Economics 101
Spring 2016
Answers to Homework #3
DueMarch 15, 2016

**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 clocks where the market demand and market supply curves are given by the equations below where P is the price per clock and Q is the quantity of clocks:

Market Demand: $P = 250 – 10Q$
Market Supply: $P = 50 + (10/3)Q$

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 $80 per clock on producers of clocks.

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 clock in this market, the new price producers will receive for a clock in this market once they have met their legal obligation to the government to remit the excise tax, and the new equilibrium quantity of clocks 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 clock 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 clocks falls to 3 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.

i) As the size of the excise tax increases, what happens to the level of tax revenue? This is a thought experiment-so provide a verbal explanation rather than a numeric answer. You might think about in this example what the tax revenue is when the excise tax is $0 per clock and what the tax revenue is when the excise tax is $200 per clock. Then, think about what must occur at excise taxes that are set between these two extremes.

Answers:

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

$250 – 10Q = 50 + (10/3)Q$

$200 = 10Q + (10/3)Q$

$3(200) = 30Q + 10Q$

$3(200) = 40Q$

15 clocks = Q

P = 250 – 10Q = 250 – 10(25) = \$100 per clock

Or, P = 50 + (10/3)(15) = \$100 per clock

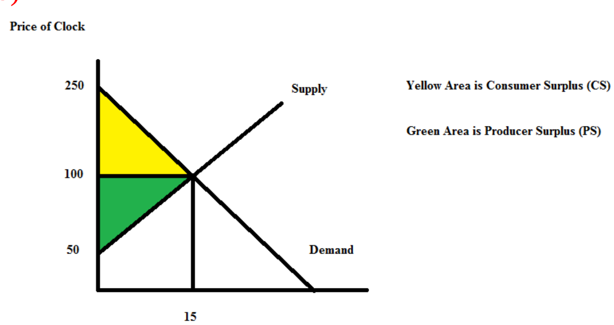
CS = (1/2)(\$250 per clock - \$100 per clock)(15 clocks)

CS = \$1125

PS = (1/2)(\$100 per clock - \$50 per clock)(15 clocks)

PS = \$375

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 130. The new supply curve will be parallel to the original supply curve (same slopes) and thus can be written as $Pt = 130 + (10/3)Qt$ 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 clocks with the excise tax we need to equate the demand curve to the new market supply curve: thus,

$250 – 10Qt = 130 + (10/3)Qt$

$120 = (10/3)Qt + 10Qt$

$3(120) = 10Qt + 30Qt$

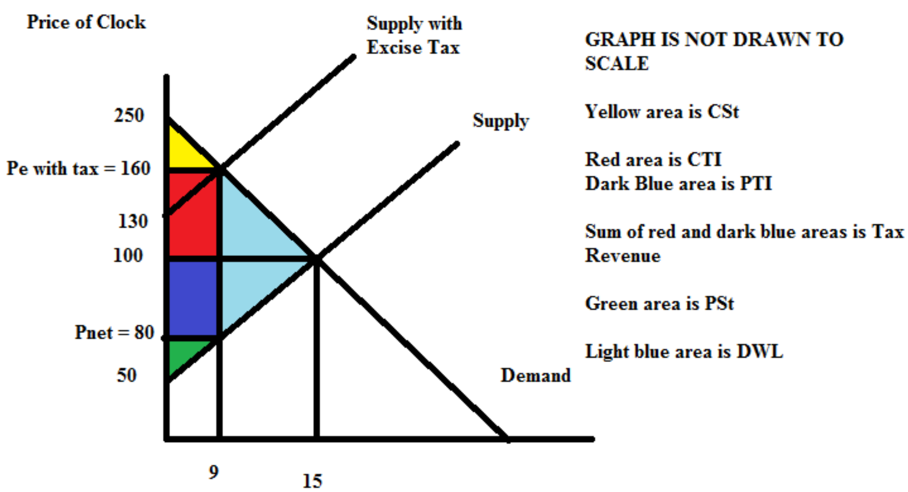
$360 = 40Qt$

Qt = 9 clocks

Pt = 250 – 10(Qt) = 250 – 10(9) = 250 – 90 = $160 per clock
Pnet = Price producers receive once they pay the excise tax to the government = Pt – excise tax per unit = $160 - $80 = $80 per clock.You can also get this number by substituting the quantity into the supply curve before adjusting for the tax.

e)CSt= (1/2)($250 per clock - $160 per clock)(9 clocks)
CSt = $405
PSt = (1/2)($80 per clock - $50 per clock)(9 clocks)
PSt = $135
Tax Revenue = ($80 per clock)(9 clocks)
Tax Revenue = $720
CTI = (Pt – P)(Qt)
CTI = ($160 per clock - $100 per clock)(9 clocks)
CTI = $540
PTI = (P – Pnet)(Qt)
PTI = ($100 per clock - $80 per clock)(9 clocks)
PTI = $180
DWL = (1/2)(Pt – Pnet)(Q – Qt)
DWL = (1/2)(Tax per unit)(Q – Qt)
DWL = (1/2)($80 per clock)(15 clocks – 9 clocks)
DWL = $240

f)




g) The government wants Qt to equal 3 units. Suppliers are willing to supply this quantity at a price of:
P = 50 + (10/3)Qt
P = 50 + (10/3)(3)
P = 50 + 10 = $60
Demanders are willing to consume this quantity at a price of:
P = 250 – 10(Qt)
P = 250 – 10(3)
P = $220
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 = $220 per clock - $60 per clock= $160 per clock.

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.

i) When the excise tax is set at $0 per clock, the tax revenue the government receives is $0. When the excise tax is set at $200 per clock in this example, the tax revenue the government receives is $0 since at this level of excise tax consumers will purchase 0 clocks. Yet, we know that an excise tax has the capacity to generate tax revenue, so it must be the case that tax revenue rises as the excise tax increases, then at some point tax revenue decreases as the excise tax continues to increase. In our example, we see that an excise tax of $80 per unit results in tax revenue of $720 while an excise tax of $160 per unit results in tax revenue of $480. (An excise tax of $40 per unit will result in tax revenue of $480, for one more data point in our analysis.)

2. Consider a small, closed economy whose market for pencils is described by the following demand and supply equations where P is the price per pencil and Q is the quantity of pencils:

Domestic Demand: $P = 20 – (1/20)Q$
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 pencil market to trade and that the world price is $8 per pencil.

b) Verbally explain whether this small economy will import or export pencils 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, $20 – (1/20)Q = (1/80)Q$
$80(20) – 4Q = Q$
$5Q = 80(20)$
$Q = 320$ pencils
$P = 20 – (1/20)Q$
$P = 20 – (1/20)(320) = \$4$ per pencil
Or, $P = (1/80)Q$
$P = (1/80)(320) = \$4$ per pencil
CS = (1/2)($20 per pencil - $4 per pencil)(320 pencils) = $2560
PS = (1/2)($4 per pencil - $0 per pencil)(320 pencils)

PS = $640

b) Since the closed domestic economy price of a pencil is less than the world price of a pencil we can conclude that this small economy will export pencils if this market is open to trade. Domestic producers who have been selling pencils for $4 per pencil will be quite happy to export pencils to the world market where they can sell the pencils for $8 per pencil.

c) If the world price is $8 per pencil, then putting this price into the demand equation we get the following:
8 = 20 – (1/20)(Qd)
Qd = 240 pencils
That is, at the world price of $8 per pencil, domestic demand for pencils is equal to 240 pencils.
Putting this price into the supply equation we get the following:
8 = (1/80)(Qs)
Qs = 640 pencils
That is, at the world price of $8 per pencil, domestic supply of pencils is equal to 640 pencils.
Exports = Qs – Qd or
Exports = 640 pencils – 240 pencils = 400 pencils

d) CStrade = (1/2)($20 per pencil - $8 per pencil)(240 pencils) = $1440
PStrade = (1/2)($8 per pencil - $0 per pencil)(640 pencils) = $2560

e) In the closed economy CS + PS = total surplus or TS. In the closed economy the TS is equal to $3200. In the open economy TStrade is equal to CStrade + PStrade or $4000. Clearly TS increases with trade: thus trade is beneficial. But, we can also see that there are winners and losers with this trade. CS in the closed economy is greater than CS in the open economy: domestic consumers will find that opening this market to trade results in their being worse off since they now must pay more for each pencil and they end up consuming fewer pencils. PS in the closed economy is smaller than PS in the open economy: domestic producers will find that opening this market to trade results in their being better off since they now receive a higher price per pencil and they also sell more pencils.

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

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

Suppose this economy opens the pencil market to trade and that the world price is $2 per pencil.

a) Given this information and assuming that this domestic economy opens its pencil 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 $1.00 per pencil 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?

Answers:
a) From problem #2 we know that the price in this economy if the pencil market is closed to trade is $4 per pencil. So, we can conclude that the world price of $2 per pencil is less than the closed market price of $4 per pencil: this implies that this domestic economy will import pencils if the market for pencils is opened to trade. To calculate the level of imports we need to know how many pencils will be domestically demanded at a price of $2 per pencil and how many pencils will be domestically supplied at a price of $2 per pencil. Thus, 2 = 20 - (1/20)Qd or Qd = 360 pencils and 2 = (1/80)Qs or Qs = 160 pencils. The level of imports will be equal to Qd – Qs or 200 pencils. There will be no exports from the domestic producers of this good since the world price is less than the closed price in this domestic economy.

CStrade = (1/2)($20 per pencil - $2 per pencil)(180 pencils) = $3240
PStrade = (1/2)($2 per pencil - $0 per pencil)(160 pencils) = $160
TStrade = $3400

b) Number of imports with tariff = 100 pencils
Number of exports with tariff = 0 pencils
Government tariff revenue = $100
CStariff= $2890
PStariff= $360
DWL with tariff = $50

To find the number of imports with tariffs: plug the tariff price of $3 per pencil 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, 3 = 20 – (1/20)(Qd with tariff) and Qd with tariff = 340 pencils. And, 3 = (1/80)(Qs with tariff) and Qs with tariff = 240 pencils. The number of imports with the tariff will equal (Qd with tariff) – (Qs with tariff) = 100 pencils.

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 pencil)(Number of Imports)
Government tariff revenue = ($1 per pencil)(100 pencils)
Government tariff revenue = $100

CStariff = (1/2)($20 per pencil - $3 per pencil)(340 pencils) = $2890

PStariff = (1/2)($3 per pencil - $0 per pencil)(240pencils) = $360

DWL with tariff = (1/2)($3 per pencil - $2 per pencil)(240 pencils – 160 pencils) + (1/2)($3 per pencil - $2 per pencil)(360 pencils – 340 pencils) = $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 (340pencils rather than 360pencils) and they pay more per pencil ($3 per pencil versus $2 per pencil). Consumer surplus decreases with the tariff relative to consumer surplus in the open economy.

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

Domestic Demand: P = 500 - 10Q

Domestic Supply: P = 100 + 10Q

The world price is $150 for a dryer.

a) Suppose this isinitially a closed economy. Find the equilibrium price and equilibrium quantity of dryers in this closed economy.

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

Suppose the government in this small domestic economy imposes an import quota of 20 dryers 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 Dryers demanded domestically with the import quota = _________________

Quantity of Dryers 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,

500 – 10Q = 100 + 10Q

20Q = 400

Q = 20 dryers

P = 500 – 10(20) = $300 per dryer

Or, P = 100 + 10(20) = $300 per dryer

b) The price of dryers in the domestic economy will equal the world price of $150 per dryer once this economy opens its dryer market to trade.

Domestic producers will produce 5dryers at this price: 150 = 100 + 10Qs or Qs, the quantity supplied domestically, is equal to 5dryers.

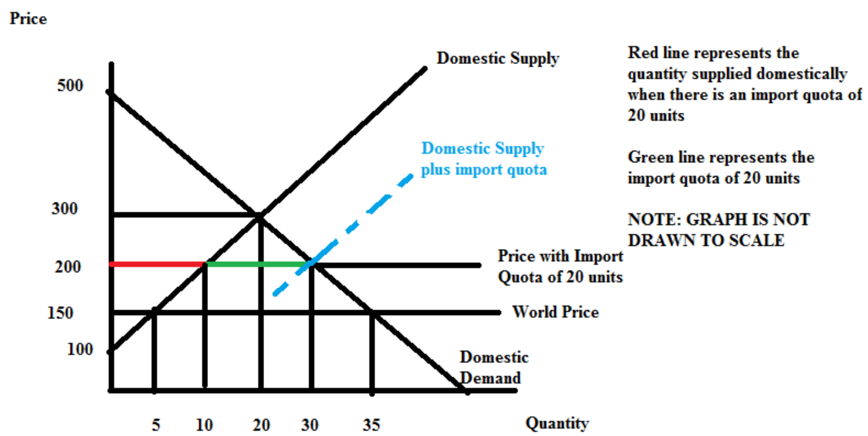
Domestic consumers will consume 35dryers at this price: 150 = 500 – 10Qd or Qd, the quantity demanded domestically, is equal to 35dryers.

The number of dryers imported into this domestic economy will equal Qd – Qs or 30 dryers.

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

c) Here are the answers followed by an explanation of how to find these answers.
Price with the import quota = $200 per dryer
Quantity of Dryers demanded domestically with the import quota = 30 dryers
Quantity of Dryers supplied domestically with the import quota = 10 dryers
DWL due to the imposition of the import quota = $250
License Holder Revenue with the imposition of the import quota = $1000

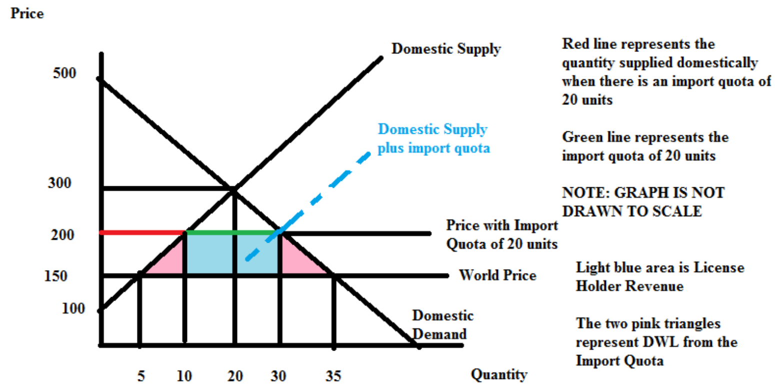
To find these answers I find it helpful to start with a graph that illustrates the domestic demand curve, the domestic supply curve, the world price, and the import quota:




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: (40, 300) or (20, 100) 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 (40, 300): 300 = b + 10(40) or b = -100. The new supply curve that includes the import quota is therefore P = 10Q – 100.

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 – 100 = 500 – 10Q and solving for Q we get Q = 30dryers = the quantity demanded domestically. We can find the price with the quota by using this quantity in the demand equation: Pquota = 500 – 10(Q) or Pquota = 500 – 10(30) = $200 per dryer. To get the quantity supplied domestically we can use the Pquota and the original supply equation: 200 = 100 + 10(Qs) or Qs = the quantity supplied domestically = 10 dryers. DWL = (1/2)($200 per dryer - $150 per dryer)(10 dryers – 5dryers) + (1/2)($200 per dryer - $150 per dryer)(35dryers – 30 dryers) = $250. License Holder Revenue = ($200 per dryer - $150 per dryer)(20 dryers) = $1000. 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 – 10 from the original supply curve (just solve this supply curve for Qs); we can replace Qd with 50 – (1/10)P from the domestic demand curve; and we can replace the import quota with 20 dryers since this is the amount of the import quota. Thus,
(1/10)P – 10 + 20 = 50 – (1/10)P
(2/10)P = 40
P with the quota = $200 per dryer
Qs = the quantity supplied domestically with the import quota = (1/10)(200) – 10 = 10 dryers
Qd = the quantity demanded domestically with the import quota = 50 - (1/10)(200) = 30 dryers
Note that the difference between Qd and Qs is 20 dryers or the amount of the import quota.

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

Demand: Q = 3000 – 3P

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

| P | Q | Total Revenue = TR |
|---|---|---|
| $0 | | |
| 120 | | |
| 180 | | |
| 200 | | |
| 250 | | |
| 450 | | |
| 600 | | |
| 800 | | |

b) In your own words describe what happens to total revenue if the price of this good goes from $450 to $600. 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!

Answer:

a)

| P | Q | Total Revenue = TR |
|---|---|---|
| $0 | 3000 | $0 |
| 120 | 2640 | 316,800 |
| 180 | 2460 | 442,800 |
| 200 | 2400 | 480,000 |
| 250 | 2250 | 562,500 |
| 450 | 1650 | 742,500 |
| 600 | 1200 | 720,000 |
| 800 | 600 | 480,000 |

b) In this example, when the price is $450, the quantity demanded is 1650 widgets and the total revenue is $742,500; when the price rises to $600, the quantity demanded is 1200 widgets and the total revenue is $720,000. When price increases fewer units will be demanded and this quantity effect will cause total revenue to fall instead of selling 1650 widgets only 1200 widgets are demanded and therefore (450)($450) or $202,500 in total revenue is lost due to the quantity effect. But, the price effect causes total revenue to increase: the good is selling for $150 more and there are 1200 widgets demanded at this higher price-this implies that the price effect is an increase in total revenue of (1200)($150) or $180,000. Combining these two effects we see that total revenue decreases by $180,000 - $202,500 or -$22,500.

c) Total revenue will be maximized at the midpoint of this market demand curve. This will occur at a price of $500 and a quantity of 1500 widgets for an amount of total revenue equal to $750,000.

6. Consider the following market demand and market supply curves for scissors where P is the price perscissor and Q is the quantity of scissors.

Demand: $P = 11 – (1/100)Q$
Supply: $P = 2 + (1/200)Q$

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 scissors?

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 by $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,
11 – (1/100)Q = 2 + (1/200)Q
9 = (3/200)Q
Q = 600scissors
P = 11 – (1/100)Q = 11 – (1/100)(600) = $5.00 per pair of scissors
Or, P = 2 + (1/200)Q = 2 + (1/200)(600) = $5.00 per pair of scissors

b) Point elasticity of demand = (-1/slope)(P/Q) = (1/(1/100))(5/600) = 5/6
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 scissors since demand is inelastic.

c) Point elasticity of supply = (1/slope)(P/Q) = (1/(1/200))(5/600) = 5/3
Since the value of point elasticity of supply is greater than one, we can conclude that supply is elastic at the equilibrium point.

d) When the price of scissors is $6 per pair, the quantity demanded is equal to 400 pairs of scissors. We can use these two points on the demand curve (Q, P) = (600, 5) and (400, 6) and the formula for arc elasticity of demand to make this calculation. Here is the formula:

$$\text{Arc Elasticity of Demand} = \left| \frac{\frac{Q2 - Q1}{Q2 + Q1}}{\frac{P2 - P1}{P2 + P1}} \right|$$

Arc elasticity of demand = | [(400 - 600)/(400 + 600)]/[(6 - 5)/(6 + 5)] |
Arc elasticity of demand = [(200)/(1000)]/[(1)/(11)] = 11/5
Since the measure of demand elasticity is greater than one, we can conclude that demand is elastic.

7. a. You are told that the income elasticity of demand for bicycles is equal to 4. What does this mean if incomes in an economy increase by 20%?

b. You are told that the cross price elasticity of demand for bicycles and bike helmets is -2. What does this mean if the price of a bike helmet decreases by 10%?

c. You are told that the cross price elasticity of demand for bicycles and bus fares is equal to 1.5 What does this mean if the price of a bus fare increases by 5%?

Answer:
a. Income elasticity is equal to the percentage change in the quantity demanded divided by the percentage change in income. So, 4 = (percentage change in the quantity demanded)/(20%) implies that the percentage change in the quantity demanded was 80%. Thus, when incomes increased by 20%, the quantity of bicycles demanded increased by 80%. This would be good news if you were in the business of selling bicycles! Since income increased and the quantity of bicycles demanded increased, this tells us that bicycles are a normal good.

b. The cross price elasticity of demand is the percentage change in the quantity demanded of good X divided by the percentage change in the price of good Y. So, -2 = (percentage change in the quantity demanded of bicycles)/(-10%) implies that the percentage change in the quantity demanded was 20%.

Thus, when the price of bike helmets fall by 10%, then the quantity of bicycles demanded increases by 20%. These two goods are complements.
c, The cross price elasticity of demand is the percentage change in the quantity demanded of good X divided by the percentage change in the price of good Y. So, 1.5 = (percentage change in the quantity demanded of bicycles)/(5%) implies that the percentage change in the quantity demanded was 7.5%. Thus, when the price of bus fares increases by 5%, then the quantity of bicycles demanded increases by7.5%. These two goods are substitutes.