm

$$P = 3000 - 80,000Q^* = 1680$$

and 1680 would be the unit price

c) (5points) Which option is better for the consumer, in the short run and in the long run?

in the short run : perfectly competitive. Because the price is cheaper.

in the long run : monopolist, Because in a perfectly competitive market, firms have no resources and incentives to research and develop their products.

Quadratic Formula: $ax^2+bx+c=0$ $\quad x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

TC = TVC+TFC $\quad$ ATC = TC/Q $\quad$ AFC = TFC/Q $\quad$ AVC = TVC/Q

MC = ∂TC/ ∂TC $\quad$ MR = ∂TR/ ∂Q