Discussion 5 - Solutions

Important Topics

- Exam Post-mortem

- Consumer Theory: Budget Constraints and Indifference Curves

Midterm 1 - Frequently Missed Questions

Exercise 1 *(Reference TA Handout 4, Question 1)* Billy sells gasoline and he knows the demand for his product is $P = 10 - 2Q$, where Q measures the quantity in gallons. He'd like to exaggerate the demand for his product to attract more investors, so he decides to report demand with quantity measured instead in half-gallons. What is the new demand equation given the change in units? Is this new demand curve more elastic?

Solution: This is to test the concept that elasticity is a units-free measure. The new equation should be $P = 10 - Q$, and this demand curve will have the same elasticity of demand at any price as will $P = 10 - 2Q$.

To see the demand curve should be $P = 10 - Q$, ask yourself two questions.

1. What quantity, in half gallons, will be demanded at $P = 10$? The answer is twice as many half gallons as full gallons must be demanded. Here, quantity demanded is zero using either measure of units. So we have point $(Q = 0, P = 10)$.

2. What quantity, in half gallons, will be demanded at $P = 0$. The answer is twice as many half gallons as full gallons must be demanded. Here, quantity demanded is 5 using gallons, which is equivalent to 10 half gallons. So we have point $(Q = 10, P = 10$.

Putting these points together, we get equation $P = 10 - Q$.

Exercise 2 Consider the market for ice cream among UW students. UW undergraduates collectively have demand for ice cream represented by $P = 30 - Q$, where Q is the quantity of ice cream and P is the price. With a tighter budget constraint, UW graduate students have demand for ice cream represented by $P = 10 - 0.5Q$. The supply curve for ice cream is represented by $Q = 3P - 4$. What is the consumer surplus for UW graduate students?

Solution: In a previous exercise, you should have calculated a market price of 9. We can find consumer surplus as the usual area between demand the price. To find the consumer surplus that belongs specifically to the graduate students, we take the market

price and use the graduate students' demand instead of market demand. Of the market quantity of 23, *only 2 units were demanded by graduate students.*

The consumer surplus is then a triangle with dimensions 2×1. *Therefore, we get a consumer surplus of* $1.

Exercise 3 Suppose Robinson has 5 hours available, and he can catch 10 fish per hour. What is the shape of PPF with fishheads on one axis and fishtails on the other? (Hint: each fish he catches has one head and one tail).

Solution: A point. If you have a fishtail, you must also have a fishhead. According, the production possibilities would be a square bounded by points $(0,0)$, $(50,0)$, $(50,50)$, *and* $(0,50)$. *The PPF, that is the* frontier, *only includes the efficient points. So the PPF only includes the point* $(50,50)$. *A point like* $(49,50)$ *is not efficient because we can produce an additional tail or head without sacrificing any of the other good.*

Exercise 4 Suppose the government announces in early November that tax credits for electric cars will no longer be available beginning in December, meaning consumers will no longer get a discount on electric cars. What will happen to the demand for electric cars during the month of November?

Solution: Consumers anticipate a future price increase for electric cars and advance their purchases to November. This is an increase in demand for November, thus a rightward shift.
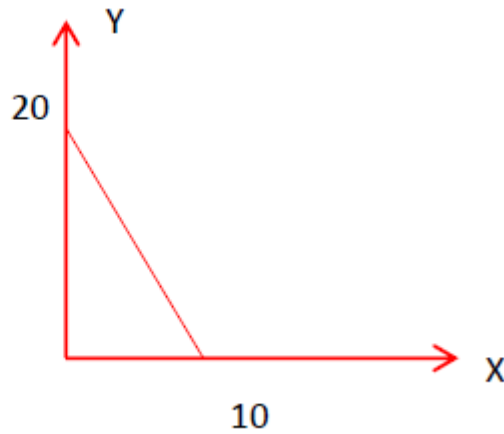
Consumer Theory

Exercise 5 Suppose Michelle's income is $100 per week and she only consumes oranges (good X) and apples (good Y). Each apple costs $5 and each orange costs $10.

1. Find the equation for Michelle's budget constraint and graph it.
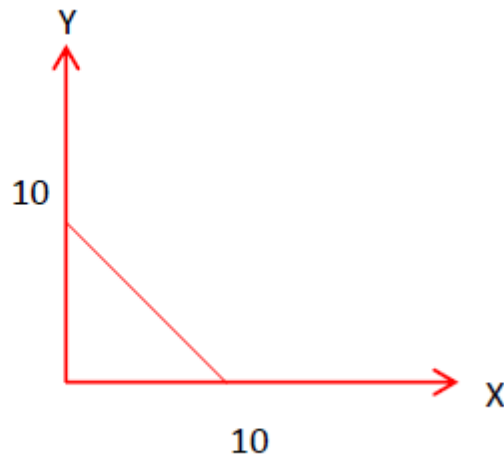
   Solution:

10X+5Y=100

2. Is the bundle (7, 6) affordable for Michelle? What about the bundle (7, 7)?

   Solution: Since the bundle (7,6) costs $70+$30 = $100, it is affordable. However, the bundle (7,7) costs $105. So it is not affordable

3. Now suppose that price of an apple increases from $5 to $10. Graph Michelle's new budget constraint and find the equation.
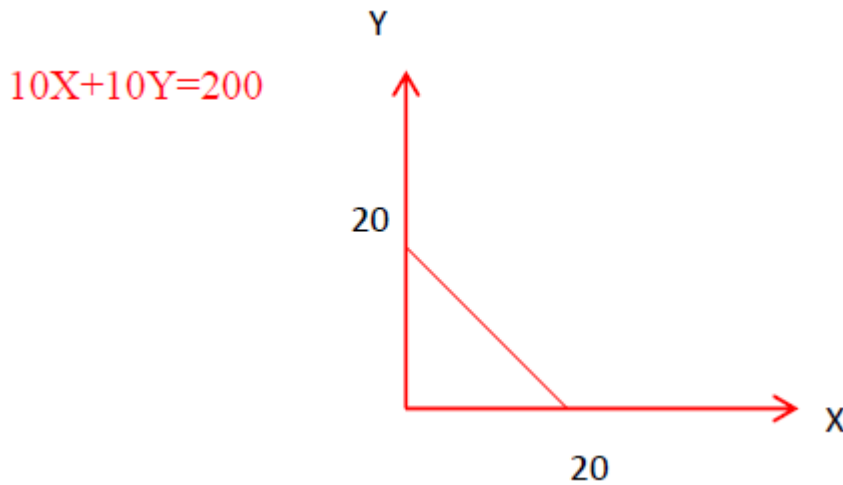
   Solution:

10X+10Y=100

4. Michelle got a raise and her income is now $200. Find the equation for Michelle's new budget constraint and graph it.

   Solution:

$10X+10Y=200$

Y axis with value 20, X axis with value 20, budget line connecting them.

Exercise 6 Mark spent \$80 to buy 10 cans of beer (good X) and \$5 bottles of wine (good Y) last week. Each can of beer cost \$$P_X$ and each bottle of wine cost \$$P_Y$. Suppose he is utility maximizing agent.

1. Now, the price of one bottle of beer has increased by \$1 and he has spent the same amount of money to buy 8 cans of beer and 5 bottles of wine. Find the price of beer before the change and the price of wine.

   Solution: We have two budget equations; $10P_X + 5P_Y = 80$, $8(P_X+1)+5P_Y = 80$ By subtracting both equations, we get $2P_X = 8$. So $P_X = 4$. Plugging $P_X = 4$ in one of any budget equations gives $P_Y = 8$ Thus $P_X = 4, P_Y = 8$

2. What is the MRS before the price change and after the price change?

   Solution:

   Before change; $MRS = \frac{MU_X}{MU_Y} = \frac{P_X}{P_Y} = \frac{4}{8} = 1/2$

   After change;$MRS = \frac{MU_X}{MU_Y} = \frac{P_X+1}{P_Y} = \frac{5}{8}$

Exercise 7 Charles derives utility from pairs of black shoes (good X) and pairs of blue jeans (good Y). The marginal utility of a pair of black shoes is $MU_X = \frac{1}{X}$. The marginal utility of a pair of blue jeans is 1. He has an income of \$120. Suppose a pair of black shoes costs \$20, and a pair of blue jeans costs \$40. Which bundle should he consume if he wants to maximize his utility?

Solution:

MRS of black shoes for blue jeans is $MRS = \frac{MU_X}{MU_Y} = \frac{1}{X}$

Price ratio between two goods (or Slope of budget constraint) is $\frac{P_X}{P_Y} = \frac{20}{40} = 1/2$

So utility maximizing Charles should equate those two numbers. That is, $1/X = 1/2$. Since budget constraint is $20X + 40Y = 120$ and $X = 2$, we have $Y = 2$. Thus (2,2) is the optimal bundle that maximizes Charles' utility.