

**Directions:**

- The homework will be collected in a box **before** the large 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. Comparative Advantage:**

Robinson Crusoe is marooned on an island and only has two sources of food: the fish he can catch and the coconuts that he can find. Robinson spends a total of 10 hours a day either looking for food or developing a way off the island. In two hours, he can either catch one fish or find 3 coconuts.

- a. How many coconuts can Robinson find in one day (that is, what is the maximum number of coconuts that Robinson can find in one day)? How many fish can he catch?

**Answer:**

The problem gives us how many fish he can catch and how many coconuts he can gather in 2 hours. Since Robinson works for 10 hours total, we calculate  $(10 \text{ hours} / 1 \text{ day})(3 \text{ coconuts} / 2 \text{ hours}) = 15 \text{ coconuts} / \text{day}$ . Similarly  $(10 \text{ hours} / 1 \text{ day})(1 \text{ fish} / 2 \text{ hours}) = 5 \text{ fish} / \text{day}$ .

- b. What is Robinson's opportunity cost of gathering one coconut? What is Robinson's opportunity cost of catching one fish?

**Answer:**

We calculate how many fish Robinson gives up if he wants an additional coconut:  
 $OC_{\text{coconut}} = (5 \text{ fish} / \text{day}) / (15 \text{ coconuts} / \text{day}) = 1/3 \text{ fish} / \text{coconuts}$ .

We calculate how many coconuts Robinson gives up if he wants an additional fish:  
 $OC_{\text{fish}} = (15 \text{ coconuts} / \text{day}) / (5 \text{ fish} / \text{day}) = 3 \text{ coconuts} / \text{fish}.$

One day, Robinson meets Wilson, who is also stranded on the island. Wilson also spends 10 hours a day catching fish and collecting coconuts. Wilson can either catch 4 fish in a day or gather 8 coconuts in a day. Wilson and Robinson would like to trade so that they can eat more than before they met each other.

- c. What is Wilson's opportunity cost of gathering an additional coconut? What is Wilson's opportunity cost of catching an additional fish?

Answer:

$OC_{\text{coconut}} = (4 \text{ fish} / \text{day}) / (8 \text{ coconuts} / \text{day}) = 1/2 \text{ fish} / \text{coconuts}.$

$OC_{\text{fish}} = (8 \text{ coconuts} / \text{day}) / (4 \text{ fish} / \text{day}) = 2 \text{ coconuts} / \text{fish}.$

- d. Who has the comparative advantage in gathering coconuts? Who has the comparative advantage in catching fish? Explain your answer.

Answer:

Robinson has the comparative advantage in gathering coconuts because he has the lower opportunity cost (Robinson gives up 1/3 of a fish while Wilson gives up 1/2 a fish). Similarly, Wilson has the comparative advantage in catching fish.

- e. When Robinson and Wilson trade, what is the range of trading prices for one fish in terms of coconuts?

Answer:

Since Wilson has the comparative advantage in catching fish, we know that he will be selling the fish. Wilson will only sell the fish if he can get at least 2 coconuts in return (Wilson's OC of catching a fish). Robinson is only willing to buy the fish if it costs him 3 or fewer coconuts per fish (Robinson's OC of catching a fish). Therefore, the trading range of prices is between 2 coconuts and 3 coconuts.

## 2. Shifts in Supply and Demand:

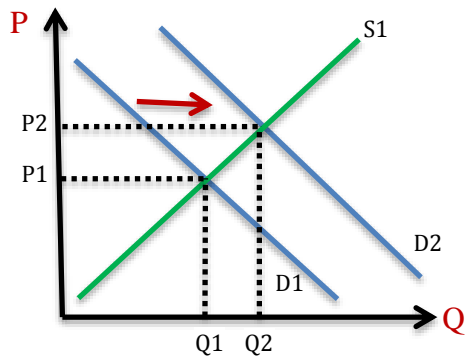
For the following scenarios, plot what will happen to the supply and demand curves for the given situation and state what will happen to the equilibrium price and quantity. Assume that each market is initially in equilibrium and then analyze the given scenario.

Note: In the answer key demand curves are in blue and supply curves are in green.

- a. The price of beef has risen due to an outbreak of Mad Cow Disease. Plot what will happen to the demand of pork, a substitute in consumption for beef.

Answer:

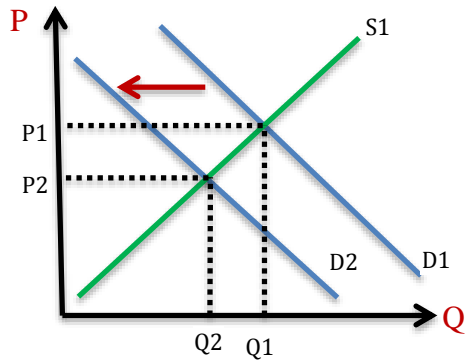
If the price of beef increases, people will substitute away from beef and buy more pork. This means demand for pork increases resulting in a higher equilibrium price and quantity.



- b. Scientists have released a study that shows that almonds are very unhealthy. Plot what will happen to the demand for almonds.

Answer:

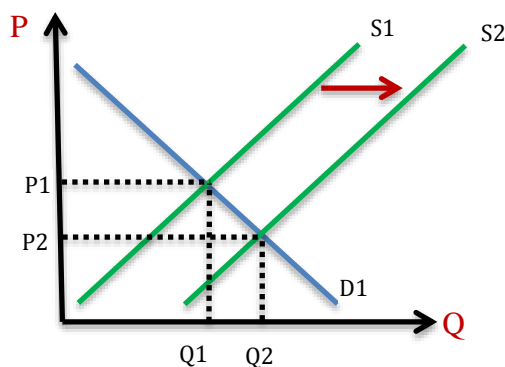
If people learn almonds are unhealthy, demand will decrease at every price. This results in a lower equilibrium price and quantity.



- c. Apple has improved the efficiency of the factories that produce iPhones. Plot what will happen to the supply of iPhones.

Answer:

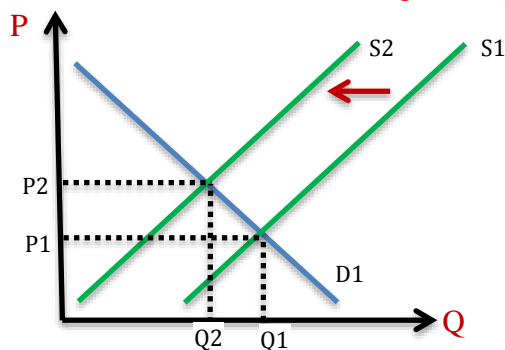
With improved factories, Apple can produce more iPhones at any given price (supply increases). This will result in a lower equilibrium price but higher equilibrium quantity.



- d. The price of fertilizer used in growing wheat has risen by 50%. Plot what will happen to the supply of wheat.

**Answer:**

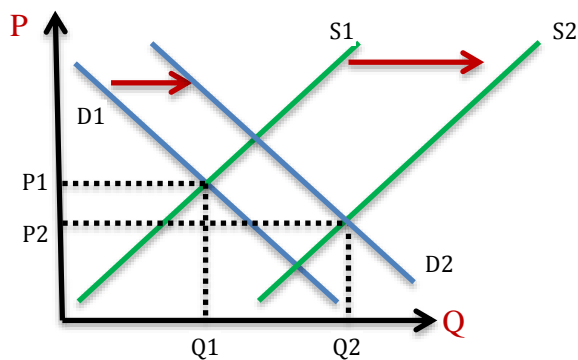
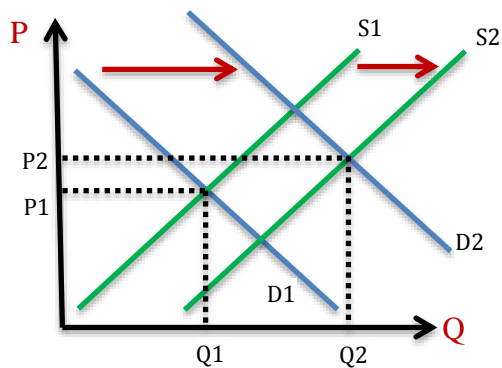
If the cost of an input rises, farmers will sell less wheat at any given price. So the supply curve shifts to the left resulting in a higher equilibrium price and quantity.



- e. Since the Star Wars film has come out, Star Wars action figures are now much more popular and more companies have started to make these action figures. Plot what will happen to the Star Wars action figure market.

**Answer:**

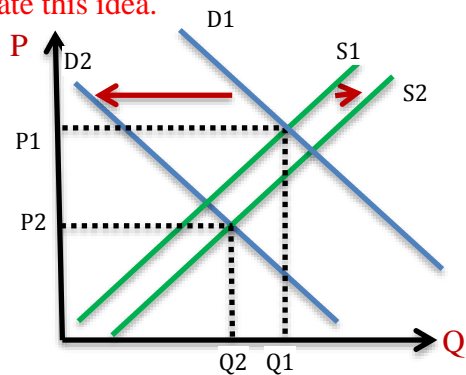
Demand increased so the demand curve shifts to the right. Supply also increased so the supply curve shifted to the right as well. While the equilibrium quantity increased, the price change is ambiguous. The price change depends on how much supply and demand increased. See the graphs below to see why there is price indeterminacy.

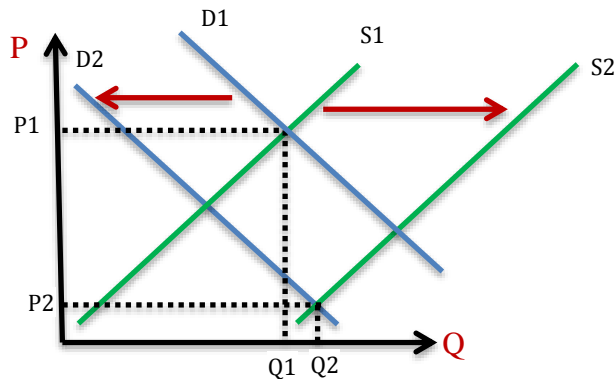


- f. Due to shifts in tastes, fewer people read news articles. The number of news outlets has increased due to the lower cost of disseminating news articles on the internet. Plot what will happen to the news article market.

**Answer:**

Demand shifts to the left and supply shifts to the right. The new equilibrium price falls but the equilibrium quantity is ambiguous. See the graphs below that illustrate this idea.





**3. Supply and Demand (Note: this problem is based on a similar one from K. Hansen's class-many thanks!)**

Suppose the market demand and market supply curves for bicycles in Madison are given by the following equations, where  $P$  is price per bicycle and  $Q$  is quantity of bicycles:

$$\text{Market demand: } P = 300 - 5Q$$

$$\text{Market supply: } P = 2.5Q$$

- a. Find the equilibrium price and quantity.

**Answer:**

Find where the two lines intersect. Setting the prices equal to each other gives us:

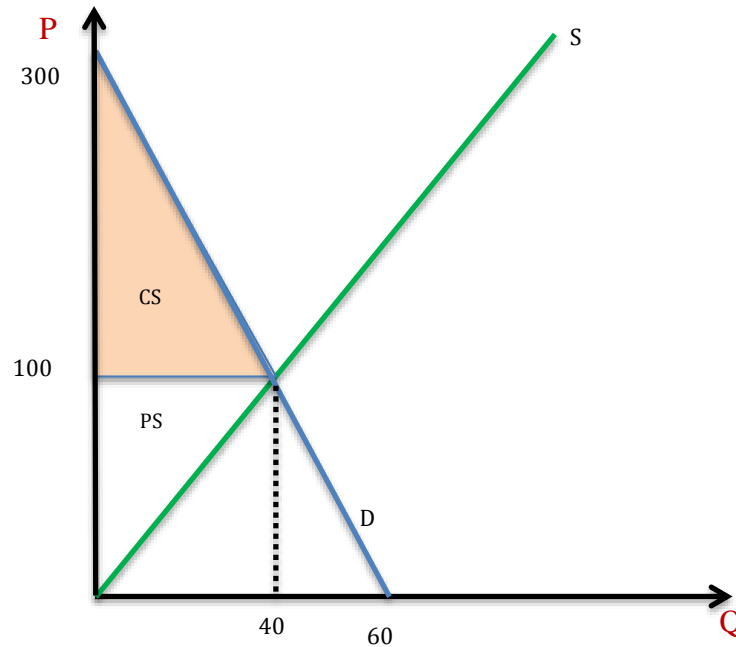
$$300 - 5Q = 2.5Q$$

$$Q^* = 40$$

Plugging  $Q^* = 40$  back into either supply or demand gives us the equilibrium price:

$$P^* = 100.$$

- b. Calculate the consumer and producer surplus in equilibrium.



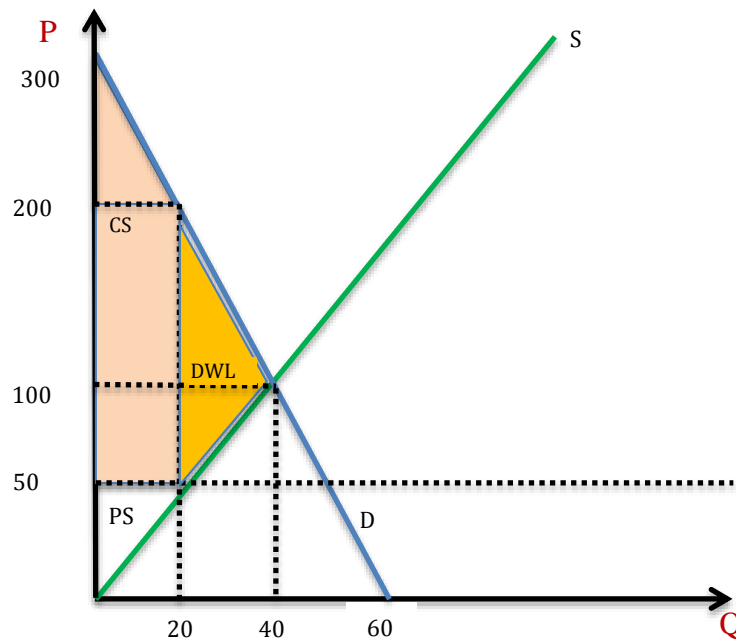
Answer:

The graph above shows the consumer surplus and producer surplus. We must find the area of the triangles

$$CS = \frac{1}{2} * (\text{base}) * (\text{height}) = \frac{1}{2} * (40 - 0) * (300 - 100) = \$4,000$$

$$PS = \frac{1}{2} * (\text{base}) * (\text{height}) = \frac{1}{2} * (40 - 0) * (100 - 0) = \$2,000$$

c. Imagine a price ceiling of \$50 is imposed in the market for bicycles. Given this intervention in the market and holding everything else constant, what are the values of the new consumer and producer surplus? What is the deadweight loss from this policy?



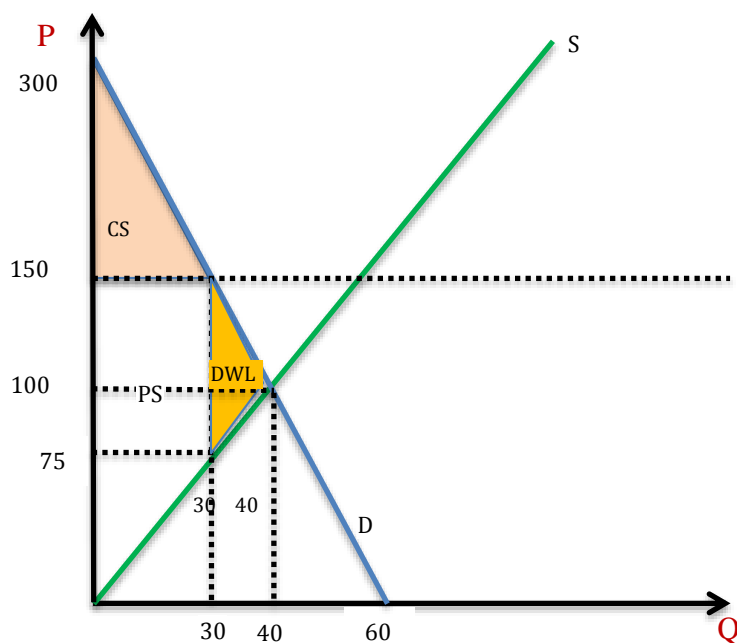
Answer: If there is a price ceiling of \$50, the quantity supplied will be  $\$50 = 2.5 Q \rightarrow Q = 20$  bicycles. This quantity was calculated by plugging the price into the supply function. At  $Q = 20$  bicycles, the price on the demand curve is  $P = 300 - 5 * 20 = \$200/\text{bicycle}$ . The graph above shows the CS and PS.

$CS = 1/2 * (\text{base}_1 + \text{base}_2) * (\text{height}) = 1/2 * (300 - 50 + 200 - 50) * (20) = \$4000$  or  $CS = (1/2)(300 - 200)(20) + (200 - 50)(20) = 1000 + 3000 = \$4000$

$PS = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (20 - 0) * (50 - 0) = \$500$

$DWL = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (200 - 50) * (40 - 20) = \$1,500$

d. Instead of a price ceiling, suppose that the Madison bicycle workers' union pushed for a price floor at \$150 in the market for bicycles. What are the values of the new consumer and producer surplus given this policy? What is the deadweight loss due to the implementation of this policy?



Answer:

If there is a price floor of \$150, the quantity demanded will be  $\$150 = 300 - 5Q \rightarrow Q = 30$ . At  $Q = 30$  bicycles, the price on the supply curve is  $P = 2.5 * 30 = \$75/\text{bicycle}$ . The graph above shows the CS, PS and DWL.

$PS = 1/2 * (\text{base}_1 + \text{base}_2) * (\text{height}) = 1/2 * (150 - 0 + 150 - 75) * (30) = \$3,375$

or  $PS = (1/2)(75 - 0)(30) + (150 - 75)(30) = 1125 + 2250 = \$3375$

$CS = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (30 - 0) * (300 - 150) = \$2,250$

$DWL = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (150 - 75) * (40 - 30) = \$375$

**4. Supply and Demand II (Note: this problem is based on a similar one from K. Hansen's class-many thanks!)**

Consider pumpkins sold at the local farmer's market. Suppose the demand for pumpkins is given by  $Q = 100 - 2P$ , and the supply is given by  $Q = 2P - 20$ .

a. Find the equilibrium price and quantity.

Answer:

Set demand and supply equal to each other:

$$100 - 2P = 2P - 20$$

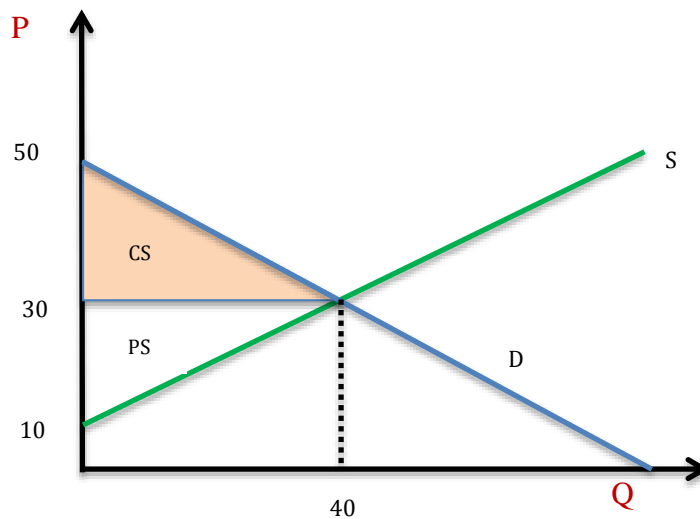
$$4P = 120$$

$$P^* = 30$$

Plug the equilibrium price back into the demand or supply function to get  $Q^* = 40$ .

b. Calculate the consumer and producer surplus in equilibrium.

Answer:



$$CS = \frac{1}{2} * (\text{base}) * (\text{height}) = \frac{1}{2} * (40 - 0) * (50 - 30) = \$400$$

$$PS = \frac{1}{2} * (\text{base}) * (\text{height}) = \frac{1}{2} * (40 - 0) * (30 - 10) = \$400$$

c. Given the above information, what is the lowest price floor that will be effective?

Answer:

The price floor has to be greater than \$30 to be effective. If it is any lower, the competitive market equilibrium price is above the price floor.

d. Given the above information, what is the highest price ceiling that will be effective?

Answer:

The price ceiling must be less than \$30 to be effective. If it is any higher, the competitive market equilibrium price is below the ceiling.

- e. Suppose that the price of squash has risen 50% due to poor growing conditions for squash. Squash is a substitute for pumpkins. What is likely to happen to the equilibrium price and quantity in the market for pumpkins?

Answer:

Demand should increase, shifting the demand curve to the right. This will lead to a higher equilibrium price and quantity.

## 5. Price Supports and Guarantees

The market demand for economics textbooks is given by  $P = 300 - 2Q$  and the supply of textbooks is given by  $P = 2Q + 20$ .

- a. What is the equilibrium price and quantity?

Answer:

Set demand and supply equal to each other:

$$300 - 2Q = 2Q + 20$$

$$4Q = 280$$

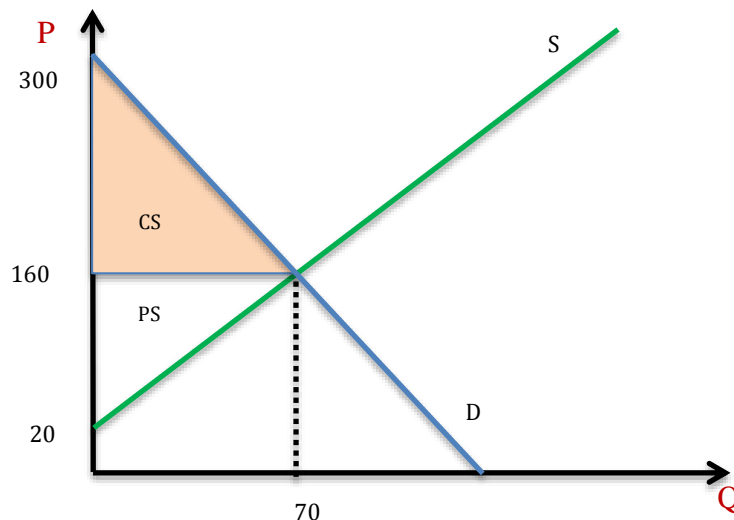
$$Q^* = 70$$

Plug the equilibrium quantity back into the demand or supply function to get:

$$P^* = \$160 \text{ per textbook}$$

- b. Calculate the value of consumer and producer surplus when this market is in equilibrium.

Answer:

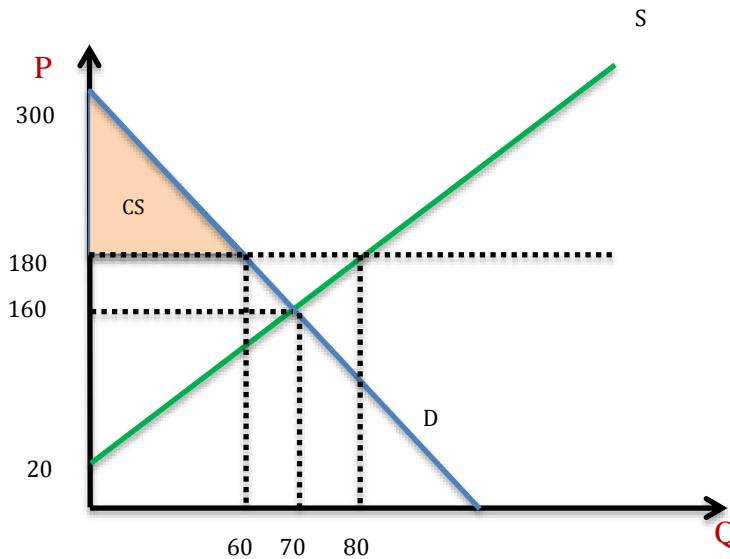


$$CS = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (70 - 0) * (300 - 160) = \$4,900$$

$$PS = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (70 - 0) * (160 - 20) = \$4,900$$

- c. Suppose the government promises to buy textbooks at \$180 per textbook. How many textbooks will the government buy? How much will the government spend on textbooks?

Answer:



Answer:

If the government will buy books at \$180 per textbook, it is similar to having a price floor at \$180. At \$180, consumers will buy  $Q = 150 - P/2 = 60$  books. The publishers will supply  $Q = -10 + P/2 = 80$  textbooks. The excess supply of textbooks is purchased by the government. The government buys  $80 - 60 = 20$  textbooks. Therefore, the government spent  $(\$180 \text{ per textbook}) * (20 \text{ textbooks}) = \$3,600$  on textbooks.

- d. Given the government policy described in (c), how many textbooks will consumers buy? What is the value of consumer surplus? Will consumers like the price guarantee?

Answer:

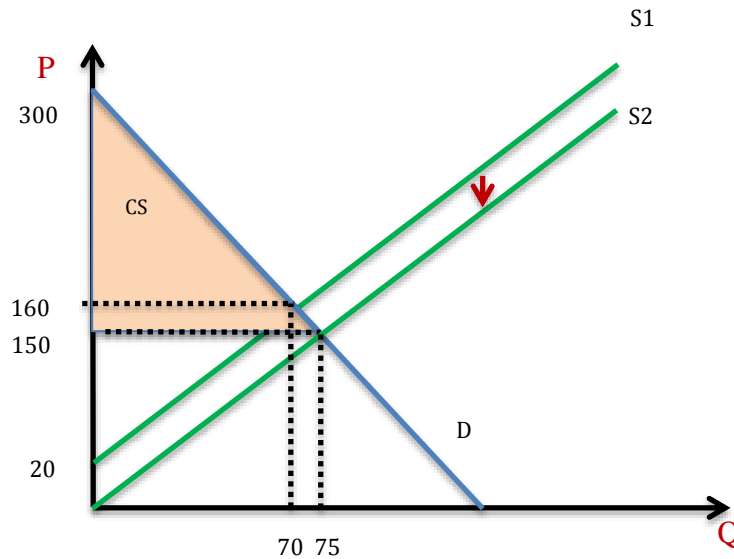
In part (c), we calculated how many textbooks consumers will buy when there is a price guarantee of \$180 per textbook: 60 textbooks.

$$CS = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (60 - 0) * (300 - 180) = \$3,600$$

Consumers will not like this outcome because their surplus went down from \$4,900 to \$3,600.

- e. Return to the original situation and now suppose that the government gives a \$20 subsidy to the publisher for every textbook sold. Given this new policy, how many textbooks will be sold and what will be the equilibrium price?

Answer:



Answer: If the government offers \$20 for each textbook sold, the supply curve will shift down because the publishers are willing to sell any quantity of books for \$20 dollars cheaper since the government is paying them that difference. So the supply curve becomes  $P = 2Q$ . Solving for the new market equilibrium:

$$2Q = 300 - 2Q$$

$$4Q = 300$$

$$Q^* = 75 \text{ textbooks}$$

Plug the equilibrium quantity back into the demand or supply function to get:

$$P^* = \$150 \text{ per textbook}$$

- f. Given the subsidy program described in (e), how much money will the government spend when implementing this program?

Answer:

The government has to pay publishers \$20 for every textbook sold. Since 75 textbooks are sold, the government spends  $(\$20 \text{ per textbook}) * (75 \text{ textbooks}) = \$1,500$ .

- g. Given the subsidy program described in (e), what is the value of consumer surplus? Do consumers prefer the subsidy program over the price guarantee program? Explain your answer fully.

Answer:

$$CS = 1/2 * (\text{base}) * (\text{height}) = 1/2 * (75 - 0) * (300 - 150) = \$5,625$$

The consumer surplus of \$5,625 is greater than the value of consumer surplus with the price guarantee (\$3,600 as we calculated in part (d)). Therefore, consumers prefer the subsidy program over the price guarantee program.

## 6. Price Subsidies:

Suppose the market demand for a taxi ride to the airport is given by  $P = 20 - Q$  and the supply of taxi rides to the airport is given by  $P = 3Q$ .

- a. What is the equilibrium price and quantity in the market for taxi rides to the airport?

Answer:

Set demand and supply equal to each other:

$$20 - Q = 3Q$$

$$4Q = 20$$

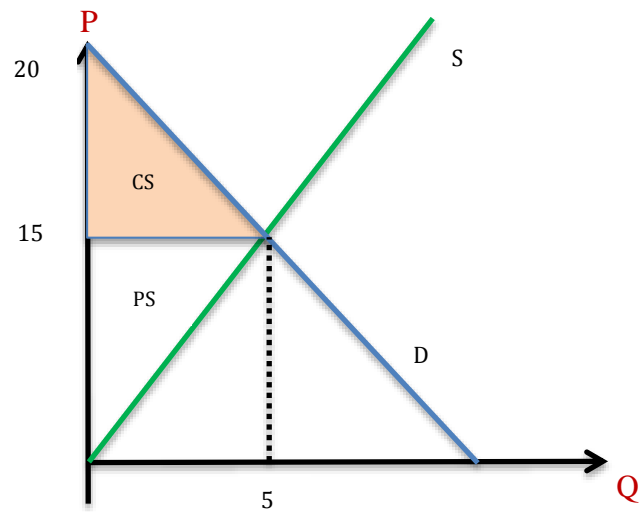
$$Q^* = 5 \text{ taxi rides}$$

Plug the equilibrium quantity back into the demand or supply function to get:

$$P^* = 15 \text{ per taxi ride}$$

- b. Calculate the value of consumer and producer surplus when this market is in equilibrium.

Answer:

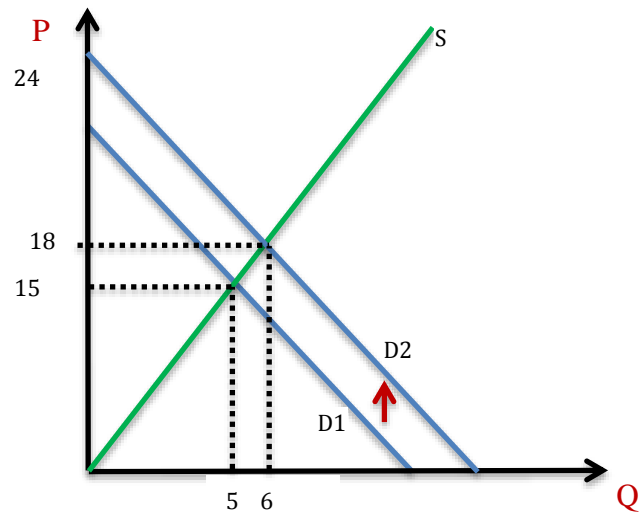


$$CS = \frac{1}{2} * (\text{base}) * (\text{height}) = \frac{1}{2} * (5 - 0) * (20 - 15) = \frac{25}{2} = \$12.50$$

$$PS = \frac{1}{2} * (\text{base}) * (\text{height}) = \frac{1}{2} * (5 - 0) * (15 - 0) = \frac{75}{2} = \$37.50$$

- c. Suppose the government now offers consumers \$4 to consumers for each taxi ride taken. What is the new equilibrium price and quantity?

Answer:



Answer:

If the government offers \$4 for each taxi ride taken, the demand curve will shift up because the consumers will now be willing to spend an addition \$4

per taxi ride since the government is paying them that difference. So the demand curve becomes  $P = 24 - Q$ . Solving for equilibrium:

$$24 - Q = 3Q$$

$$4Q = 24$$

$$Q^* = 6 \text{ taxi rides}$$

Plug the equilibrium quantity back into the demand or supply function to get:

$$P^* = 18 \text{ per taxi ride}$$

- d. Given the government program described in (c), how much money does the government spend on this program?

Answer:

With 6 taxi rides taken, the government must pay consumers a total of (\$4 per taxi ride) \* (6 taxi rides) = \$24.