ECON 444 Problem Set 2

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1 Problem 1

Problem Constraints

- Market Demand: $Q(p) = 1000 * p^x$
- Marginal Cost (Supply): $p = 2$
- $x = -3$

What price would a monopolist choose?

In order to maximize profits a monopolist would set marginal revenue equal to marginal cost:

$$\text{MR} = \text{MC}$$

We already have that marginal cost is a constant, but what is marginal revenue? We can determine this value by defining total revenue:

$$\text{TR} = p * Q$$

We know that marginal revenue is the first derivative of total revenue, since it is the additional revenue for each additional unit.

$$\text{MR} = \frac{d\text{TR}}{dQ}$$

$$\frac{d\text{TR}}{dQ} = \frac{d(p * Q)}{dQ}$$

Here we must use our market demand equation and we can put p in terms of Q:

$$Q = 1000 * p^x$$

$$\frac{Q}{1000} = p^x$$

$$p = (\frac{Q}{1000})^{1/x}$$

Plugging this back in we can continue.

$$\frac{d((\frac{Q}{1000})^{1/x} * Q)}{dQ}$$

According to our problem constraints $x = 3$.

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$$\frac{d((\frac{Q}{1000})^{-1/3} * Q)}{dQ} = \frac{d(\frac{Q^{2/3}}{1000^{-1/3}})}{dQ} = \frac{2}{3}(\frac{Q}{1000})^{-1/3}$$
$$\text{MR} = \frac{4}{3}(\frac{Q}{1000})^{1/3}$$

Now solve for monopolist price:

$$\text{MR} = \text{MC}$$
$$\frac{2}{3}(\frac{Q}{1000})^{-1/3} = 2$$
$$\frac{Q}{1000} = 3^{-3}$$
$$Q = 1000(3)^{-3} \approx 37.04$$

To get the price of sale, plug this quantity into demand (translated into terms of price above):

$$p = (\frac{Q}{1000})^{-1/3} = (\frac{37.04}{1000})^{-1/3} = 3$$

The monopolist would choose a **price of 3**. Now let's calculate profit if $FC = 25$.

$$\pi = \text{TR} - \text{TC} = p * Q - (FC + Q * \text{MC})$$
$$\pi = 3 * 37.04 - (25 + 37.04 * 2) = 12.03704$$

The monopoly's profit level is **\$12.04**.

2 Problem 2

2.1 Part a

2.2 Part b

2.3 Part c

3 Problem 3

3.1 Part a

3.2 Part b

3.3 Part c

4 Problem 4

4.1 Part a

4.2 Part b