1. Assume that the market for Cable TV is determined by the following equations:

\[ Q_s = 4P, \]
\[ Q_d = 500 - P. \]

a. Find the equilibrium price and quantity in the Cable TV market. Make a (large) graph showing the equilibrium point.

\[ a. \text{ At equilibrium, we have:} \]
\[ Q_s = Q_d \]
\[ 4P = 500 - P \]
\[ 5P = 500 \]
\[ P = 100 \]
\[ Q = 4P = 400 \]

b. Suppose Congress imposes a tax \( T \) on consumers of Cable TV. On your graph from part a., draw an example of the effective demand curve and indicate the new equilibrium quantity and price, the amount consumers actually pay \( (P^C) \), and the amount producers actually receive \( (P^P) \) once the tax is imposed. Locate on your graph the consumer surplus, producer surplus, government revenue, and deadweight loss resulting from the imposition of the tax.

\[ b. \text{ The tax causes the demand curve to shift to the left by the amount of the tax } T. \text{ At the new equilibrium the market price and quantity have fallen compared to part (a).} \]
\[ \text{Producers receive the new lower market price } (P^P = P^*), \text{ while consumers end up paying} \]
\[ P^C = P^* + T. \text{ Area A = CS, Area B = PS, Area C = Gov't Revenue, Area D = DWL} \]
c. Solve for the new equilibrium price and quantity in the market as a function of T. Also, solve for deadweight loss as a function of T. Describe the relationship between the size of the tax and deadweight loss. What does deadweight loss mean in practical terms?

\[
Q_s = Q_d^* \\
4P = 500 - P - T \\
5P = 500 - T \\
P^* = 100 - 1/5 T \\
Q^* = 4P^* = 400 - 4/5 T
\]

Because T > 0, we can see that the new equilibrium price and quantity are lower than they were before the tax.

Deadweight loss: Area Triangle D
\[
DWL = \frac{1}{2} \cdot \text{base} \cdot \text{height} \\
= \frac{1}{2} \times (P_C - P_P) \times (Q - Q^*) \\
= \frac{1}{2} \times T \times [400 - (400 - 4/5 T)] \\
= \frac{1}{2} \times T \times 4/5 T \\
= \frac{2}{5} T^2
\]

The deadweight loss increases proportionately to the square of the tax rate T. In other words, deadweight loss increases faster than the size of the tax.

Deadweight loss captures the fact that the buyers and sellers who decide to leave the market because of the tax lose the benefits from trading that they would have had in a free market. Because these individuals are no longer participating in the market, the government does not collect any tax revenue from their activities, so there is nothing to make up for their loss of consumer and producer surplus: it’s a deadweight loss to society.

d. Solve for government revenue as a function of T. Now, assuming that the size of the tax is \( T_1 = $250 \) per unit, how much revenue will the government collect?

\[
\text{Government Revenue} = T \times Q^* \\
= T \times (400 - 4/5 T) \\
= 400 T - 4/5 T^2
\]

When \( T = T_1 = $250 / \text{unit} \): \( \text{Government Revenue} = 400 \times 250 - 4/5 \times 250^2 = 100,000 - 50,000 = $50,000 \)

e. Eager to make even more money off of Cable addicts, Congress decides to raise the tax to \( T_2 = $300 \) per unit. How much revenue will the government collect now? Explain what has happened.

\[
\text{Government Revenue} = 400 \times 300 - 4/5 \times 300^2 = $48,000
\]

Congress hoped to raise more revenue by increasing the tax rate, but instead ended up with $2,000 less than before. What happened? The tax got so large that it pushed enough people out of the market for the government’s revenue to start shrinking.
Remember that government revenue is determined by $T \times Q^*$, so if $Q^*$ becomes too small as a result of a tax hike, the increase in $T$ may not be enough to make up for it, and revenue will start to fall.

2. Fenway Park is a relatively small park, and seating is limited to only 34,000. Hence, the number of tickets issued is fixed at that figure. (Assume for what follows that all seats are equally desirable and that all 34,000 are sold at the same price.) Seeing a golden opportunity to increase its revenue, assume the City of Boston decided to levy a per ticket tax of $5, to be paid by the ticket buyer. Boston sports fans, a famously civic-minded lot, dutifully send in the $5 per ticket.

Draw a well-labeled graph showing the impact of the tax. On whom does the tax burden fall—buyers, sellers, or both? Why?

Since the supply of tickets is fixed at 34,000, the supply curve is completely inelastic, i.e. vertical. Assuming a normal, downward sloping demand curve, a tax on consumers shifts the demand curve down by a vertical distance equal to the amount of the tax—here that is $5.

![Market for Game Tickets](image)

Without the tax, the equilibrium price would be $P^*$—this is what consumers would pay and what producers would receive. With the tax, the demand curve shifts down by $5 and the amount producers receive is reduced to $P^p$. However, the amount consumers must pay is $P^c$, which is exactly what they would pay without the tax, $P^*$. Hence, the burden on consumers, $P^c - P^*$, is zero, while the burden on producers is $P^* - P^p = $5.

This results from the fact that supply is completely inelastic—the Red Sox cannot alter supply in response to changes in price. So they absorb the entire tax in lower ticket prices.