Economics 101
Summer 2015
Answers to Homework #3
Due Tuesday, June 9, 2015

Directions: The homework will be collected in a box **before** the lecture. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

Please realize that you are essentially creating "your brand" when you submit this homework. Do you want your homework to convey that you are competent, careful, professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional. For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you do any work for someone else!

1. Consider the market for watches where the market demand and market supply curves are given by the equations below where P is the price per watch unit and Q is the quantity of watches measured in watch units (that means that you can have fractional units of watches in your answers!):

Market Demand: $P = 500 - 10Q$
Market Supply: $P = 100 + (10/3)Q$

a) Given the above information, find the equilibrium price and quantity in this market. Then calculate the value of consumer surplus (CS) and producer surplus (PS).

b) Draw a graph illustrating this market and in your graph identify the equilibrium price, equilibrium quantity, all intercepts, the area that is CS and the area that is PS.

Suppose that the government in this economy decides to impose an excise tax of $50 per watch on producers of watches.

c) Given this excise tax, write an equation that represents the supply curve in this market now that producers have this new additional cost.

d) Given this excise tax, find the new price consumers will pay for a watch in this market, the new price producers will receive for a watch in this market once they have met their legal obligation to the government to remit the excise tax, and the new equilibrium quantity of watches that will be sold in this market.

e) Given this excise tax, calculate the value of consumer surplus with the tax (CSt), producer surplus with the tax (PSt), tax revenue the government receives from implementing the tax, consumer tax incidence (CTI), producer tax incidence (PTI), and the deadweight loss (DWL) due to the implementation of this excise tax.

f) Draw a graph illustrating this market and this excise tax. In your graph identify the price consumers pay for a watch now that the tax has been implemented, the price producers receive once they have paid the government the excise tax, the area of CSt, the area of PSt, the area of CTI, the area of PTI, and the area of DWL.

g) Suppose that the government decides it wants to implement an excise tax in this market so that consumption of watches fall to 12 units. Calculate the size of the excise tax that would be needed (assume

that there is no initial excise tax) for the government to accomplish this goal. Show how you found your answer.

h) As the size of the excise tax increases, what happens to the area of DWL? Provide a verbal explanation and assume that the demand curve is downward sloping and the supply curve is upward sloping.

Answers:

a) To find the equilibrium price and equilibrium quantity we set the demand equation equal to the supply equation: thus,

$500 – 10Q = 100 + (10/3)Q$

$400 = 10Q + (10/3)Q$

$3(400) = 30Q + 10Q$

$3(400) = 40Q$

30 watch units $= Q$

$P = 500 – 10Q = 500 – 10(30) = \$200$ per watch unit

Or, $P = 100 + (10/3)(30) = \$200$

$CS = (1/2)(\$500$ per watch unit $- \$200$ per watch unit$)(30$ watch units$)$

$CS = \$4500$

$PS = (1/2)(\$200$ per watch unit $- \$100$ per watch unit$)(30$ watch units$)$

$PS = \$1500$

b)
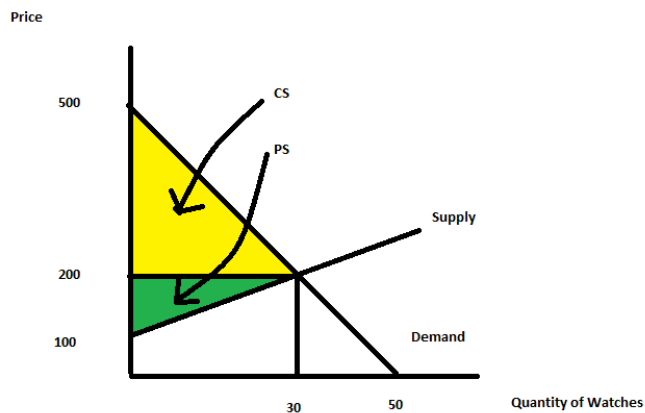
c) The new supply curve that includes the excise tax will shift to the left of the original supply curve. The y-intercept of this new supply curve will be equal to the amount of the original y-intercept from the first supply curve plus the amount of the excise tax per unit: thus, the new supply curve with the excise tax will have y-intercept of 150. The new supply curve will be parallel to the original supply curve (same slopes) and thus can be written as $Pt = 150 + (10/3)Qt$ where Pt is the price with the excise tax and Qt is the quantity of the good with the excise tax.

d) To find the new equilibrium quantity in the market for watches with the excise tax we need to equate the demand curve to the new market supply curve: thus,

$500 – 10Qt = 150 + (10/3)Qt$

$350 = (10/3)Qt + 10Qt$

$3(350) = 10Qt + 30Qt$

$105/4 = Qt$

26.25 watch units $= Qt$

$Pt = 500 – 10(Qt) = 500 – 10(26.25) = 500 – 262.5 = \$237.50$ per watch unit

Pnet = Price producers receive once they pay the excise tax to the government = Pt – excise tax per unit = $237.50 - $50.00 = $187.50 per watch unit. You can also get this number by substituting the quantity into the supply curve before adjusting for the tax.

e) CSt = (1/2)($500 per watch unit - $237.50 per watch unit)(26.25 watch units)
CSt = $3445.31
PSt = (1/2)($187.50 per watch unit - $100 per watch unit)(26.25 watch units)
PSt = $1148.44
Tax Revenue = ($50 per watch unit)(26.25 watch units)
Tax Revenue = $1312.5
CTI = (Pt – P)(Qt)
CTI = ($237.50 per watch unit - $200 per watch unit)(26.25 watch units)
CTI = $984.38
PTI = (P – Pnet)(Qt)
PTI = ($200 per watch unit - $187.50 per watch unit)(26.25 watch units)
PTI = $328.13
DWL = (1/2)(Pt – Pnet)(Q – Qt)
DWL = (1/2)(Tax per unit)(Q – Qt)
DWL = (1/2)($50 per watch unit)(30 watch units – 26.25 watch units)
DWL = $93.75

f)
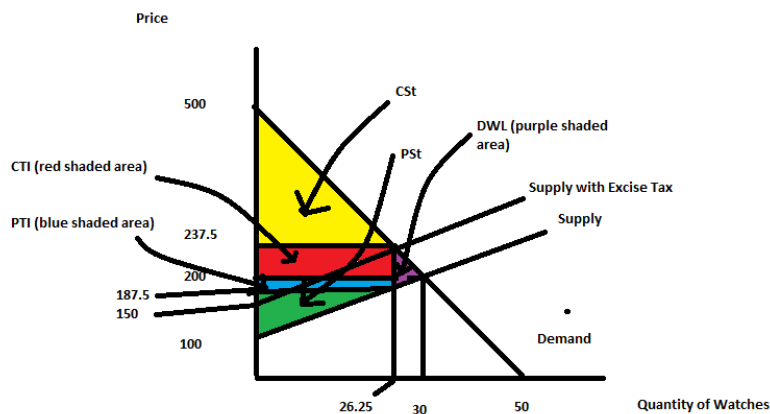
g) The government wants Qt to equal 12 units. Suppliers are willing to supply this quantity at a price of:
P = 100 + (10/3)Qt
P = 100 + (10/3)(12)
P = 100 + 10(4) = $140
Demanders are willing to consume this quantity at a price of:
P = 500 – 10(Qt)
P = 500 – 10(12)
P = $380
To figure out the excise tax we need to set the excise tax per unit = (price demanders are willing to pay for Qt) – (price suppliers must get to supply Qt) or Excise Tax per unit = $380 per watch unit - $140 per watch unit = $240 per watch unit.

h) Holding everything else constant, the large the excise tax the larger the DWL. A larger excise tax will have two impacts on DWL: the first impact is that the larger excise tax amount enters into the calculation of the DWL and this larger numeric value of the excise tax will result in a larger amount of DWL due to the impact of the excise tax on the level of prices in this market. But there is also a quantity effect where a

larger excise tax results in a larger change in the amount of the good consumed for a given market with a downward sloping demand curve and an upward sloping supply curve.

2. Consider a small, closed economy whose market for cups is described by the following demand and supply equations where P is the price per cup and Q is the quantity of cups:
Domestic Demand: $P = 10 – (1/20)Q$
Domestic Supply: $P = (1/80)Q$

a) Assume this market is a closed market. Find the equilibrium price, equilibrium quantity, the value of consumer surplus (CS), and the value of producer surplus (PS). Show your work.

Suppose this economy opens the cup market to trade and that the world price is $6 per cup.

b) Verbally explain whether this small economy will import or export cups given this information.

c) Now, provide a numerical value for your answer in (b). Make sure you show how you found your answer.

d) Suppose this market is still open to trade. Calculate the value of CS in the domestic economy when this market is open to trade (CStrade) and the value of PS in the domestic economy when this market is open to trade (PStrade).

e) Economists state that "trade is beneficial but has distributional consequences". Explain this statement using your calculations in this problem as proof to support this statement.

Answers:
a) To find the equilibrium price and equilibrium quantity set the demand curve equal to the supply curve:
thus, $10 – (1/20)Q = (1/80)Q$
$80(10) – 4Q = Q$
$5Q = 80(10)$
$Q = 160$ cups
$P = 10 – (1/20)Q$
$P = 10 – (1/20)(160) = $2 per cup
Or, $P = (1/80)Q$
$P = (1/80)(160) = $2 per cup
$CS = (1/2)($10$ per cup - 2 per cup)(160 cups) = 640
$PS = (1/2)($2$ per cup - 0 per cup)(160 cups)
$PS = 160

b) Since the closed domestic economy price of a cup is less than the world price of a cup we can conclude that this small economy will export cups if this market is open to trade. Domestic producers who have been selling cups for $2 per cup will be quite happy to export cups to the world market where they can sell the cups for $6 per cup.

c) If the world price is $6 per cup, then putting this price into the demand equation we get the following:
$6 = 10 – (1/20)(Qd)$
$Qd = 80$ cups
That is, at the world price of $6 per cup, domestic demand for cups is equal to 80 cups.
Putting this price into the supply equation we get the following:
$6 = (1/80)(Qs)$
$Qs = 480$ cups

3. Consider a small economy whose market for cups is described by the following demand and supply equations where P is the price per cup and Q is the quantity of cups:

Domestic Demand: $P = 10 – (1/20)Q$
Domestic Supply: $P = (1/80)Q$

Suppose this economy opens the cup market to trade and that the world price is $1 per cup.

a) Given this information and assuming that this domestic economy opens its cup market to trade, find the value of imports, value of exports, value of consumer surplus with trade (CStrade), value of producers surplus with trade (PStrade), and the value of total surplus with trade (TStrade). Explain how you found your answers.

Suppose a tariff of $0.50 per cup is imposed on this good by the domestic economy's government.

b) Given this tariff, find the values of the following items. Show how you found your answers.

Number of imports with tariff = _____
Number of exports with tariff = _____
Government tariff revenue = _____
CStariff = _____
PStariff = _____
DWL with tariff = _____

c) From the perspective of this domestic economy analyze the impact of this tariff. Who benefits from the tariff and how do they benefit? Who loses from the imposition of the tariff and what is their loss?

CStrade = (1/2)($10 per cup - $1 per cup)(180 cups) = $810
PStrade = (1/2)($1 per cup - $0 per cup)(80 cups) = $40
TStrade = $850

b) Number of imports with tariff = 50 cups
Number of exports with tariff = 0 cups
Government tariff revenue = $25
CStariff = $722.50
PStariff = $90
DWL with tariff = $12.50

To find the number of imports with tariffs: plug the tariff price of $1.50 per cup into the domestic demand curve and then into the domestic supply curve to determine the quantity demanded domestically with the tariff and the quantity supplied domestically with the tariff. Thus, 1.50 = 10 – (1/20)(Qd with tariff) and Qd with tariff = 170 cups. And, 1.50 = (1/80)(Qs with tariff) and Qs with tariff = 120 cups. The number of imports with the tariff will equal (Qd with tariff) – (Qs with tariff) = 50 cups.

There will be no exports with the tariff since the price with the tariff will still be lower than the closed economy price. This country will continue to import the good after it imposes the tariff.

Government tariff revenue = (Tariff per cup)(Number of Imports)
Government tariff revenue = ($0.50 per cup)(50 cups)
Government tariff revenue = $25

CStariff = (1/2)($10 per cup - $1.50 per cup)(170 cups) = $722.50

PStariff = (1/2)($1.50 per cup - $0 per cup)(120 cups) = $90

DWL with tariff = (1/2)($1.50 per cup - $1 per cup)(120 cups – 80 cups) + (1/2)($1.50 per cup - $1 per cup)(180 cups – 170 cups) = $12.50

c) Imposition of the tariff benefits domestic producers since the tariff enables them to sell the good at a higher price than the world price while also enabling domestic producers to sell more of the product than they would if this were just an open economy. Producer surplus increases with the tariff relative to producer surplus in the open economy.

Imposition of the tariff hurts domestic consumers. They get less of the good (170 cups rather than 180 cups) and they pay more per cup ($1.50 per cup versus $1 per cup). Consumer surplus decreases with the tariff relative to consumer surplus in the open economy.

4. Consider a small economy whose market for computers is described by the following demand and supply equations where P is the price per computer and Q is the quantity of computers:
        Domestic Demand: P = 1000 - 10Q
        Domestic Supply: P = 200 + 10Q
The world price is $300 for a computer.

a) Suppose this is initially a closed economy. Find the equilibrium price and equilibrium quantity of computers in this closed economy.

b) Now, suppose this economy opens its computer market to trade. What will be the price of a computer given this decision? Calculate the number of computers produced by domestic producers, the number of computers demanded by domestic consumers, the number of imported computers into this economy, and the number of exported computers from this economy. Show how you found your answers.

Suppose the government in this small domestic economy imposes an import quota of 40 computers in this market once it is open to trade.

c) Given this import quota and the provided information, find the values for the following (make sure you explain how you got your answer!). Hint: you might find it helpful to draw a graph to guide your work.
Price with the import quota = _____
Quantity of Computers demanded domestically with the import quota = _____
Quantity of Computers supplied domestically with the import quota = _____
DWL due to the imposition of the import quota = _____
License Holder Revenue with the imposition of the import quota = _____

Answers:
a) To find the equilibrium price and equilibrium quantity in the closed economy set the demand equation equal to the supply equation: thus,
$1000 - 10Q = 200 + 10Q$
$20Q = 800$
$Q = 40$ computers
$P = 1000 - 10(40) = \$600$ per computer
Or, $P = 200 + 10(40) = \$600$ per computer

b) The price of computers in the domestic economy will equal the world price of $300 per computer once this economy opens its computer market to trade.

Domestic producers will produce 10 computers at this price: $300 = 200 + 10Q_s$ or Qs, the quantity supplied domestically, is equal to 10 computers.

Domestic consumers will consume 70 computers at this price: $300 = 1000 - 10Q_d$ or Qd, the quantity demanded domestically, is equal to 70 computers.

The number of computers imported into this domestic economy will equal Qd – Qs or 60 computers.

There will be no computers exported from this domestic economy because the world price is less than the closed economy price of a computer for this domestic economy.

c) Here are the answers followed by an explanation of how to find these answers.
Price with the import quota = $400 per computer
Quantity of Computers demanded domestically with the import quota = 60 computers
Quantity of Computers supplied domestically with the import quota = 20 computers
DWL due to the imposition of the import quota = $1000
License Holder Revenue with the imposition of the import quota = $4000

To find these answers I find it helpful to start with a graph that illustrates the domestic demand curve, the domestic supply curve and the world price:
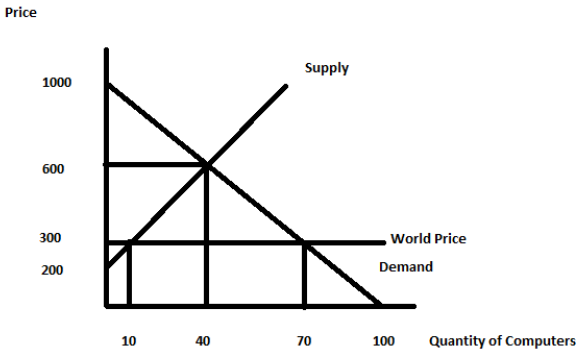
Now, we need to add in the import quota to the graph. I am going to provide two methods to use when analyzing the impact of an effective import quota: you should review both of these methods and then determine which method is easier for you to understand and implement.

Method One:
We know the effect of the quota is to shift the Supply curve in this market to the right by the amount of the quota: the new supply curve will have the same slope as the original supply curve but it will have a different y-intercept. Thus, the new supply curve with the import quota will be $P = b + 10Q$ where "b" is the new y-intercept. We can find the value of "b" by substituting in one point that we know sits on this new supply curve: (50, 300) or (80, 600) are two points that we can easily see from the above graph as points that would sit on this new supply curve. Let's use (50, 300): $300 = b + 10(50)$ or $b = -200$. The new supply curve that includes the import quota is therefore $P = 10Q – 200$.

Combine this new supply curve with the demand curve to find the price with the quota, the total quantity provided in the market and the total quantity domestically demanded in the market (these will be the same amount), the quantity domestically supplied in the market, the license holder revenue, and the deadweight loss. So, $10Q – 200 = 1000 – 10Q$ and solving for Q we get $Q = 60$ computers = the quantity demanded domestically. We can find the price with the quota by using this quantity in the demand equation: Pquota = $1000 – 10(Q)$ or Pquota = $1000 – 10(60) = \$400$. To get the quantity supplied domestically we can use the Pquota and the original supply equation: $400 = 200 + 10(Qs)$ or Qs = the quantity supplied domestically = 20 computers. DWL = $(1/2)(\$400$ per computer - $\$300$ per computer)(20 computers – 10 computers) + $(1/2)(\$400$ per computer - $\$300$ per computer)(70 computers – 60 computers) = \$1000. License Holder Revenue = $(\$400$ per computer - $\$300$ per computer)(40 computers) = \$4000. The graph below illustrates these ideas.
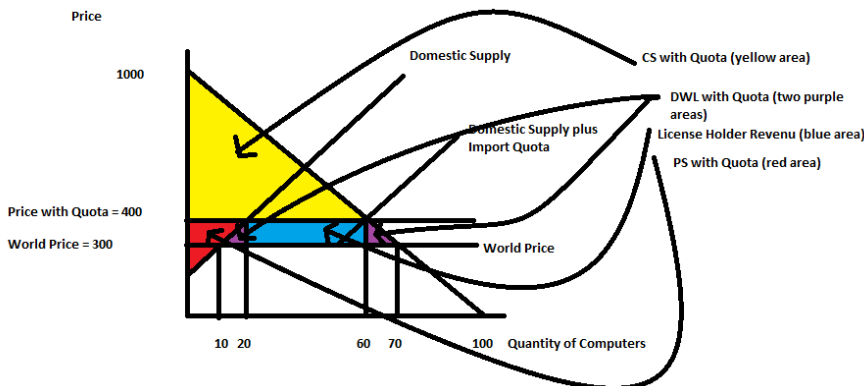
Method Two:

With an import quota, the market equates the quantity supplied domestically plus the import quota amount to the quantity demanded domestically: or, symbolically

Qs + import quota = Qd

We can replace Qs with (1/10)P – 20 from the original supply curve (just solve this supply curve for Qs); we can replace Qd with 100 – (1/10)P from the domestic demand curve; and we can replace the import quota with 40 computers since this is the amount of the import quota. Thus,
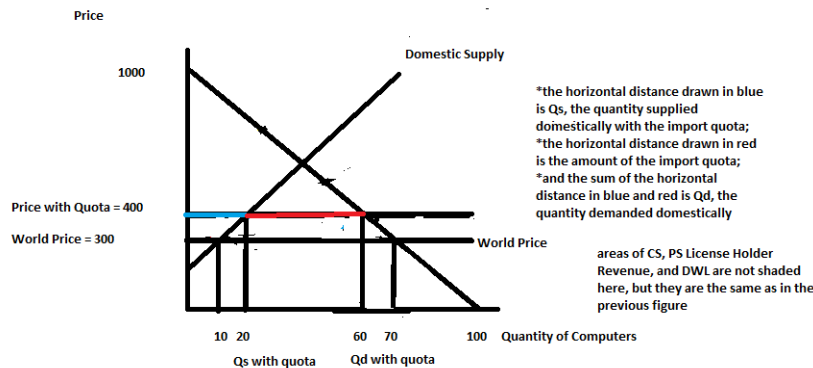
(1/10)P – 20 + 40 = 100 – (1/10)P

(2/10)P = 80

P with the quota = $400

Qs = the quantity supplied domestically with the import quota = (1/10)(400) – 20 = 20 computers

Qd = the quantity demanded domestically with the import quota = 100 - (1/10)(400) = 60 computers

Note that the difference between Qd and Qs is 40 computers or the amount of the import quota.

Here's a graph to illustrate this idea:

The calculations of CS with the quota, PS with the quota, license holder revenue, and DWL are the same as discussed under Method One.

5. It is Thanksgiving and Uncle Henry and Rooster have gotten into a heated argument (this happens every year!). Rooster just got hired in an entry-level management position where he will earn $45,000 during his first year of employment. Uncle Henry is long retired but he is busy reminiscing about the "good old days" and he insists that life was much tougher for him when he was starting out. In fact he states that his first job paid him on $2500 a year. Uncle Henry got this job in 1948 while Rooster got his job in 2013 (the 2014 data weren't available last Thanksgiving).

a. Rooster argues that Uncle Henry is making a serious error in his argument. Write an explanation about what you think Uncle Henry's error is.

Rooster goes to the computer and finds the Bureau of Labor Statistics site that provides him with the Consumer Price Index for 1948, 2013, and for the base year 1983.

Year	CPI with base year 1983
1948	24.1
1983	100.00
2013	232.96

b. Given the above data, what scale is the CPI measured on?

c. Compute the following table's missing values using 1983 as the base year. Make sure you show the work you did to get the missing values. Round your answer to the nearest whole number.

	Nominal Value	Real Value using 1983 as Base Year
Uncle Henry's Salary		
Rooster's Salary		

d) Compute the following table's missing values using 2013 as the base year. Make sure you show the work you did to get the missing values. Round your answer to the nearest whole number.

	Nominal Value	Real Value using 2013 as Base Year
Uncle Henry's Salary		
Rooster's Salary		

e) Uncle Henry contends that Rooster's salary is 18 times greater than his starting salary was. Thus, Uncle Henry concludes that Rooster has it much easier than Uncle Henry did when he was first starting out. Analyze this argument and provide some clarity for these two relatives! (If you need to in your answer, round any calculations to two places past the decimal.)

Answer:
a) Uncle Henry's error is that he is comparing a 1948 dollar to a 2013 dollar: dollars do not maintain constant purchasing power over time so basically Uncle Henry is comparing salaries that are measured in units that do not have the same value over time. Uncle Henry needs to convert these nominal salaries into real salaries if he wants to compare salaries from two different points in time.

b) The CPI is measured on a 100 point scale: we can see this since the base year CPI is given as 100.

c)

	Nominal Value	Real Value using 1983 as Base Year
Uncle Henry's Salary	$2500	2500(100)/24.1 = $10,373
Rooster's Salary	$45,000	45000(100)/232.96 = $19,317

d)

	Nominal Value	Real Value using 2013 as Base Year
Uncle Henry's Salary	$2500	[2500(100)]/[(24.1)(100)/(232.96)] = $24,166
Rooster's Salary	$45,000	[45000(100)]/[(232.96)(100)/(232.96)] = $45,000

e) Uncle Henry gets his number by comparing the ratio of Rooster's nominal salary to his nominal salary:

Nominal salary ratio = (45,000)/(2500) = 18

But, this is essentially comparing apples and oranges since the two salaries are measured using nominal dollars. So, let's compare the real salary ratio (note it will not matter which year you use as base year in this calculation):

Real salary ratio using 1983 as the base year = Rooster's real salary/Uncle Henry's real salary
Real salary ratio using 1983 as the base year = $19,317/$10,373 = 1.86

Real salary ratio using 2013 as the base year = Rooster's real salary/Uncle Henry's real salary
Real salary ratio using 2013 as the base year = $45,000/$24,166 = 1.86

6. Consider the following demand curve for widgets where P is the price per widget and Q is the quantity of widgets.

   Demand: Q = 1000 – 2P

a) Fill in the following table using the above information.

P	Q	Total Revenue = TR
$0		
20		
80		
100		
200		
320		
440		
500		

b) In your own words describe what happens to total revenue if the price of this good goes from $100 to $120. In your answer make sure you include references to the price and quantity effects.

c) What is the maximum total revenue that could be earned given this demand curve and holding everything else constant? Assume that the supplier is free to set any price they want and their goal is to set their price to maximize their total revenue. Note: this price may not be in the table you just filled in!

c) Total revenue will be maximized at the midpoint of this market demand curve. This will occur at a price of $250 and a quantity of 500 widgets for an amount of total revenue equal to $125,000.

7. Consider the following market demand and market supply curves for pencils where P is the price per pencil and Q is the quantity of pencils.
   Demand: $P = 2 - (1/100)Q$
   Supply: $P = 0.2 + (1/200)Q$

a) Given the above information find the equilibrium price and quantity in this market. Show your work.

b) Calculate the point elasticity of demand at equilibrium. Provide the general formula and show your calculations. Is demand elastic or inelastic? Explain your answer. Given this answer, will producers enhance their total revenue by increasing or by decreasing the price they charge for pencils?

c) Calculate the point elasticity of supply at equilibrium. Provide the general formula and show your calculations. Is supply elastic or inelastic? Explain your answer.

d) Suppose the price increases to $1.00. Using the arc elasticity formula calculate the price elasticity of demand between the initial equilibrium and this new point on the demand curve. Provide the general formula and show your work. Is demand inelastic or elastic? Explain your answer.

Answer:
a) Set demand equal to supply: thus,
$2 - (1/100)Q = 0.2 + (1/200)Q$
$1.8 = (3/200)Q$
$Q = 120$ pencils
$P = 2 - (1/100)Q = 2 - (1/100)(120) = \$0.80$ per pencil
Or, $P = 0.2 + (1/200)Q = 0.2 + (1/200)(120) = \$0.80$ per pencil

b) Point elasticity of demand $= (-1/\text{slope})(P/Q) = (1/(1/100))(.8/120) = 2/3$
Since the value of point elasticity of demand is less than one, we can conclude that demand is inelastic at the equilibrium point. We can also see that total revenue will increase if producers raise the price of pencils since demand is inelastic.

c) Point elasticity of supply $= (1/\text{slope})(P/Q) = (1/(1/200))(.8/120) = 1.33$
Since the value of point elasticity of supply is greater than one, we can conclude that supply is elastic at the equilibrium point.

d)

$$\text{Arc Elasticity of Demand} = \left| \frac{\dfrac{Q_2 - Q_1}{Q_2 + Q_1}}{\dfrac{P_2 - P_1}{P_2 + P_1}} \right|$$

Arc elasticity of demand $= \left| [(100 - 120)/(100 + 120)]/[(.8 - 1)/(.8 + 1)] \right|$
Arc elasticity of demand $= [(20)/(220)]/[(.2)/(1.8)] = 9/11$
Since the measure of demand elasticity is less than one, we can conclude that demand is inelastic.

8. Joe has $100 in income that he can spend on either good X or good Y. Good X costs $2 per unit while good Y costs $4 per unit.

a) Given the above information, draw a graph of Joe's budget line (call it BL1) and write an equation in slope-intercept form for Joe's budget line measuring good Y as the good on the vertical axis.

b) Given Joe's income and the prices of these two goods and given Joe's preferences he finds that he maximizes his satisfaction when he chooses to consume bundle A which consists of 30 units of good X and 10 units of good Y. Can Joe afford this bundle given his income and the prices of the two goods? Prove this mathematically. Does consumption of bundle A exhaust Joe's available income?

c) Suppose that the price of good X decreases to $1. Joe's income and the price of good Y stay constant. Joe now finds that he maximizes his satisfaction when he consumes consumption bundle B which consists of 56 units of good X. Draw a graph that represents Joe's BL1, his new budget line (BL2) and bundle A. Calculate how many units of good Y Joe consumes when he consumes consumption bundle B (make sure you show how you found this answer). Mark bundle B in your graph.

d) Suppose that Joe was constrained to stay on his first indifference curve-the one that bundle A sits on- while paying the new price for good X. We can construct this budget line 3 where Joe's income has been compensated (in this case lowered) so that he can reach the indifference curve that bundle A is on, but he cannot reach a higher level of satisfaction. On budget line 3 Joe finds that he maximizes his satisfaction by consuming bundle C which consists of 36 units of good x and 8 units of good Y. Draw a graph that illustrates BL1, BL2, BL3, bundle A, bundle B, and bundle C. Sketch in indifference curve 1 and indifference curve 2 in your graph.

e) How much would Joe's income have to be decreased by in order for his to have the same utility as he had initially but now face the lower price of good X? You have all the necessary information at hand to calculate this decrease in income. Show how you found your answer.

f) What is the amount of the substitution effect for good X given the above information? What is the amount of the income effect for good X given the above information? Explain your answer.