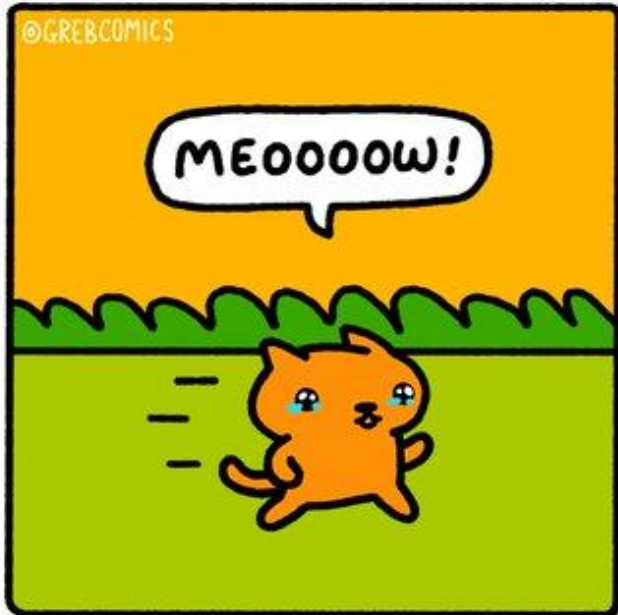




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# Taxes and subsidies

Chapter 6

# Objectives

- To understand taxes and subsidies
  - What they mean
  - How they affect supply and demand
  - How they affect welfare

# Commodity tax: introduction

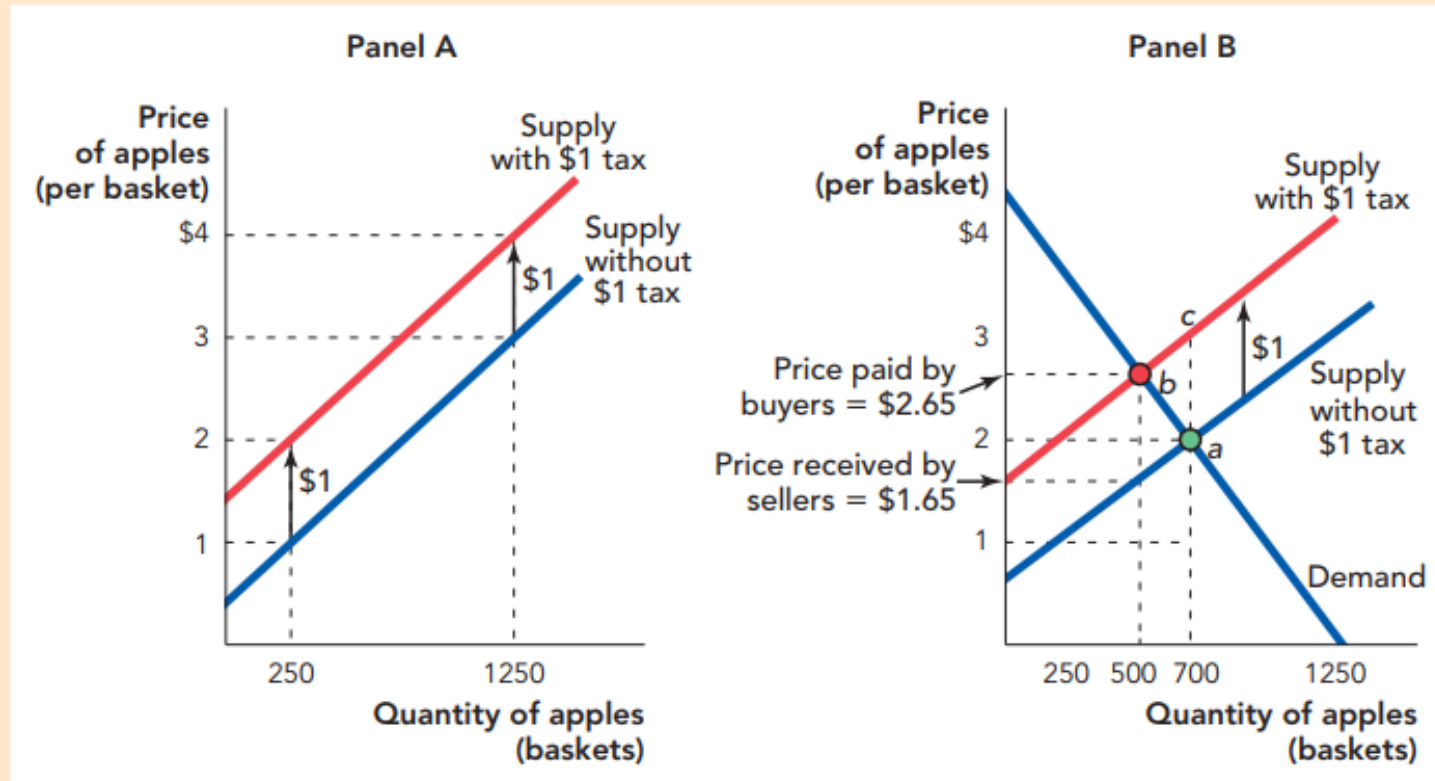
- A commodity tax creates a wedge between what buyers pay ( $P_b$ ) and what sellers receive ( $P_s$ ) and the difference is equal to the tax ( $T$ ).
- In terms of economic outcomes, **it does not matter who pays: the sellers or the buyers**

# Commodity tax: suppliers and buyers

- A (commodity) tax can be levied on the **suppliers**. In this case, it shifts the supply curve “**up**” by the amount of the tax.
  - Why? The tax increases the **total** marginal cost of production -- the firm has to pay its marginal production cost and its tax “liability”.
- A (commodity) tax can also be levied on the **buyers**. In this case, it shifts the demand curve “**down**” by the amount of the tax.
  - Why? The demand curve represents the buyer’s willingness to pay. If a tax is imposed, the buyer is **willing to pay the producer less** because she has a **tax “liability”** she must pay, so that the **total amount** that buyers are willing to pay **including the tax** is the same.

# Commodity tax: suppliers

FIGURE 6.1



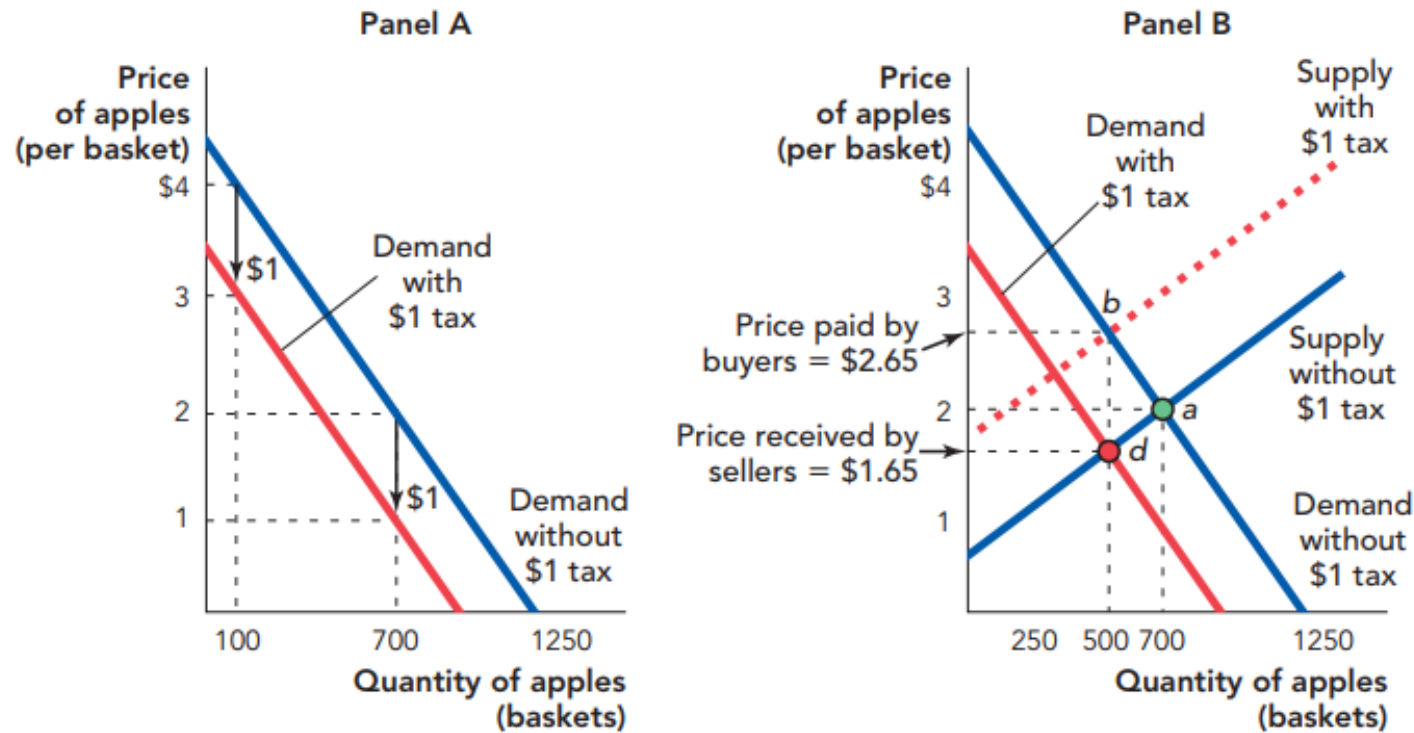
## A Tax on Apple Sellers

**Panel A:** A \$1 tax on apple sellers shifts the supply curve up by \$1.

**Panel B:** A \$1 tax on apple sellers shifts the supply curve up by \$1, changing the equilibrium from point a to point b.

# Commodity tax: buyers

FIGURE 6.2



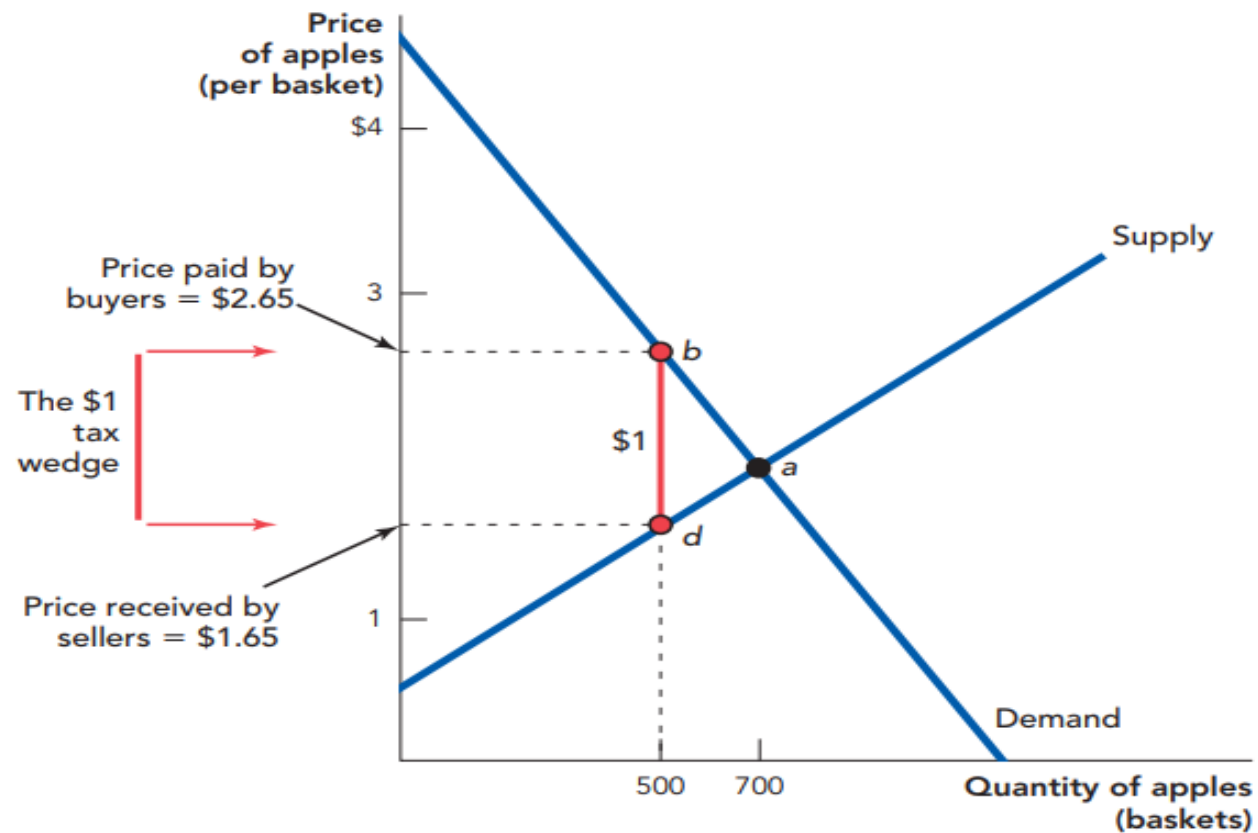
## A Tax on Apple Buyers

**Panel A:** A \$1 tax on apple buyers shifts the demand curve down by \$1.

**Panel B:** A \$1 tax on apple buyers shifts the demand curve down by \$1, changing the equilibrium from point *a* to point *d*.

# The Tax Wedge

FIGURE 6.3

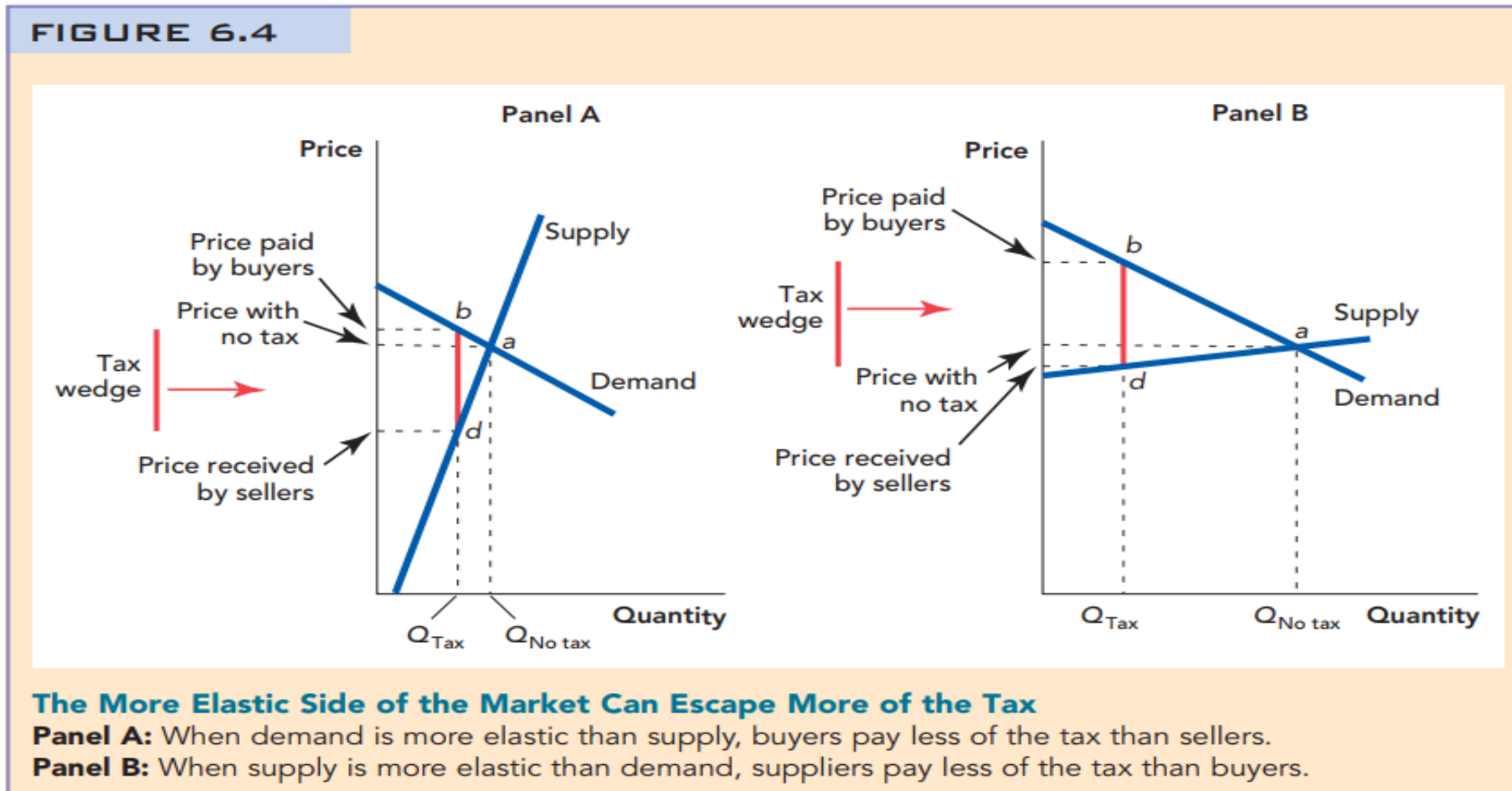


**The Tax Wedge** If the tax is \$1, the price paid by the buyers must be \$1 higher than the price received by the sellers. Driving a \$1 tax wedge into the diagram shows us the new equilibrium must be where the price paid by the buyers is \$2.65, the price received by the sellers is \$1.65, and the quantity traded is 500.

# The Tax Wedge

- We now want to measure the **tax burden** or the **tax incidence**.
- The **tax incidence**, or **tax burden** can be considered by going back to the original equilibrium price.
- The tax burden, in terms of price, that falls on consumers is  $b - a$
- The tax burden, in terms of price, that falls on sellers is  $a - d$
- Total burden, in terms of price, is  $b - d = T$

# Elastic vs Inelastic Supply and Demand



# Elastic vs Inelastic Supply and Demand

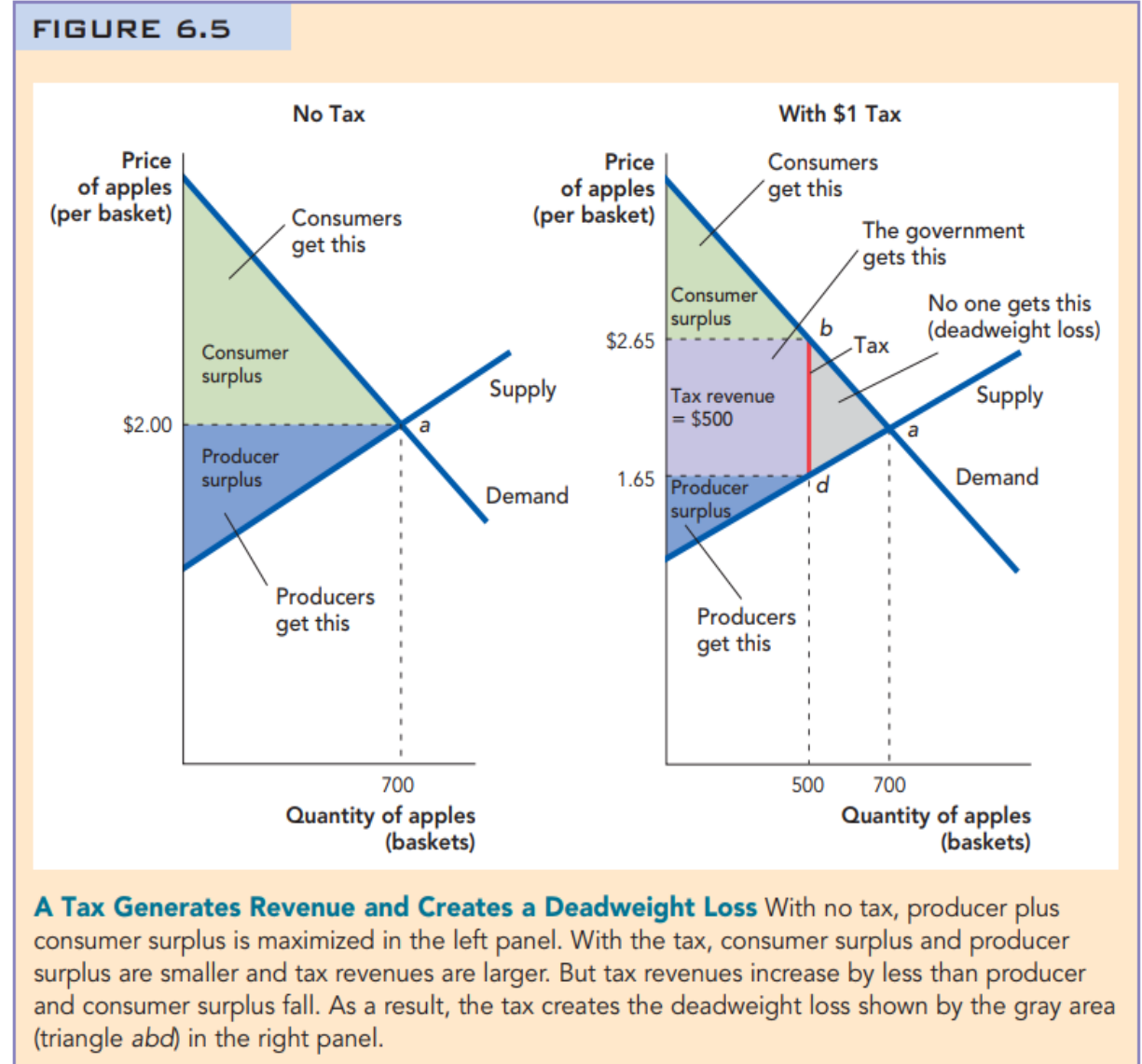
- When demand is more elastic than the supply, buyers pay less of the tax than sellers.
  - Why? Think about cereal brands, generic drugs.
  - Which kind of consumers are more likely to switch?
  - Can you think of more examples?
- When supply is more elastic than the demand, sellers pay less of the tax than buyers.
  - Why? Think about prescription drugs, baby formula.
  - Which kind of suppliers are more likely to switch?
  - Can you think of more examples?

# Deadweight loss

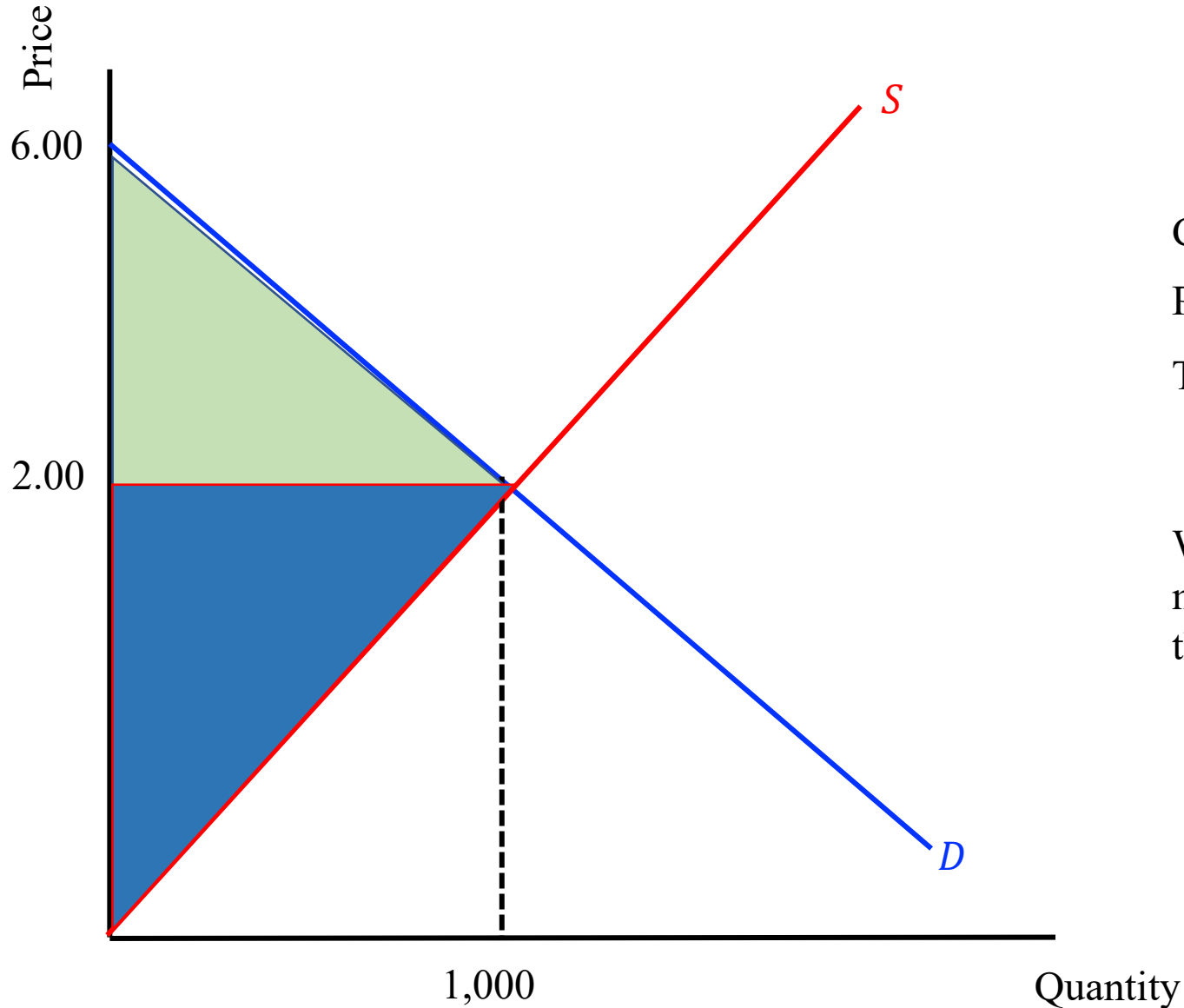
Given that costs (burden) of taxes can fall on **buyers** and **sellers**, it would be nice if we had a way to **calculate the costs**. Luckily, we do.

Recall **consumer** and **producer surplus**.

When taxes are imposed, consumer and producer surplus shrinks!



# Consumer and Producer Surplus



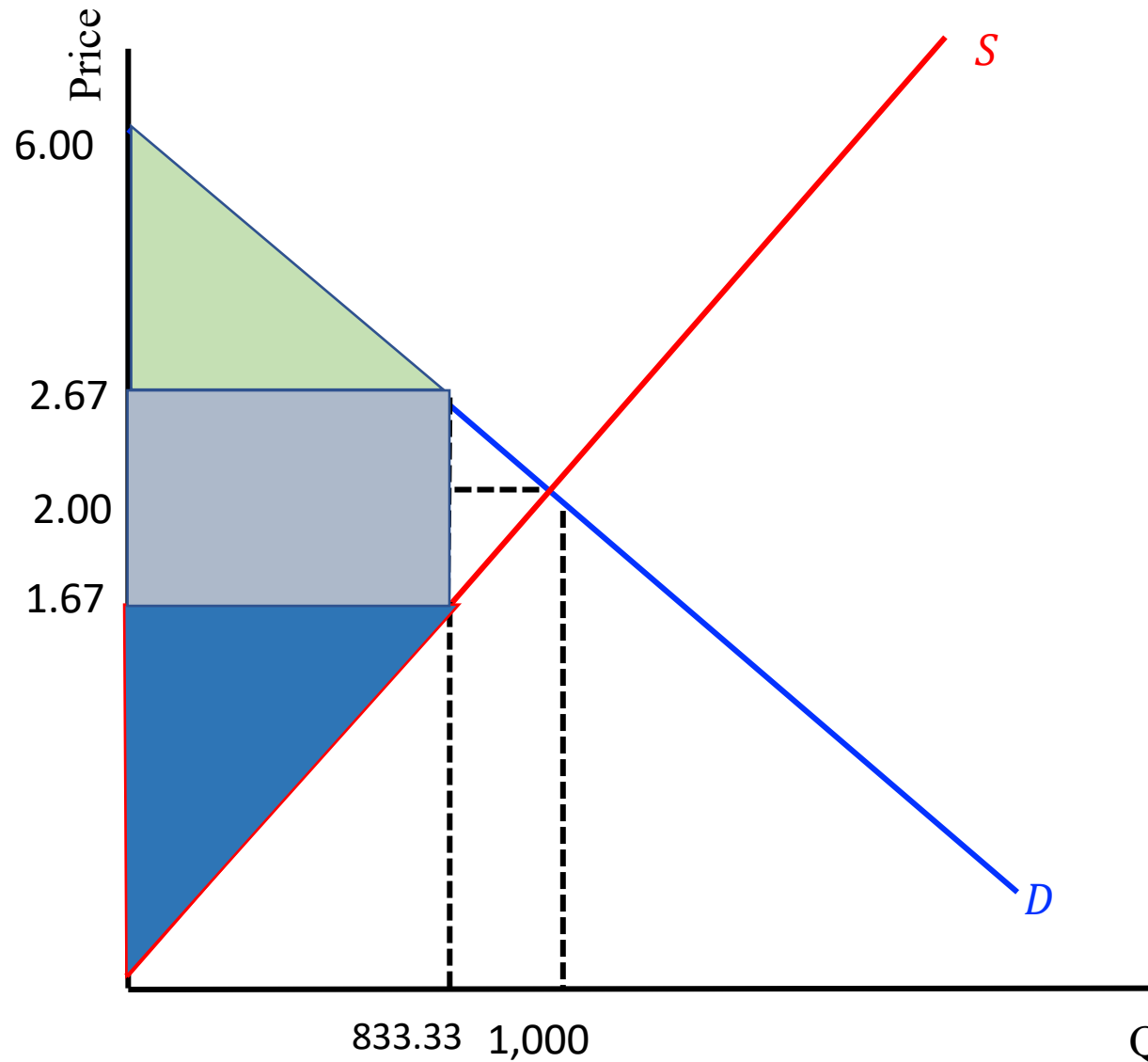
$$\text{Consumer Surplus} = \frac{1}{2}(6 - 2)1,000 = 2,000$$

$$\text{Producer Surplus} = \frac{1}{2}(2 - 0)1,000 = 1,000$$

$$\text{Total Surplus} = \$3,000$$

With competitive markets, **total surplus** was maximized at the point of equilibrium -- and that this was indicative of *efficiency*

# Welfare Implications of tax



In the new equilibrium, the buyers pay a total of **\$2.67** per gallon of gasoline (**\$2.67 = \$1.67 + \$1.00**).

Consumer Surplus =  $\frac{1}{2}(6.00 - 2.67)833.33 = \$1,388.88$

In the new equilibrium, the seller receives **\$1.67** per gallon of gasoline.

Producer Surplus =  $\frac{1}{2}(1.67 - 0.00)833.33 = \$694.44$

**Government Gain in Revenues = \$833.33**

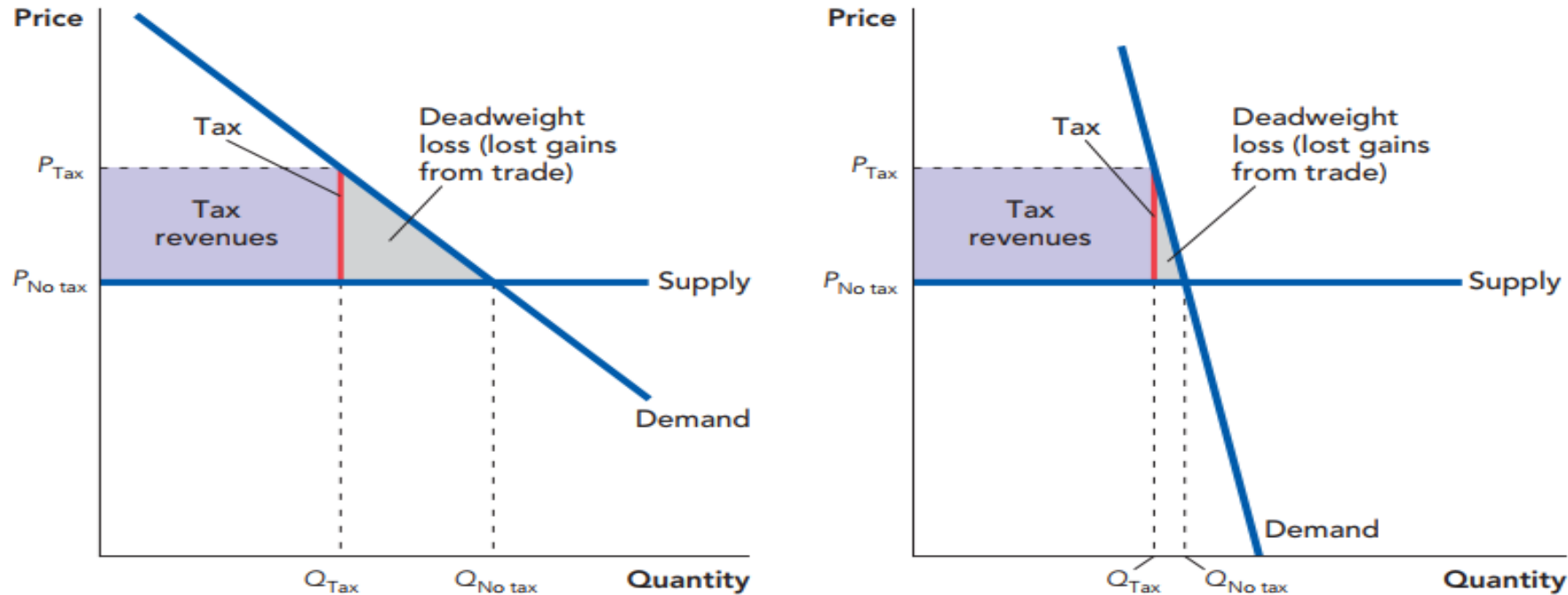
With taxes, we can still measure what happens to **consumer** and **producer** surplus after the **tax**. Recall with taxes there is a third actor – the **government** and the **government** receives **revenue** from the **taxes**.

# Welfare Implications of tax

- Not all of the loss of consumer surplus was “transferred” to the government.
- Not all of the loss of producer surplus was “transferred” to the government.
- The area of producer surplus and consumer surplus that is “completely” lost after the tax is referred to as the **deadweight loss**.
- Deadweight loss is a measure of how **far the total surplus** departs from the **efficient** outcome

# Deadweight Loss: Elastic vs Inelastic Demand

FIGURE 6.6

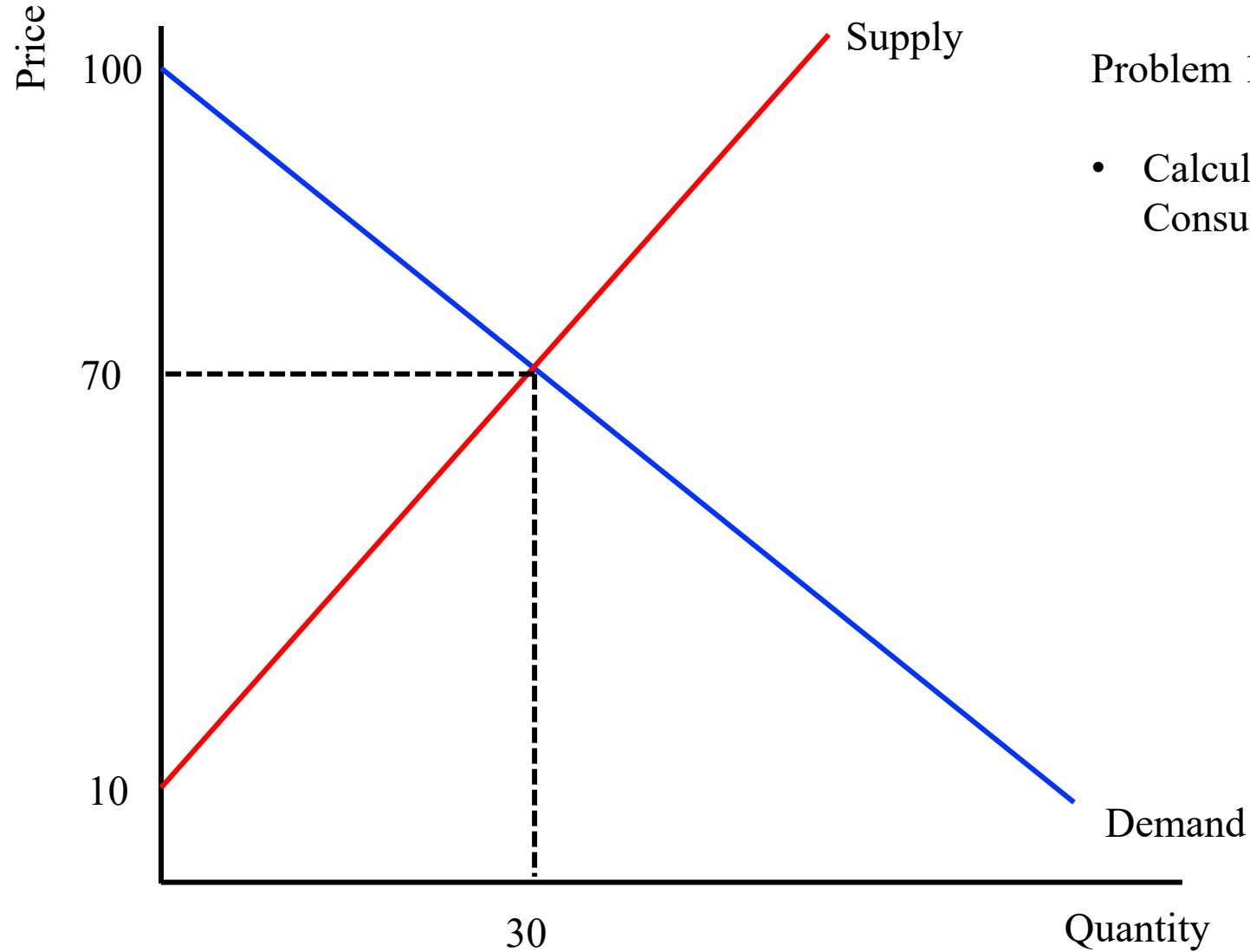


**The Deadweight Loss from Taxation Is Larger the More Elastic the Demand Curve** The tax rate and tax revenues are the same but the deadweight loss is larger in the left panel where the demand curve is more elastic.

# Deadweight Loss: Elastic vs Inelastic Demand

- Deadweight losses arise when there are **distortions** (as in the case of a tax) leading to **inefficiencies**.
  - There is a **distortion** with a tax because a tax drives a **wedge** between what buyers pay and what sellers receive.
- Both buyers and sellers will bear some of the burden from **efficiency loss** from a taxation.
  - the **deadweight loss** is **lower** than if the demand curve is more **inelastic**.
  - the **deadweight loss** is **lower** than if the supply curve is more **inelastic**.

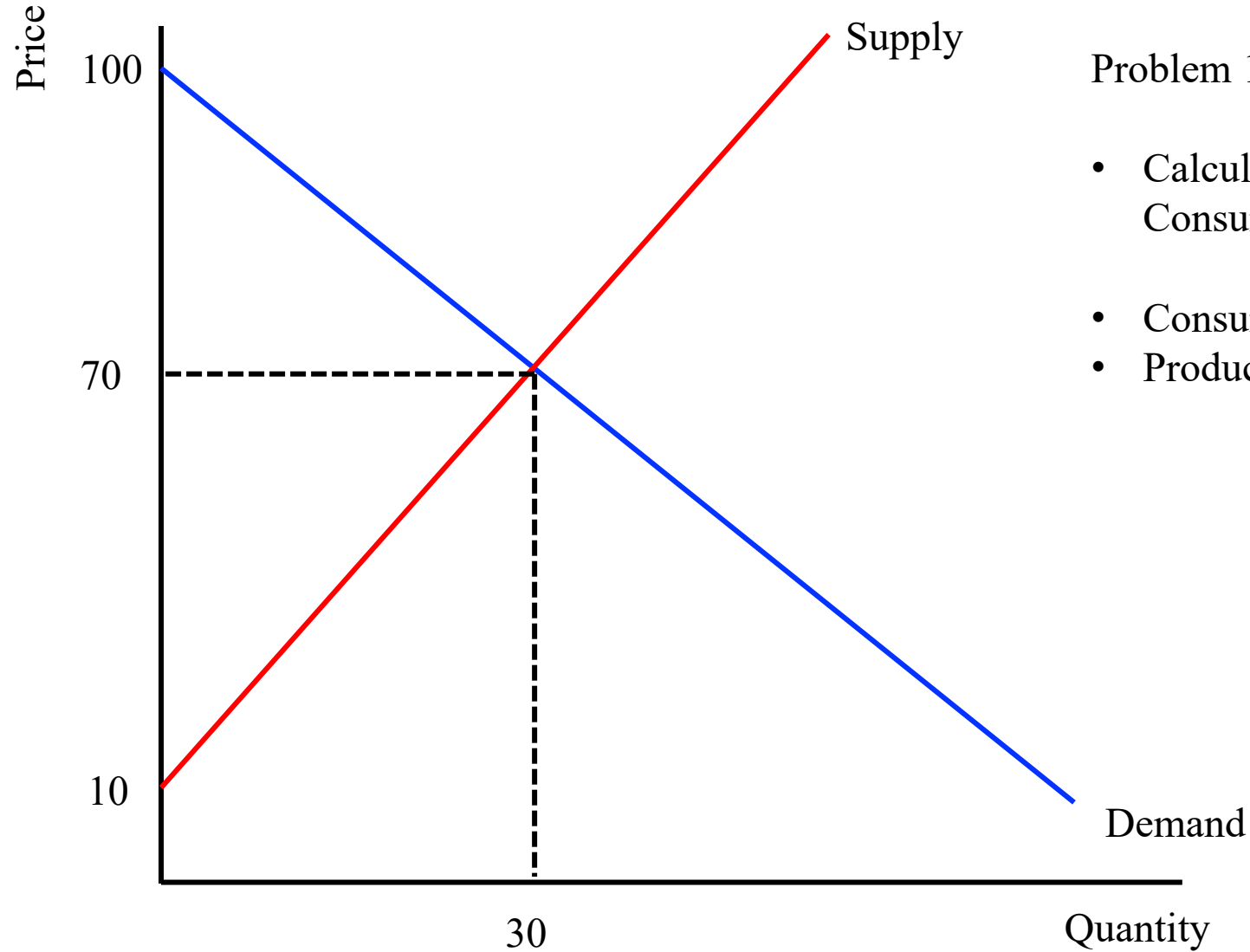
# Practice Problems



## Problem 1

- Calculate Producer Surplus and Consumer Surplus

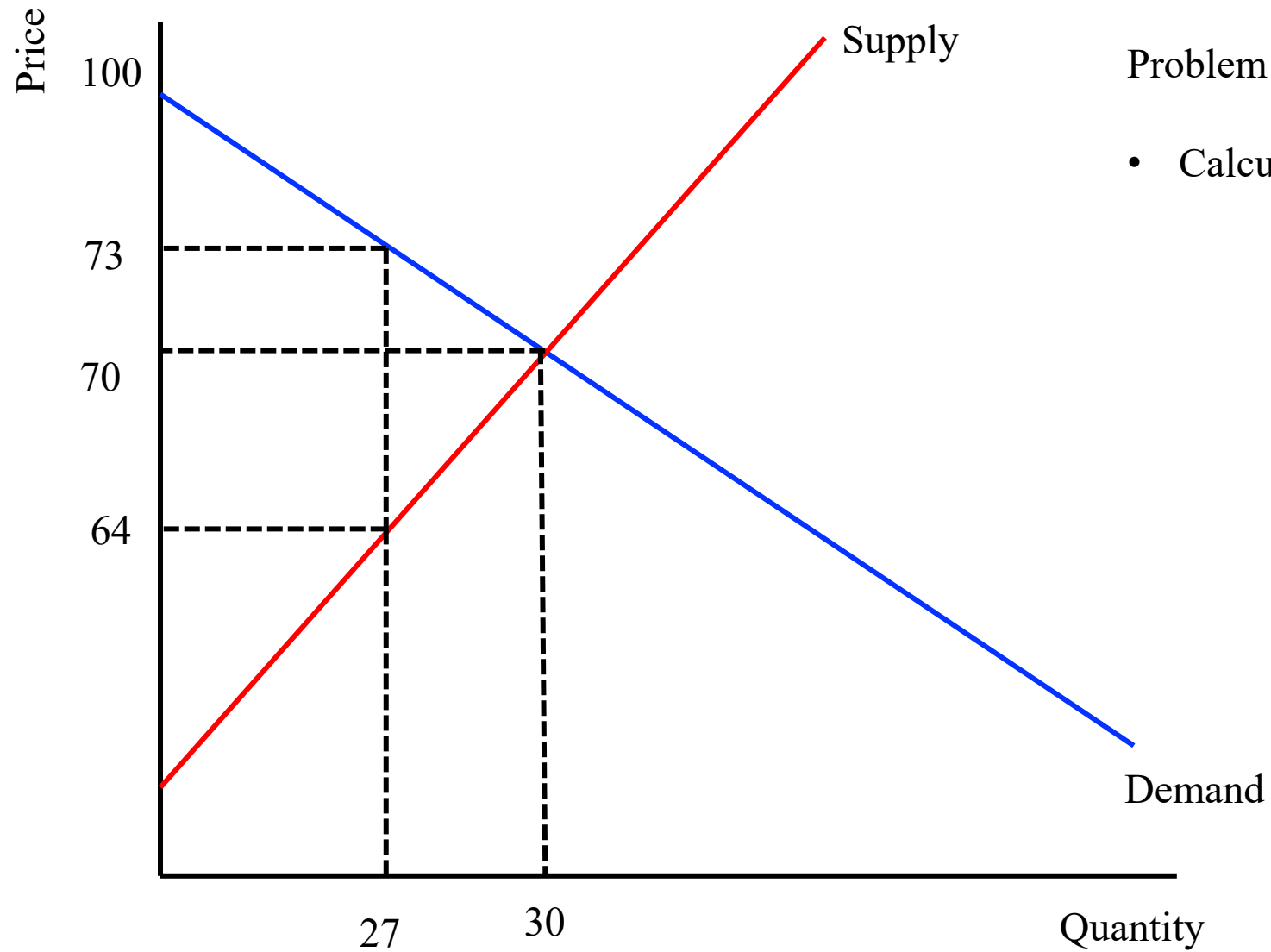
# Practice Problems



## Problem 1

- Calculate Producer Surplus and Consumer Surplus
- Consumer Surplus:  $0.5 * 30 * 30$
- Producer Surplus:  $0.5 * 60 * 30$

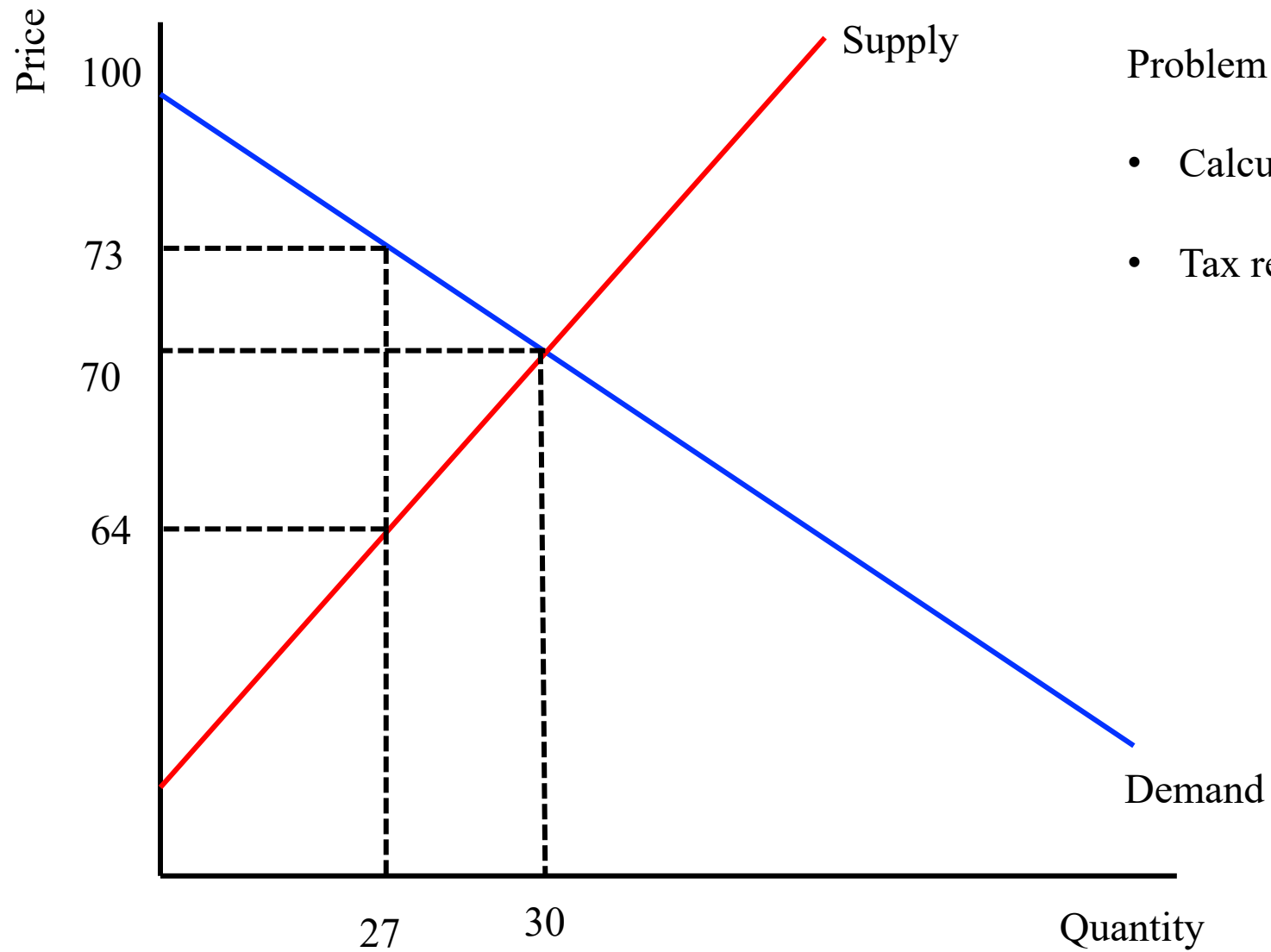
# Practice Problems



Problem 1

- Calculate Tax Revenue

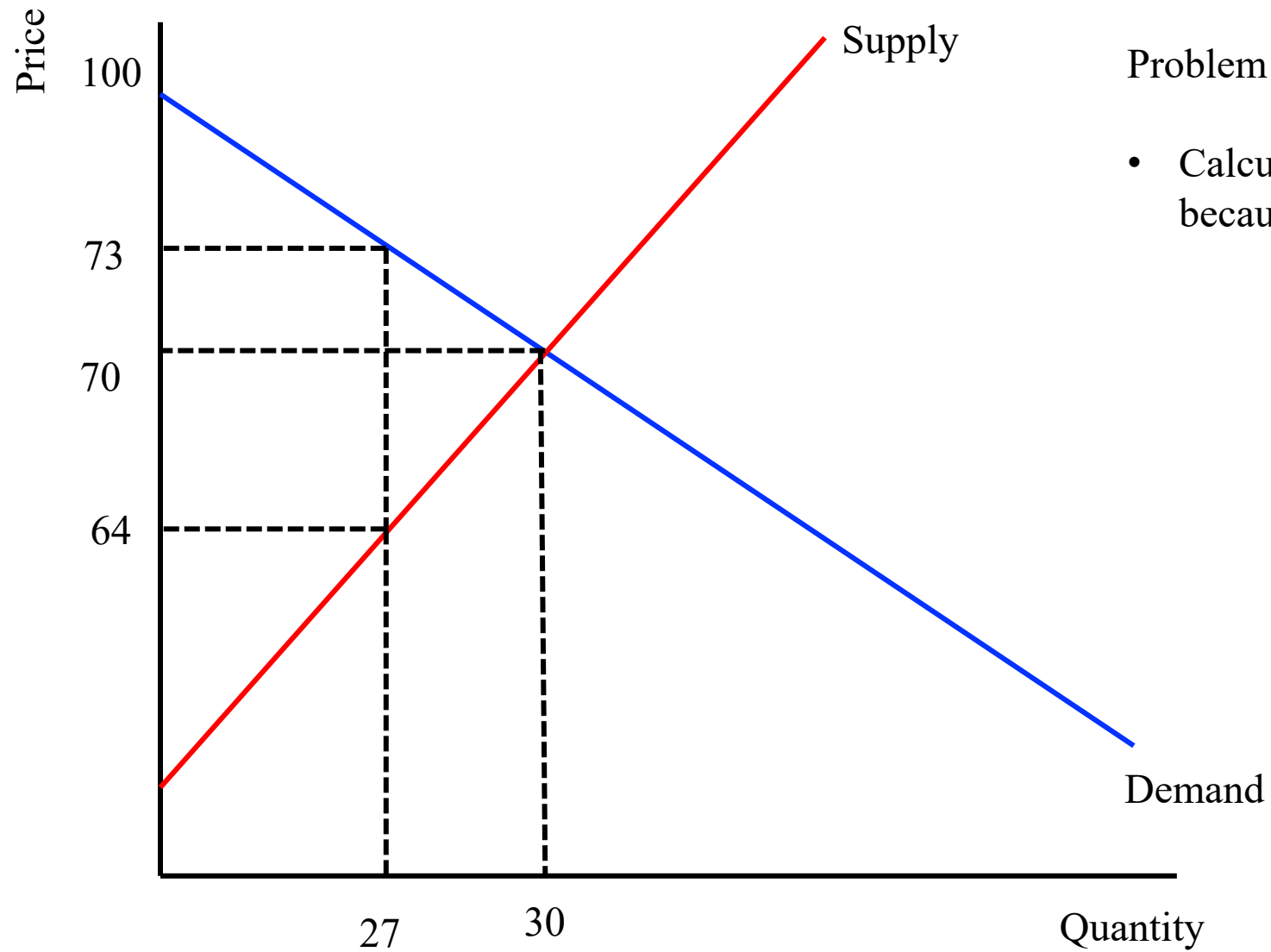
# Practice Problems



## Problem 1

- Calculate Tax Revenue
- Tax revenue:  $(73 - 64) * 27$

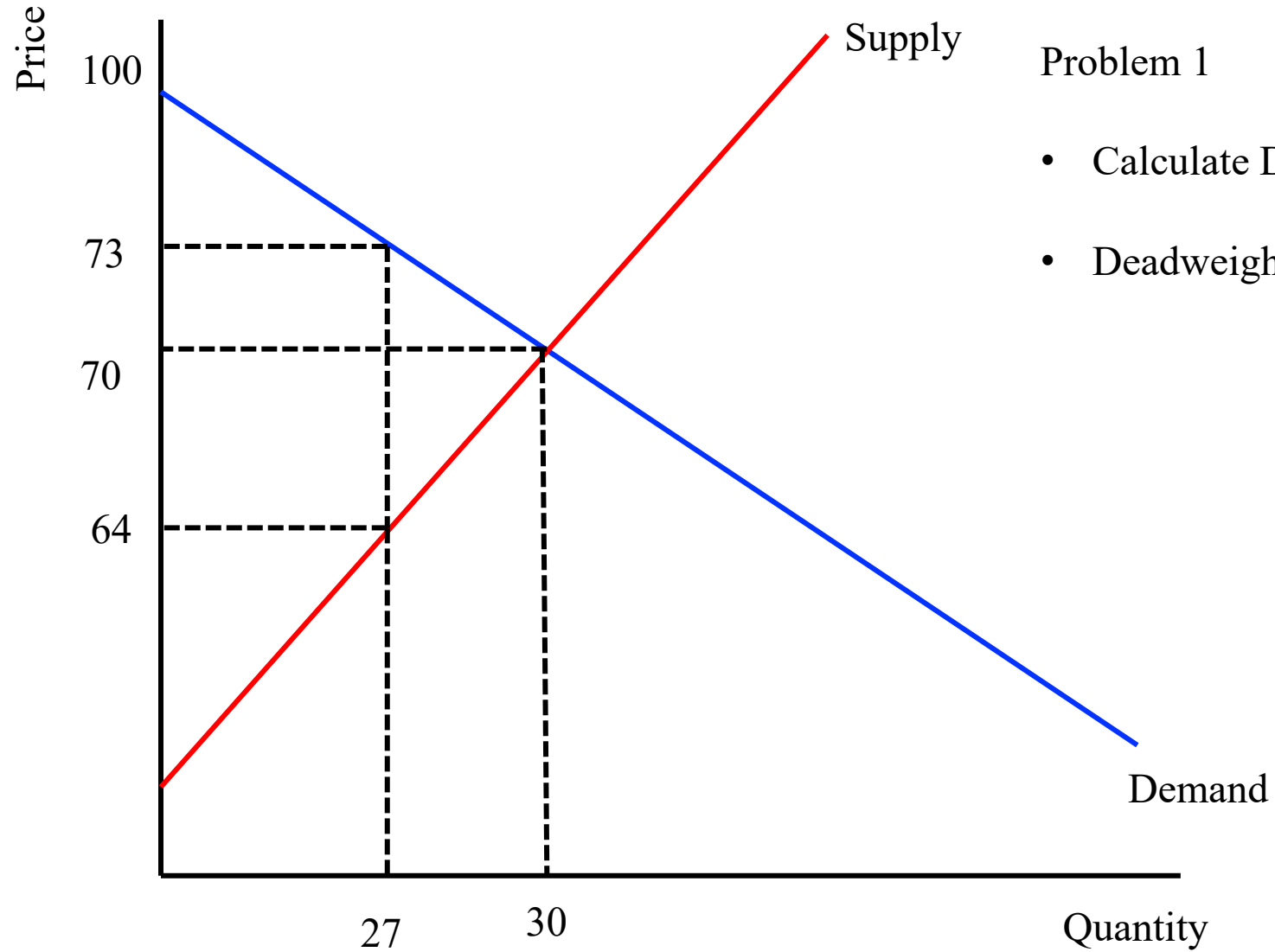
# Practice Problems



## Problem 1

- Calculate Deadweight Loss because of tax

# Practice Problems

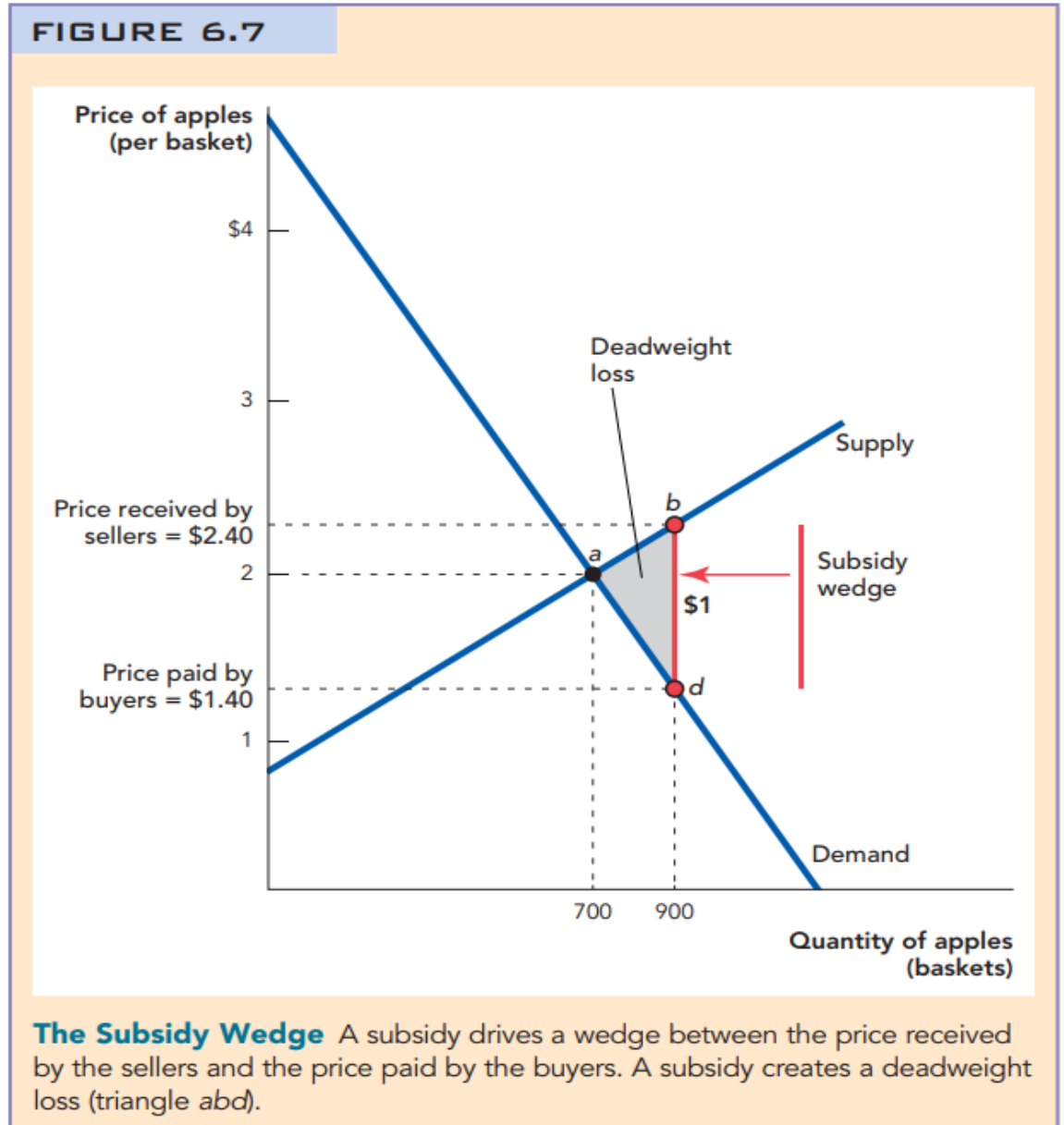


## Problem 1

- Calculate Deadweight Loss because of tax
- Deadweight loss:  $0.5 * (73-64) * (30-27)$

# Subsidy wedge

A **subsidy** drives a wedge between the price received by the sellers and the price paid by the buyers. A subsidy also creates a **deadweight loss**.



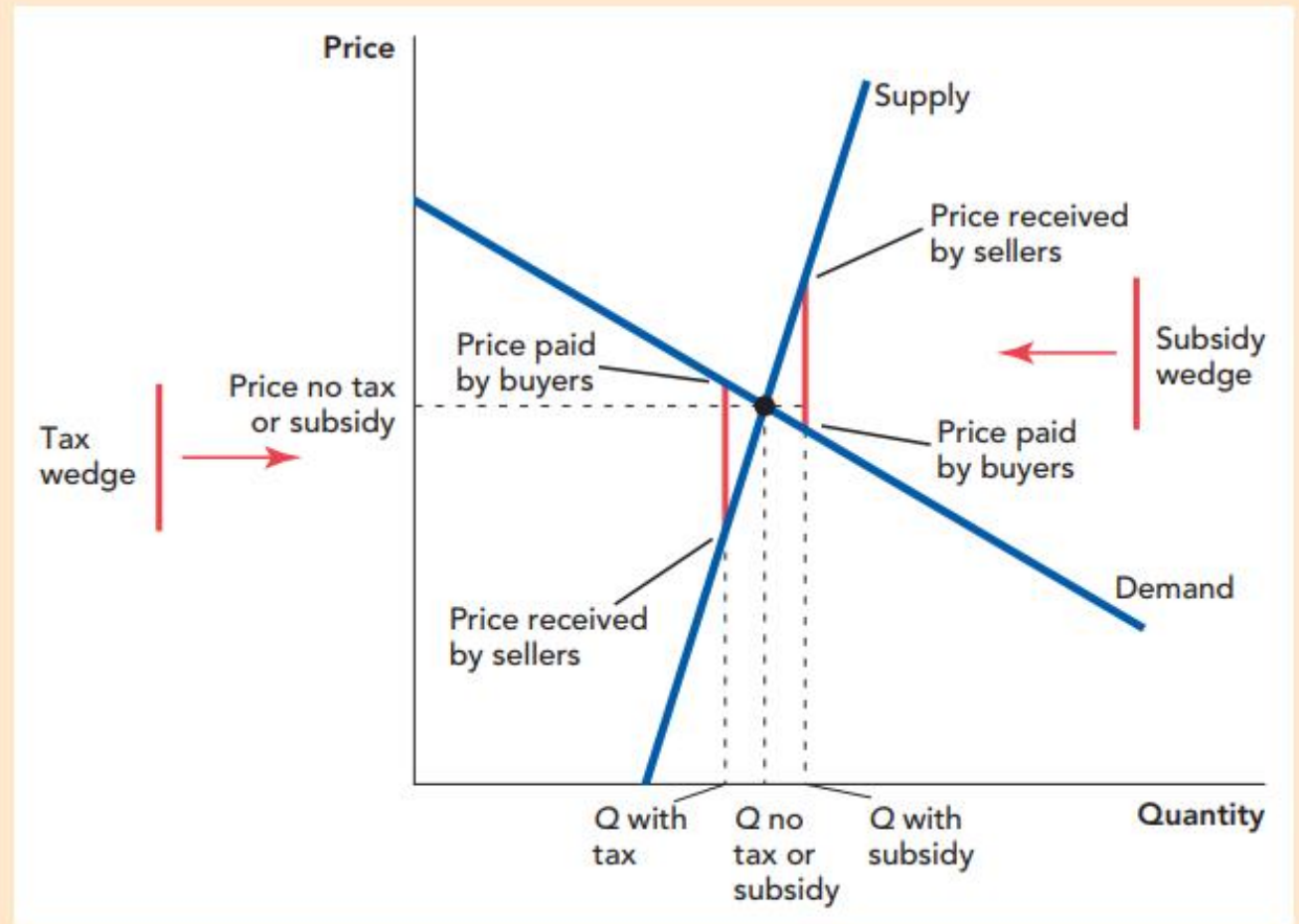
# Subsidies

- Who gets the subsidy does not depend on who gets the check from the government.
- Who benefits from a subsidy does depend on the elasticities of demand and supply.
  - If demand is relatively more inelastic, buyers receive more of the benefits from the subsidy.
  - If supply is relatively more inelastic, sellers receive more of the benefits from the subsidy.
- Subsidies must be paid for by taxpayers and they create an inefficient increase in transactions (trade).

# Tax or Subsidy Burden

- The more elastic side of the market will receive a smaller share of the subsidy (smaller benefit).
- The less elastic (more inelastic) side of the market will receive a greater share of the subsidy (greater benefit)

FIGURE 6.8

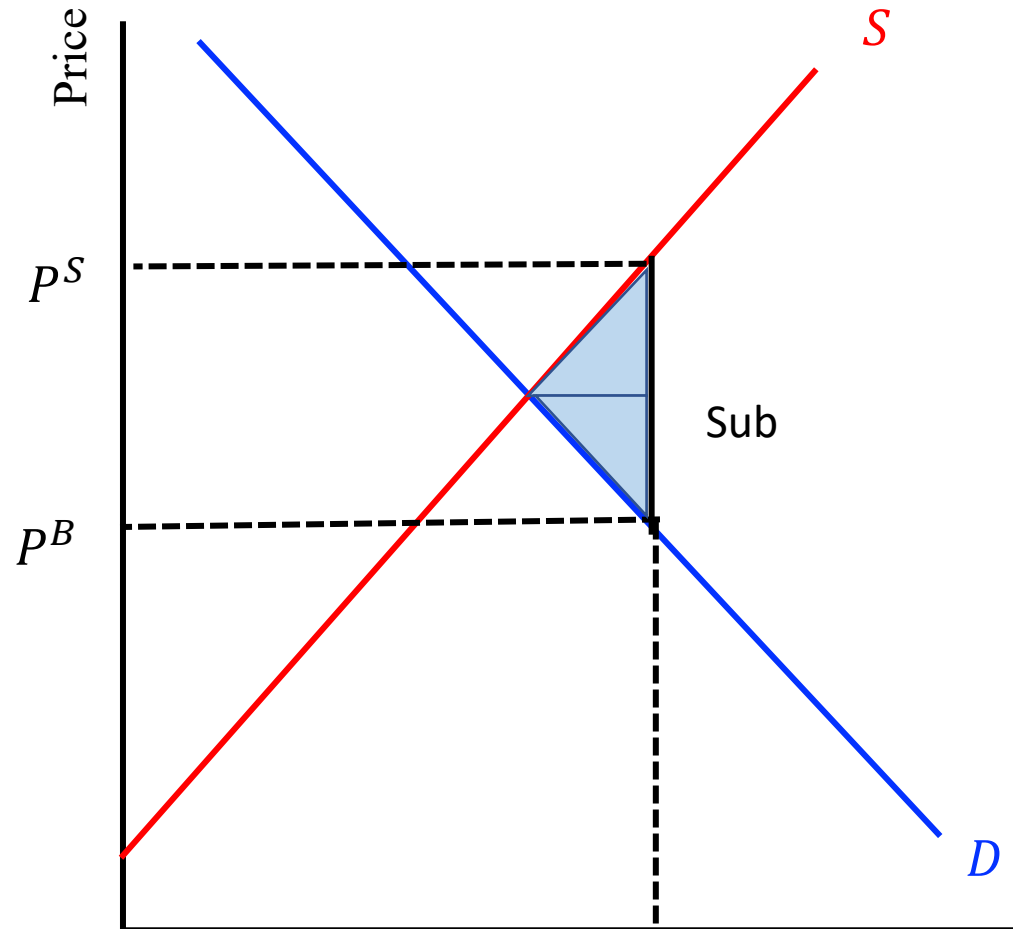


**Whoever Bears the Burden of a Tax Receives the Benefits of a Subsidy**  
When demand is more elastic than supply, suppliers bear more of the burden of a tax and receive more of the benefit of a subsidy.

# Subsidy Example: Rental Housing

- Now let's assume that we offer subsidies to the renter or to families that are looking to rent an apartment. How will this impact the market for apartment rentals?

# Subsidy Example: Rental Housing



The subsidy increases the number of housing units for rent.

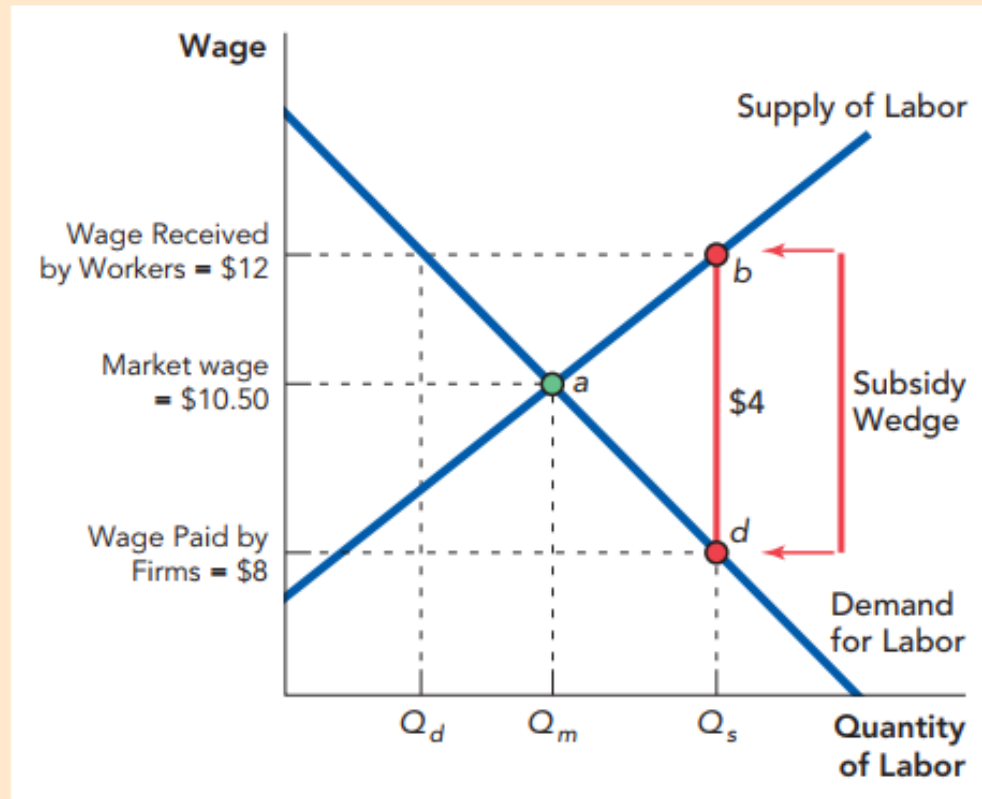
Consumers pay a **lower amount** out of pocket and renters receive a **higher amount**

The cost of the program is the subsidies that **must be paid** by the government

$Q^S$  Quantity of Apartments

# Earned Income Subsidy Schemes

FIGURE 6.9



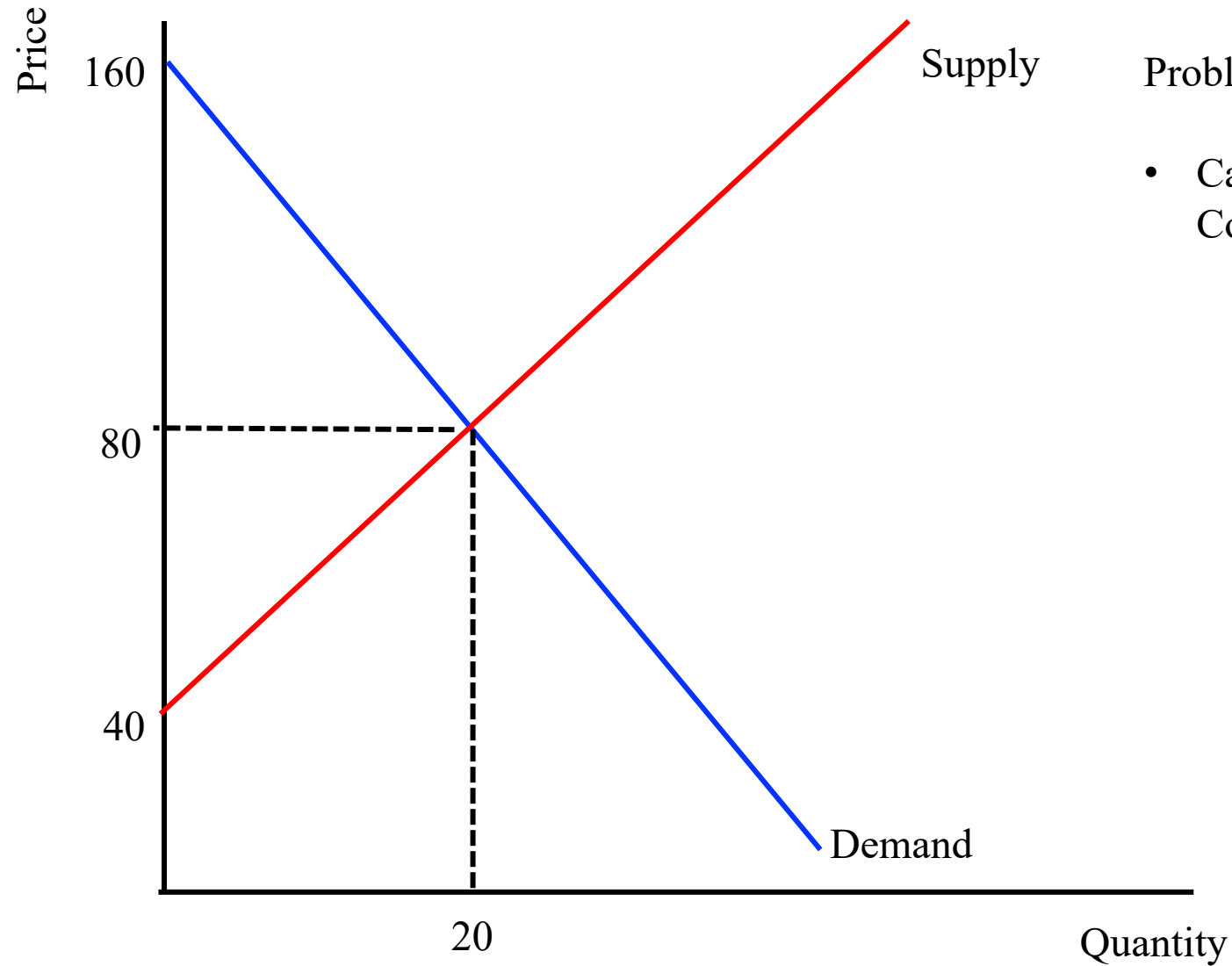
## A Subsidy to Wages Increases Employment

The free market wage for low-skill workers is \$10.50. A subsidy to firms that hire low-wage workers increases the wage received by workers to \$12 and reduces the wage paid by firms to \$8. As a result, employment increases from  $Q_m$  to  $Q_s$ . The cost of the subsidy to the government is the subsidy amount, \$4, times the number of workers employed,  $Q_s$ .

# Minimum wage subsidy schemes

- **Wage subsidy schemes** offer subsidies to employers who take on unemployed individuals from target groups for defined periods.
  - Target groups are often described by age and duration of unemployment, but other characteristics can be included.
- The reduction in unemployment is not equivalent, however, to the number of subsidized job placements.
- Both **deadweight losses** and **displacement** effects must be considered when assessing the impact.
  - Displacement occurs where workers from the target group are recruited in preference to others, thus altering the composition of unemployment, rather than reducing it.

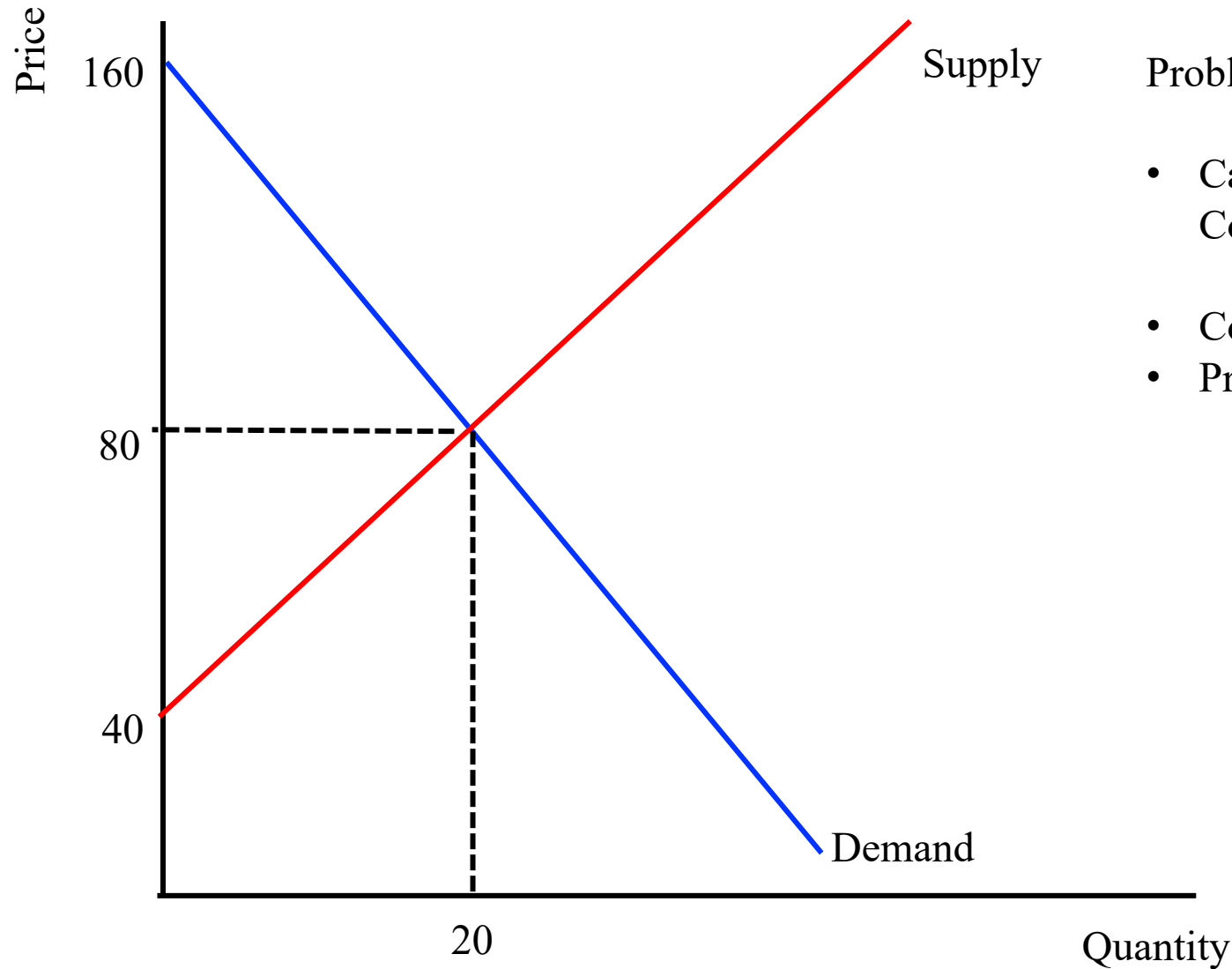
# Practice Problems



Problem 2

- Calculate Producer Surplus and Consumer Surplus

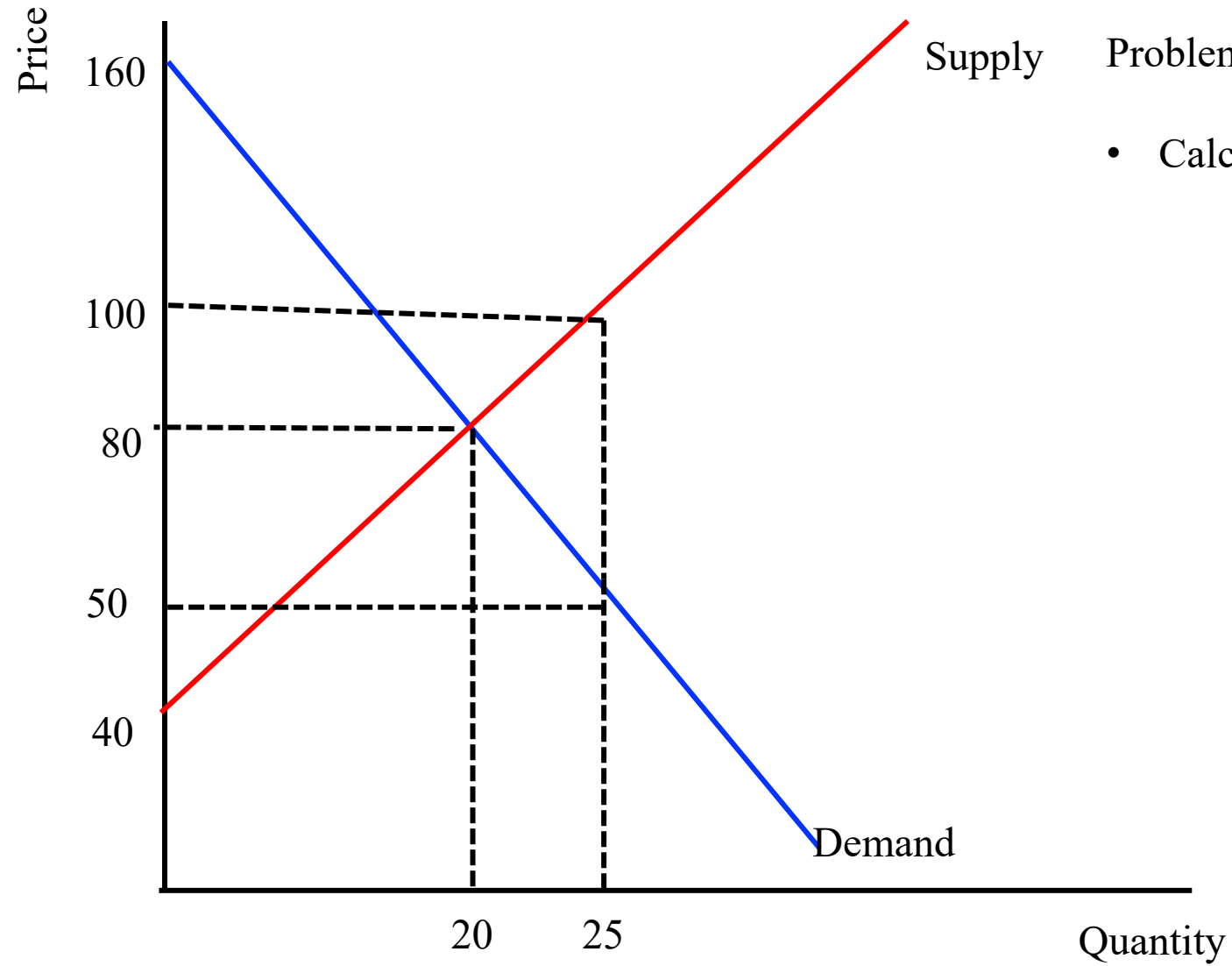
# Practice Problems



## Problem 2

- Calculate Producer Surplus and Consumer Surplus
- Consumer Surplus:  $0.5 * 80 * 20$
- Producer Surplus:  $0.5 * 40 * 20$

# Practice Problems



Supply

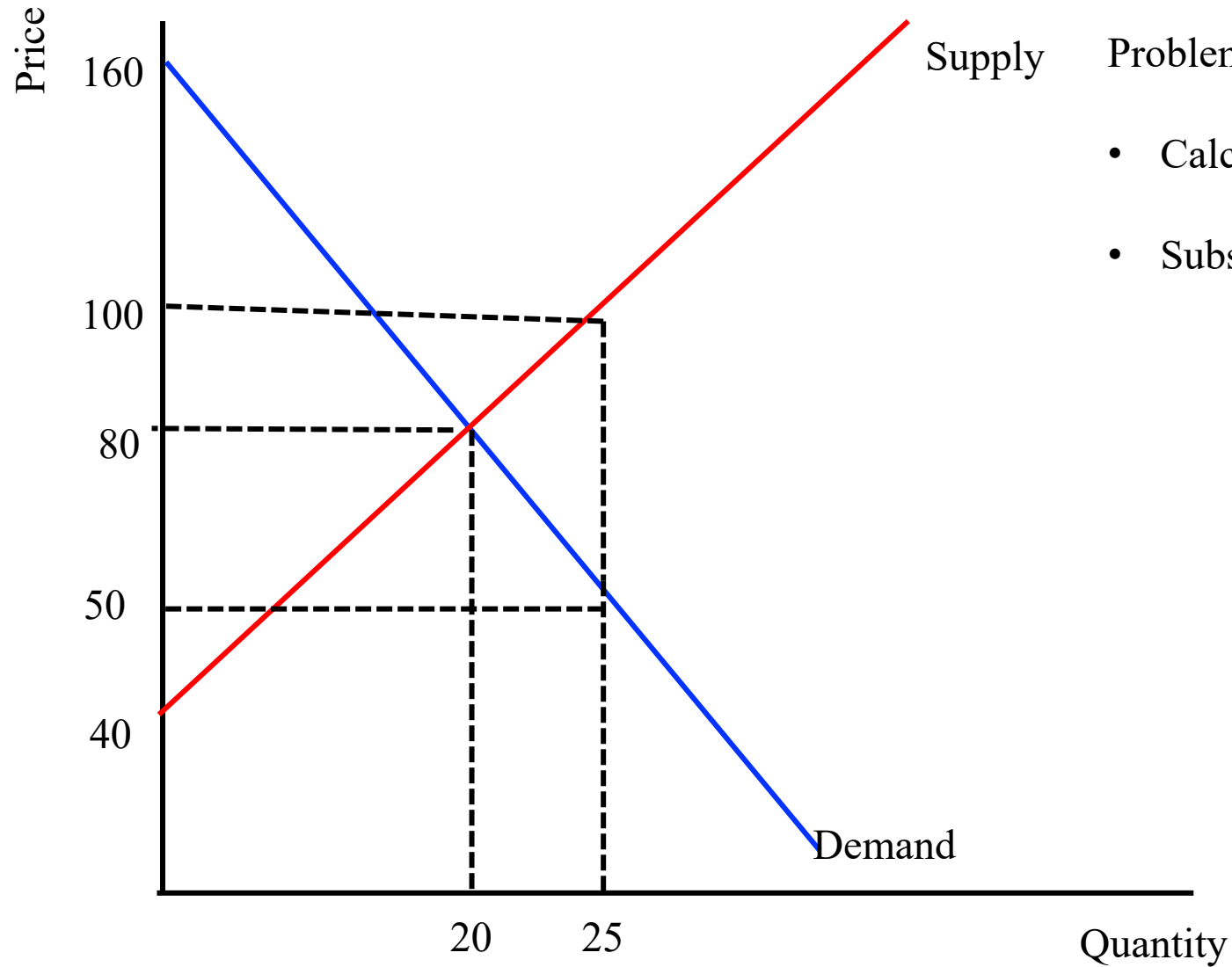
Problem 2

- Calculate Subsidy Value

Demand

Quantity

# Practice Problems



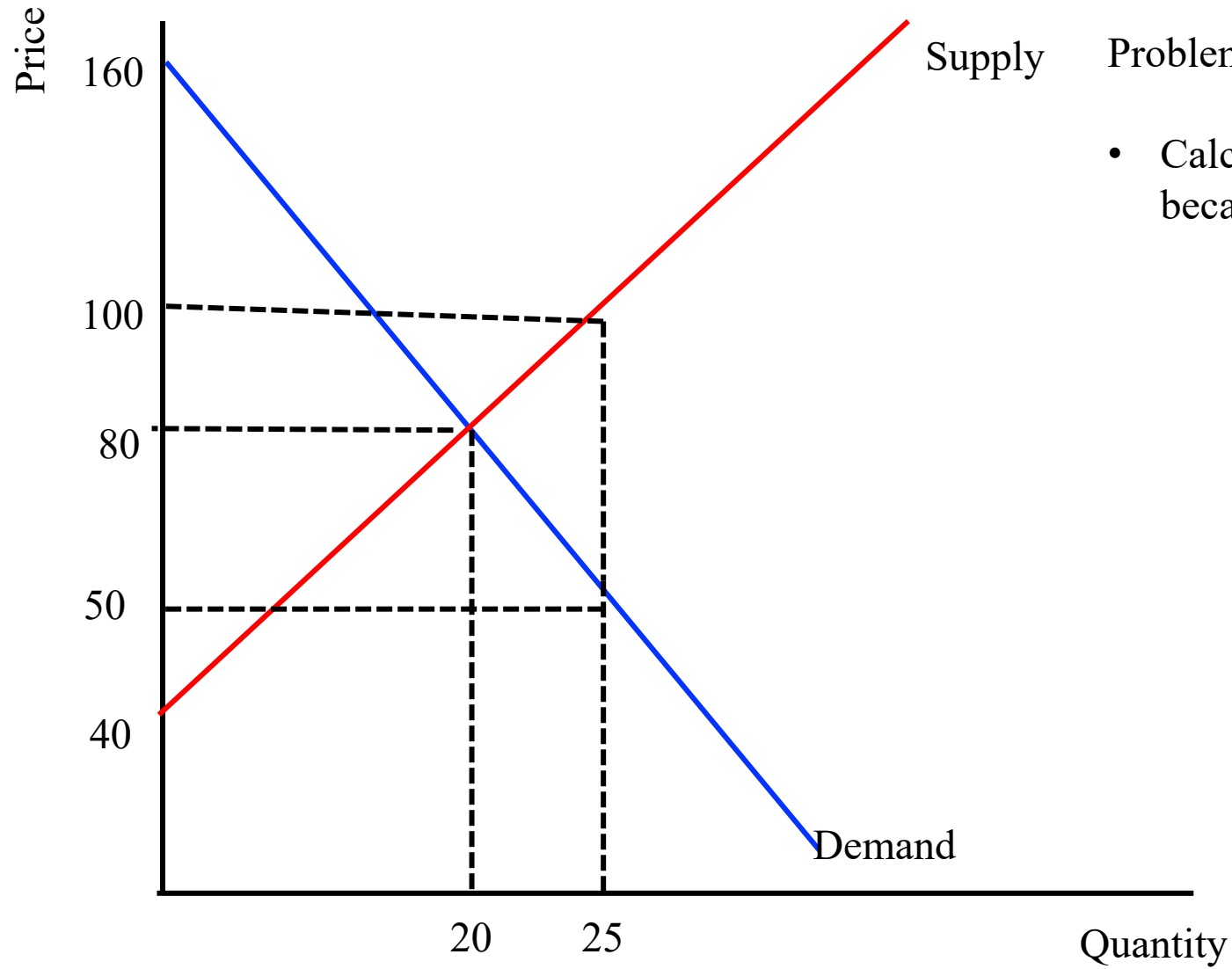
Supply

Problem 2

- Calculate Subsidy Value
- Subsidy Value:  $(100-50) * 25$

Demand

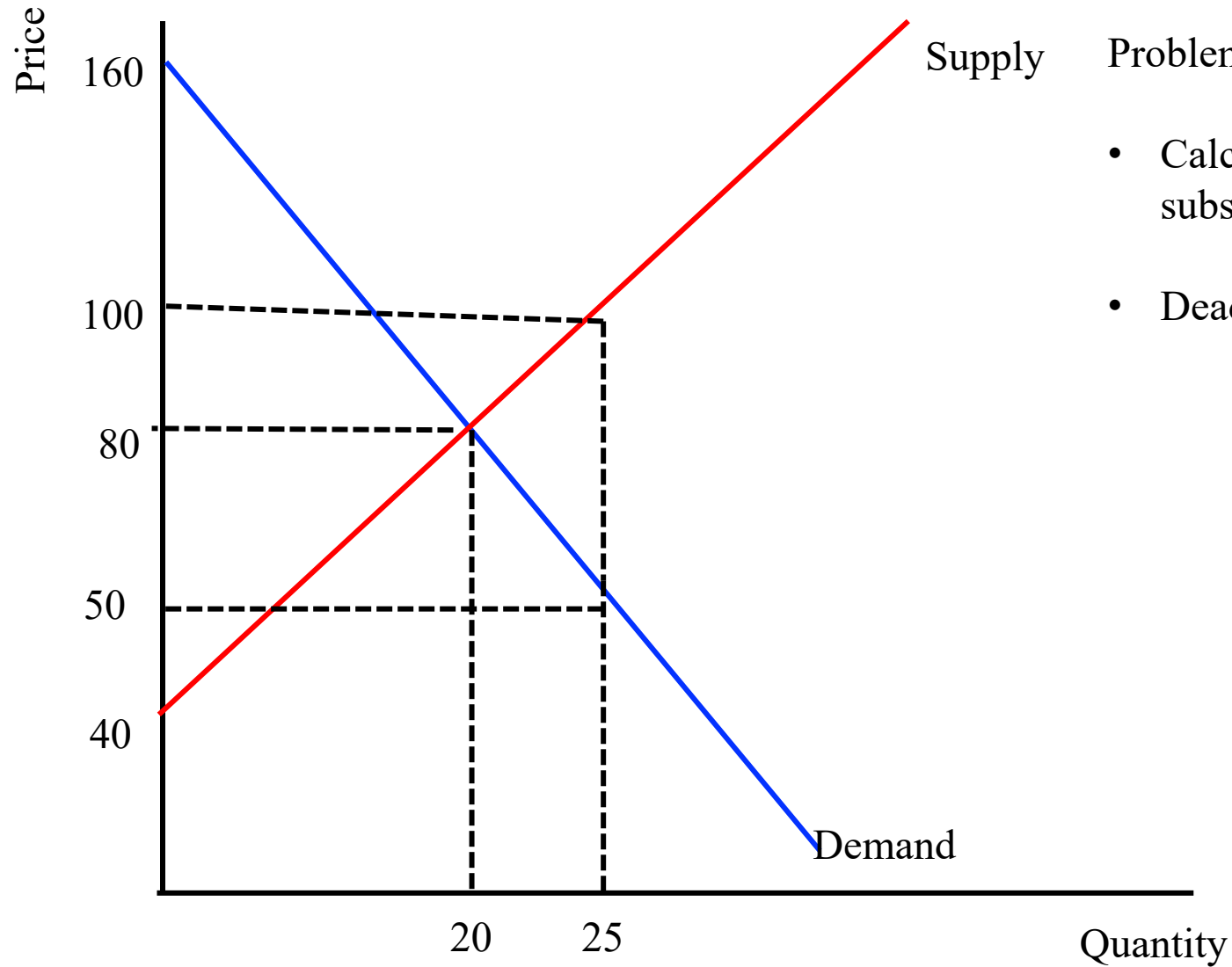
# Practice Problems



Problem 2

- Calculate Deadweight Loss because of subsidy

# Practice Problems



## Problem 2

- Calculate Deadweight Loss because of subsidy
- Deadweight Loss:  $0.5 * (100 - 50) * (25 - 20)$

Credits to @grebcomics and Cowen and Tabarrok (2014)