

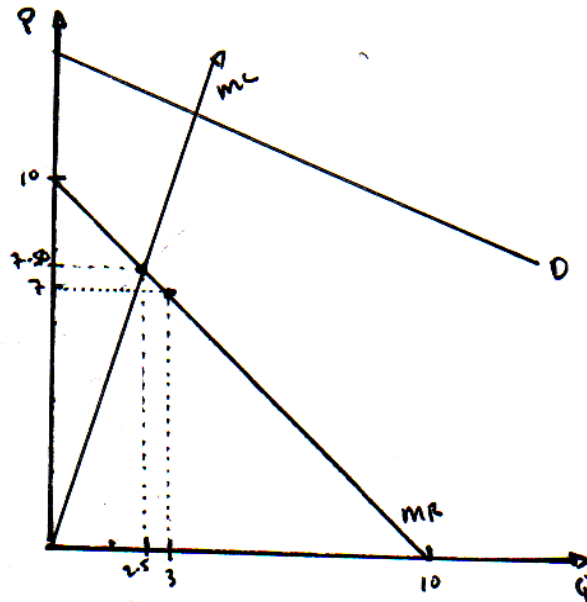
Problem Set #8
Principles of Microeconomics
Professor Hungerman

1. Suppose that the rock band The Strokes are coming to South Bend, and Ticketmaster gets to decide how much to charge for tickets. Ticketmaster is a monopoly and does not price discriminate.

A. What is price discrimination? Why might Ticketmaster not price discriminate?

Price Discrimination means charging a price for different units of a good (eg, a discount for the second unit purchased) or charging a different price to different people. Ticketmaster will not price discriminate because the people who qualify for cheap tickets may just turn around and resell their discounted tickets to other people. Thus, Ticketmaster may lose sales if they price discriminate because people will not pay Ticketmaster for the higher priced tickets, but rather will get their tickets from those who purchased them at a lower price.

B. Suppose that the *marginal revenue* function that describes demand for strokes tickets is $10 - q$ where q is the quantity of strokes tickets sold. Thus, if Ticketmaster sells 3 tickets, the additional revenue brought in by the third ticket sold is $10 - 3 = 7$. What quantity of tickets will maximize Ticketmaster's total revenue? Will Ticketmaster choose to sell this quantity? What is the price elasticity of demand at this quantity?



Total revenue will be maximized when marginal revenue is zero, which is also the point where demand is unit elastic (the price elasticity of demand is one). The point where this occurs is where $10 - q = 0$, or $q = 10$. As long as there are variable costs and marginal cost is greater than zero, Ticketmaster will not sell at this price.

C. Suppose Ticketmaster has a *marginal cost* function equal to $3q$. What quantity will Ticketmaster choose to produce?

Ticket master will sell where marginal cost equals marginal revenue, or $3q = 10 - q$. This happens when $q = 2.5$

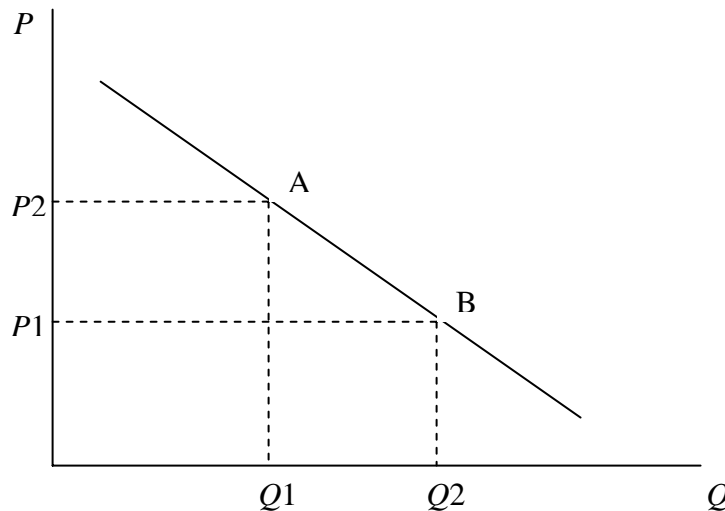
See graph for part B

D. True/False: Ticketmaster will charge \$7.50 for each Strokes ticket.

If $q = 2.5$, marginal revenue is \$7.50 for the last ticket sold. We know that the MR curve lies below the demand curve, and that the monopolist will use the demand curve to figure out what price to charge. Thus, we know that the monopolist will charge a price higher than \$7.50.

See graph for part B

2. Consider moving from point A to point B on the following demand curve.



A. Suppose you go from point A to point B. What areas in the picture represent the revenue gained, and the revenue lost from doing so? Write down the formula that represents the change in total revenue that occurs when moving from point A to point B (your answer should be a function of P_1 , P_2 , Q_1 , and Q_2).

When we go from A to B, we lose the revenue associated with the rectangle that goes from P_1 to P_2 , and from the origin to Q_1 . We gain revenue associated with the rectangle that goes from the origin to P_1 , and from Q_1 to Q_2 . So the change in total revenue is the area of latter rectangle minus the area of the former:

$$\Delta TR = P_1[Q_2 - Q_1] - Q_1[P_2 - P_1]$$

- B. Suppose a formula that does a good approximation for the price elasticity of demand between these two points is

$$\eta = \frac{\frac{\Delta Q}{Q1}}{\frac{\Delta P}{P1}}$$

Where $\Delta Q = Q2 - Q1$ and similarly $\Delta P = P2 - P1$ Using your formula for total revenue from part A, write down the formula for *marginal revenue*. Then, using this new formula for price elasticity of demand and some algebra, rearrange this new formula to show that

$$MR = P1 \left[1 - \frac{1}{\eta} \right]$$

Given the formula $\Delta TR = P1[Q2 - Q1] - Q1[P2 - P1]$, we know that $MR = \frac{\Delta TR}{\Delta Q}$, so

$$\begin{aligned} MR &= (P1[Q2 - Q1] - Q1[P2 - P1]) \frac{1}{\Delta Q} \\ &= (P1 * \Delta Q - Q1 * \Delta P) \frac{1}{\Delta Q} \\ &= P1 - Q1 \frac{\Delta P}{\Delta Q} \\ &= P1 \left[1 - \frac{Q1 \Delta P}{P1 \Delta Q} \right] \\ &= P1 \left[1 - \frac{1}{\eta} \right] \end{aligned}$$

- C. At what point does MR equal zero? At what point does MR become negative?

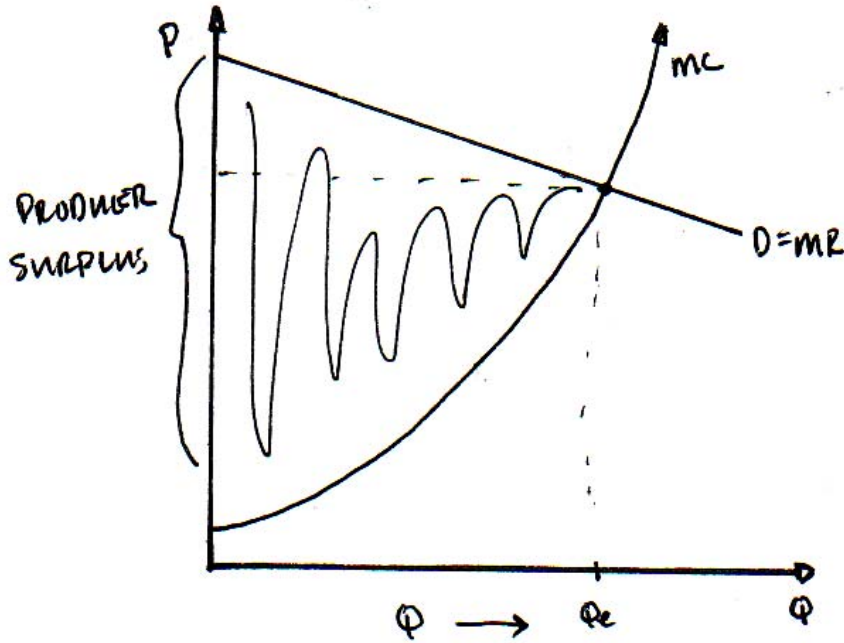
MR is zero when η is unity, and becomes negative when η is less than one—when demand is inelastic.

- D. Explain what this formula for MR says about the relationship between marginal revenue and price.

Note, we can say that η is always positive. That means that MR equals price times something less than one—so MR is less than price. This makes sense, because as we go from A to B there is a rectangle showing that some of our original revenue at point A is lost, this is because the price has to fall to elicit an increase in quantity demanded. Suppose instead that demand was perfectly elastic at P1. Then the rectangle representing lost revenue would vanish, and marginal revenue would just be P1. The size of the rectangle representing lost revenue is determined by the price elasticity of

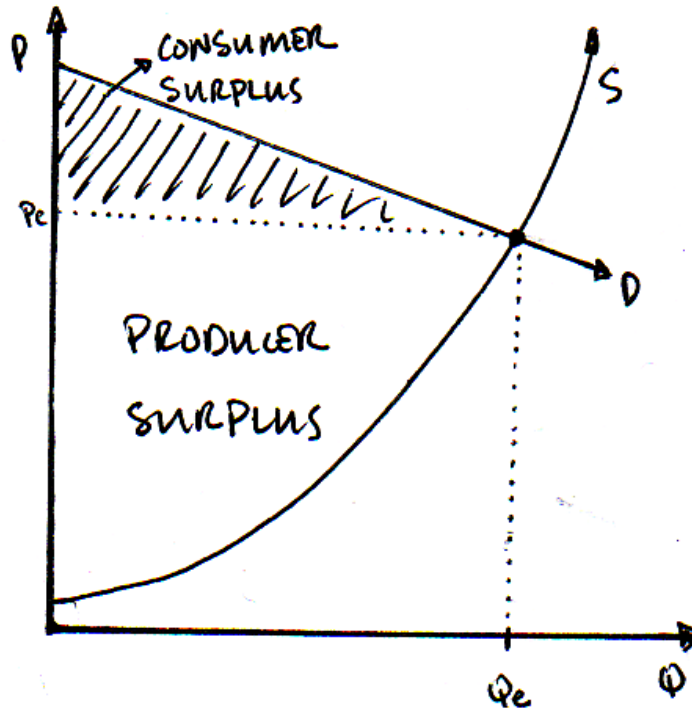
demand—the more elastic demand, the smaller the rectangle, the larger is η , and the closer is price to marginal revenue.

3. Suppose you were Mayor of a poor city in a developing country. Clean water is supplied by a (non price-discriminating) monopolist. People in your city are complaining that there should be more clean water in your city.
 - A. Suppose water was not easily resold, and that, if allowed, the monopolist could perfectly price discriminate. What would happen to the supply of clean water if you allowed the monopolist to price discriminate?



Under perfect price discrimination, the demand curve and the MR curve become the same. The monopolist will therefore increase production until the MC curve and the demand curve meet—so the supply of clean water will rise.

- B. Now suppose that you could privatize clean water supply and make the provision of clean water a perfectly competitive industry. What would the supply of clean water be then?



In a perfectly competitive industry the quantity supplied is determined where the (aggregate) supply curve intersects the demand curve. In the short run, this intersection is the same as the intersection described in part A—so with perfect competition the amount of clean water will be higher than it would be if water were supplied by a non-price-discriminating monopolist, and the same as the quantity supplied by a perfectly-price-discriminating monopolist.

- C. Suppose that you are up for election, and that the citizens of the town will vote for you based on how well they like the way you address the clean water shortage. If voters care about consumer surplus, which solution would be the smartest for you to support—the one outlined in part A, or in part B? What if the voters cared more about producer surplus?

Parts A and B provide solutions resulting in the same amount of water supplied. However, with perfect price discrimination, all the surplus in the market is producer surplus. So if voters care more about producer surplus, it would be smarter to support solution A. Solution B does create consumer surplus, however, so if voters care most about consumer surplus, then it would be smartest for you to support solution B.

Extra Credit:

Prove, without using calculus, that if an industry goes from being perfectly competitive to a monopoly, that producer surplus rises. A compelling answer will likely involve some algebraic work. I will add 3 points to your midterm score if you can come up with a convincing proof. A somewhat-convincing proof may be worth a point or two (but don't waste my time).