# Chapter 2: Supply and Demand

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## Question 1

**1.** One assumption of the supply and demand model is that all goods bought and sold are identical. Why do you suppose economists commonly make this assumption? Does the supply and demand model lose its usefulness if goods are not identical?

### Solution 1

**1.** Economists make this assumption, along with many others, in order to capture the meaningful relationships of the real world in simplified models. The models then can predict how variables within these relationships change in response to economic factors. If goods are not identical, many predictions of the model will still prove to be correct. However, we would be less confident in the predictions resting most heavily on that assumption.

## Question 2

**2.** List the assumptions of the supply and demand model. Then, for each assumption, give one example of a market in which the assumption is satisfied, and one example of a market in which that assumption is not satisfied. Is it reasonable to use the supply and demand model when assumptions are violated?

### Solution 2

**2.** Assumption 1. We focus on supply and demand in a single market. This assumption is satisfied if we look at the market for hotel rooms in Lincoln, Nebraska, which is likely to be independent of the market for hotel rooms in other cities. This assumption is not satisfied if we look at the market for gold in Lincoln, Nebraska, which would be dependent on gold’s global supply and demand.

Assumption 2. All goods sold in the market are identical. This assumption is satisfied if we look at the market for a commodity such as crude oil. If we look at shoes, the fact that there are countless distinctions between different types and styles of shoes means that the assumption is not satisfied.

Assumption 3. All goods sold in the market sell for the same price, and everyone has the same information. This assumption is satisfied in a market such as retail gasoline stations. Although gas prices differ by a few cents per gallon between retailers, they match one another within a fairly close range. And prices are visible to anyone in the vicinity of the gas station. An example of a market where this assumption is not satisfied would be home furnishings. A furniture item such as a desk, for example, could have a significant price range, with the price of the most expensive desk being multiple times higher than that of an inexpensive one.

Assumption 4. There are many buyers and sellers in the market. This assumption is satisfied in the market for fresh fruit, where there are many small orchards supplying produce and many consumers shopping for peaches, apples, oranges, and pears. In contrast, the market for intercity passenger rail transportation in the United States has only one seller: Amtrak. Such a market would not satisfy the assumption.

The supply and demand model can still be useful even when these four assumptions are not met, because the basic economic relationships captured in the model apply even outside the boundaries of such assumptions.

## Question 3

\***3.** The demand for organic carrots is given by the following equation:



where  is the price of organic carrots,  is the price of conventional carrots, and I is the average consumer income. Notice how this isn’t a standard demand curve that just relates the quantity of organic carrots demanded to the price of organic carrots. This demand function also describes how other factors affect demand — namely, the price of another good (conventional carrots) and income.

**a.** Graph the inverse demand curve for organic carrots when  and  What is the choke price?

**b.** Using the demand curve drawn in (a), what is the quantity demanded of organic carrots when  When 

**c.** Suppose PC increases to 15, while I remains at 10. Calculate the quantity demanded of organic carrots. Show the effects of this change on your graph and indicate the choke price. Has there been a change in the demand for organic carrots, or a change in the quantity demanded of organic carrots?

**d.** What happens to the demand for organic carrots when the price of conventional carrots increases? Are organic and conventional carrots complements or substitutes? How do you know?

**e.** What happens to the demand for organic carrots when the average consumer’s income increases? Are carrots a normal or an inferior good?

### Solution 3

**3. a.** We begin with the demand equation and substitute the given values for  and I:



This simplifies to



To find the inverse demand curve, we want to rearrange terms to express P as a function of Q:



The choke price can be found by solving for the price that corresponds to a quantity demanded of zero:



A graph compares Quantity of organic carrots to Price in dollars per unit.
The horizontal axis is labeled, Quantity of organic carrots and ranges from 0 to 100. The vertical axis is labeled, Price in dollars per unit and ranges from 0 to 20 dollars. A demand curve labeled, D originates from (0, 20) and follows a negative slope till (100, 0)
Revised Category (to be entered after TL's approval):

**b.** Substitute 5 for  in the demand function to find :



Substitute 10 for  in the inverse demand function to find :



**c.** We begin with the demand equation and substitute the given values for  and I:



This simplifies to



To find the inverse demand curve, we want to rearrange terms to express P as a function of Q:



We can substitute 10 for the price of organic carrots to find the quantity demanded:



We find the choke price by finding the price that would make quantity demanded equal to zero:



The demand for organic carrots has changed because the entire curve has shifted to the right.

**d.** The demand for organic carrots has increased, shifting the demand curve to the right. This shows that the two goods are substitutes for one another, because an increase in the price of conventional carrots has led to a higher quantity of organic carrots demanded at any given price.

**e.** There is a positive coefficient  on the variable for income. This means that an increase in income will shift the demand for organic carrots to the right. As a consequence, we know that organic carrots are a normal good.

A graph compares Quantity of organic carrots to Price in dollars per unit.
The horizontal axis is labeled, Quantity of organic carrots and ranges from 0 to 110, in increments of 10.  The vertical axis is labeled, Price in dollars per unit and ranges from 0 to 22 dollars, in increments of 2.  A demand curve labeled, D subscript 1 originates from (0, 20) and follows a negative slope till (100, 0). A second demand curve labeled, D subscript 2 originates from (0, 22 dollars) and follows a negative slope till (100, 110). Two points are marked at the middle of two curves respectively and a horizontal dashed line is corresponded from the points to (0, 10) and two vertical dashed lines are corresponded to (0, 50) and (0, 60). The shift between the two demand curves is denoted by arrow marks. 
Revised Category (to be entered after TL's approval):

## Question 4

\***4.** Out of the following events, which are likely to cause the demand for coffee to increase? Explain your answers.

**a.** An increase in the price of tea

**b.** An increase in the price of doughnuts

**c.** A decrease in the price of coffee

**d.** The Surgeon General’s announcement that drinking coffee lowers the risk of heart disease

**e.** Heavy rains causing a record-low coffee harvest in Colombia

### Solution 4

**4. a.** Since tea and coffee are the classic examples of substitutes, as the price of tea increases, the demand for coffee is likely to increase.

**b.** An increase in the price of doughnuts decreases the quantity demanded of doughnuts. Because doughnuts and coffee are complements, this will likely decrease the demand for coffee.

**c.** A decrease in the price of coffee will decrease the quantity demanded of coffee via a movement along the demand curve.

**d.** The Surgeon General’s announcement will likely increase the number of people who are interested in drinking coffee and, thus, increase the demand for coffee.

**e.** Heavy rain will decrease the supply of coffee. This can be shown as an inward shift of the supply curve. As a result, the equilibrium price increases and the equilibrium quantity decreases. This adjustment is accomplished via a movement along the demand curve.

## Question 5

**5.** How is each of the following events likely to shift the supply curve or the demand curve for fast-food hamburgers in the United States? Make sure you indicate which curve (curves) is affected and if it shifts out or in.

**a.** The price of beef triples.

**b.** The price of chicken falls by half.

**c.** The number of teenagers in the economy falls due to an aging population.

**d.** Mad cow disease, a rare but fatal medical condition caused by eating tainted beef, becomes common in the United States.

**e.** The Food and Drug Administration publishes a report stating that a certain weight-loss diet, which encourages the intake of large amounts of meat, is dangerous to one’s health.

**f.** An inexpensive new grill for home use that allows consumers to make delicious hamburgers is heavily advertised on television.

**g.** The minimum wage rises.

### Solution 5

**5. a.** An increase in the price of beef represents an increase in the cost of an input. This will cause the supply curve to shift in as the production becomes more expensive.

**b.** Demand for fast-food hamburgers in the United States will likely shift in since many consumers see chicken and beef as substitutes. As chicken becomes less expensive, more people will consume chicken and reduce their consumption of hamburgers, resulting in a decrease in the demand for fast-food hamburgers.

**c.** The demand curve shifts in.

**d.** Consumers’ awareness of the mad cow disease shifts the demand for fast-food hamburgers in.

**e.** Fewer people will follow this diet, causing the demand curve to shift in.

**f.** As consumers purchase the advertised inexpensive new grill, they are more likely to prepare hamburgers at home. Given that at-home hamburgers and fast-food hamburgers are likely to be substitutes in the minds of consumers, the demand for fast-food hamburgers can be expected to shift in.

**g.** An increase in the minimum wage increases the supplier’s cost of production, which leads to a decrease in supply. This is shown as a shifting in of the supply curve.

## Question 6

**6.** The supply of wheat is given by the following equation:



where  is the quantity of wheat supplied, in millions of bushels; PW is the price of wheat per bushel;  is the price of corn per bushel; and PF is the price of tractor fuel per gallon.

**a.** Graph the inverse supply curve when corn sells for $4 a bushel and fuel sells for $2 a gallon. What is the supply choke price?

**b.** How much wheat will be supplied at a price of $4? $8?

**c.** What will happen to the supply of wheat if the price of corn increases to $6 per bushel? Explain intuitively; then graph the new inverse supply carefully and indicate the new choke price.

**d.** Suppose instead that the price of corn remains $4, but the price of fuel decreases to $1. What will happen to the supply of wheat as a result? Explain intuitively; then graph the new inverse supply. Be sure to indicate the new choke price.

### Solution 6

**6. a.** We begin with the supply equation and substitute values for the price of corn and the price of tractor fuel:



Now we rearrange terms to express price as a function of quantity supplied:



To find the price that would make quantity supplied equal to zero, substitute a zero for :



The supply choke price is 4.

A graph compares Quantity to Price in dollars per unit. 
The horizontal axis is labeled, Quantity. The vertical axis is labeled, Price in dollars per unit. The value marked on the vertical axis reads, 4 dollars. A supply curve labeled S, originates from the 4 dollars mark and follows a positive slope.
Revised Category (to be entered after TL's approval):

**b.** Using the supply equation, when 



When 



**c.** Wheat and corn are substitutes in production, so an increase in the selling price of corn that causes farmers to grow more corn will decrease the supply of wheat. Start with the supply equation again, substituting the value of 6 for the price of corn and 2 for the price of fuel:



Convert this to an inverse supply function by expressing price as a function of quantity:



The price that would make  equal to zero is 5. This is the supply choke price.

A graph plots quantity along the horizontal axis and price in dollars per unit along the vertical axis.
A positive curve labeled S 1 originates at value 4 dollars along the vertical axis. Another positive curve labeled S 2 originates at value 5 dollars along the vertical axis.

**d.** Start with the supply equation again, substituting the value of 4 for the price of corn and the value of 1 for the price of fuel:



Convert this to an inverse supply function by expressing price as a function of quantity:



At a price of 3.75, quantity supplied would be zero. This is the supply choke price.

A graph plots quantity along the horizontal axis and price in dollars per unit along the vertical axis.
A positive curve labeled S 1 originates at value 4 dollars along the vertical axis. Another positive curve labeled S 2, drawn below the first curve, originates at value 3 point 75 dollars along the vertical axis.

## Question 7

**7.** Bitcoin and other cryptocurrencies are demanded by those who wish to use them to complete transactions or those who wish to speculate on their future value. Bitcoins are supplied by thousands of competing miners who harness computing power to “dig” for Bitcoins by solving math problems. The more Bitcoins mined, the more difficult the math problems become.

**a.** Use the information provided in the chapter opener to explain why the supply curve of Bitcoins is likely to be upward-sloping.

**b.** Increases in computing speed have, all else being equal, made it easier for miners to mine Bitcoins. Draw a properly labeled graph showing how an increase in computing power affects the supply of Bitcoins.

**c.** Suppose that the only change in the market for Bitcoins is the change described in part (b). How would that change affect the equilibrium price and quantity of Bitcoins sold?

### Solution 7

**7. a.** As a greater quantity of Bitcoins are mined, the math problems that must be solved to find them increase in difficulty. Bitcoin miners will only be willing to use costly computing power to solve those difficult problems if the selling price of the Bitcoins is high. In other words, higher prices convince more people to expend more effort digging for Bitcoins.

**b.**

A graph plots quantity of Bitcoins along the horizontal axis and price of Bitcoins in dollars per bitcoin along the vertical axis.
Two positive curves labeled S 1 and S 2 are drawn parallel to each other depicting shift in sales. The distance between the curves indicating an increase is marked with arrows.

The increase in computing speed makes it easier and less costly to find Bitcoins. More Bitcoins are cost-effective to dig for at any given price; the supply of Bitcoins shifts to the right.

**c.**

A supply and demand graph is shown for Bitcoins.
The data of the graph are as follows: The quantity of Bitcoins is represented along the horizontal axis, and its values are Q 1 and Q 2. The price is represented along the vertical axis, and its values are P 1 and P 2. There are two points: (Q 1, P 1) and (Q 2, P 2). The positive S 1 curve passes through (Q 1 and P 1), and the positive S 2 curve passes through (Q 2 and P 2). A negative demand curve labelled D runs through both the points (Q 1, P 1) and (Q 2, P 2).

Suppose the market for Bitcoins is initially described by the demand for Bitcoins (D) and the supply of Bitcoins (S1). The market equilibrium price is P1 and the market equilibrium quantity is Q1. The increase in the supply of Bitcoins due to an increase in computing power shifts the supply to S2. The new equilibrium price and quantity are P2 and Q2. So, the increase in the supply of Bitcoins causes the price of Bitcoins to decrease and the quantity of Bitcoins changing hands to increase.

## Question 8

**8.** In March 2002 the retail price of gasoline was $1.19 per gallon — exactly the same as it was in August 1990. Yet, total gasoline production and consumption rose from 6.6 million gallons per week in 1990 to 8.7 million gallons per week in 2002. Using the graph below, draw the appropriate shifts in the demand and supply curves to explain these two phenomena.

A graph shows supply and demand curve for gasoline.
The horizontal axis is labeled millions of gallons per week, and a point on the horizontal axis is labeled 6 point 6. The vertical axis reads price in dollars per gallon, and a point is marked at 1 point 19 dollars. A positive curve labeled S subscript 1990, and a negative curve labeled D subscript 1990 at a point which represents the market equilibrium of the gasoline market in 1990 and aligns with the points 6 point 6 millions of gallons per week at 1 point 19 dollars.

### Solution 8

**8.** As stated in the problem, the total consumption as well as the production of gasoline increased. So, both supply and demand increase. Shifts are such that the equilibrium price remains constant, but the equilibrium quantity increases from 6.6 million to 8.7 million, that is, the horizontal price line $1.19 goes through the old and new equilibrium points.

A graph shows supply and demand curve to demonstrate shift in price of gasoline.
The horizontal axis is labeled millions of gallons per week, and two points on the horizontal axis are labeled as 6 point 6 and 8 point 7. The vertical axis reads price in dollars per gallon, and a point is marked at 1 point 19 dollars. A positive supply curve labeled S 1, and a negative curve labeled D 1 intersect at a point E 1 and aligns with the points 6 point 6 millions of gallons per week at 1 point 19 dollars. Another positive supply curve labeled S 2, and a negative curve labeled D 2 intersect at a point E 2 and aligns with the points 8 point 7 millions of gallons per week at 1 point 19 dollars. The shift is to the right.

## Question 9

**9.** When the demand for toilet paper increases, the equilibrium quantity sold increases. Consumers are buying more, and producers are producing more.

**a.** How do producers receive the signal that they need to increase production to meet the new demand?

**b.** Based on the facts given above, can you say that an increase in the demand for toilet paper causes an increase in the supply of toilet paper? Carefully explain why or why not.

### Solution 9

**9.** **a.** Producers react to the signal of a higher price that has resulted from an increase in demand. Along a given supply curve, they expand the quantity supplied.

**b.** No, the increase in demand does not cause an increase in supply. It causes only an increase in quantity supplied along a stationary supply curve.

## Question 10

\***10.** Suppose the demand for towels is given by  and the supply of towels is given by 

**a.** Derive and graph the inverse supply and inverse demand curves.

**b.** Solve for the equilibrium price and quantity.

**c.** Suppose that supply changes so that at each price, 20 fewer towels are offered for sale. Derive and graph the new inverse supply curve.

**d.** Solve for the new equilibrium price and quantity. How does the decrease in supply affect the equilibrium price and quantity sold?

**e.** Suppose instead that supply does not change, but demand decreases so that at each price 25 fewer towels are desired by consumers. Solve for the new equilibrium price and quantity. How does the decrease in demand affect the equilibrium price and quantity sold? How do those changes compare to your response in (d)?

### Solution 10

**10.** **a.** The inverse supply is



whereas the inverse demand is



The graph is shown at the right.

**b.** Define QE and PE as equilibrium quantity and price, respectively. In equilibrium, price is such that quantity demanded is equal to quantity supplied. Therefore, in equilibrium,



The equilibrium price is then



A graph compares Quantity of towels to Price in dollars per towel.
The horizontal axis is labeled, Quantity of towels and ranges from 0 to 100. The vertical axis is labeled, Price in dollars towel and ranges from 0 to 10 dollars. A demand curve labeled, D originates from (0, 10 dollars) and follows a negative slope till (100, 0). A supply curve labeled S, originates from the origin and follows a positive slope while intersecting the demand curve.
Revised Category (to be entered after TL's approval):

**c.** The new supply function is



Hence, the new inverse supply function is



A graph compares Quantity of towels to Price in dollars per towel.
The horizontal axis is labeled, Quantity of towels and ranges from 0 to 100. The vertical axis is labeled, Price in dollars towel and ranges from 0 to 20 dollars. A demand curve labeled, D originates from (0, 20 dollars) and follows a negative slope till (100, 0). A supply curve labeled S subscript 1, originates from the origin and follows a positive slope while intersecting the demand curve. A second supply curve labeled, S subscript 2 originates from (0, 2) and follows a positive slope while intersecting the demand curve. 

**d.** Solving for the new equilibrium price and quantity, we get



The equilibrium price is now



The decrease in supply has lowered the equilibrium quantity to 60 and raised the equilibrium price to 8.

**e.** If the quantity of towels demanded at any given price is 25 less than before, this means that the demand equation becomes  and the inverse demand is 

Therefore, in equilibrium,



The equilibrium price is now 

The decrease in demand has lowered both the equilibrium price and quantity. This is in contrast to the decrease in supply that lowered the equilibrium quantity and raised the equilibrium price.

## Question 11

**11.** The market for whisky in Scotland is described by the following demand and supply equations:





where P is the price of a liter of whisky and Q is the number of liters sold per week, in thousands. Suppose the Scottish government mandates a price of £60 per liter.

**a.** Is the market in equilibrium? Why or why not?

**b.** At the government’s price, is there an excess demand or excess supply of whisky?

**c.** Suppose that the government decides to let the price of whisky be determined by the market rather than by the government. Based on your answer to (b), would you expect the price of whisky to increase, decrease, or stay the same? Explain your reasoning intuitively.

### Solution 11

**11.** **a.** The market for whisky in Scotland is not in equilibrium. At the government price of £60 per liter, there are 20,000 liters of whisky demanded and 80,000 liters of whisky supplied. Because quantity supplied does not equal quantity demanded, the market is not in equilibrium.

**b.** At the government price of £60 per liter, there are 20,000 liters of whisky demanded and 80,000 liters of whisky supplied. Because quantity supplied is 60,000 liters greater than quantity demanded, there is a 60,000-liter excess supply.

**c.** If the government lets the price float (be determined by the market), sellers would try to get rid of the excess supply by undercutting the prices offered by their competition. This would happen until the price reached its equilibrium price. So, the excess supply places downward pressure on prices, and the price will decrease.

## Question 12

**12.** The inverse demand for carbon-steel chef’s knives is given by  where *P* is the price of a chef’s knife and *QD* is the quantity of chef’s knives desired per week, in thousands. The inverse supply of chef’s knives is given by  where *QS* is the quantity of chef’s knives offered for sale each week, in thousands.

**a.** Accurately graph the inverse supply and inverse demand curves, with *P* on the vertical axis and *Q* on the horizontal axis.

**b.** What are the buyers’ and sellers’ choke prices in your graph? How can you find those same choke prices by looking at the inverse demand and inverse supply equations?

**c.** Equate inverse demand and inverse supply to find the market equilibrium quantity of chef’s knives sold. (Hint: In equilibrium,  so you can replace both *QD* and *QS* with a generic letter *Q*.)

**d.** Plug the quantity you found in (c) into the inverse demand curve to solve for the equilibrium price. Then double-check your work by plugging that same quantity into the inverse supply curve.

### Solution 12

**12. a.**

A graph shows the relationship between supply and demand.
The graph plots quantity of chef’s knives along the horizontal axis and price in dollars per knife along the vertical axis. The graph shows a supply curve labeled S which ascends linearly from price 20 dollars, quantity 0 and a demand curve labeled D descends linearly from price 120 dollars at quantity 0 to price 0 at quantity 240 knives.

**b.** The buyer’s choke price is $120; the seller’s choke price is $20. These choke prices are the intercept (constant) terms from the inverse demand  and inverse supply  equations.

**c.** Because buyers and sellers face the same price, and both demand and supply equations are expressed in terms of the price *P*, we can say that





Because  in equilibrium,



**d.**



Double-checking, we get



## Question 13

**13.** In the United States, the biggest shopping day each year is “Black Friday,” the day after Thanksgiving. Every Black Friday, the local branch of a major retailer makes this offer to the public: the first 100 54-inch HD flat-screen televisions sold will sell at the discounted price of $50 each. Customers line up before the store opens its doors to take advantage of this tremendous bargain.

**a.** In this scenario, what is the “price” of a 54-inch flat-screen television?

**b.** How would that “price” likely change if the retailer offered the first 500, instead of the first 100, televisions at $50 apiece? If only the first 50 were offered at the discounted price?

### Solution 13

**13.** **a.** The “price” of a 54-inch flat-screen television is the $50 sticker price plus the value of the time each customer must spend waiting in line to take advantage of such a low price.

**b.** When the first 500 televisions are offered for sale at that same sticker price, the less time consumers should expect to spend waiting in line—they will not have to line up as early as their chance of getting a great deal increases. So, the “price,” which includes both the sticker price and waiting time, will decrease. If only the first 50 televisions are offered for sale at the discounted price, a customer’s chance of getting one decreases; however, customers can increase their odds by lining up earlier. Thus, the “price,” which includes both the sticker price and waiting time, will increase.

## Question 14

**14.** Determine the effects of the following events on the price and quantity of beer sold. Assume that beer is a normal good.

**a.** The price of wine, a substitute for beer, decreases.

**b.** The price of pizza, a complement to beer, increases.

**c.** The price of barley, an ingredient used to make beer, increases.

**d.** Brewers discover they can make more money producing wine than they can producing beer.

**e.** Consumers’ incomes increase as the economy emerges from a recession

### Solution 14

**14.** **a.** When the price of wine decreases, consumers will increase their consumption of wine and this, in turn, will cause a leftward shift in the demand for beer. Both the equilibrium price and equilibrium quantity of beer will decrease.

**b.** When the price of pizza increases, consumers will decrease their consumption of pizza and this, in turn, will decrease the demand for beer. A lower equilibrium price and quantity will result.

**c.** The higher price of barley increases costs for suppliers of beer. This causes the supply of beer to shift to the left, resulting in a higher equilibrium price and lower equilibrium quantity.

**d.** Firms will leave the beer industry to enter the winemaking industry. This causes a decrease in the supply of beer, which leads to a higher equilibrium price and lower equilibrium quantity.

**e.** Assuming that beer is a normal good, the increase in incomes will cause a rightward shift in demand. Both the equilibrium price and quantity will increase.

## Question 15

\***15.** Suppose the demand for down pillows is given by  and that the supply of down pillows is given by 

**a.** Solve for the equilibrium price.

**b.** Plug the equilibrium price back into the demand equation and solve for the equilibrium quantity.

**c.** Double-check your work by plugging the equilibrium price back into the supply equation and solving for the equilibrium quantity. Does your answer agree with what you got in (b)?

**d.** Solve for the elasticities of demand and supply at the equilibrium point. Which is more elastic: demand or supply?

**e.** Invert the demand and supply functions (in other words, solve each for P) and graph them. Do the equilibrium point and relative elasticities shown in the graph appear to coincide with your answers?

### Solution 15

**15. a.** In equilibrium,  so that



The equilibrium price for pillows is 40.

**b.** The equilibrium quantity is



**c.** The equilibrium quantity using the supply equation is



Hence,  just like what was obtained in (b).

**d.** The elasticity of supply or demand can be calculated using the expression



Note that  and  at the equilibrium point. The slope of the demand curve is  so that



whereas the slope of our supply curve is 0.5, so



The elasticity of demand lies within the interval  Hence, the demand is inelastic. The coefficient of elasticity of supply indicates that supply is elastic. Out of the two, the supply is more elastic.

**e.** Inverting the demand function, we get



Inverting the supply function yields



At the equilibrium, we get





Therefore, the equilibrium point coincides with our previous answer. Since the equilibrium point is the same and since the slopes of both curves are also unchanged, the elasticities will correspond to the previously derived coefficients in part (d).

A graph shows supply and demand curves for pillows. The horizontal axis is labeled Quantity of pillows, and two points on the horizontal axis are labeled 60 and 100, respectively. The vertical axis reads price in dollars per pillow, and three points are marked at 10, 40, and 100 dollars. A supply curve labeled S ascends linearly from 10 dollars, and a demand curve labeled D descends linearly from 100 dollars. Both the curves intersect at a point that aligns with the points 60 pillows at 40 dollars.


## Question 16

**16.** In both the United States and France, the demand for haircuts is given by  But in the United States, the supply is given by  while in France, the supply is given by 

**a.** Graph supply and demand for haircuts for each country. (Use the same scale on each axis and graph carefully!)

**b.** Solve for the equilibrium price and quantity of a haircut in each country.

**c.** Suppose that the demand for haircuts in the United States increases by 100 units at each price, so the new demand is  Place this new demand curve in the appropriate graph, and solve for the new equilibrium price and quantity in the United States.

**d.** Suppose that, in a similar fashion, the demand for haircuts in France increases by 100 units at each price. Add the new demand curve for haircuts to the appropriate graph, and solve for the new equilibrium price and quantity.

**e.** Drawing on your answers to (c) and (d), comment on the following statement: “The impact of an increase in demand depends critically on the slope of the supply curve.”

### Solution 16

**16.** **a.**

Two supply and demand graphs compare the price of haircut in the United States and in France.
Both the graphs have the horizontal axis labeled as quantity of haircuts, and the vertical axis labeled as price of haircut. Graph a, plots the data of the United States. A supply curve labeled S ascends from 15 dollars on the vertical axis and a demand curve labeled D descends from 30 dollars  on the vertical axis. Both the curves intersect at a point. Graph b, plots the data of France. A supply curve labeled S ascends from above a point on the vertical axis and a demand curve labeled D descends from 30 dollars  on the vertical axis. Both the curves intersect at a point.

**b.** In the United States,  implies that  Solving for P, we obtain  Substituting  into either the demand or supply equation gives us 

In France,  implies that  Solving for P, we obtain  Substituting  into either the demand or supply equation gives us 

So, the equilibrium price and quantity in each market are the same.

**c.**

A supply and demand graph shows shift in demand for haircut in the United States.
The horizontal axis is labeled as quantity of haircuts, and the vertical axis is labeled as price of haircut. A positive supply curve labeled S ascends from a little over 15 dollars on the vertical axis, and a demand curve labeled D descends from 30 dollars on the vertical axis. Both the curves intersect at a point. Another demand curve labeled D 2 is drawn parallel to the D curve to indicate shift to the right. D 2 curve intersects the supply curve S.

In the United States,  implies that  Solving for *P*, we obtain  Substituting  into either the demand or supply equation gives us  Thus, the increase in demand causes quantity to increase by 66.67 units and price to increase by $3.33.

**d.**

A supply and demand graph shows shift in demand for haircut in France.
The horizontal axis is labeled as quantity of haircuts, and the vertical axis is labeled as price of haircut. A positive supply curve labeled S ascends from a little over 0 dollars on the vertical axis, and a demand curve labeled D descends from 30 dollars on the vertical axis. Both the curves intersect at a point. Another demand curve labeled D 2 is drawn parallel to the D curve to indicate shift to the right. D 2 curve intersects the supply curve S.

In France,  implies that  Solving for P, we obtain  Substituting  into either the demand or supply equation gives us  So, the increase in demand causes quantity to increase by 40 units and price to increase by $6.

**e.** Both countries experienced the same increase in demand. In the United States, where the supply curve is relatively flat, the increase in demand caused output to increase a lot and the price to increase a little. In France, where the supply curve is relatively steep, the increase in demand caused output to increase a little and the price to increase a lot. Thus, the steeper the supply curve is, the more a given demand change will impact the price, and the less it will affect the quantity.

## Question 17

**17.** Suppose that budding economist Buck measures the inverse demand curve for toffee as and the inverse supply curve as  Buck’s economist friend Penny likes to measure everything in cents. She measures the inverse demand for toffee as  and the inverse supply curve as 

**a.** Find the slope of the inverse demand curve and compute the price elasticity of demand at the market equilibrium using Buck’s measurements.

**b.** Find the slope of the inverse demand curve and compute the price elasticity of demand at the market equilibrium using Penny’s measurements. Is the slope the same as Buck calculated? How about the price elasticity of demand?

### Solution 17

**17.** **a.** We first find the market equilibrium quantity



The equilibrium price is



The slope of the inverse demand curve is  hence, the price elasticity of demand is



The demand at the equilibrium is unit elastic.

**b.** The market equilibrium quantity is



The equilibrium price is



The slope of the inverse demand function is  The price elasticity of demand is



The slope is 100 times greater compared to Buck’s calculations. However, the price elasticity of demand is unchanged because the price elasticity of supply and that of demand are not affected by the unit of measurement used.

## Question 18

**18.** Some policy makers have claimed that the U.S. government should purchase illegal drugs, such as cocaine, to increase the price that drug users will face and therefore reduce their consumption. Does this idea have any merit? Illustrate this logic in a simple supply and demand framework. How does the elasticity of demand for illegal drugs relate to the efficacy of this policy? Are you more or less willing to favor this policy if you are told demand is inelastic?

### Solution 18

**18.** It does have merit. The demand curve will shift out when government becomes an added purchaser and the price the drug users will face will increase. I would not support such a policy because drug usage is an addiction; that is, the demand for drugs is quite inelastic.

Assuming the demand for illegal drugs is elastic, the price and quantity demanded increase as a result of the movement along the supply curve.

Assuming the demand curve for illegal drugs is inelastic, due to the intervention, both price and quantity increase.

However, the amount consumed by drug users will decrease in both cases once one subtracts the amounts sold to the government. The more inelastic the demand is, the smaller is the quantity response by illegal drug users. Therefore, such would not be an optimal policy in this situation. Increasing the (legal/penal) cost of supplying and demanding illegal drugs would be far more effective since it would shift the actual supply and demand curves in, reducing the quantity used by drug addicts.

A graph shows supply and demand curve to demonstrate shift in demand of drugs.
The horizontal axis is labeled quantity of drugs, and two points on the horizontal axis are labeled as Q 1 and Q 2. The vertical axis is labeled as price per unit, and two points are marked at P 1 and P 2. A positive supply curve labeled S 1 that ascends from the origin where both the axes meet, and a slightly negative curve labeled D 1 intersect at a point E 1 and aligns with the points Q 1 and P 1. Another negative curve labeled D 2 intersects the supply curve S 1 at a point E 2 and aligns with the points Q 2 and P 2. The shift is to the right.

A graph shows supply and demand curve to demonstrate shift in demand of drugs.
The horizontal axis is labeled quantity of drugs, and two points on the horizontal axis are labeled as Q 1 and Q 2. The vertical axis is labeled as price per unit, and two points are marked at P 1 and P 2. A positive supply curve labeled S 1 that ascends from the origin where both the axes meet, and a steep negative curve labeled D 1 intersect at a point E 1 and aligns with the points Q 1 and P 1. Another steep negative curve labeled D 2 intersects the supply curve S 1 at a point E 2 and aligns with the points Q 2 and P 2. The shift is to the right.

## Question 19

\***19.** Suppose that Jo has an inverse demand for frogs’ legs given by  while Kyle’s inverse demand for frogs’ legs is given by  Graphs of each consumer’s demand curve are shown below.

Two graphs of consumer’s demand curve are shown.
In both the graphs, the horizontal axis is labeled quantity frog’s legs, and the vertical axis is labeled price of frog’s legs. Jo’s demand curve D has a downward slope marked at three points A, B, and C. Point A is marked as slope equals negative 3. Point B is marked as slope equals negative 4 over 3. Point C is marked as slope equals negative 1 over 3. Kyle’s demand curve D also has a downward slope, but it is linear and is marked at two points Q and R. The points are labeled as slope equals negative 1 at all points.

**a.** Show that Jo’s demand for frogs’ legs is unit elastic.

**b.** Show that Kyle’s elasticity of demand for frogs’ legs differs at different points on his demand curve.

**c.** Use your answers to (a) and (b) to comment on the difference between the slope of a demand curve and the elasticity of demand.

### Solution 19

**19.** **a.** The elasticity of demand at any point can be calculated as  is the slope of the demand curve. But we are given the slope of the inverse demand curve,  So, the elasticity of demand can be rewritten as  or  where “slope” is the slope of the inverse demand curve. Thus, for Jo, the elasticity of demand at point A is  The elasticity of demand at point B is  The elasticity of demand at point C is  So, at all points on Jo’s demand curve, the elasticity of demand is  Jo’s demand is unit elastic.

**b.** At point Q, Kyle’s elasticity of demand is  demand is elastic. At point R, Kyle’s elasticity of demand is  demand is inelastic. So, Kyle’s elasticity of demand varies at different points on his demand curve.

**c.** Jo has a demand curve where the slope changes from point to point, but the elasticity doesn’t. Kyle has a demand curve where the slope is always the same, but the elasticity changes from point to point. So, we can conclude that slope and elasticity are related (the formula for elasticity includes the slope of the demand curve), but are most definitely not the same.

## Question 20

**20.** The cross-price elasticity of demand measures the percentage change in the quantity of a good demanded when the price of a different good changes by 1%. The income elasticity of demand measures the percentage change in the quantity of a good demanded when the income of buyers changes by 1%.

**a.** What sign might you expect the cross-price elasticity to have if the two goods are shampoo and conditioner? Why?

**b.** What sign might you expect the cross-price elasticity to have if the two goods are gasoline and ethanol? Why?

**c.** What sign might you expect the cross-price elasticity to have if the two goods are coffee and shoes? Why?

**d.** What sign might you expect the income elasticity to have if the good in question is hot stone massages?

**e.** What sign might you expect the income elasticity to have if the good in question is Ramen noodles?

**f.** What sign might you expect the income elasticity to have if the good in question is table salt?

### Solution 20

**20. a.** Cross-price elasticity would likely be negative, because an increase in the price of shampoo would likely cause people to use less conditioner. The higher price of shampoo would decrease the quantity of shampoo demanded, so people would buy less conditioner, which is a complement good.

**b.** Gasoline and ethanol are viewed as substitutes. An increase in the price of gasoline would cause an increase in the demand for ethanol. This gives us a positive number for cross-price elasticity.

**c.** There is not an obvious connection between these two goods. Most likely, cross-price elasticity would be zero. A change in the price of one does not have a predictable effect on the quantity of the other.

**d.** A hot stone massage is considered a luxury good, so demand would increase as incomes increase. The income elasticity would be positive.

**e.** We can expect a negative number for income elasticity. Ramen noodles are viewed as a low-cost meal. People will buy more Ramen noodles when incomes decrease.

**f.** Table salt is a necessity, and the amount purchased is largely independent of income. Zero would be the most likely number for income elasticity.

## Question 21

**21.** Which of the following cases will result in the largest decrease in equilibrium price? The largest change in equilibrium quantity? Verify your answers by drawing graphs.

**a.** Demand is highly inelastic; there is a relatively large increase in supply.

**b.** Demand is highly elastic; there is a relatively small increase in supply.

**c.** Supply is highly inelastic; there is a relatively small decrease in demand.

**d.** Supply is highly elastic and demand is very inelastic; there is a relatively large increase in supply.

### Solution 21

**21.** **a.** Because demand is inelastic, the rightward shift of supply will cause a fairly significant decrease in price.

hA graph shows supply and demand curve to demonstrate shift in supply.
The horizontal axis is labeled quantity, and the vertical axis is labeled as price. A positive supply curve labeled S 1, and a negative demand curve labeled D intersect at a point E 1. Another positive supply curve labeled S 2 intersects the demand curve D at a point E 2. The shift is to the right, which is indicated by delta Q on the horizontal axis and delta P on the vertical axis. Delta Q is narrower than delta P.

**b.** If the demand curve is flat and the shift in supply is relatively small, then price decreases only slightly.

A graph shows supply and demand curve to demonstrate shift in supply.
The horizontal axis is labeled quantity, and the vertical axis is labeled as price. A positive supply curve labeled S 1, and a negative demand curve labeled D intersect at a point E 1. Another positive supply curve labeled S 2 intersects the demand curve D at a point E 2. The shift is to the right, which is indicated by delta Q on the horizontal axis and delta P on the vertical axis. Delta P is narrower than delta Q.

**c.** The price will fall due to the decrease in demand. Equilibrium quantity decreases only slightly because the supply curve is steep.

A graph shows supply and demand curve to demonstrate shift in demand.
The horizontal axis is labeled quantity, and the vertical axis is labeled as price. A positive supply curve labeled S 1, and a negative demand curve labeled D 1 intersect at a point E 1. Another negative demand curve labeled D 2 intersects the supply curve at a point E 2. The shift is to the left, which is indicated by delta Q on the horizontal axis and delta P on the vertical axis. Delta Q is narrower than delta P.

**d.** This scenario will result in the largest decrease in price because the demand curve is steep and the supply curve is flat.

A graph shows supply and demand curve to demonstrate shift in supply.
The horizontal axis is labeled quantity with two points marked at Q 1 and Q 2, and the vertical axis is labeled as price with two points marked at P 1 and P 2. A positive supply curve labeled S 1, and a negative demand curve labeled D intersect at a point E 1 that aligns with the points Q 1 and P 1. Another positive supply curve labeled S 2 intersects the demand curve D at a point E 2 that aligns with the points Q 2 and P 2.