Chapter 8 Practice Problems

Elements of Microeconomics (discussion section 4)

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Question 1

Consider the market for coffee. The equations for quantity demanded and quantity supplied are as follows:

$$Q_D = 100 - 4P$$
$$Q_S = 5P + 10$$

(a) Derive the inverse supply and demand equations ($P = ...$)

(b) Graph the inverse supply and demand equations.

(c) Is supply/demand elastic or inelastic in this case?

(d) Solve for the equilibrium price and quantity in this market, and illustrate this equilibrium on your graph.

(e) Indicate where on the graph represents the consumer and producer surplus in this market.

(f) Now, assume that there is a tax levied (on sellers) in the market for coffee in the amount of \$4 per cup. Does the supply or demand curve shift?

(g) What is the new equation for Q_S *and* the inverse supply curve?

(h) Add this new inverse supply curve to your existing graph.

(i) Has the supply curve shifted left or right? By how much has the curve shifted?

(j) What is the new price faced by buyers in this market with the tax? What is the new price faced by sellers in this market with the tax?

(k) Who bears the largest incidence of the tax, buyers or sellers? Why?

(l) Indicate the areas on the graph which represent the producer surplus, consumer surplus, tax revenue, and dead weight loss.

(m) Calculate the values of the producer surplus, consumer surplus, tax revenue, and dead weight loss after the tax is levied in this market.

(n) Would the dead weight loss increase or decrease if the same tax was levied and (ceteris paribus) $Q_S = \frac{1}{2}P + 10$? What if (ceteris paribus) $Q_D = 100 - P$? Why is this the case?

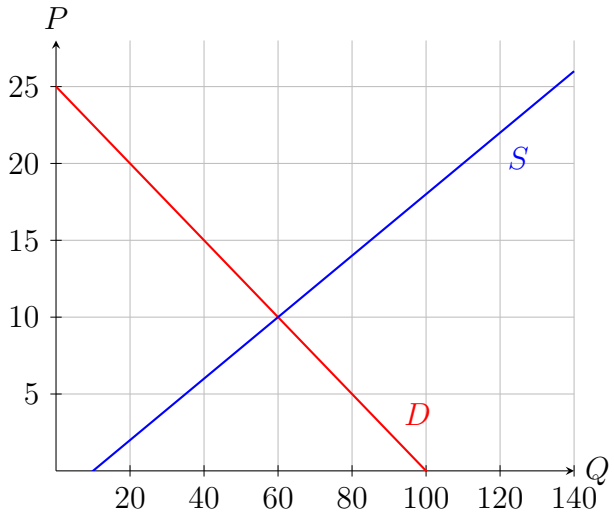
Answer:

(a)

$$Q_D = 100 - 4P$$
$$4P = 100 - Q_D$$
$$P = 25 - \frac{1}{4}Q_D$$

$$Q_S = 5P + 10$$
$$5P = Q_S - 10$$
$$P = \frac{1}{5}Q_S - 2$$

(b) Graph:

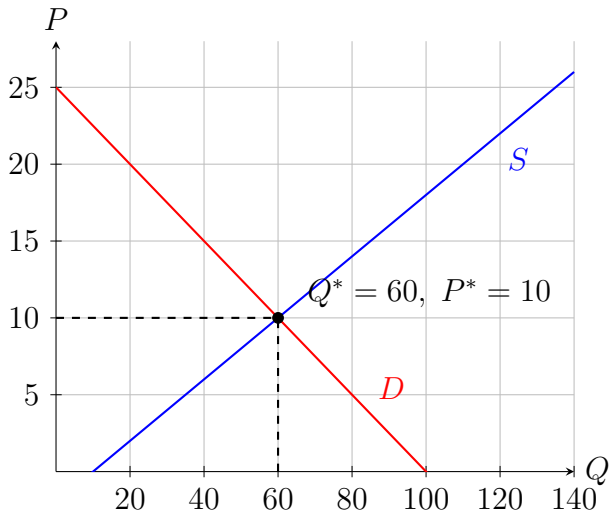


(c) Supply is elastic because when price increases by 1, Q_S increases by 5 which is more than 1. Demand is also elastic because when price increases by 1, Q_D decreases by 4 which is more than 1.

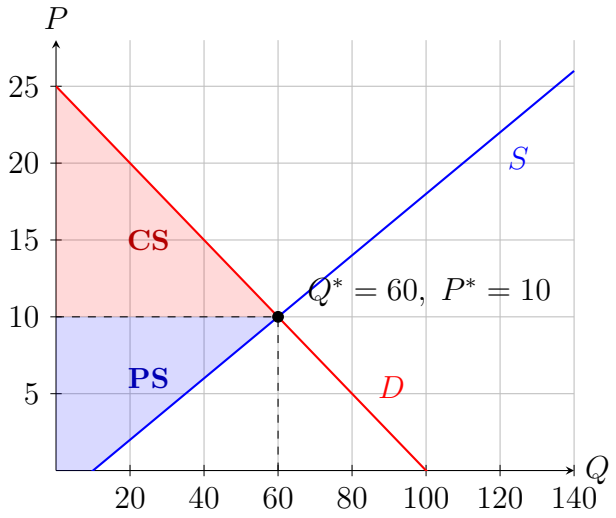
(d)

$$Q_S = Q_D$$
$$5P + 10 = 100 - 4P$$
$$9P = 90$$
$$P^* = 10$$
$$Q_D = 100 - 4(10)$$
$$Q^* = 60$$

$\implies P^* = 10$ and $Q^* = 60$



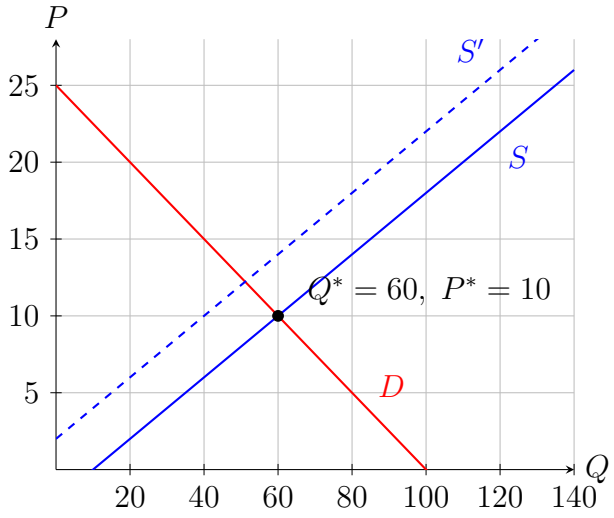
(e) Consumer(pink) and producer(blue) surplus in this market in equilibrium:



(f) The supply curve shifts when there is a tax levied.

(g) When there is a tax of \$4 per cup, at any given Q_S, P will be \$4 higher, so we get $P = \frac{1}{5}Q_S + 2$ as the new inverse supply curve, and so $Q_S = 5P - 10$.

(h) Graph:



(i) The supply curve has shifted left. There has been a shift upward of 4, representing the \$4 increase in price. This comes from the increase in the intercept of the P equation by 4 units.

(j) The new price faced by the buyers is the price at which the new supply curve meets the existing demand curve:

$$\begin{aligned} Q_S^{new} &= Q_D \\ 5P - 10 &= 100 - 4P \\ 9P &= 110 \\ P^{Buyer} &= \frac{110}{9} \end{aligned}$$

The new Q_D at this price is $Q_D = 100 - 4(\frac{110}{9}) = \frac{460}{9}$

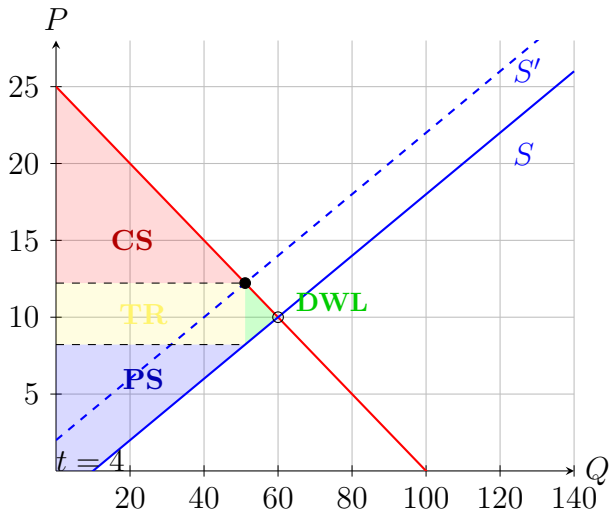
So, the price faced by sellers after the tax is the price at which $Q_S = \frac{460}{9}$ *(note that this is the original supply curve):

$$\begin{aligned} P &= \frac{1}{5}Q_S - 2 \\ P &= \frac{1}{5}(\frac{460}{9}) - 2 \\ P &= \frac{460}{45} - 2 \\ P^{Seller} &= \frac{370}{45} \end{aligned}$$

The new price faced by buyers is $P^{Buyer} = \frac{110}{9}$ and the new price faced by sellers is $P^{Seller} = \frac{370}{45}$

(k) Buyers pay more of the tax/face the largest incidence of the tax because their demand is less elastic than supply, ie buyers respond less to the change in price than do the sellers.

(l) Graph:



(m) Producer surplus:

$$PS = 2 * \frac{370}{45} + \frac{1}{2} * (\frac{460}{9} - 2) * \frac{370}{45}$$
$$PS = 261.2$$

Consumer surplus:

$$CS = \frac{1}{2} * (25 - \frac{110}{9}) * \frac{460}{9}$$
$$CS = 326.5$$

Tax Revenue:

$$TR = (\frac{110}{9} - \frac{370}{45}) * \frac{460}{9}$$
$$TR = 204.4$$

Dead weight loss:

$$DWL = \frac{1}{2} * (60 - \frac{460}{9}) * (\frac{110}{9} - \frac{370}{45})$$
$$DWL = 17.8$$

(n) If $Q_S = \frac{1}{2}P + 10$, DWL will decrease because supply has become more inelastic. If $Q_D = 100 - P$, DWL will decrease because demand has become more inelastic.

Question 2

Assume we are in the market for cars, and a tax has been levied on the car manufacturers of size $\$X$. Illustrate the dead weight loss caused by this tax in the following 4 scenarios on a supply/demand graph:

(a) Supply is elastic, demand is inelastic

(b) Supply is elastic, demand is elastic

(c) Demand is elastic, supply is inelastic

(d) Demand is elastic, supply is inelastic

Answer: See Figure 5 in Chapter 8 of your book for an accurate illustration of what this would look like.

Question 3

Consider the market for twizzlers. Assume demand and supply are both relatively elastic in this market. Illustrate the dead weight loss and tax revenue caused by a tax of the following three sizes:

1. \$2 per twizzler
2. \$4 per twizzler
3. \$6 per twizzler

What happens to the size of the tax revenue as the size of the tax increases?

***(Note that I did not give any specific equations for Q_S or Q_D, so you can't calculate the DWL or TR, I just want you to show what happens to DWL/TR as the tax per twizzler increases, nothing precise is necessary)

Answer: See figure 6 in your book for an illustration of what this would look like.

As the size of the tax increases, the tax revenue will grow up to a point where it begins to shrink. This is the result of decreasing Quantities being sold in the market as the price gets higher and higher.