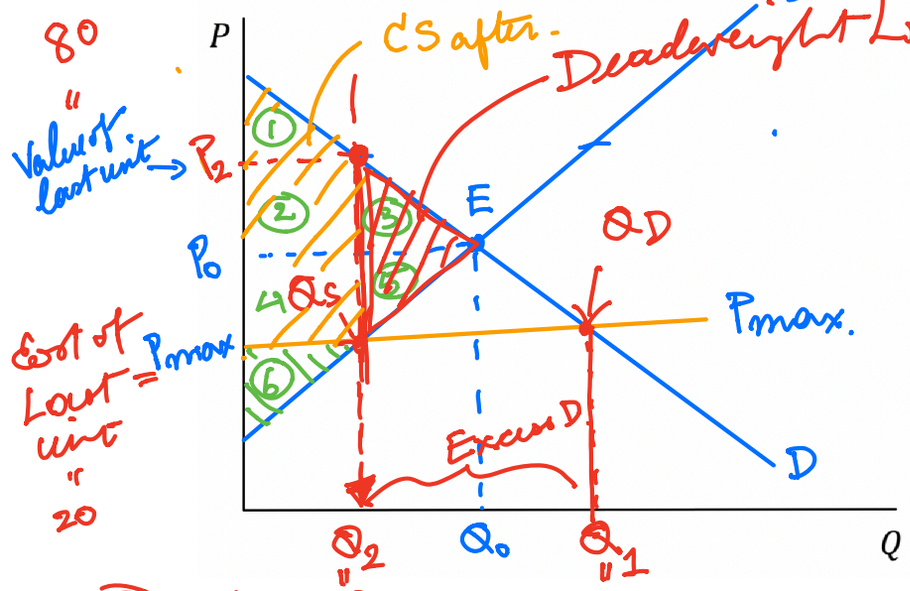
# Chapter 10 Applications of Demand and Supply

We discuss three applications:

1. Maximum Price (Ceiling Price)
2. Minimum Price (Floor Price)
3. Tax and Subsidy – subsidy is negative tax.
~~4. Subsidy~~

**1. Maximum Price (Ceiling Price)** Suppose the market is in equilibrium at $E = (Q_0, P_0)$. If the government imposes and controls the price to be at $P_{Max}$. No seller can sell at any price higher than $P_{Max}$.

- Is $P_{Max} > P_0$?




At $P_{Max}$, there will be Excess D = $Q_D - Q_S = Q_1 - Q_2 > 0$.

Can the market mechanism work to raise the price to the Equilibrium Price $P_0$?

The actual quantity that is bought and sold = $Q_S = Q_2 = \min\{Q_1, Q_2\}$

What is the value placed on the last unit bought? $= P_2$

What is the cost of producing the last unit sold? $= P_{max}$

| | Before ($P_0$) | After ($P_{max}$) | Change |
|---|---|---|---|
| Consumer's Surplus | 1+2+3 | 1+2+4 | 4−3 |
| Producer's Surplus | 4+5+6 | 6 | −4−5 |

Change in Social Welfare = −(3+5)

= Deadweight Loss.

Society wants more resources to be used to produce more of this product – no resources allocation efficiency.

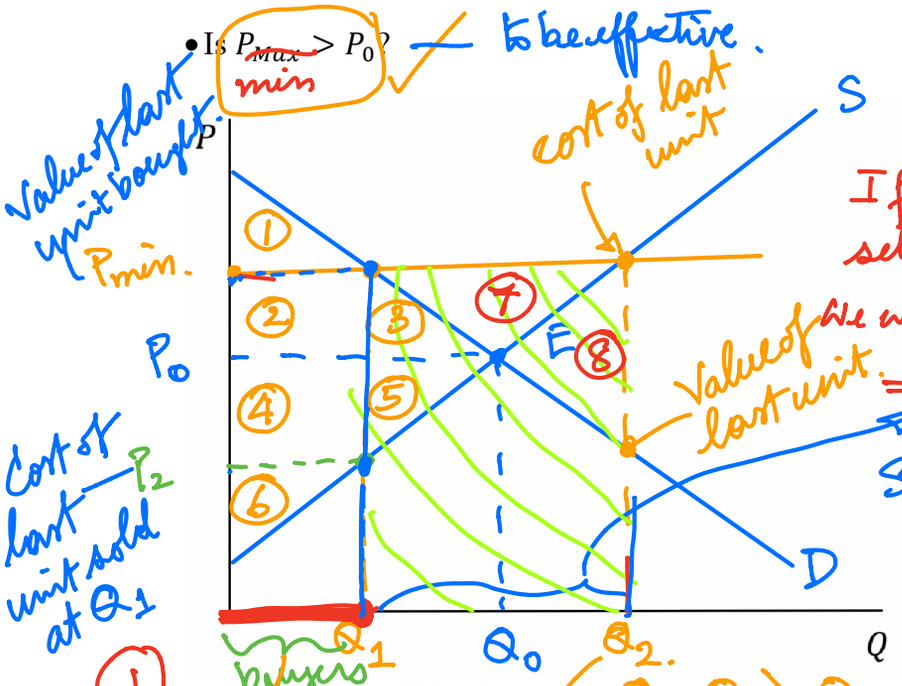
– but price cannot increase because we assume that the govt can fully enforce Max Price policy.

– price should be higher from $P_{max}$

**Deadweight Loss** is the loss of Social Welfare caused by market distortion.

**2. Minimum Price (Floor Price)** Suppose the market is in equilibrium at $E = (Q_0, P_0)$. The government imposes and controls the price to be at $P_{Min}$. The buyers cannot buy at any price less than $P_{Min}$.

- Is $P_{Min} > P_0$?




At $P_{Min}$, there will be Excess $= Q_2 - Q_1 > 0$

Can the market mechanism work to lower the price to the Equilibrium Price $P_0$?

The actual quantity that is bought and sold $= Q_1 = \min\{Q_1, Q_2\}$

What is the value placed on the last unit bought? $= P_{min}$

What is the cost of producing the last unit sold? $= P_2$

| | Before | After | Change |
|---|---|---|---|
| Consumer's Surplus | ①+②+③ | ① | −(②+③) |
| Producer's Surplus | ④+⑤+⑥ | ②+④+⑥ | +②−⑤ |

$-(③+⑤)$

If govt can enforce $P_{min}$ sellers will produce $Q_2$ we will have excess S. Value of last unit $= Q_2 - Q_1$ as unsold quantity. } to govt.

Suppose the govt buys all unsold quantity, the govt will pay $= P_{min}(Q_2 - Q_1)$

Again Value of last unit $= P_{min}$ is higher than cost of last unit so does not have res. allocation efficiency.

If sellers produce only $Q_1$ at price $P_{min}$.
social welfare will be lost = ③ + ⑤
= deadweight Loss

If sellers produce $Q_2$ and all sold out because $Q_1$ is sold to buyers ($Q_2 - Q_1$) is sold to government. } what will be the producers surplus.

| | Before | After | Change |
|---|---|---|---|
| CS | ① + ② + ③ | ① | ~~② + ③~~ |
| PS | ④ + ⑤ + ⑥ | ④ + ⑤ + ⑥ ② + ③ + ⑦ | ~~② + ③ + ⑦~~ |

So No Social Welfare Loss ?

More Social Welfare = + ⑦

No! Deadweight Loss = ⑧
from the fact that at $Q_2$, value of the last unit is less than the cost of the last unit.

**Deadweight Loss** is the loss of Social Welfare caused by market distortion.
At any quantity $Q > Q_0$, the value of the product is less than the cost of producing it. Thus we have the deadweight loss that comes from over production. The area that represents this deadweight loss is =

**3. Tax** The government collect a tax of $t$ bahts/unit. This is called Specific Tax. When tax is a percentage of price it is called Ad Valorem tax. = VAT value added tax of 7%

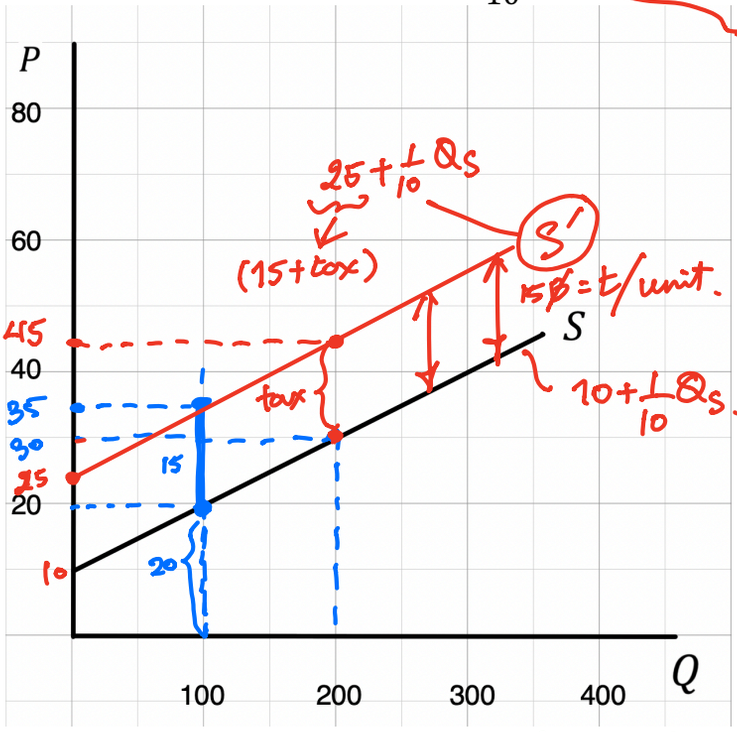
There are two possibilities: – { paid by sellers / paid by buyers.

**Case 1.** The ***sellers pay tax*** to the government $t$ bahts/unit.

Tax $t = 15$ *bahts/unit* on the sellers will affect the Supply curve. How? – shift up – Supply decreases. by shifting up vertically = 15฿ = t ฿/unit.

If sellers can sell 100 units. sellers pay the government (100) x (15) = 1,500 tax.

$$Supply: P = 10 + \frac{1}{10}Q_S$$




Supply $P = 10 + \frac{1}{10}Q_S$.

If the price is = 30฿ the Quantity Supplied = 200 units.

But with tax = 15฿. can keep only 15 = 30 – 15.

willingness & ability to sell is unchanged if the sellers consider the amount they actually can keep (after tax)

So to be willing & able to sell 200 units. the price the buyers have to pay must be 45฿ So that after tax the sellers can keep = 45 – 15 = 30฿.

After tax, the buyers feel that the supply has decreased. from S to S' – if we look at the price paid by buyers.

But the seller's ability & willingness to sell is the same if we look at the amount ฿ the sellers can keep (after tax).

Given the Demand and Supply:

tax on sellers

$$D:\ P = 70 - \frac{1}{5}Q_D$$

$$S:\ P = 10 + \frac{1}{10}Q_S$$

$$S':\ P = (10 + t) + \frac{1}{10}Q_S$$

$$= (10 + 15) + \frac{1}{10}Q_S$$

$$= 25 + \frac{1}{10}Q_S$$

$\frac{1}{5} + \frac{1}{10}$

$\frac{2+1}{10}$

t is on RHS.

$$70 - \frac{1}{5}Q_2 = 25 + \frac{1}{10}Q_2.$$

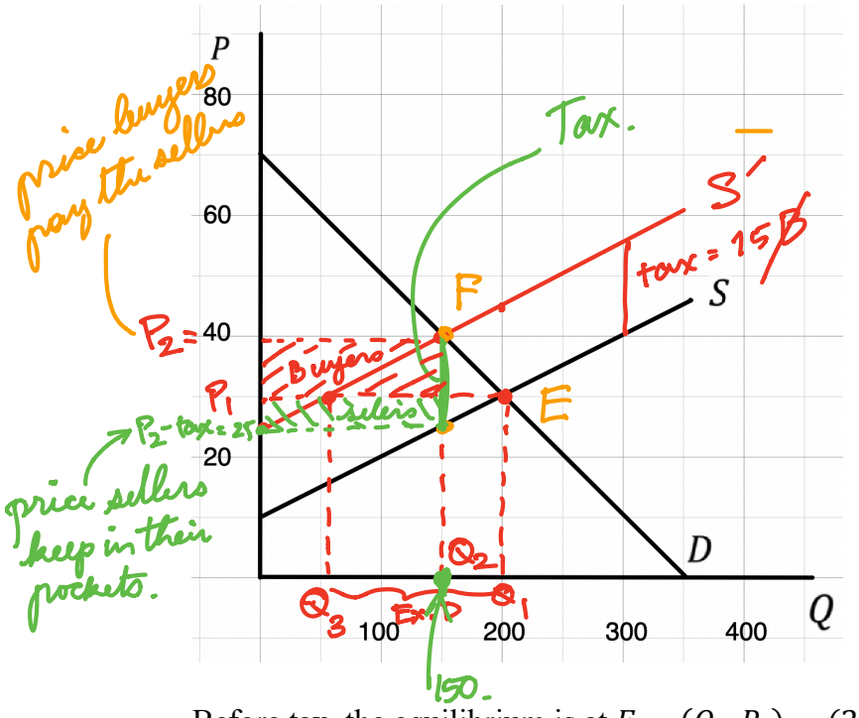
$10 + t$

$$45 = \frac{3}{10}Q_2$$

$$Q_2 = 150$$

$$P_2 = 70 - \frac{1}{5}(150) = 40$$

$$= 25 + \frac{1}{10}(150) = 40.$$




Before tax, the equilibrium is at $E = (Q_1, P_1) = (200,30)$.

Once tax is imposed, at the original equilibrium price $P_1$ there is an Excess D = $Q_1 - Q_3 > 0$

$\Longrightarrow$ The price thus will increase/~~decrease~~ to.

The new equilibrium will be at $F = (Q_2, P_2) = (150, 40)$.

Solving equations to find the new equilibrium:

With tax,
the eq. quantity decreases from $Q_1 = 200$ to $Q_2 =$ 150
the eq. price increases from $P_1 = 30$ to $P_2 =$ 40.

Question: Is $P_2$ = 40 the price the buyers pay or the ~~sellers receive in their pockets~~? (before tax, after tax)

**Tax Burden (Tax Incidence)** *(Compare the total payment out of the pockets of buyers and total amount received by the sellers)*

30 → 40 10 ฿ higher.

**Before:**
Price the buyers pay $P_1 = 30$, sellers receive $P_1 = 30$

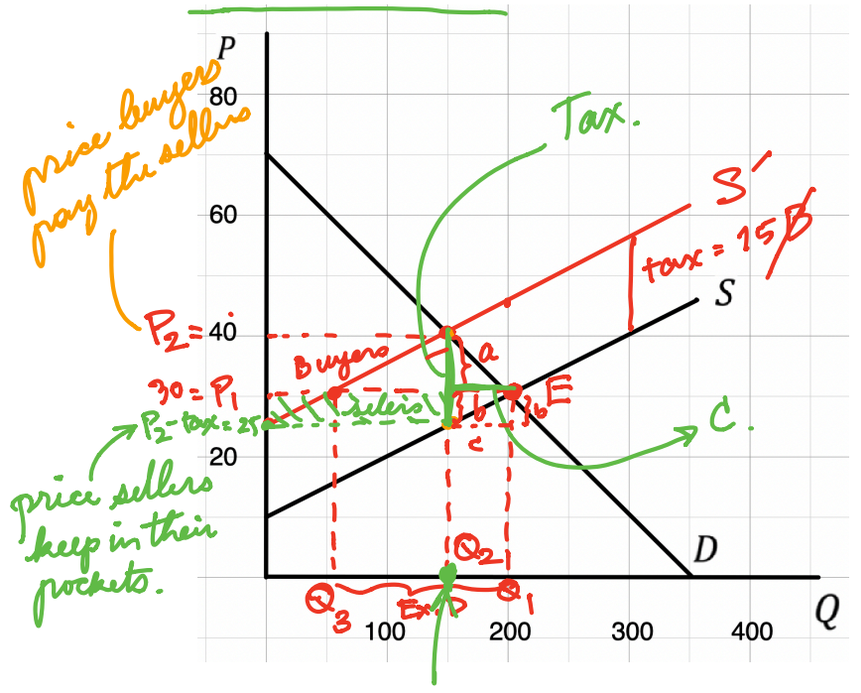
**After:**
Price the buyers pay $P_2 = 40$, sellers receive 40 − 15 = 25 ฿. (in their pocket. tax)

**Tax burden:** Buyers' = 40−30 = 10 bahts/unit ($P_2 - P_1$) → 10+5 = 15 = tax.
Sellers' = 30−25 = 5 bahts/unit = $P_1 - (P_2 - \text{tax})$ ∴ tax 15 ฿ shared by the buyers & sellers.

**Total Tax burden:** Buyers' = 10×150 = 1500 bahts = Area
new. $Q_2$ = 150 Sellers' = 5×150 = 750 bahts = Area

**Total Tax Collected:** $Q_2$ = 150 tax = 15 ฿/unit.
= 150 × 15 = 2250 — tax collected is shared between buyers (1,500) and sellers (750)

**Share of Tax Burden:**




slope of D at E = $-\frac{a}{c}$
slope of S at E = $\frac{b}{c}$.

Both buyers and sellers share the burden of tax. The share of burden is determined by the relative value of the price elasticities of demand and supply.

Let

$a = burden\ on\ buyers/unit = P_2 - P_1$

$b = burden\ on\ sellers/unit = P_1 - (P_2 - tax)$

Note $a + b = tax$

At the original equilibrium, $E = (Q_1, P_1) = (200,30)$, the price elasticity of demand and price elasticity of supply are

$$\eta_D = \frac{1}{Slope\ of\ D\ at\ E}\frac{P_1}{Q_1} = \frac{1}{-a/c}\frac{P_1}{Q_1}$$

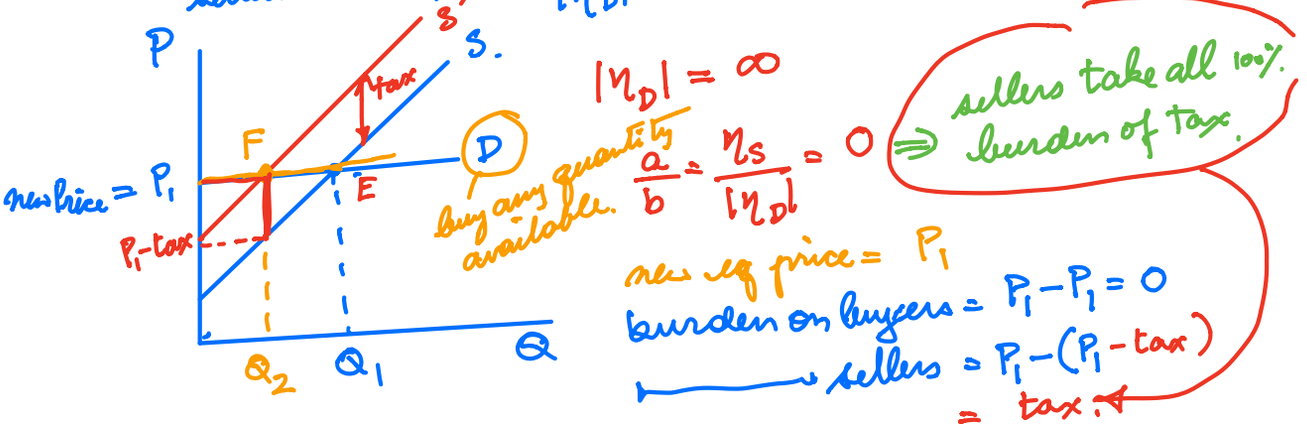
$$\eta_S = \frac{1}{Slope\ of\ S\ at\ E}\frac{P_1}{Q_1} = \frac{1}{b/c}\frac{P_1}{Q_1}$$

Thus

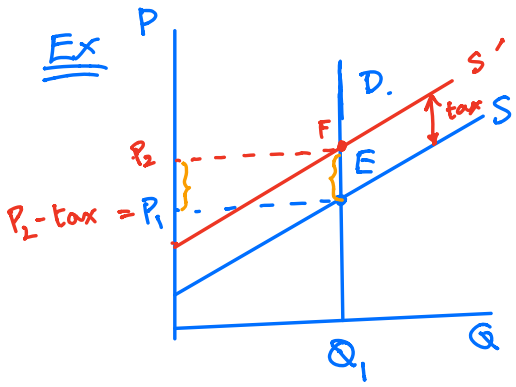
$$\frac{\eta_S}{|\eta_D|} = \frac{\frac{1}{b/c}\frac{P_1}{Q_1}}{\frac{1}{a/c}\frac{P_1}{Q_1}} = \frac{a}{b} = \frac{burden\ on\ buyers/unit}{burden\ on\ sellers/unit}$$

If $\eta_S > |\eta_D|$, buyers will bear more tax burden than sellers do. Those who are more sensitive to price change will have less burden.

**Example** At the point $E = (Q_1, P_1) = (200,30)$, $\eta_S = 1.5$, $|\eta_D| = 0.75$, then $\frac{\eta_S}{|\eta_D|} = \frac{1.5}{0.75} = 2$. That means the buyers' burden is twice that of sellers'



**Ex**




at E, $|\eta_D| = 0$

$\frac{a}{b} = \frac{\text{buyer's burden}}{\text{seller's burden}} = \frac{\eta_S}{|\eta_D|} = \infty$

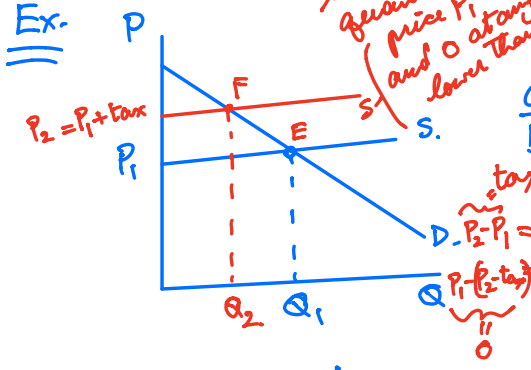
$\rightarrow b = 0$.

buyers take all 100% burden

buyer's burden: $a = P_2 - P_1 = \text{tax}$

sellers $\rightarrow = P_1 - (P_2 - \text{tax}) = 0$ ($P_2 - \text{tax} = P_1''$)

**Ex.**




sell any quantity at price $P_1$ and 0 at any price lower than $P_1$

$\eta_S = \infty$

$\frac{a}{b} = \frac{\text{buyer's burden}}{\text{seller's burden}} = \frac{\eta_S}{|\eta_D|} = \frac{\infty}{|\eta_D|} = \infty$

buyers take 100% burden

sellers — 0% —

$\frac{a}{b} = \frac{\eta_S}{|\eta_D|} = \frac{\text{buyer's burden}}{\text{seller's burden}}$.

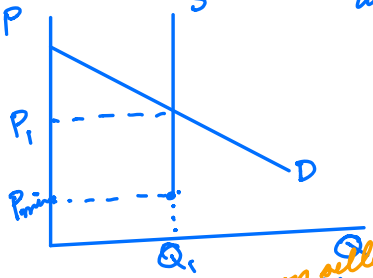
$\eta_S = 0.2$ - inelastic

$|\eta_D| = 0.1$

At original Eq. point E, if Supply is relatively more elastic than demand, sellers will take less burden

---

H.W.

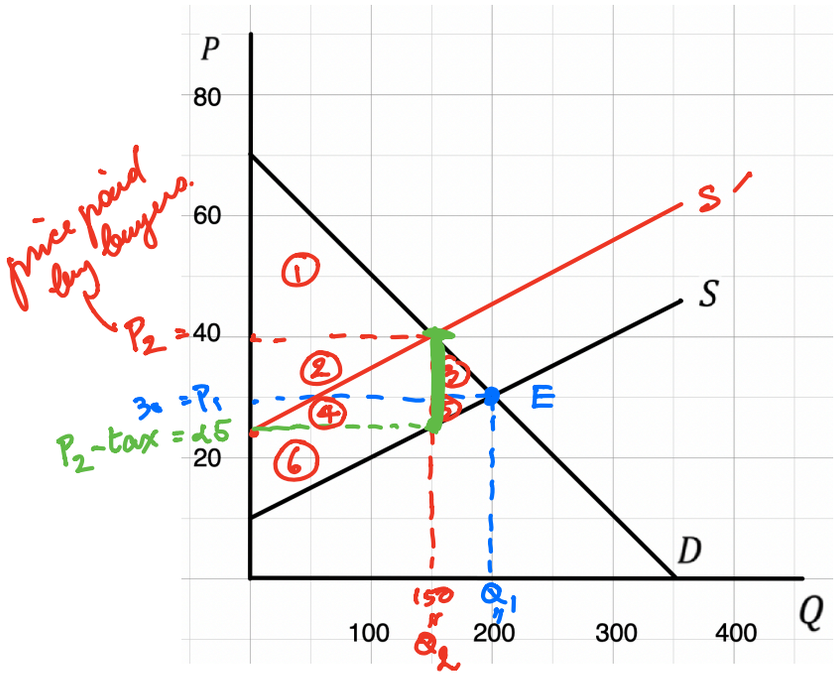



sellers will sell $Q_1$ whatever the price as long as it is higher than $P_{min}$.

a) How tax = t $/unit on sellers affects the Supply

b) Show the tax burden on the graph that will be according to $\frac{\eta_S}{|\eta_D|}$

**Change in Consumer's and Producer's Surpluses**




price paid by buyers.

$P_2$ = 40

$P_1$ = 30

$P_2$ − tax = 25

| | Before | After | Change |
|---|---|---|---|
| Consumer's Surplus | ①+②+③ | ① | −(②+③) |
| Producer's Surplus | ④+⑤+⑥ | ⑥ | −(④+⑤) |

Total loss of Social welfare from consumers + producers.

is the tax burden of buyers + sellers = tax revenue to the govern't.

Deadweight Loss =

So part of the loss of social welfare of buyers and sellers go to

govern't. ② + ④

Deadweight Loss ③ + ⑤

40 = $P_2$ = What is the value the buyers place on the last unit bought?

25 = $P_2$ − tax = What is the cost of producing the last unit sold?

Value of the last unit bought = 40 > 25 = cost of last unit sold