

Due October 25th, 2023, 10PM Eastern

Instructions:

- Submit your assignments on Gradescope as a PDF. You may either handwrite your answers and scan them into a PDF, or type your answers and convert them to PDF. If you are handwriting your answers, please make sure your handwriting is legible.
- Clearly label any intercepts, slopes, jumps, or kinks on your graphs. If you do not label these, you will not receive full credit. Don't worry about making graphs exactly to scale; just make them reasonable.
- You only need to submit answers for graded questions. The ungraded questions are for your own edification.

1. (10 points) **Vinyl**

Consider the market for vinyl records. There are two types of consumers in this market: high-value consumers and low-value consumers. The aggregate demands for vinyl records by each type of consumer are given by:

$$\begin{aligned}q_h &= 60 - p \\ q_l &= 20 - 4p\end{aligned}$$

Each type of consumer represents half of all vinyl buyers.

The market for vinyl records is perfectly competitive with free entry, and producers have the following cost function:

$$C(q) = 200 - 10q + 2q^2$$

Note that the \$200 represents a quasi-fixed cost in the long run.

- (a) (2 points) Write the market demand function.
- (b) (4 points) What is the long-run equilibrium price of records, quantity of vinyl records supplied by each firm, total quantity demanded, and number of firms in the market?
- (c) (4 points) Suppose the government imposes a \$10 per unit tax on vinyl records. What is the new long-run equilibrium price of records, quantity of vinyl records supplied by each firm, total quantity demanded, and number of firms in the market? How does this compare to the pre-tax equilibrium in part (b)? (Hint: What is the slope of the long-run supply curve? What does that tell you about the incidence of the tax?)

2. (10 points) **Virtus**

Suppose Caesar's Gym is the only gym in the city of Rome, New York. It serves two types of users: people who go daily and people who go weekly. Aggregate demand for each type of user is given by:

$$Q_d = 50 - p$$
$$Q_w = 40 - 2p$$

Each type of user represents half of all gym goers.

Suppose that it costs $c = 16$ per month to serve a gym goer, regardless of frequency. Caesar charges a monthly subscription to use his gym.

- (a) (4 points) Suppose Caesar can only set one price. What price does Caesar set? How many gym subscriptions are sold to each type of user?
- (b) (4 points) Suppose Caesar does some market research, and finds that the marginal cost actually depends on the user, with $c_d = 20$ per month to serve a daily user and $c_w = 10$ per month to serve a weekly user. He decides to price discriminate, setting one price for daily users and one price for weekly users. What prices does Caesar set? How many gym subscriptions are sold to each type of user? (Hint: Imagine Caesar is maximizing profit over two completely separate products, subscriptions for daily users and subscriptions for weekly users; what does his profit function look like?)
- (c) (2 points) Which of the above prices is better for daily users? For weekly users? For Caesar? For welfare? Explain your reasoning.

3. (10 points) **Vitium**

Inverse demand for vape cartridges has the following functional form:

$$p(q) = \frac{8}{\sqrt{q}}$$

Suppose that the market for these cartridges is a monopoly, and the monopolist has the following cost function:

$$C(q) = 5 + q$$

- (a) (2 points) Find the profit-maximizing price and quantity
- (b) (2 points) The Lerner Index is a measure of market power, which has the following form:

$$LI = \frac{p - mc}{p}$$

For a monopolist, the Lerner Index is also equal to the inverse of the price elasticity of demand (in absolute value). Find the Lerner Index for this monopolist and the price elasticity of demand at the equilibrium price.

- (c) (4 points) Suppose the government imposes a \$1 per unit tax on vape cartridges. What is the new equilibrium price and quantity? How much revenue does the government raise?
- (d) (2 points) Define the passthrough as the percentage of the tax passed onto consumers. What is the passthrough of the tax in part (c)?

4. Ungraded Questions

- (a) The Postal Service has a monopoly over stamps, which are necessary for sending mail. A roll of stamps have a constant marginal cost of \$1, and the Postal Service has a fixed cost of \$1000 for a stamp producing machine. The Postal Service faces an inverse demand curve for rolls of stamps given by $P = 10 - 0.01Q$.
- What is the profit-maximizing price and quantity for the Postal Service?
 - What is the Lerner Index and price elasticity of demand at the profit-maximizing price and quantity you found in part (a)? Is this a reasonable value for a monopolist?
 - What is the deadweight loss generated by this monopoly?
 - Suppose a separate market exists for philately, the collection of stamps. These collectors have an inverse demand curve of $P_2 = 30 - 0.02Q_2$, where Q_2 is the number of rolls of stamps for the collector's market. If the Postal Service can charge a different price to collectors, what prices should it charge to maximize its profit?
 - Suppose that instead of price discriminating, the Postal Service can choose to launch a subscription service, called Stamps Plus, which collectors can subscribe to for an access fee, plus a fee for each roll of stamps. Is it better for the Postal Service to launch Stamps Plus? Explain your answer with a graph. (Hint: what kind of tariff is this?)
 - Compute the access fee and per-roll fee for Stamps Plus.
- (b) Consider the economy for yoga mats, which is perfectly competitive. One particular supplier of yoga mats has the following cost function:

$$C(q) = 3q^2 - 3q + 12$$

Note that the \$12 represents a quasi-fixed cost in the long run.

The market price is \$3.

- What is the firm's short-run level of production?
- What is the firm's short-run supply decision?
- Suppose the market has free entry. What is the firm's long-run level of production?
- What is the firm's long-run supply decision?
- Suppose $P = 21 - 2Q$, and we have many firms with the same cost function as above. What is the long-run number of firms in this market?