Economics 101
Fall 2018
Answers to Homework #2
Due Thursday, October 11, 2018

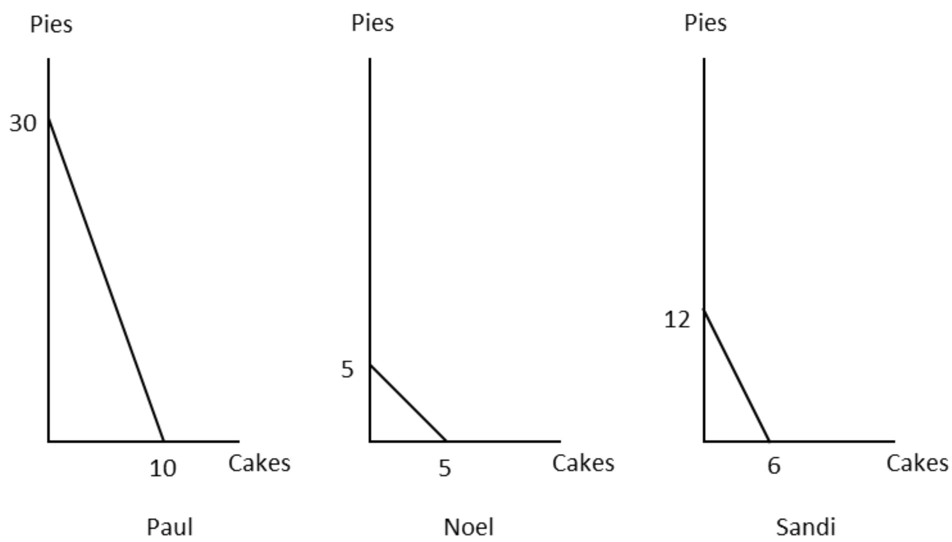
Directions:

- The homework will be collected in a box labeled with your TA's name **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.
- Please **staple** your homework: we expect you to take care of this prior to coming to the large lecture. You do not need to turn in the homework questions, but your homework should be neat, orderly, and easy for the TAs to see the answers to each question.
- Late homework will not be accepted so make plans ahead of time.
- Show your work. Good luck!

Part I: PPF

1. Paul, Noel, and Sandi work in a bakery where they make pies and cakes. In one day, Paul can make 30 pies or 10 cakes or any combination of these two goods that lie on the line containing these two production points. Noel can make 5 pies or 5 cakes or any combination of these two goods that lie on the line containing these two production points. Sandi can make 12 pies or 6 cakes or any combination of these two goods that lie on the line containing these two production points. Assume that PPF of each person is a straight line.

   a. With cakes measured on the horizontal axis, draw the PPF for each person on separate graphs and then find the equations for each individual's PPF.



Paul: p = 30 – 3c

Noel: p = 5 – c

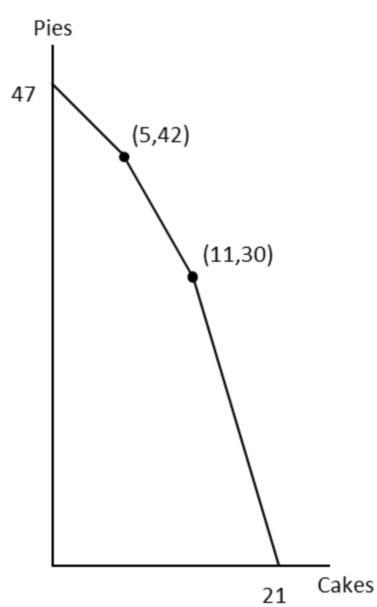
Sandi: p = 12 – 2c

b. What are the opportunity costs of producing 1 pie in terms of the number of cakes for Paul, Noel, and Sandi? Who has the comparative advantage in the production of cakes?

The opportunity cost of producing 1 pie is 1/3 cake for Paul, 1 cake for Noel, and 1/2 cake for Sandi.

The opportunity cost of producing 1 cake is 3 pies for Paul, 1 pie for Noel, and 2 pies for Sandi. Thus, Noel has comparative advantage in the production of cake.

c. Plot the joint PPF and find the equations of each segment of the joint PPF. Provide the relevant domain for each of these equations.

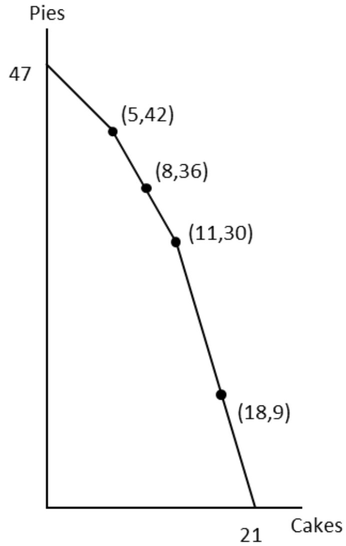


p = 47 – c for $0 \le c \le 5$

p = 52 – 2c for $5 \le c \le 11$

p = 63 – 3c for $11 \le c \le 21$

d. If 36 pies and 8 cakes are produced in the bakery, what does Paul produce? What do Noel and Sandi produce, respectively? If 18 cakes and 9 pies are produced, what do Paul, Noel, Sandi produce, respectively?



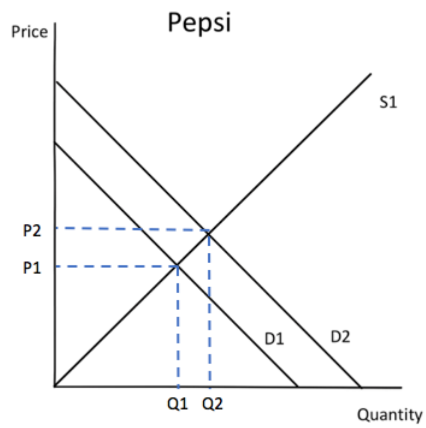
At (8,36), Paul produces 30 pies. Noel produces 5 cakes. Sandi produces 6 pies and 3 cakes.

At (18,9), Paul produces 9 pies and 7 cakes. Noel produces 5 cakes. Sandi produces 6 cakes.

Part II: Demand and Supply

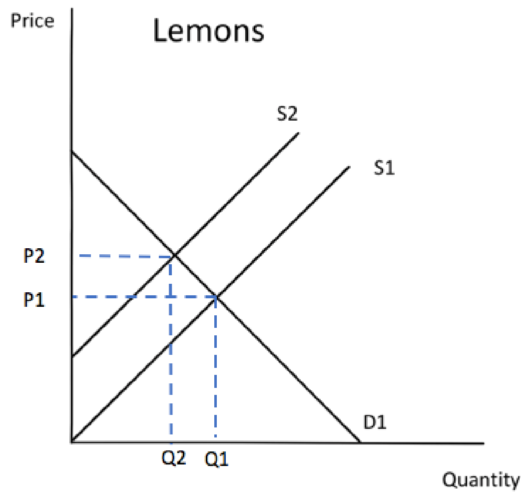
2. For the following scenarios assume the market is in equilibrium.
   a. Assume that Coke and Pepsi are substitute goods. How would an increase in the price of Coke affect the equilibrium price and the equilibrium quantity of Pepsi?

   The demand curve for Pepsi will shift to the right as shown in the graph below (D1 to D2). This will lead to an increase in the price of Pepsi as well as an increase in the quantity of Pepsi.



b. Suppose there is an increase in the price of lemons, which are an input in the production of lemonade. What will happen to the equilibrium price and equilibrium quantity of Lemonade?

This will shift the supply curve to the left, leading to a decrease in supply (S2). This will lead to an increase in the price of lemonade and a decrease in the equilibrium quantity of lemonade.

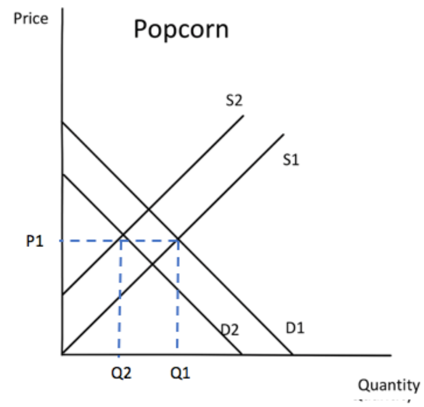


c. At the Union Terrace, beer and popcorn are complements. Suppose that there is an increase in the price of beer and an increase in the price of corn, an input in the production of popcorn. How would these changes affect the equilibrium quantity and equilibrium price in the market for popcorn?

The increase in the price of beer will lead to a decrease in the quantity demanded of beer. Since beer and popcorn are complements, this will lead to a decrease in the demand for popcorn. This can be seen by the shift to the left of the demand curve in the graph below (D1 to D2).

Since corn is an input price, it will lead to increase in the cost of producing corn and this will cause the supply curve for popcorn to shift to the left. This is shown on the graph by a shift to the left of the supply curve (S1 to S2).

This means that in the market for popcorn the equilibrium quantity will decrease but the change in the equilibrium price is indeterminate. That is, the new equilibrium price may be greater than, less than, or equal to the initial equilibrium price in this market.

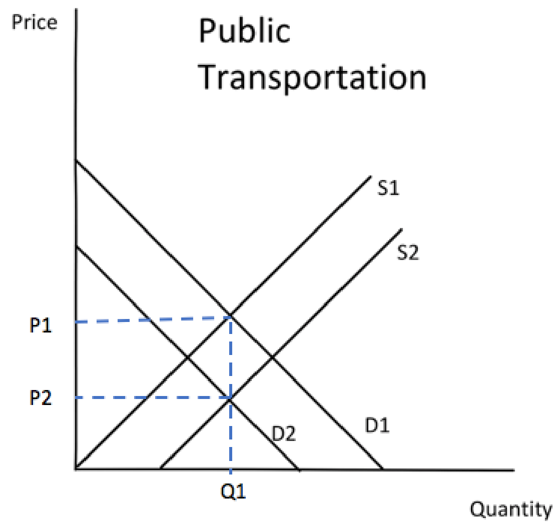


d. What would happen to the equilibrium quantity and the equilibrium price of public transportation, an inferior good, if at the same time income increases and the price of gas decreases? Assume for this question that gasoline is an input in the supply of public transportation.

The decrease in the price of gas will lead to lower costs of production for the suppliers of public transportation: the supply curve will shift to the right reflecting this reduction in costs (S1 to S2).

The demand curve for public transportation shifts to the left when income increases because public transportation is an inferior good: as income increases the quantity of the inferior good demanded decreases at every price (D1 to D2).

The change in the equilibrium quantity of public transportation is uncertain but the equilibrium price of public transportation will decrease. That is, the new equilibrium quantity is indeterminate: the equilibrium quantity may increase, decrease, or remain the same relative to its initial equilibrium quantity.

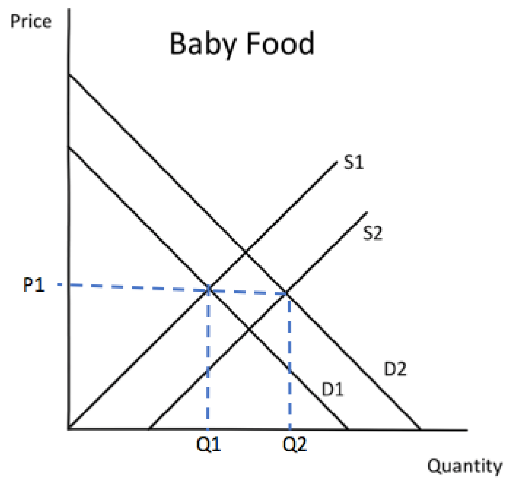


e. What happens to the equilibrium price and equilibrium quantity in the market for baby food if there are technological advances in the production of baby food and at the same time a baby boom happens? Assume that a baby boom means that a greater than normal number of babies are born during a period of time?

An increase in the number of babies being born means that more baby food will be demanded at every price: the demand for baby food will shift to the right (D1 to D2).

Technological advances reduce the cost of producing baby food: thus, the supply of baby food will increase at every price and the supply curve for baby food will shift to the right (S1 to S2).

This will lead to an increase in the equilibrium quantity of baby food relative to the initial equilibrium quantity but the new equilibrium price change will be indeterminate: the price may increase, decrease, or remain the same relative to the initial equilibrium price.



3. This is a two-part question. For parts A and B refer to the following scenario.

   The quantity supplied of cheese curds is always equal to twice the price per unit of cheese curds. The quantity of cheese curds demanded decreases by one unit of cheese curds every time the price per unit of cheese curds increases by one dollar. When the price of cheese curds is equal to one dollar, the quantity demanded of cheese curds is equal to 8 units of cheese curds.

   Part A:

   a. What is the equation for the demand curve for cheese curds? In your equation use Q as the symbol for the quantity of cheese curd units and P as the price per unit of cheese curds.

      Q = 9 - P or P = 9 - Q

   b. What is the equation for the supply curve for cheese curds? In your equation use Q as the symbol for the quantity of cheese curd units and P as the price per unit of cheese curds.

      2P = Q or (½) * Q = P

   c. Find the equilibrium price and quantity in the market for cheese curds.

      To find the equilibrium, you have to find where the supply and demand curves intersect. In this case you need to set them equal to each other to solve for P.
      Q = 9 - P = 2P = Q
      9 – P = 2P

9 = 3P
3 = P
That is, the equilibrium price per unit of cheese curds is $3.

Plugging in this value for the price into either the supply or demand curves we get Q = 6 units of cheese curds. Here's the work:
Supply: 2(3) = quantity supplied
Demand: 9 – 3 = quantity demanded

The equilibrium quantity is therefore 6 units of cheese curds and the equilibrium price is $3 per unit of cheese curds.

d. Calculate the value of consumer surplus in the market for cheese curds.

Graphically the consumer surplus is the triangular area below the demand curve and above the equilibrium price. We need to find the width and height of this triangle to calculate its area.

To find the height we need the intercept of the demand curve on the price axis. To find this we set Q = 0. P = 9 – 0 = $9 per unit of cheese curds. Therefore, the demand curve intercepts the vertical axis at P = 9 and the height of the triangle is the y-intercept minus the equilibrium price, which is 9 - 3 = 6 or $6 per unit of cheese curds.

The width of the triangle is the distance from 0 to the equilibrium quantity or 6 units of cheese curds.

Area of a triangle = ½ width* height = (1/2)($6 per unit of cheese curds)(6 units of cheese curds) = $18. Notice that if you include the units of measurement here you find that consumer surplus is measured in dollars.

The consumer surplus is $18.

e. Calculate the value of producer surplus in the market for cheese curds.

Graphically the producer surplus is the triangular area above the supply curve and beneath the equilibrium price. We need to find the height and width of this triangle in order to calculate its area.

The height of the triangle is the distance between the intercept of the supply curve on the price axis and the equilibrium price. The supply curve intercepts the price axis when Q = 0. For this supply curve, when Q = 0, then P is also equal to 0. So, the height of the triangle is 3 – 0 = $3 per unit of cheese curds.

The width of the triangle is the distance from 0 to the equilibrium quantity and therefore is equal to 6 units of cheese curds.

Area of a triangle = ½ width* height = (1/2)($3 per unit of cheese curds)(6 units of cheese curds) = $9.

The producer surplus is equal to $9.

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f. Calculate the value of total surplus in the market for cheese curds.

The total surplus is equal to the sum of producer surplus and consumer surplus.
$18 + $9 = $27
The total surplus is $27.

Part B:

Now assume that the demand for cheese curds decreases by 3 cheese curds at every price. The supply curve does not change for part B.

a. Given this new information, what is the equation for the new demand curve for cheese curds?

The original demand curve was given by: Q = 9 - P or P = 9 - Q (from part A). Now, we want three fewer units of cheese curds at each price. Thus, Q = (9 - P) - 3. So we get Q = 6 - P or P = 6 – Q as our new demand curve for cheese curds.

b. Find the new equilibrium price and the new equilibrium quantity.

To find the equilibrium, you have to find where the supply and demand curves intersect. In this case, you need to set the demand and supply equation equal to each other to solve for P.
Q = 6 - P and we use the supply curve from part A. 2P = Q
2P = 6 - P
3P = 6
P = $2 per unit of cheese curds
Plugging in this new equilibrium price of $2 per unit of cheese curds into either the supply or demand curve we get Q = 4 units of cheese curds. Here's the work:
Supply: 2(2) = 4 = quantity supplied
Demand: 6 – 2 = 4 = quantity demanded
The new equilibrium quantity is therefore 4 units of cheese curds.

g. Calculate the new value of consumer surplus.

Graphically the consumer surplus is the triangular area below the demand curve and the above the equilibrium price. We need to find the height and the width of the triangle. The width is easier; it goes from 0 to the equilibrium quantity. Therefore, the width of the triangle is 4 units of cheese curds.

The height of the triangle is the distance from the equilibrium price of $2 per unit of cheese curds to the y-intercept of the demand curve, or $6 per unit of cheese curds. Thus this distance is equal to $4 per unit of cheese curds.

Area of a triangle = ½ width* height = (1/2)($4 per unit of cheese curds)(4 units of cheese curds) = $8.
The consumer surplus is $8.

h. Calculate the new value of producer surplus.

Graphically the producer surplus is the triangular area above the supply curve and below the equilibrium price. We need to find the height and the width of the triangle. The width is easier; it goes from 0 to the equilibrium quantity. Therefore, the width of the triangle is 4 units of cheese curds.

The height of the triangle is the distance from the equilibrium price to the y-intercept of the supply curve. The supply curve intercepts the price axis when Q = 0. This means, P = 0, so the distance is 2 – 0 = $2 per unit of cheese curds.

Area of a triangle = ½ width* height = (1/2)($2 per unit of cheese curds)(4 units of cheese curds) = $4.
The producer surplus is $4.

c. Calculate the new value of total surplus.

The total surplus is equal to the sum of producer surplus and consumer surplus.
Thus, 8 + 4 = $12
The total surplus is $12.

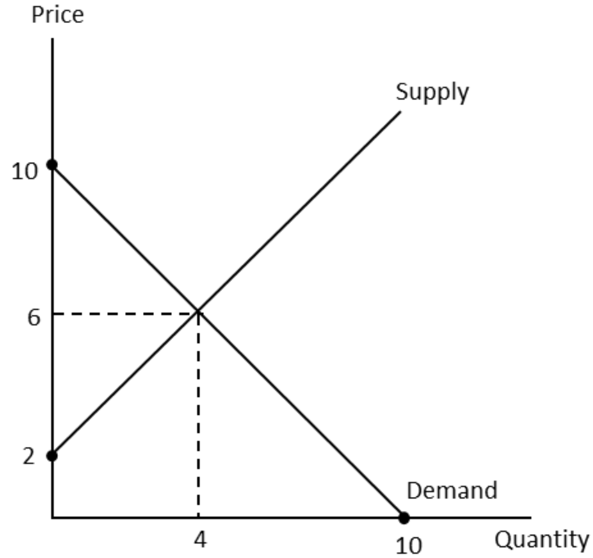
Part III: Consumer Surplus, Producer Surplus, Deadweight Loss

4. Consider the market for electricity in an island country. The price (P) is given in dollars per kilowatt hour (kWh) and the quantity (Q) is measured in kilowatt hours (kWh). Demand and Supply equations for the electricity are as follows:

   Market Demand: $P = 10 - Q_d$

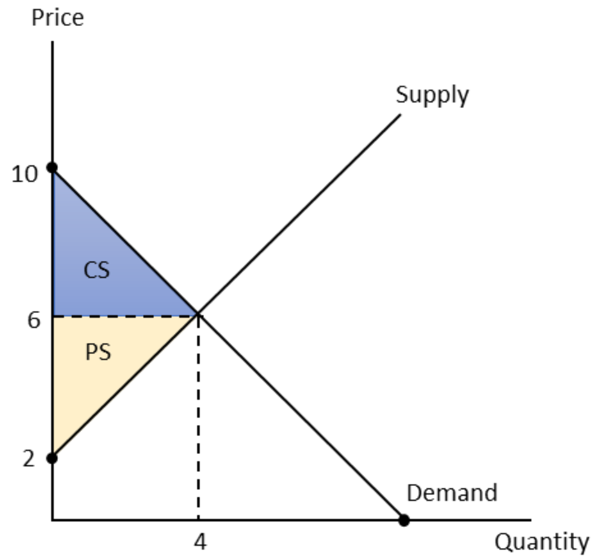
   Market Supply: $P = 2 + Q_s$

a. Find the equilibrium price and equilibrium quantity in the market for electricity. Plot a graph to describe the equilibrium. Be sure your graph is completely and clearly labeled (label all intercepts, label the axis, label the equilibrium price and the equilibrium quantity, label any curves that your draw).



To find the equilibrium price and quantity start by setting the equations equal to one another.
P = 10 – Q = 2 + Q then Q = 4 kWh, P = $6 per kWh.
The equilibrium price is 6 dollars per kWh and the equilibrium quantity is 4 kWh.

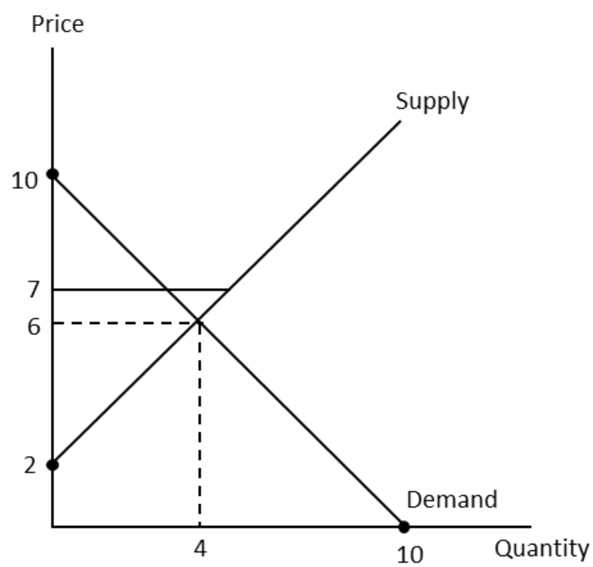
b. What is the value of consumer surplus and producer surplus at the equilibrium? Use a graph to illustrate your work and find the numerical values for both the consumer and the producer surplus.



The value of consumer surplus is the area of the blue upper triangle.
Consumer surplus = ½*(10 - 6)*4 = $8.

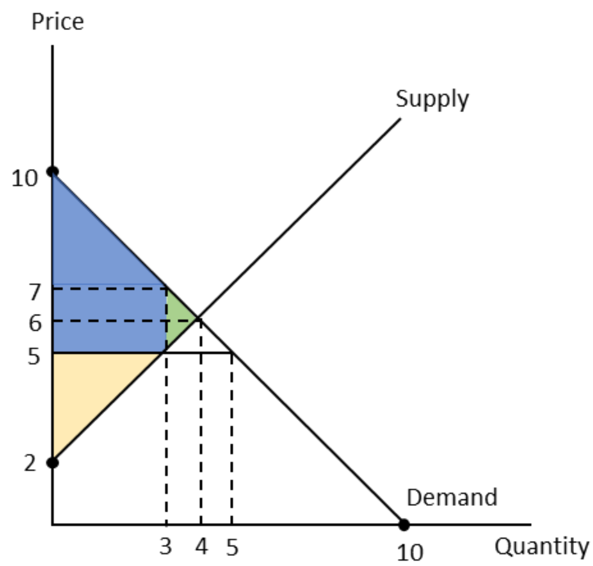
The value of producer surplus is the area of the yellow lower triangle.
Producer surplus = ½*(6 - 2)*4 = $8.

c. Assume that during the past summer, because of the record-breaking heat, the government set a price ceiling in the market for electricity at 7 dollars per kWh. Is there a shortage or a surplus in the market once the price ceiling is set? Calculate the value of consumer surplus, producer surplus, and deadweight loss due to the implementation of this price ceiling.



The price ceiling in the market for electricity is above the equilibrium price, so there is no effect on the market. Price and quantity remain at the equilibrium level we calculated in (a). There is no shortage or surplus. The consumer surplus and producer surplus are the same as in (b) and there is no deadweight loss.

d. Assume that the government sets a price ceiling at 5 dollars per kWh. With this new price ceiling is there a shortage or a surplus in the market once the price ceiling is implemented? Calculate the value of consumer surplus, producer surplus, and deadweight loss due to the implementation of this price ceiling.



Because the price ceiling is below the equilibrium price it is effective. With a price of \$5 per kWh the quantity the quantity demanded exceeds the quantity supplied. Q_d = 5 and Q_s = 3: at this price there is a shortage of 2 kWh of electricity.

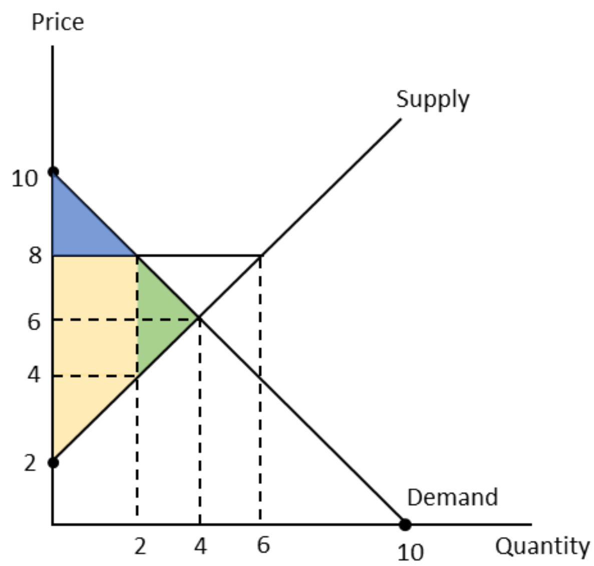
Consumer Surplus is the blue area underneath the demand curve and above the equilibrium price for quantities up to and including 3 kWh of electricity. Consumer Surplus = sum of a triangle + a rectangle = (1/2)(\$10 per kWh - \$7 per kWh)(3 kWh) + (\$7 per kWh - \$5 per kWh)(3 kWh) = \$10.50.

Producer surplus is the yellow area below the price ceiling price of \$5 per kWh and above the supply curve up to and including a quantity of 3 kWh. Producer Surplus = (1/2)(\$5 per kWh - \$2 per kWh)(3 kWh) = \$4.50.

Deadweight loss is the green area in the graph: DWL = (1/2)(\$7 per kWh - \$5 per kWh)(1 kWh) = \$1.

If we compare the original total surplus of \$16 to the new total surplus of \$15 (the \$10.50 + \$4.50) we see that total surplus decreases with the implementation of the price ceiling by a total of \$1. This \$1 is the deadweight loss due to the implementation of an effective price ceiling.

e. Suppose the government wants to find out the impact of a price floor in the electricity market. If the price floor is set at 8 dollars per kWh, would there be a shortage or a surplus in the market? Calculate the value of consumer surplus, producer surplus, and deadweight loss in this scenario.



Because the price floor of $8 per kWh is greater than the equilibrium price, the price floor is effective. At a price of $8 per kWh, the quantity supplied exceeds the quantity demanded by 4 kWh. To see this, calculate the quantity demanded at $8 per kWh and the quantity supplied at $8 per kWh: $Q_d = 2$ and $Q_s = 6$.

Consumer Surplus is the blue triangle area below the demand curve and above the price floor price of $8 per kWh. Consumer Surplus = (1/2)($10 per kWh - $8 per kWh)(2kWh) = $2.

Producer surplus is the yellow trapezoid area below the price floor of $8 per kWh and above the supply curve. Producer Surplus = the area of a triangle + the area of a rectangle = (1/2)($2 per kWh)(2 kWh) + ($4 per kWh)(2 kWh) = $10.

Deadweight loss is the green area in the graph. Deadweight loss = (1/2)($4 per kWh)(2kWh) = $4.

If we compare the original total surplus of $16 to the new total surplus of $12 (the $2 + $10) we see that total surplus decreases with the implementation of the price floor by a total of $4. This $4 is the deadweight loss due to the implementation of an effective price floor.

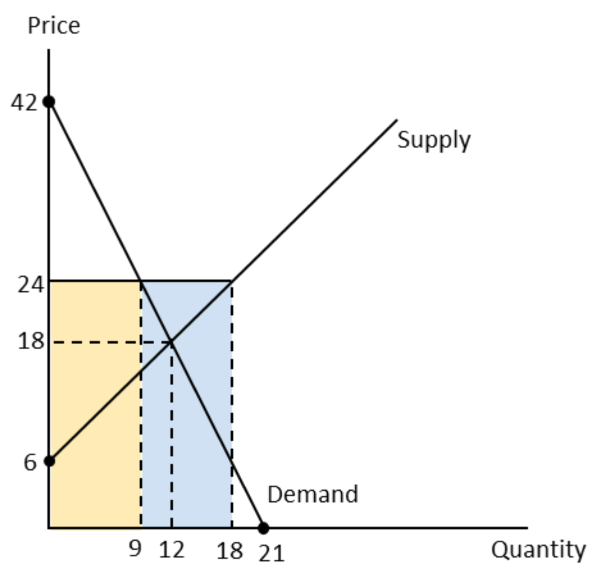
5. Consider the market for tomatoes. The demand and the supply equations for tomatoes are given by the following equations where P is the price per box of tomatoes and Q is the number of tomato boxes.

   Market Demand: $P = 42 – 2Q_d$
   Market Supply: $P = 6 + Q_s$

a. Find the equilibrium price and the equilibrium quantity in the market for tomatoes.

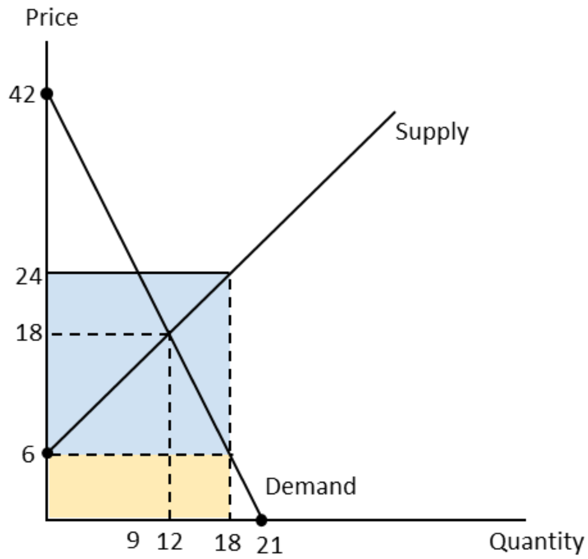
Solving P = 42 – 2Q = 6 + Q, we get Q = 12 boxes of tomatoes and P = $18 per box of tomatoes. The equilibrium price is 18 dollars per box of tomatoes and the equilibrium quantity is 12 boxes of tomatoes.

b. Suppose the government starts a price support program to help tomato farmers. Suppose the price of a box of tomatoes is set at $24, and the government promises to purchase any excess quantity of tomatoes at that price. If this program is implemented, what will be the quantity supplied by producers? What will be the quantity purchased by consumers? How much do consumers spend on tomatoes with this program? What is the cost for the government to implement the program? Assume that the government's costs are only the costs associated with buying any surplus boxes of tomatoes.



24 = 6 + Q_s gives us Q_s = 18 boxes of tomatoes. The quantity supplied by producers is 18 boxes of tomatoes. Consumers demand only 9 boxes as we can calculate from the demand equation 24 = 42 - 2Q_d. Consumers spend $24*9 = $216 on tomatoes. The expenditure by consumers on tomatoes is the area of the yellow rectangle. The excess supply of 18 - 9 = 9 boxes of tomatoes are purchased by the government and this costs the government $24*9 = $216. The cost to the government of this program is the area of the blue rectangle.)

c. Instead of the program described in part (b), the government chooses to implement an alternative program called the price guarantee program. With this program the government wants to ensure that the consumers will buy the quantity of tomatoes that producers are willing to produce if the producers are guaranteed a price of $24 per box of tomatoes. To reach this goal the government promises to pay any difference between the price consumers are willing to pay and the guaranteed price of $24 to the producers of the tomatoes. Given this program, what will be the quantity purchased by consumers? What price will consumers pay for a box of tomatoes? How much do consumers spend on tomatoes? What is the cost to the government to implement this program?



As in (b), the supply equation P = 6 + Q_s tells us producers supply 18 boxes of tomatoes when the price is $24 per box of tomatoes. In order to get consumers to purchase 18 boxes of tomatoes the price per box for the consumers must be $6 per box: P = 42 – 2Q and if Q = 18 then P = 42 – 2(18) = 42 – 36 = $6 per box. Consumers spend $6*18 = $108 on tomatoes. The expenditure of consumers on tomatoes is the area of the yellow rectangle in the figure. The difference between the price guaranteed to producers ($24 per box of tomatoes) and the price consumers are willing to pay for this quantity ($6 per box of tomatoes) is paid by the government: thus, the government pays $24 - $6 = $18 per box of tomatoes sold or $18*18 = $324. The cost to the government is the area of the blue rectangle.