

## First Midterm Exam

Each part of a question (a, b, c, etc.) is worth 5 points. Make sure to allot your time accordingly. Total of 30 points, -1 for messiness.

When you are finished, please keep the exam sheet and hand in your blue book. Thanks.

1. *Jets*. Two large jets, the A350-1000 and the Boeing 777X are designed to replace older, less fuel-efficient aircraft. Currently there are 500 orders for these jets. The demand function for this segment of the aircraft market is  $Q_d = 500P^{-1.8}$ .

- (a) Using the formula for price elasticity of demand,  $\eta = \frac{\partial Q_d}{\partial P} \frac{P}{Q_d}$ , find the elasticity of demand when  $P = 1$ . How would the elasticity change if  $P$  fell to 0.8?
- (b) Suppose that the price of jet fuel falls by 40%. Which of the following is more likely to be the new demand curve for the planes? Explain your reasoning (one could make good arguments either way).

$$Q_d = 400P^{-1.8} \quad Q_d = 600P^{-1.8}$$

- (c) Suppose supply of these airplanes is  $S(P) = 500P$ . Given your answer to part (b), find the new equilibrium price and quantity. Show the change in total spending on a diagram. How much is a change in producer surplus and how much in variable costs?

2. *Music*. In 2015, there were 10.8 digital streaming subscriptions, and the yearly price of each subscription was \$107. In 2016, there were 22.6 digital subscriptions sold at a yearly price of \$100.

In 2015, there were 1,103 digital downloads sold at a price of \$2 each. In 2016, there were 837 digital downloads sold at a price of \$2.13.

All of the above prices are in nominal dollars.

- (a) Suppose you want to make a price index for all digital music using only the above data. Show that the price index for 2016 is 102, setting 2015=100.
- (b) Since the price index rises from 100 to 102, one could say that consumers of digital music are worse off in 2016. Drawing from our class discussions and readings, explain whether this is accurate.
- (c) Make a new graph of 2016 music demand and supply. Demand is linear, and supply is perfectly elastic at  $P = 100$ . Equilibrium quantity is without any taxes is  $Q^{2016} = 40.4$ . Suppose that a 5% sales tax is introduced on digital music. The tax is collected by the digital music providers. Suppose that demand elasticity is  $\eta = -1.5$ . Show the tax revenue and the deadweight loss in your diagram, and find their values numerically.