Midterm 1 Prep

Supply and Demand

1. The market for bike locks is described by the demand curve $P = 80 - Q_d$ and the supply curve $Q_s = 2P - 10$. Answer the following questions:

   (a) When the price of bike locks is \$40 how many bike locks will be demanded? How many bike locks will be produced? Why would this not be the equilibrium price? Which way will the price move in this market.

   (b) What is the marginal willingness to pay for the 40th bike lock? What is the marginal cost of the 40th unit?

   (c) What is the market equilibrium values of price and quantity in the market of bike locks?

2. The market contains two consumers A and B with the following demand functions: $Q_A^D = 40 - 5P$ and $Q_B^D = 18 - 5P$

   (a) Find the aggregate demand curve for this market. Draw this curve

   (b) Let market supply be given by $Q_{mkt}^S = 2P - 2$. Solve for the equilibrium quantity and price.

Supply/Demand Curve Shifters

1. For the following comparative static scenarios, describe what will happen the equilibrium price and quantity?

   (a) A stimulus check makes people richer

   (b) A flood wipes out wheat crops in the midwest

   (c) A flood wipes out crops in the midwest *and* more people start getting into bread-making

Elasticities

1. Suppose that when the price of the new macbook is \$1,600 per tire, quantity demanded in Boulder is 40,000. Now suppose that the price has fallen to \$1,400, and the quantity demanded is 50,000. What is the price elasticy of demand? Interpret this elasticity in words.

2. A firm increases its price from \$8 to \$12 and sees demand for the product fall by 20%. What would the price elasticity of demand be for this product?

3. If disposable incomes rise by 5% and demand changes from 100 units to 105, what is the income elasticity of demand? Interpret this number

4. What type of good would you expected to have a negative income elasticity of demand?

Utility Functions

1. For the following utility functions, solve for the marginal utility with respect to x. Interpret the marginal utility at $x = 3$. Is this utility diminishing as you increase x?

   (a) $U(x, y) = x^{1/3}y^{1/3}$
   (b) $U(x, y) = 3x + 4y$
   (c) $U(x, y) = x^{3/4}y^{1/4}$

2. For the following utility functions, draw two indifference curves for these utility functions.

   (a) $U(x, y) = x^{1/3}y^{1/3}$
   (b) $U(x, y) = 3x + 4y$
   (c) $U(x, y) = x^{3/4}y^{1/4}$

3. In words, describe what an indifference curve is

4. For the following utility functions, Calculate the marginal rate of substitution $MRS_{x,y}$. Interpret the marginal rate of substitution.

   (a) $U(x, y) = x^{1/3}y^{1/3}$
   (b) $U(x, y) = 3x + 4y$
   (c) $U(x, y) = x^{3/4}y^{1/4}$

Budget Constraints

1. In words, write out the meaning of the budget constraint:

$$P_x x + P_y y = I$$

2. Write out the budget constraint for $P_x = 10$, $P_y = 2$, and $I = 30$. Graph this curve.

3. What happens to the above budget constraint for the following conditions:

   (a) P_x moves to \$5
   (b) I goes up to 60.
   (c) P_y drops to \$1.

4. For which of the above conditions, will the consumer be better off? How do you know?

Optimality Conditions

1. In words, write out why we need the optimality condition to hold for optimal consumption:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

2. For the following utility functions, write out the optimality condition

   (a) $U(x, y) = x^{1/3}y^{1/3}$
   (b) $U(x, y) = 3x + 4y$
   (c) $U(x, y) = x^{3/4}y^{1/4}$

3. Write out the three main utility functions we have talked about in class. What are the optimality conditions for each of them?

Optimal Demand

1. Interpret in words the optimization problem that consumers face:

$$\max_{x,y} U(x,y) \text{ subject to } P_x x + P_y y = I$$

2. What are the two things you need to solve for optimal demand?

3. Solve the following problems for demand

   (a) $U(x,y) = \min(2x, y)$ and $P_x = 3, P_y = 1, I = 20$
   (b) $U(x,y) = 2x + y$ and $P_x = 1, P_y = 3, I = 24$
   (c) $U(x,y) = x^{\frac{2}{3}} y^{\frac{1}{3}}$ and $P_x = 2, P_y = 2, I = 18$

Consumption Curves

1. Solve for the demand functions $x^*(P_x, P_y, I)$ and $y^*(P_x, P_y, I)$ for the following utility functions:

   (a) $U(x,y) = x^{1/2} y^{1/2}$
   (b) $U(x,y) = \min(x, 2y)$
   (c) $U(x,y) = 2(x + y)$

2. Solve for the demand functions $x^*(P_x, P_y, I)$ and $y^*(P_x, P_y, I)$ for $U(x,y) = x^{1/2} y^{1/2}$. Answer the following

   (a) What is the deriviative with respect to income, I? Does this imply the good is a normal good or a inferior good?
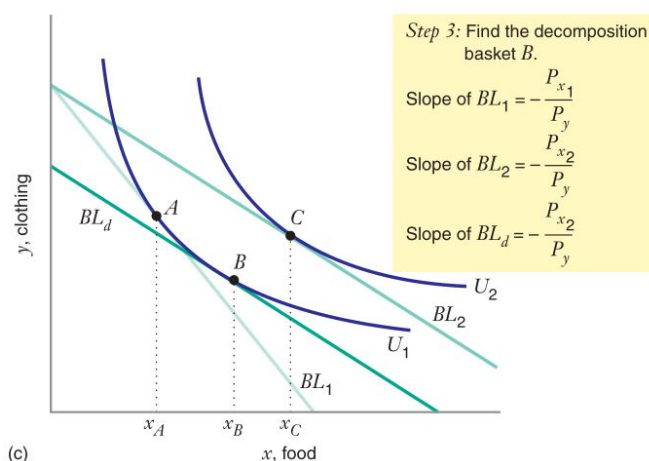   (b) Are x and y normal goods?
   (c) Graph the demand curve $x^*(P_x)$ for $I = 12$ and $P_y = 4$ with P_x on the y-axis and x^* on the x-axis.
   (d) Graph the engel curve $x^*(I)$ for $P_x = 4$ and $P_y = 2$ with I on the y-axis and x^* on the x-axis.

Income and Substitution Effect

1. In words, describe what the income effect and the substitution effects are.

2. Suppose that the price for good x increases, show using the optimality condition, why you know that demand for x must decrease.

3. How do you know if the income effect is positive or negative?

4. For the below figure, highlight the income effect and the substitution effect. Is this good a normal good or an inferior good?

Step 3: Find the decomposition basket B.

Slope of $BL_1 = -\dfrac{P_{x_1}}{P_y}$

Slope of $BL_2 = -\dfrac{P_{x_2}}{P_y}$

Slope of $BL_d = -\dfrac{P_{x_2}}{P_y}$

(c)

Consumer Welfare

1. If the demand for a product is $Q_D = 100 - 4P$, what is the consumer surplus generated when the market price is $P = 10$? Suppose a tax is imposed that raises the equilibrium price to $P = 12$. What is the new consumer surplus? What is the loss in consumer surplus from this tax?

2. If the demand for a product is $Q_D = 144 - 12P$, what is the consumer surplus generated when the market price is $P = 6$? Suppose a subsidy is imposed that lowers the equilibrium price to $P = 4$. What is the new consumer surplus? What is the gains for consumers from this subsidy?

Labor-Leisure

1. The current wage in Boulder is 12. The consumer's utility function for labor, L, and the composite good Y is given by $U(L, Y) = L^{1/2}Y^{1/2}$.

   (a) Write out the budget constraint for leisure and the composite good.

   (b) Solve for this consumer's optimal amount of hours worked, $24 - L$, and the amount of the composite good, Y, they consume.

   (c) Now, suppose a minimum wage increases wages to 15. Solve for hours worked and the amount of the composite good consumed.

2. Say that the wage raised from \$15 to \$20 and the amount of labor supplied decreases. Explain why that could be possible.