# Chapter 7:

# Consumers, Producers, and the Efficiency of Markets

This work is licensed by Joseph Tao-yi Wang for the use of NTU OCW ONLY. The copyright belongs to the above mentioned licensor(s).

# In This Chapter

- What is consumer surplus? How is it related to the demand curve?
- What is producer surplus? How is it related to the supply curve?
- Do markets produce a desirable allocation of resources? Or could the market outcome be improved upon?

# Welfare Economics

- Allocation of resources refers to:
  - How much of each good is produced
  - Which producers produce it
  - Which consumers consume it
- Welfare economics studies how the allocation of resources affects economic well-being
  - Conclusion: The equilibrium of supply and demand maximizes the total benefits received by all buyers and sellers combined.

# Consumer Surplus

- Willingness to pay, $\boldsymbol{WTP}$
  - Maximum amount the buyer will pay for that good
  - How much the buyer values the good
- Consumer surplus, $\boldsymbol{CS = WTP - P}$
  - Amount a buyer is willing to pay minus the amount the buyer actually pays
  - Benefits buyers receive from participating in a market.

# Exampkle 1A: Willingness to Pay

You work at the local store that sells refurbished iPads. The store is running a sale on the refurbished iPad mini 5.

Each of your roommates wants to buy an iPad mini 5. Their willingness to pay is given in the table below.

| Name | WTP |
|---|---|
| Alexis | $15,000 |
| Kelly | 10,500 |
| Quinn | 18,000 |
| Jamir | 7,500 |

Q: If the sale price is $12,000, who will buy an iPad, and what is the quantity demanded?

slido

If the sale price is $12,000, who will buy an iPad? (Could be more than one)

ⓘ Start presenting to display the poll results on this slide.

slido

If the sale price is $12,000, what is the quantity demanded?

ⓘ Start presenting to display the poll results on this slide.

# Exampkle 1A: Willingness to Pay

You work at the local store that sells refurbished iPads. The store is running a sale on the refurbished iPad mini 5.

Each of your roommates wants to buy an iPad mini 5. Their willingness to pay is given in the table below.

| Name | WTP |
|---|---|
| Alexis | \$15,000 |
| Kelly | 10,500 |
| Quinn | 18,000 |
| Jamir | 7,500 |

Q: If the sale price is \$12,000, who will buy an iPad, and what is the quantity demanded?

A: Alexis & Quinn will buy an iPad mini. Kelly & Jamir will not.

- Hence, $Q^d = 2$ when $P =$ \$12,000

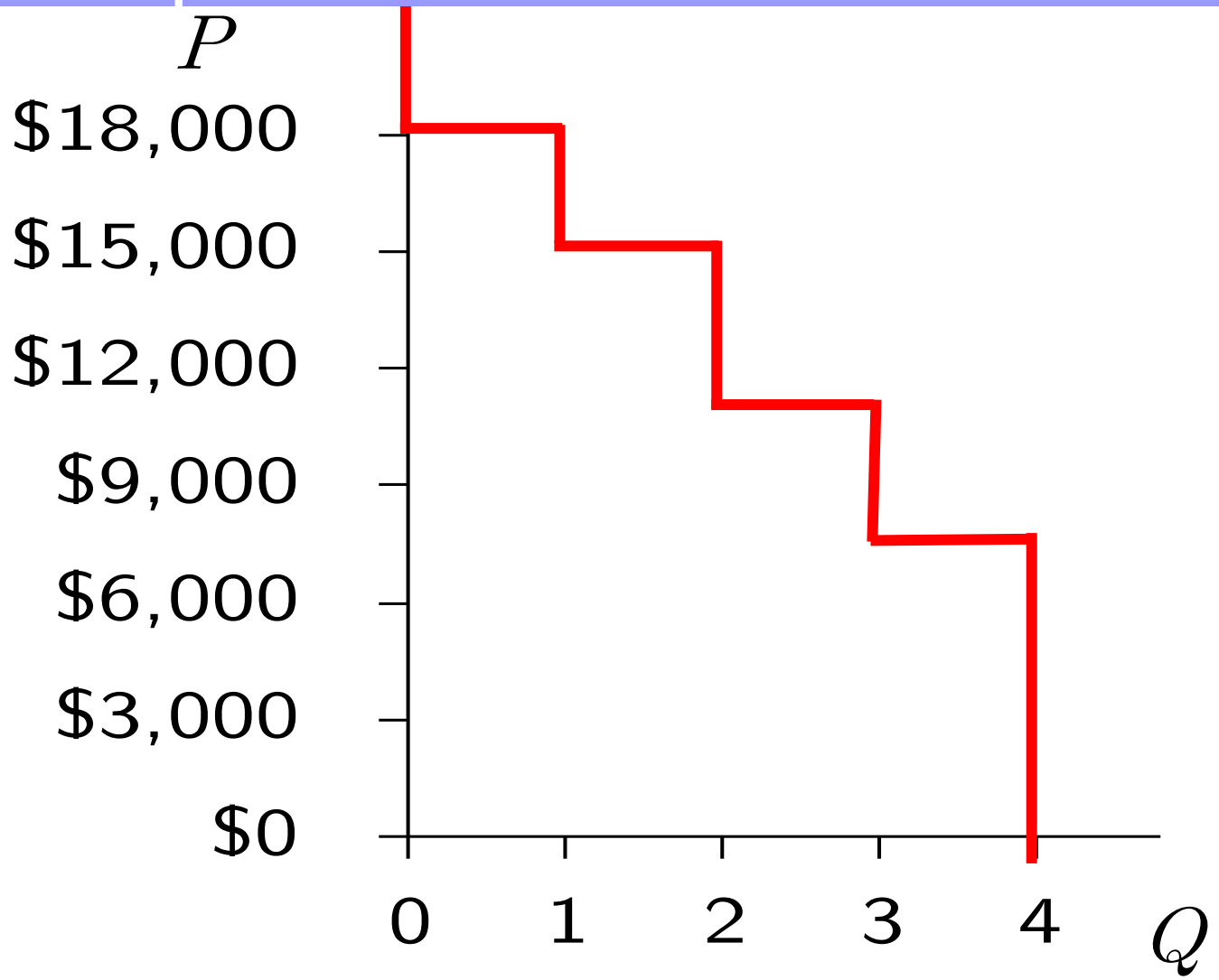
# Example 1B: WTP and the Demand Curve

Derive the demand schedule:

| Name | WTP |
|---|---|
| Alexis | $15,000 |
| Kelly | 10,500 |
| Quinn | 18,000 |
| Jamir | 7,500 |

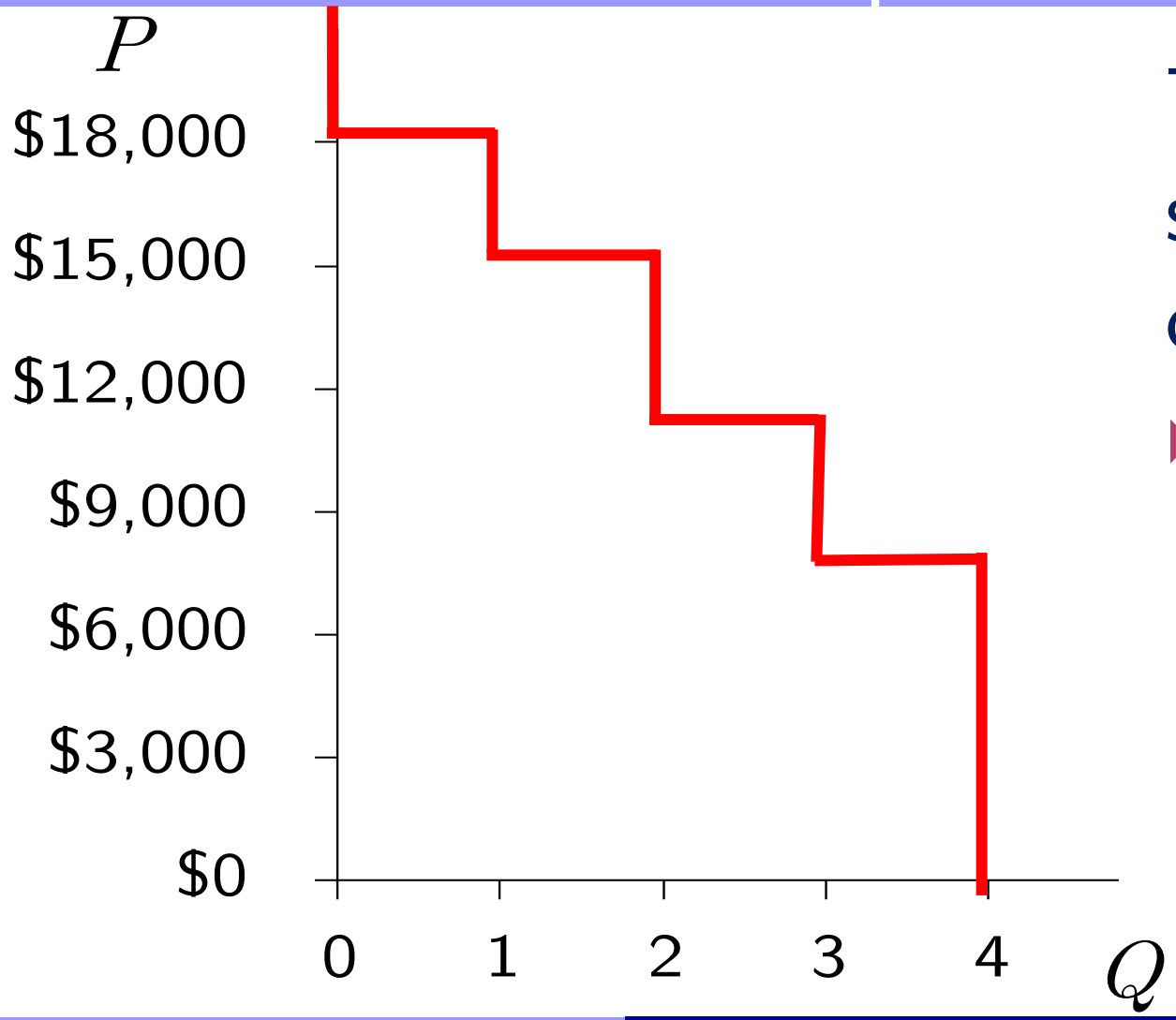
| P (price of iPad mini) | who buys | $Q^d$ |
|---|---|---|
| $18,001 & up | nobody | 0 |
| 15,001 – 18,000 | Quinn | 1 |
| 10,501 – 15,000 | Alexis, Quinn | 2 |
| 7,501 – 10,500 | Kelly, Alexis, Quinn | 3 |
| 0 – 7,500 | Jamir, Kelly, Alexis, Quinn | 4 |

# Example 1C: The Demand Curve




| P | | $Q^d$ |
|---|---|---|
| $18,001 & up | | 0 |
| 15,001 | 18,000 | 1 |
| 10,501 | 15,000 | 2 |
| 7,501 | 10,500 | 3 |
| 0 | 7,500 | 4 |

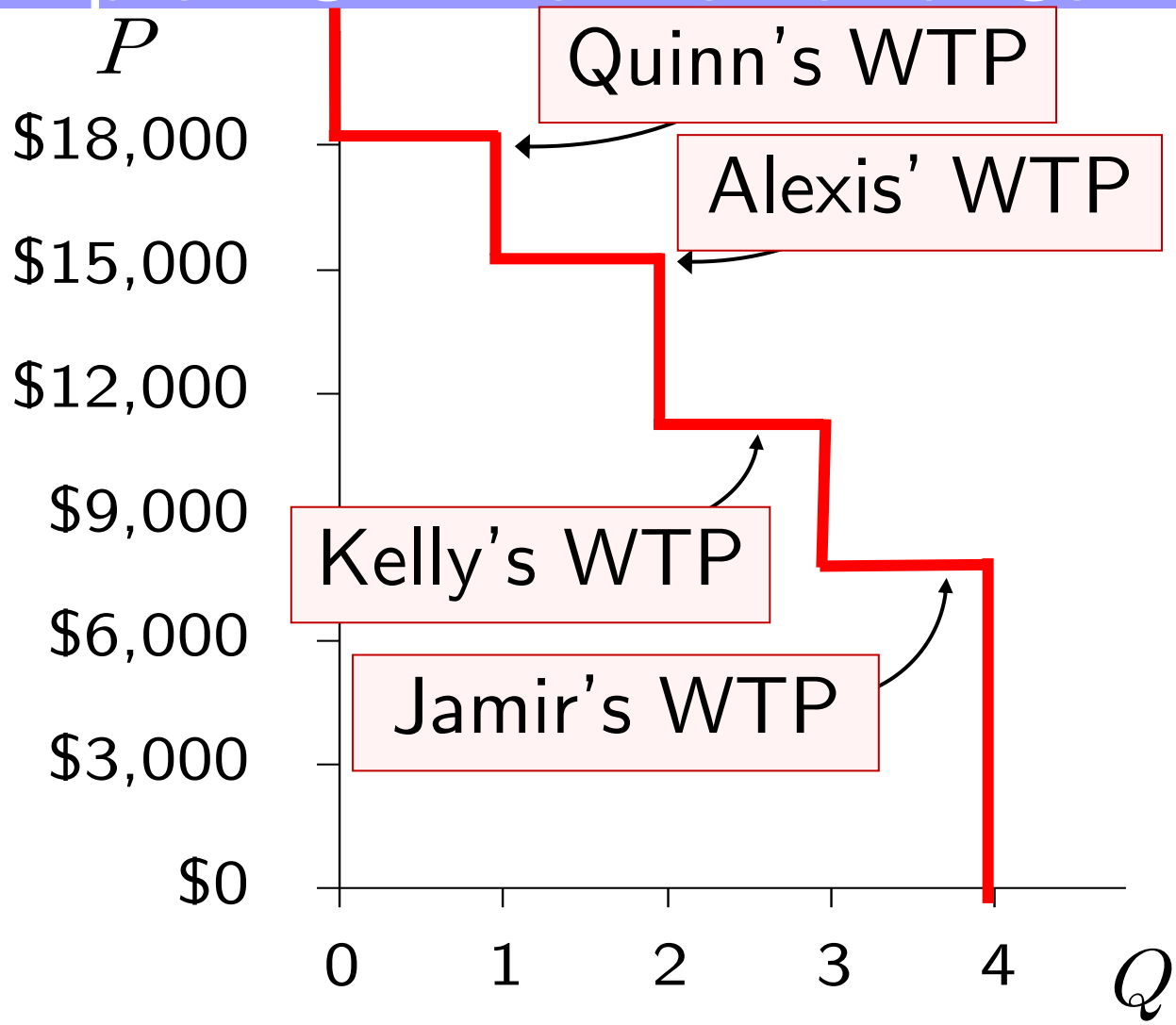
# About the Staircase Shape...




This ***D*** curve looks like a staircase with 4 steps – one per buyer.

- If there were a huge # of buyers, as in a competitive market, there would be a huge # of very tiny steps, and it would look more like a smooth curve.

# Example 1C: The Demand Curve




At any ***Q***, the height of the ***D*** curve is the WTP of the ***marginal buyer***, the buyer who would leave the market if ***P*** were any higher.

# Example 1D: Calculating Consumer Surplus

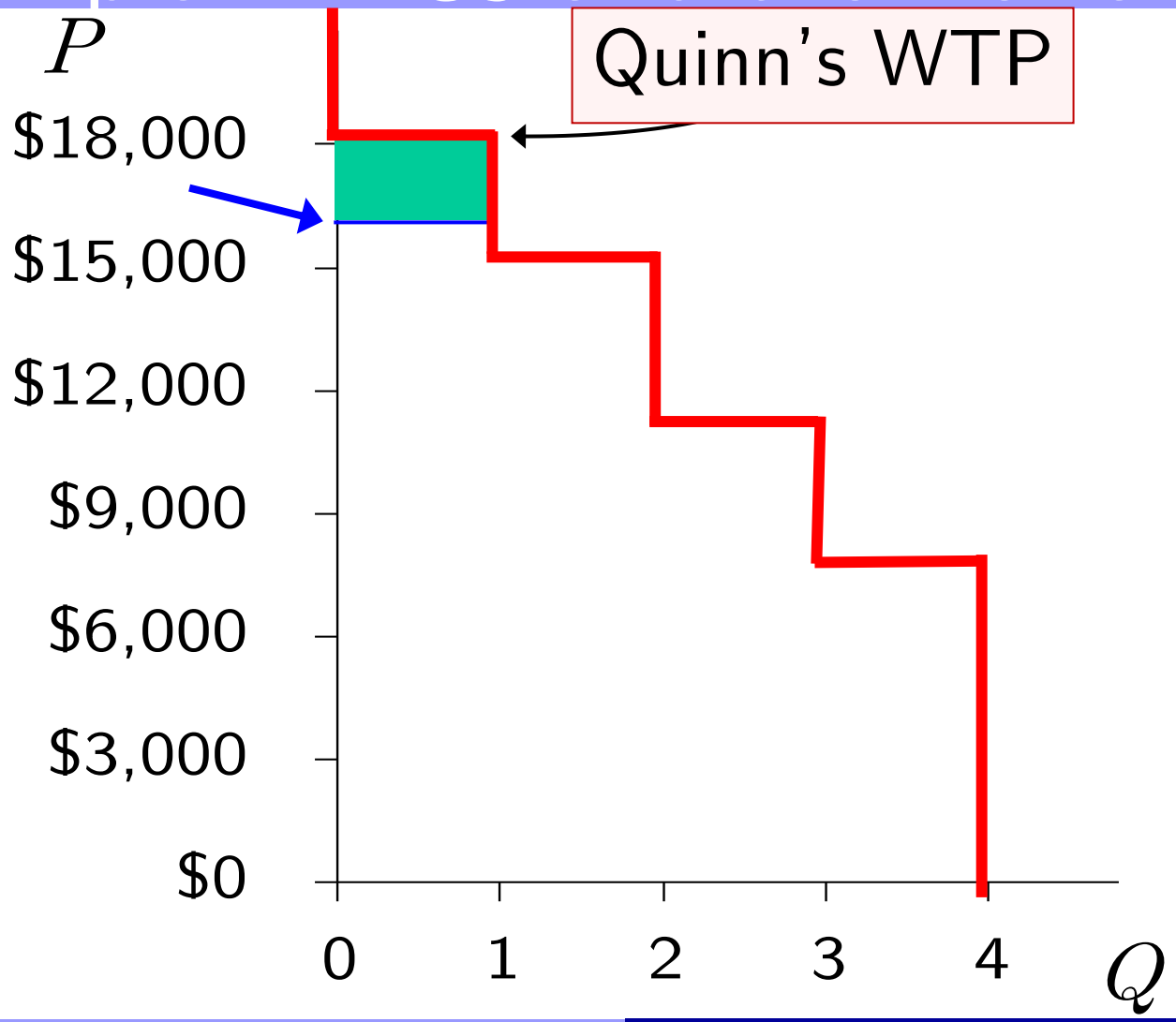
$$CS = WTP - P$$

| Name | WTP |
|---|---|
| Alexis | \$15,000 |
| Kelly | 10,500 |
| Quinn | 18,000 |
| Jamir | 7,500 |

Suppose $P = \$15{,}600$.

- Quinn's $CS =$
  - $\$18{,}000 - 15{,}600 = \$2{,}400$.
- The others get no $CS$ because they do not buy an iPad mini at this price.
- Total $CS = \$2{,}400$.

# Example 1E: CS and the Demand Curve

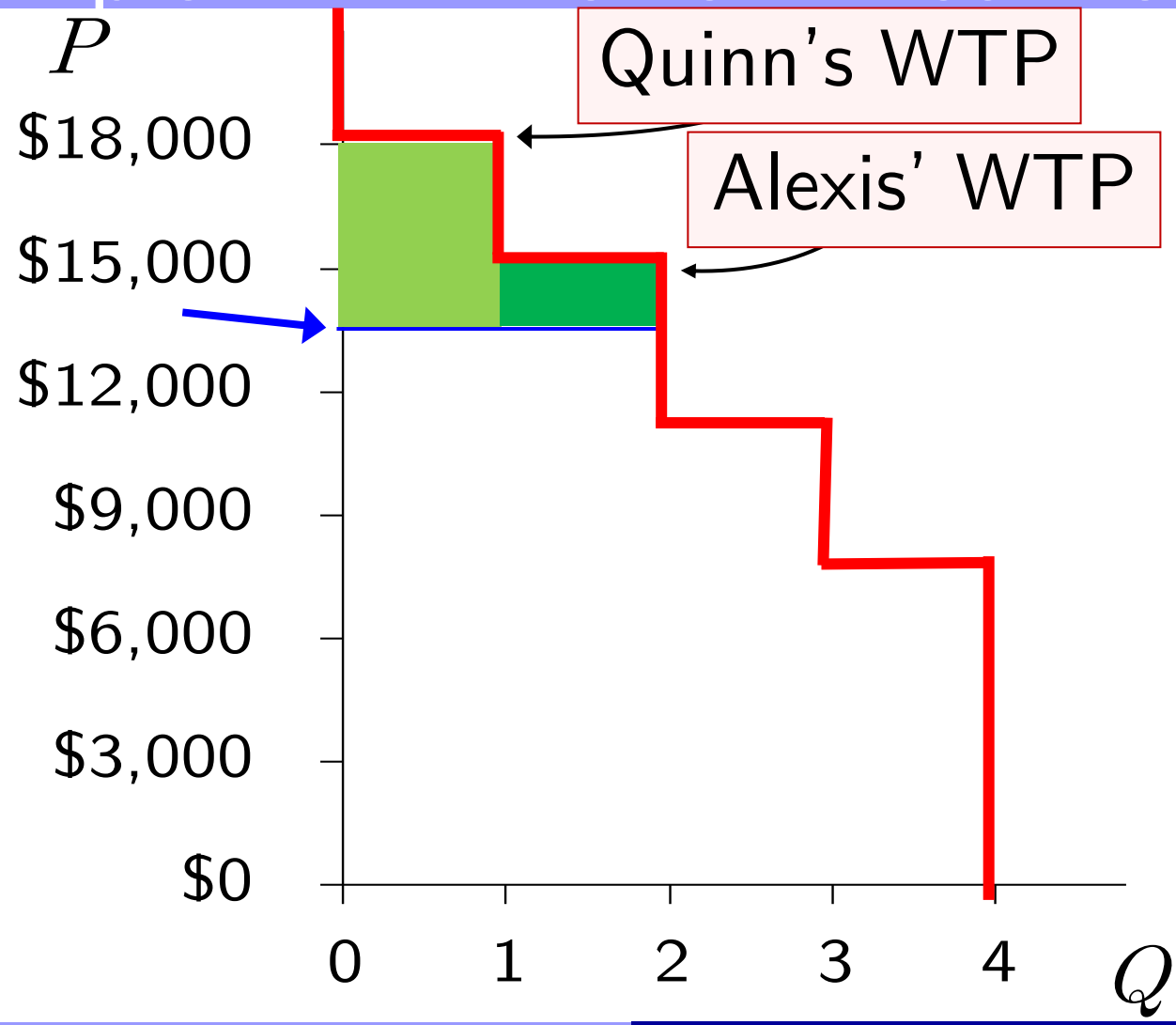



P = $15,600

Quinn's CS = $18,000 − 15,600 = $2,400

Total CS = $2,400

# Example 1E: A Lower Price Increases CS




Suppose P = $13,200

Quinn's CS = $18,000 – 13,200 = $4,800

Alexis' CS = $15,000 – 13,200 = $1,800

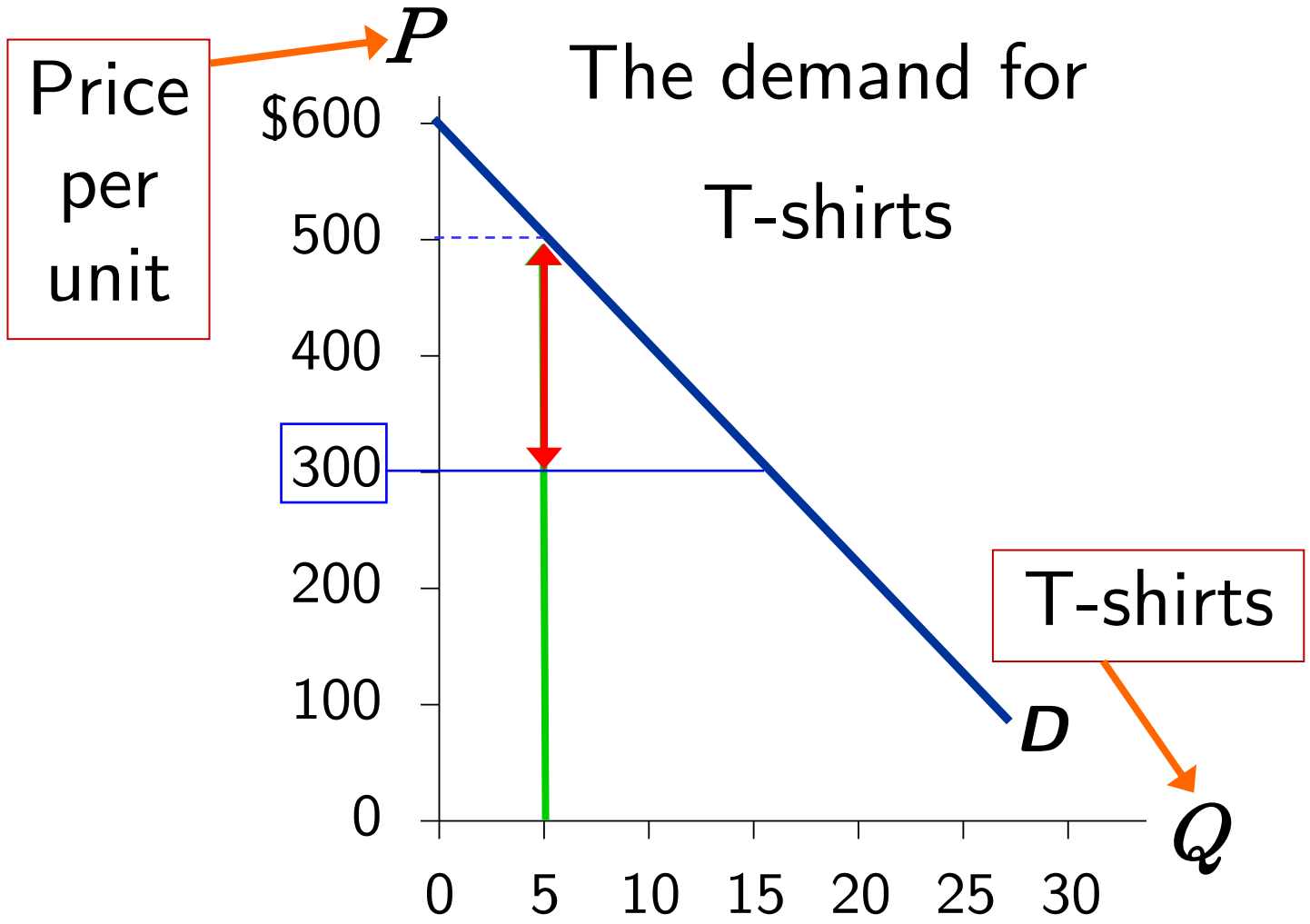
Total CS = $6,600

# Consumer Surplus

## Total Consumer Surplus

- The sum of the consumer surplus of all buyers in the market
- The area below the demand curve and above the price
  - The height of the demand curve
    = the value buyers place on the good (***WTP***)
  - Each buyer's $\boldsymbol{CS = WTP - P}$

# Example 2: Consumer Surplus for One Buyer

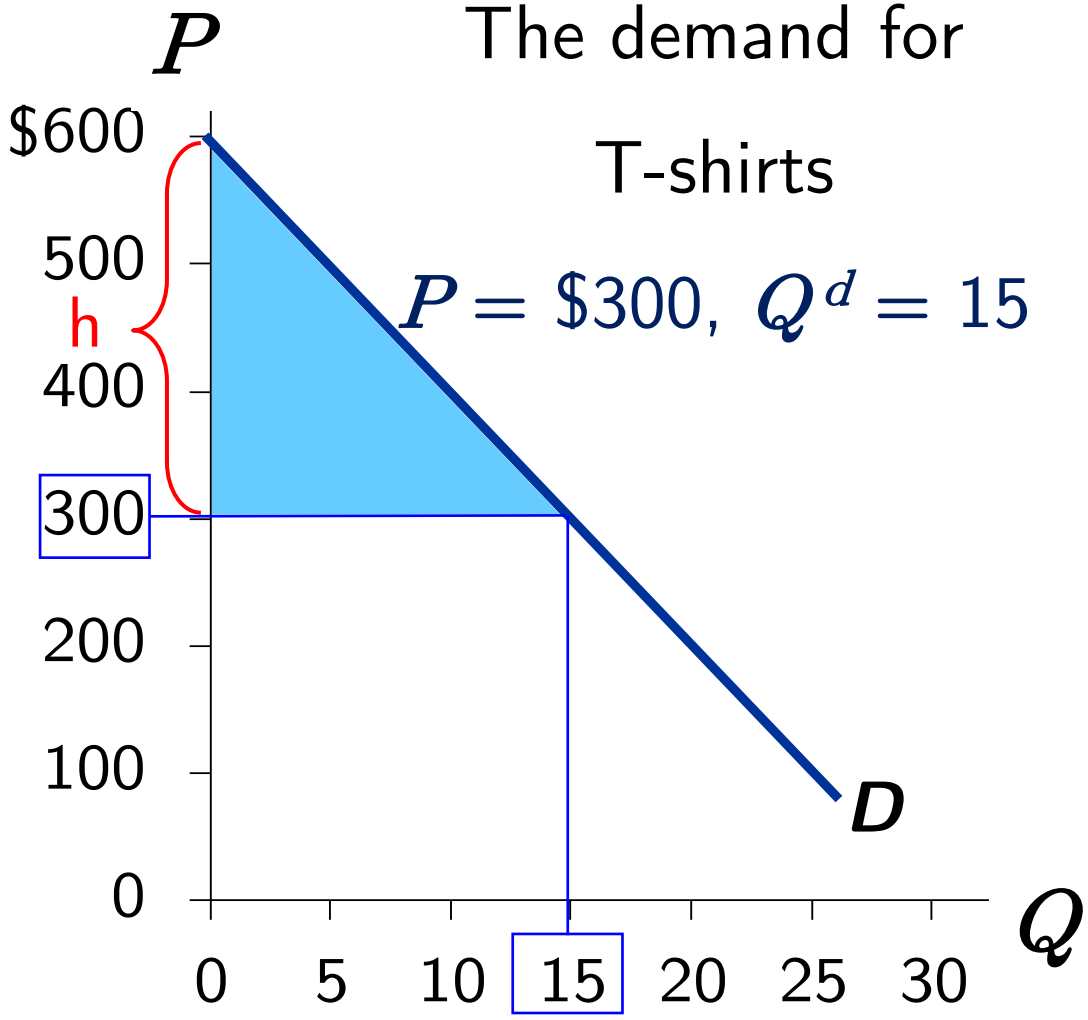



At $Q = 5$, the marginal buyer is willing to pay \$500 for a T-shirt.

Suppose $P = \$300$.

Then his consumer surplus = \$200.

# Example 2A: Total Consumer Surplus




***CS*** is the area between ***P*** and the ***D*** curve, from 0 to ***Q***.

Recall: area of a triangle equals ½ x base x height

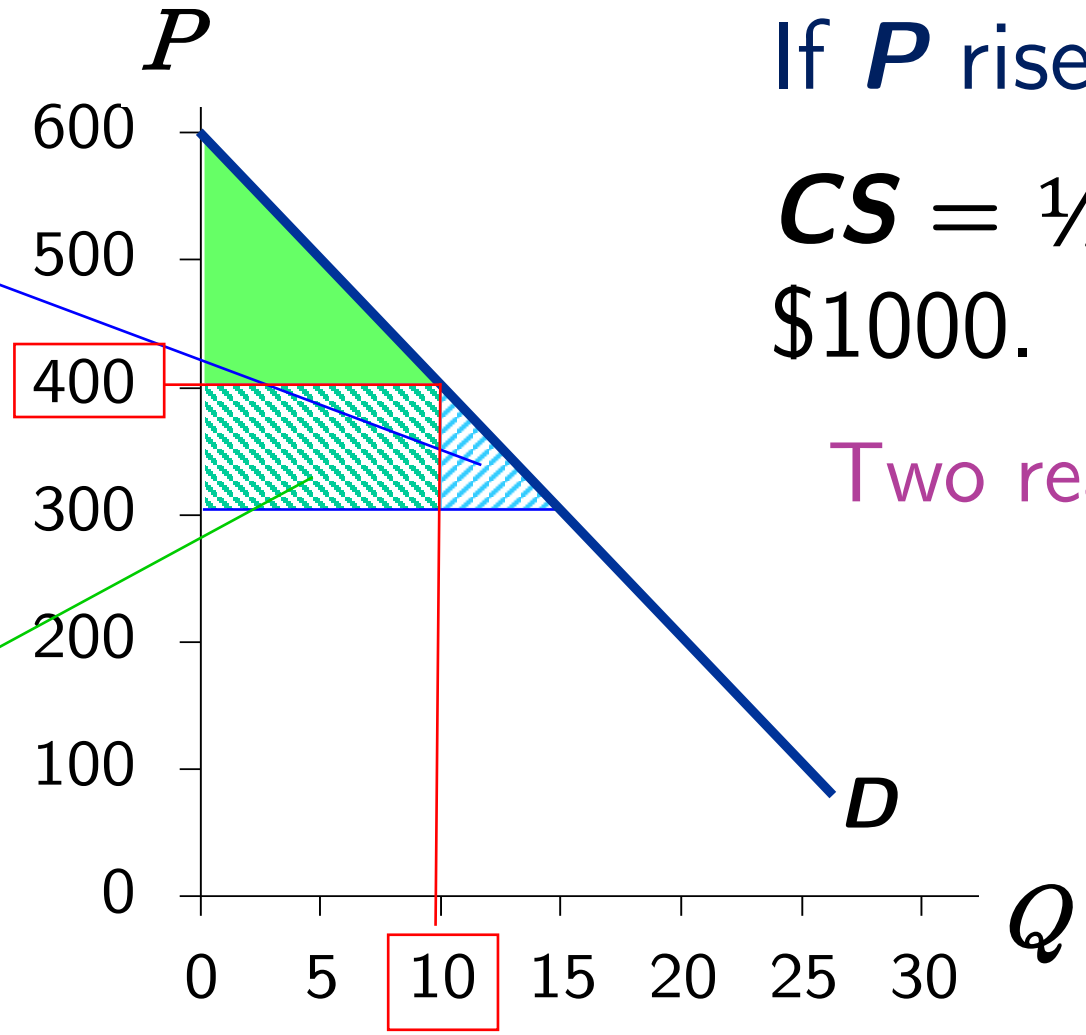
Height =$600 – 300 = $300.

So, ***CS*** = ½ x 15 x $300 = $2250.

# Example 2B: A Higher Price Reduces CS

1. Fall in CS due to buyers leaving the market

2. Fall in CS due to remaining buyers paying the higher P




If ***P*** rises to \$400,

***CS*** = ½ x 10 x \$200= \$1000.

Two reasons for the fall in ***CS***.

# Active Learning 1: Consumer Surplus

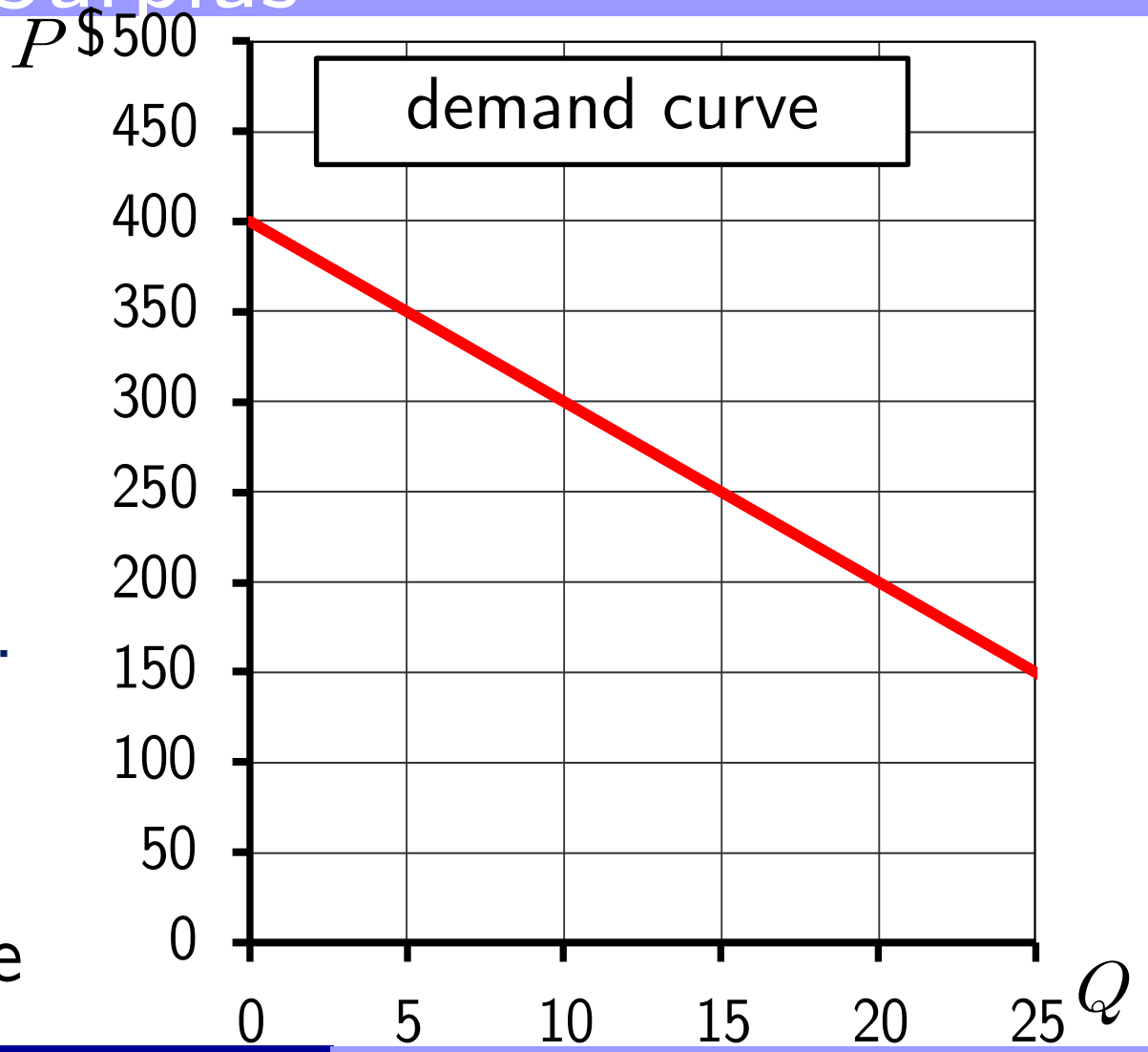
A. Find marginal buyer's WTP at Q = 10.

B. Find total CS for P = \$300

Suppose P falls to \$200.
How much will CS increase due to...

C. buyers entering the market

D. existing buyers paying lower price



slido

Find marginal buyer's WTP at $Q = 10$.

ⓘ Start presenting to display the poll results on this slide.

slido

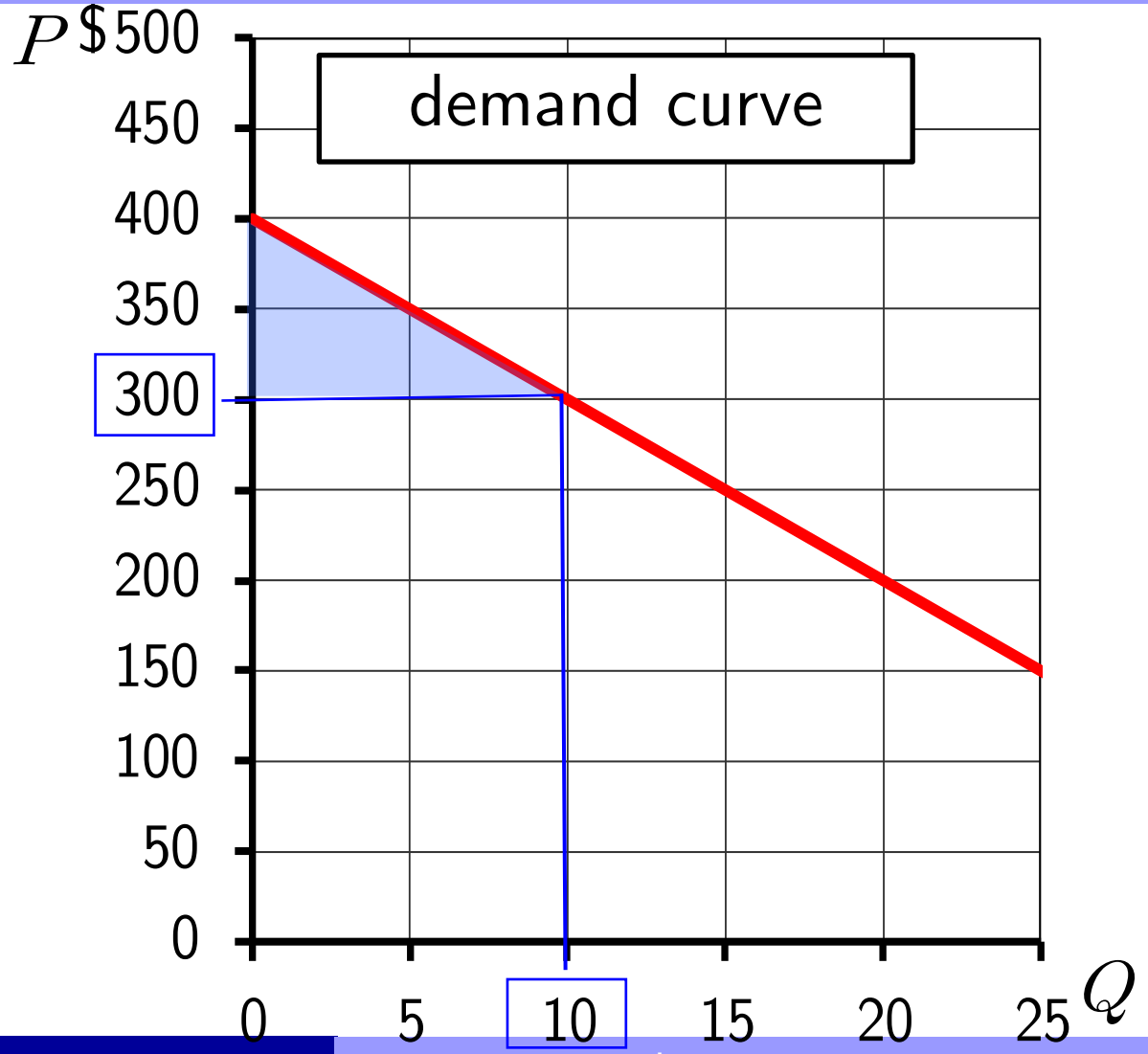
Find total CS for P = $300.

ⓘ Start presenting to display the poll results on this slide.

# Active Learning 1: Answers

A. At Q = 10, marginal buyer's WTP is \$300.

B. CS = ½ x 10 x \$100 = \$500



slido

Suppose P falls to $200.
How much will CS increase due to buyers entering the market?

ⓘ Start presenting to display the poll results on this slide.

slido

Suppose P falls to $200.
How much will CS increase due to existing buyers paying lower price?

ⓘ Start presenting to display the poll results on this slide.

# Active Learning 1: Answers

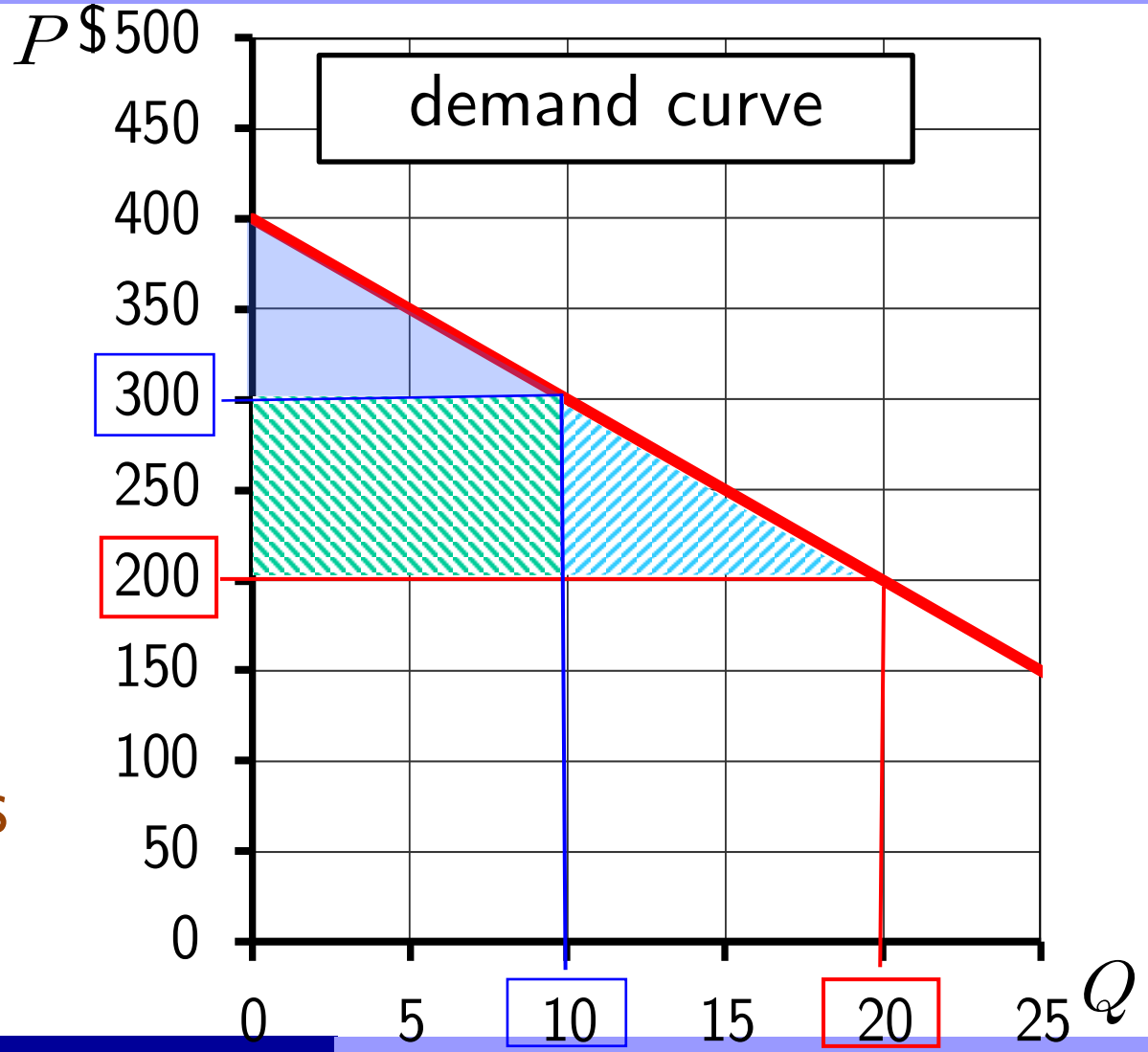
A. At Q = 10, marginal buyer's WTP is $300.

B. CS = ½ x 10 x $100 = $500

P falls to $200.

C. CS for the additional buyers = ½ x 10 x $100 = $500

D. Increase in CS on initial 10 units = 10 x $100 = $1,000



slido

# Audience Q&A Session

ⓘ Start presenting to display the audience questions on this slide.

# Producer Surplus

- Cost: Value of everything a seller must give up to produce a good
  - Including opportunity cost
- Willingness to Sell, ***WTS***
- The lowest price accepted by a seller for one unit of a good or service
  - The cost is a measure of willingness to sell: produce and sell the good/service only if the price $>$ cost

# Producer Surplus

- Producer Surplus, $PS = P$ - cost
- Amount a seller is paid for a good minus the seller's cost of providing it
  - Price received minus willingness to sell
- Measures the benefit sellers receive from participating in a market

# Example 3A: Cost and Willingness to Sell

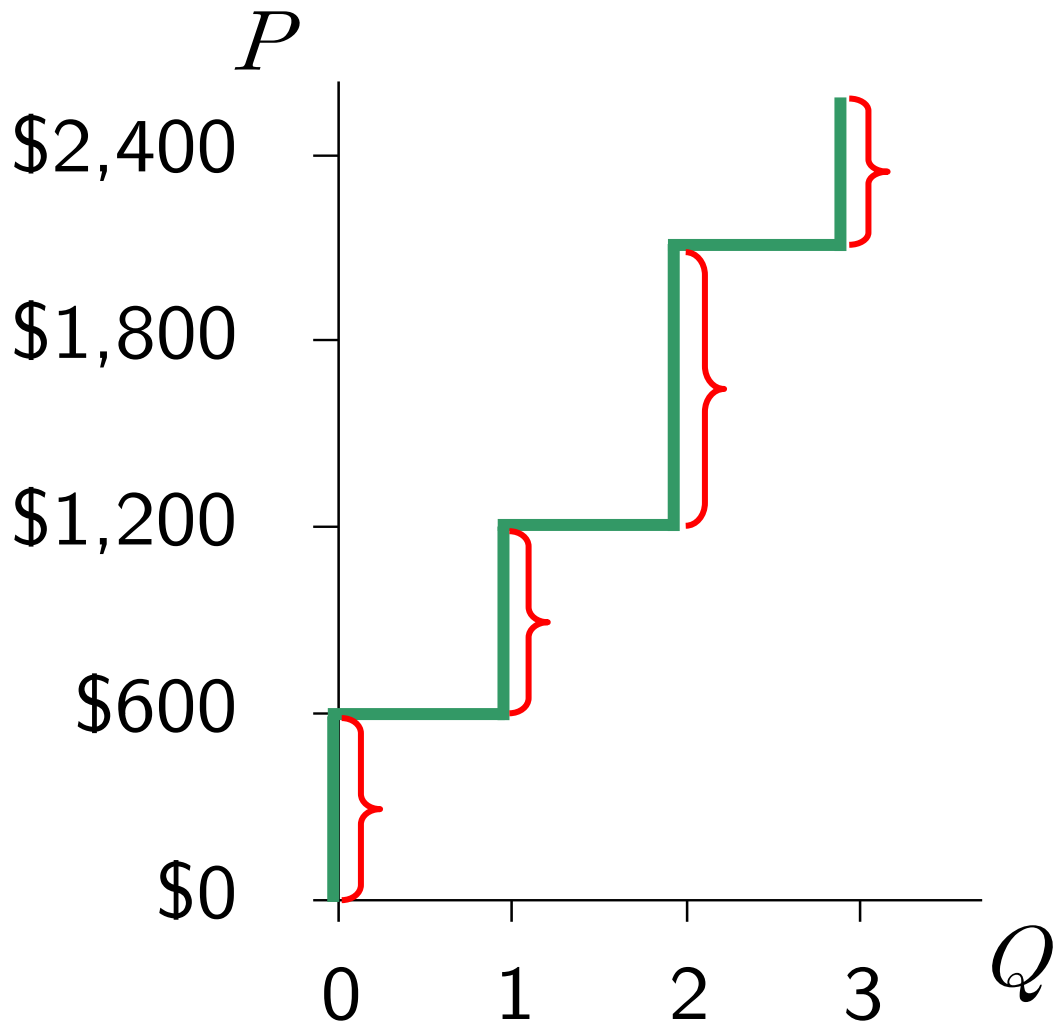
You are the lucky owner of 3 properties with identical lawns that need mowing. There are 3 lawn-mowing business in town that you can hire. The table below shows their willingness to sell:

| Name | cost |
|---|---|
| Chiang | \$600 |
| Chuck | 1,200 |
| Rosy | 2,100 |

Q: Derive the supply schedule from the cost data.

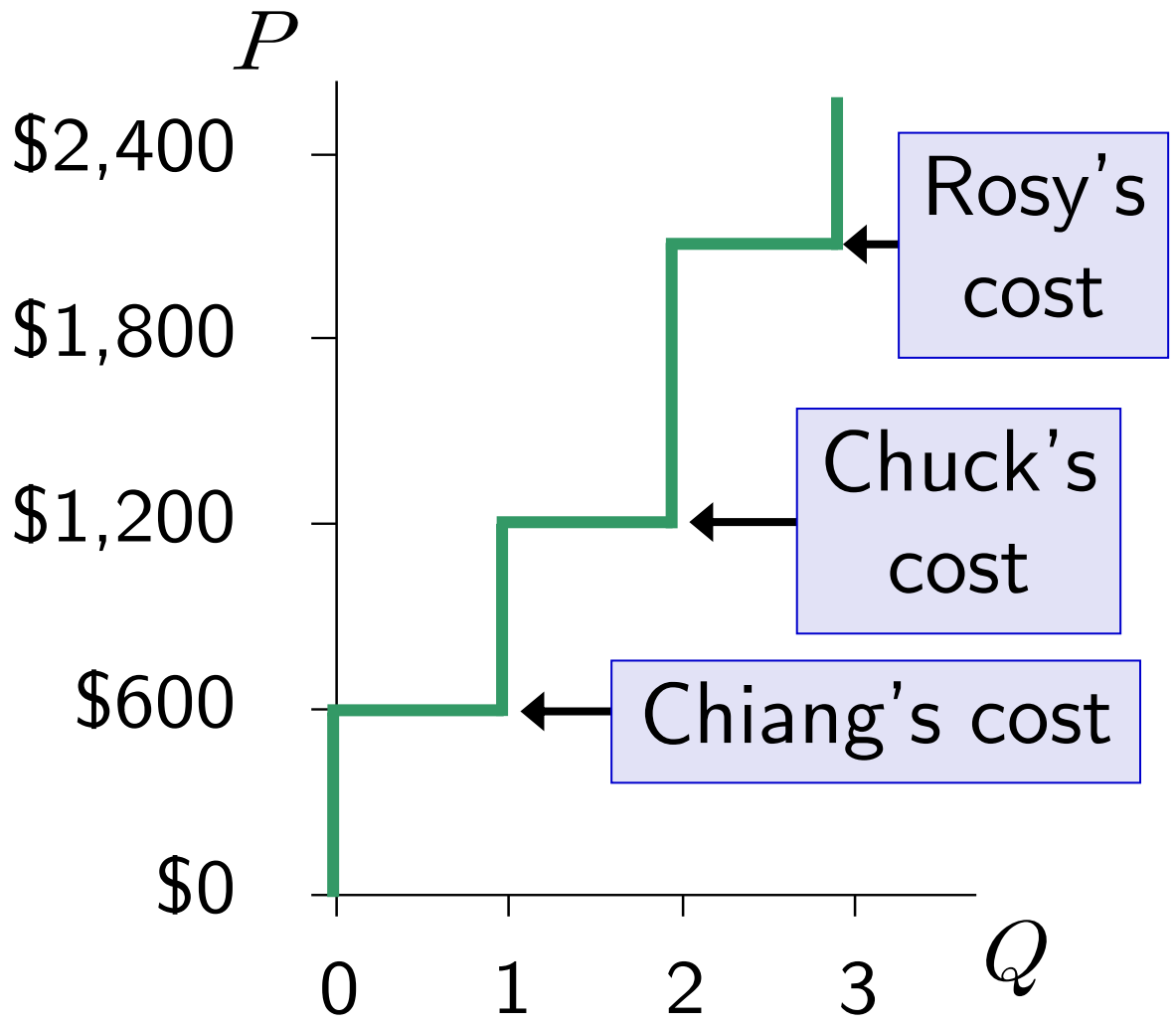
| $P$ | $Q^s$ |
|---|---|
| \$0 – 599 | 0 |
| 600 – 1,199 | 1 |
| 1,200 – 2,099 | 2 |
| 2,100 & up | 3 |

# Example 3B: The Supply Curve



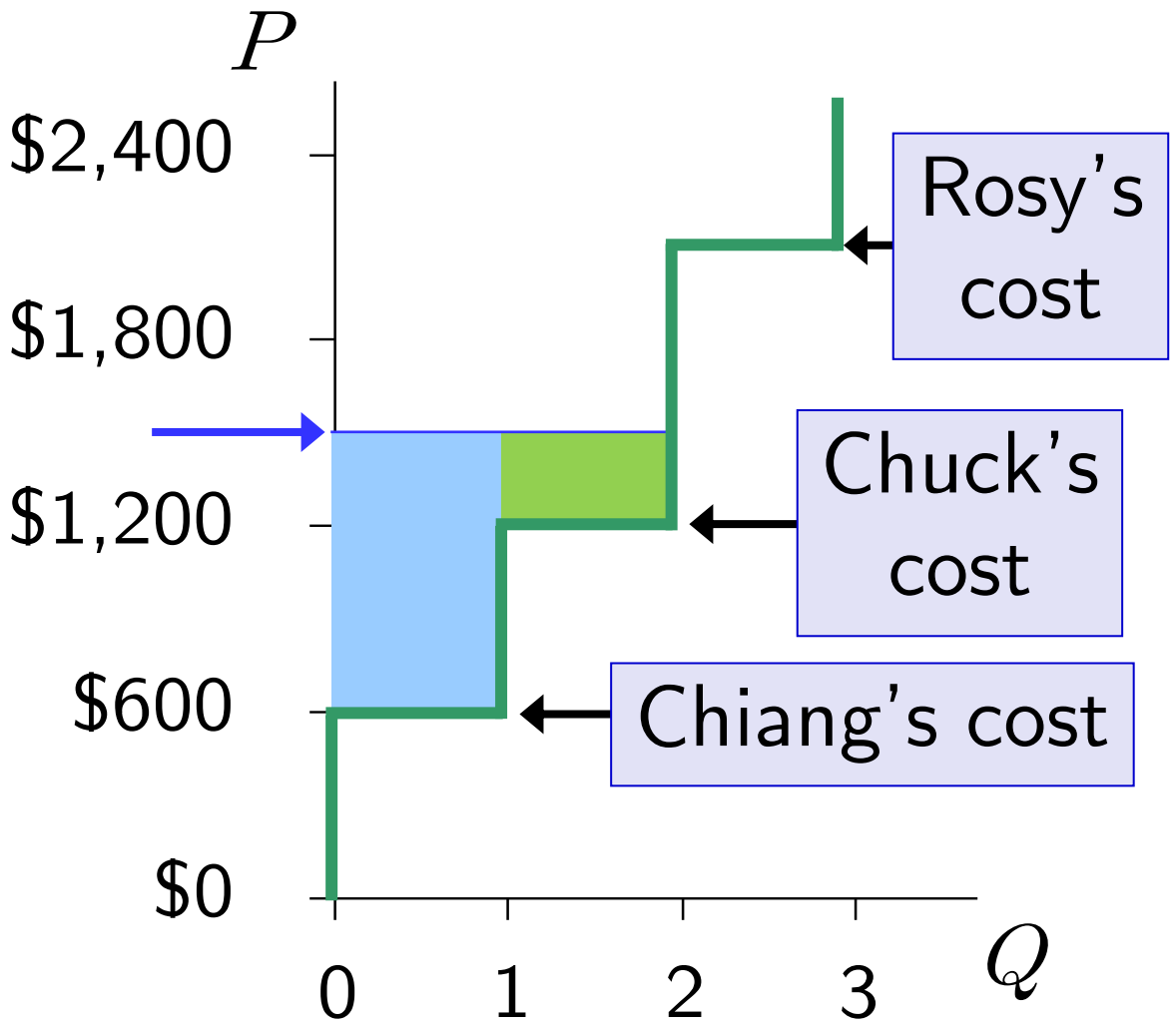

| $P$ | $Q^s$ |
|---|---|
| \$0 – 599 | 0 |
| 600 – 1,199 | 1 |
| 1,200 – 2,099 | 2 |
| 2,100 & up | 3 |

# Example 3B: The Supply Curve




At each Q, the height of the S curve is the cost of the marginal seller, the seller who would leave the market if the price were any lower.

# Example 3C: Producer Surplus & the S curve




PS = P – cost

Suppose P = \$1,500.

Chiang: 1,500 – 600 = \$900

Chuck: 1,500 – 1,200 = \$300

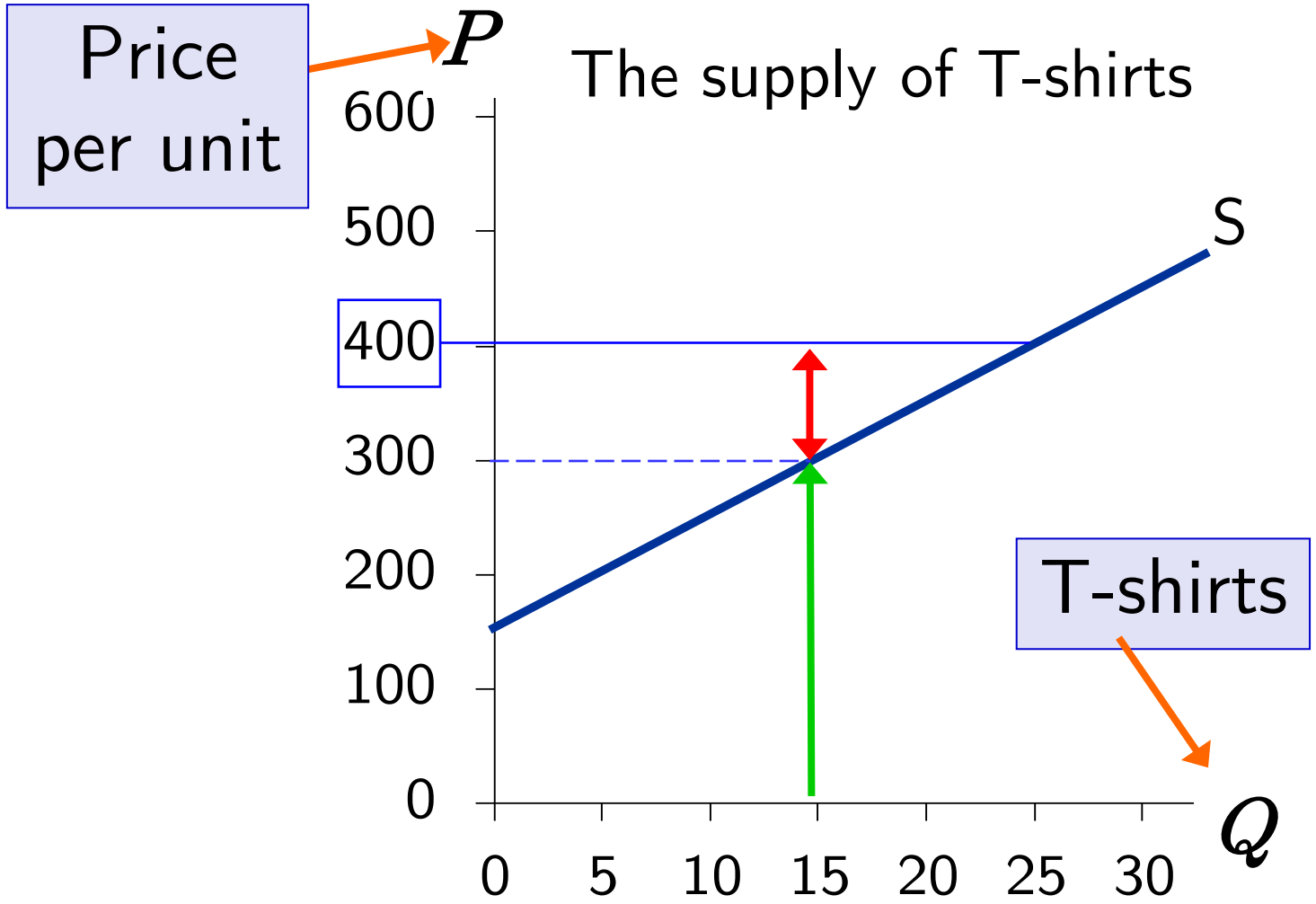
Rosy: \$0

Total PS = \$1,200

# Producer Surplus

- Total Producer Surplus
- The sum of the producer surplus of all sellers in the market
- The area below the price and above the supply curve
  - The height of the supply curve measures sellers' costs
  - Each seller's $\boldsymbol{PS} = \boldsymbol{P}$ – cost

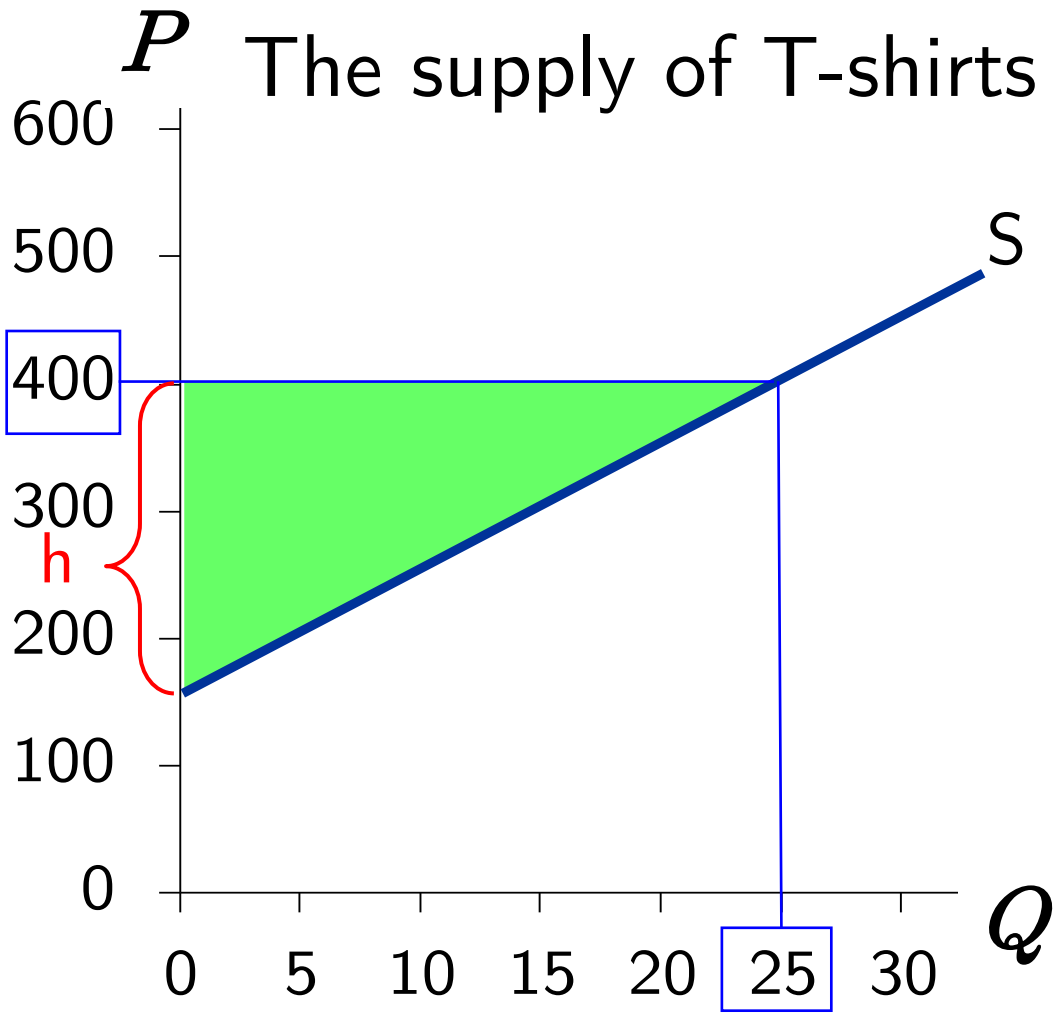
# Example 4A: Producer Surplus for One Sellers




Suppose $P = \$400$.

At $Q = 15$, the marginal seller's cost is \$300, and her producer surplus is \$100.

# Example 4B: Total Producer Surplus



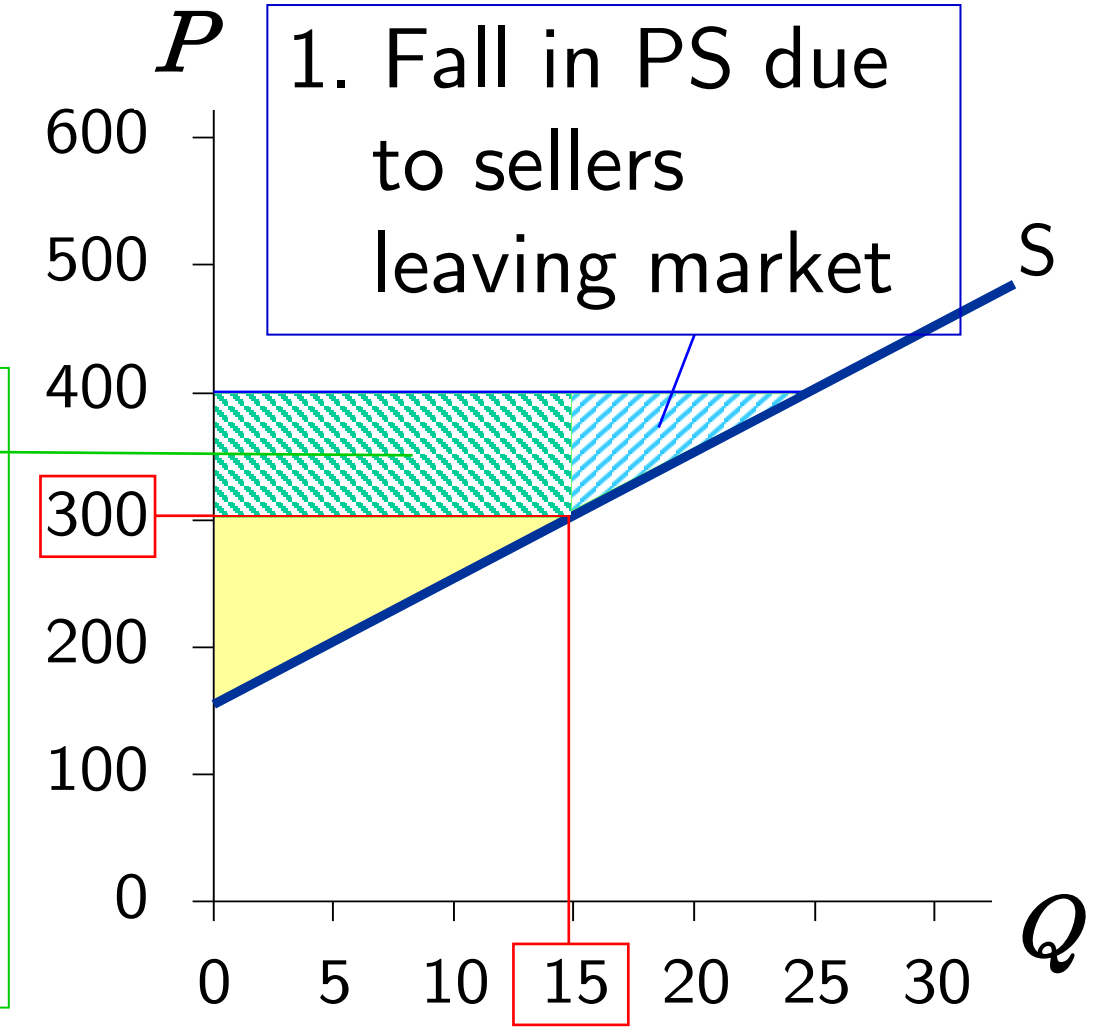

***PS*** is the area between ***P*** and the ***S*** curve, from 0 to ***Q***.

The height of this triangle is \$400 – 150 = \$250.

So,

$$\boldsymbol{PS} = \tfrac{1}{2} \times b \times h$$
$$= \tfrac{1}{2} \times 25 \times \$250$$
$$= \underline{\$3125}$$

# Example 4C: A Lower Price Reduces PS




If $P$ falls to \$300,

$$PS = \frac{1}{2} \times 15 \times \$150 = \underline{\$1125}$$

Two reasons for the fall in ***PS***.

# Active Learning 2: Producer Surplus

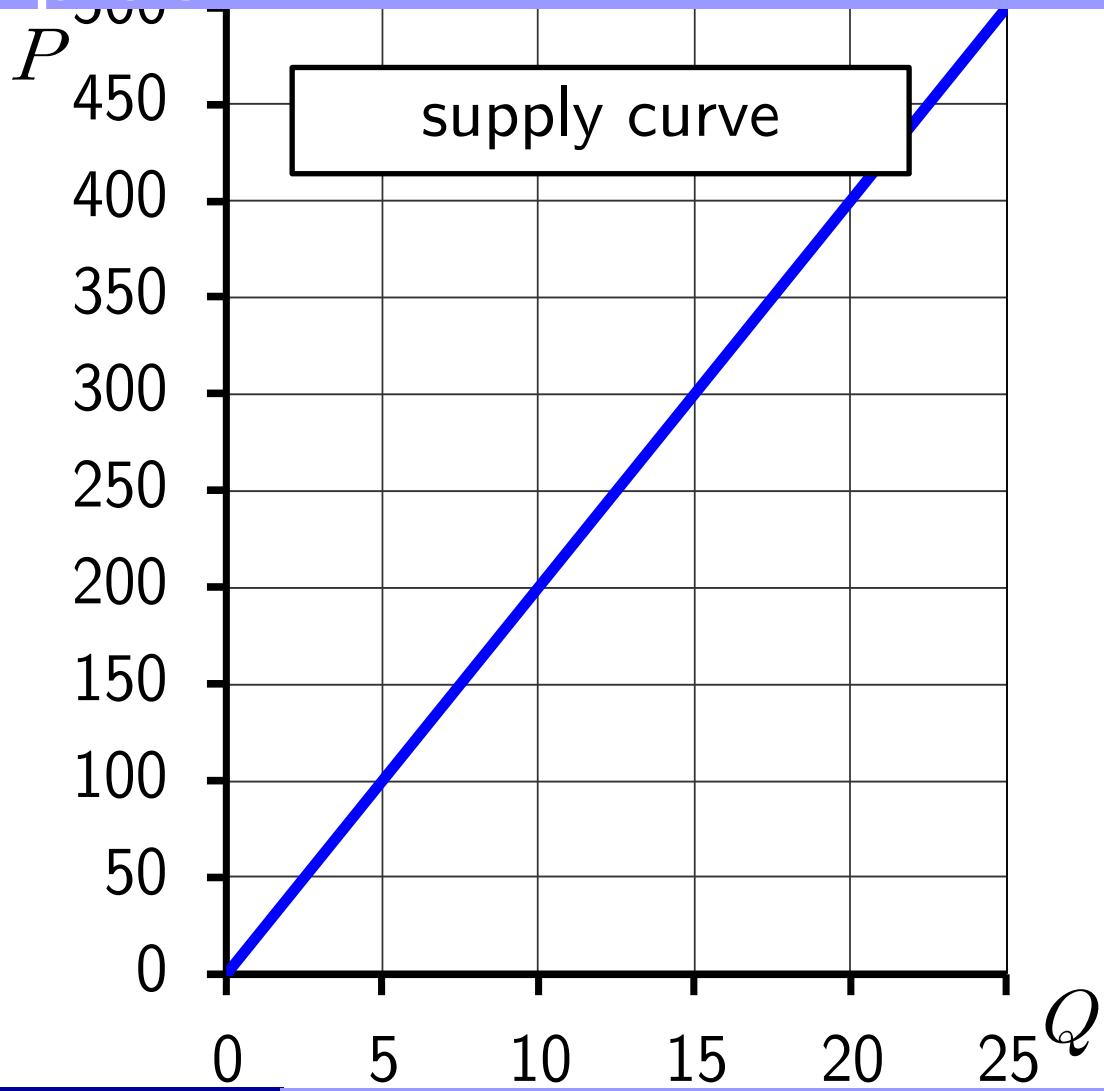
A. Find marginal seller's cost at $\boldsymbol{Q} = 10$.

B. Find total ***PS*** for $\boldsymbol{P} = \$200$.

Suppose ***P*** rises to \$300. Find the increase in ***PS*** due to:

C. selling 5 additional units

D. getting a higher price on the initial 10 units



slido

Find marginal seller's cost at $Q = 10$.

ⓘ Start presenting to display the poll results on this slide.

slido

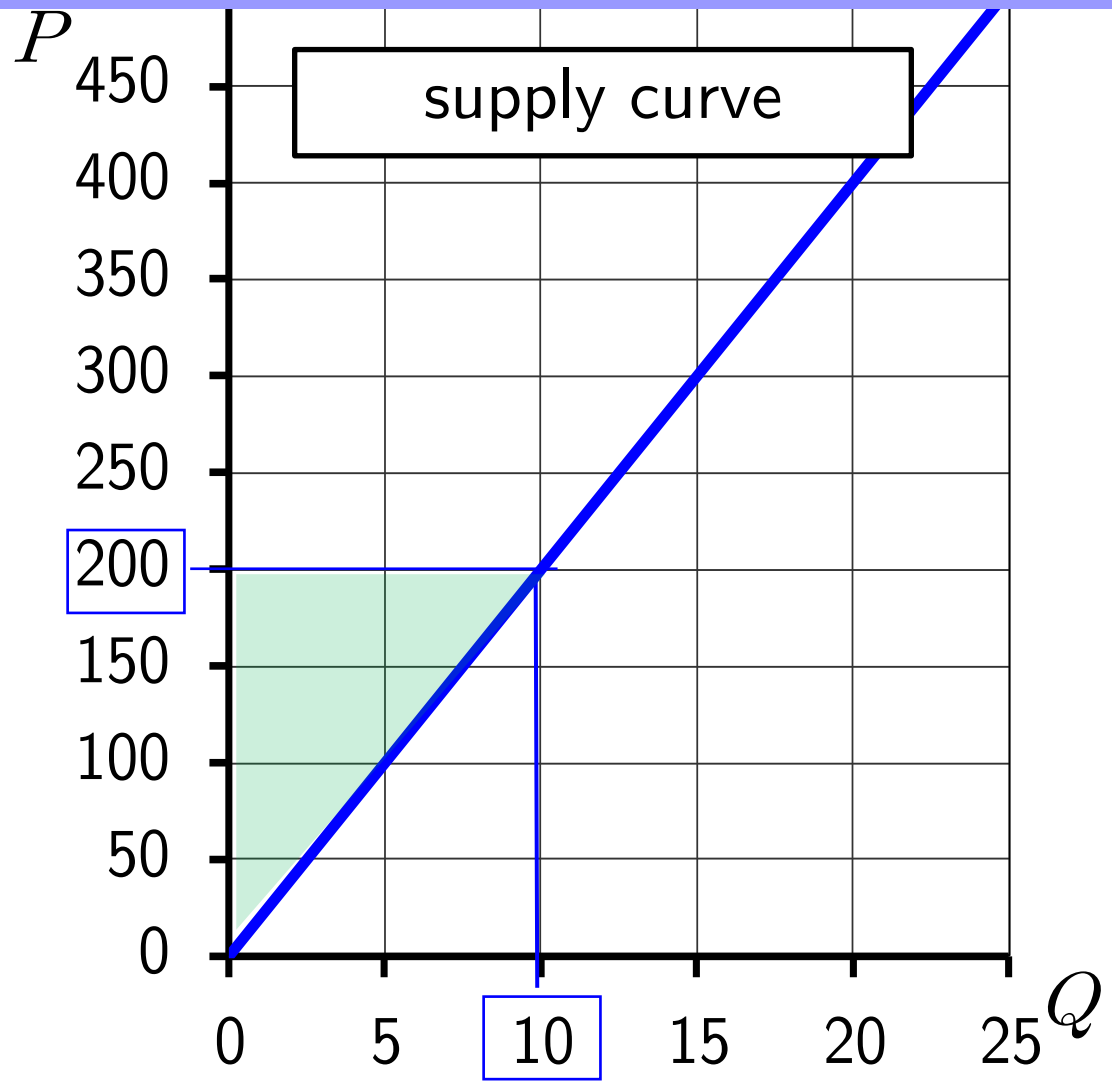
Find total PS for P = $200.

ⓘ Start presenting to display the poll results on this slide.

# Active Learning 2: Answers

A. At $Q = 10$, marginal cost = \$200

B. $PS = ½ \times 10 \times \$200 = \$1{,}000$



slido

Suppose P rises from $200 to $300.
Find the increase in PS due to selling 5 additional units.

ⓘ Start presenting to display the poll results on this slide.

slido

Suppose P rises from $200 to $300.
Find the increase in PS due to getting a higher price on the initial 10 units.

ⓘ Start presenting to display the poll results on this slide.

# Active Learning 2: Answers

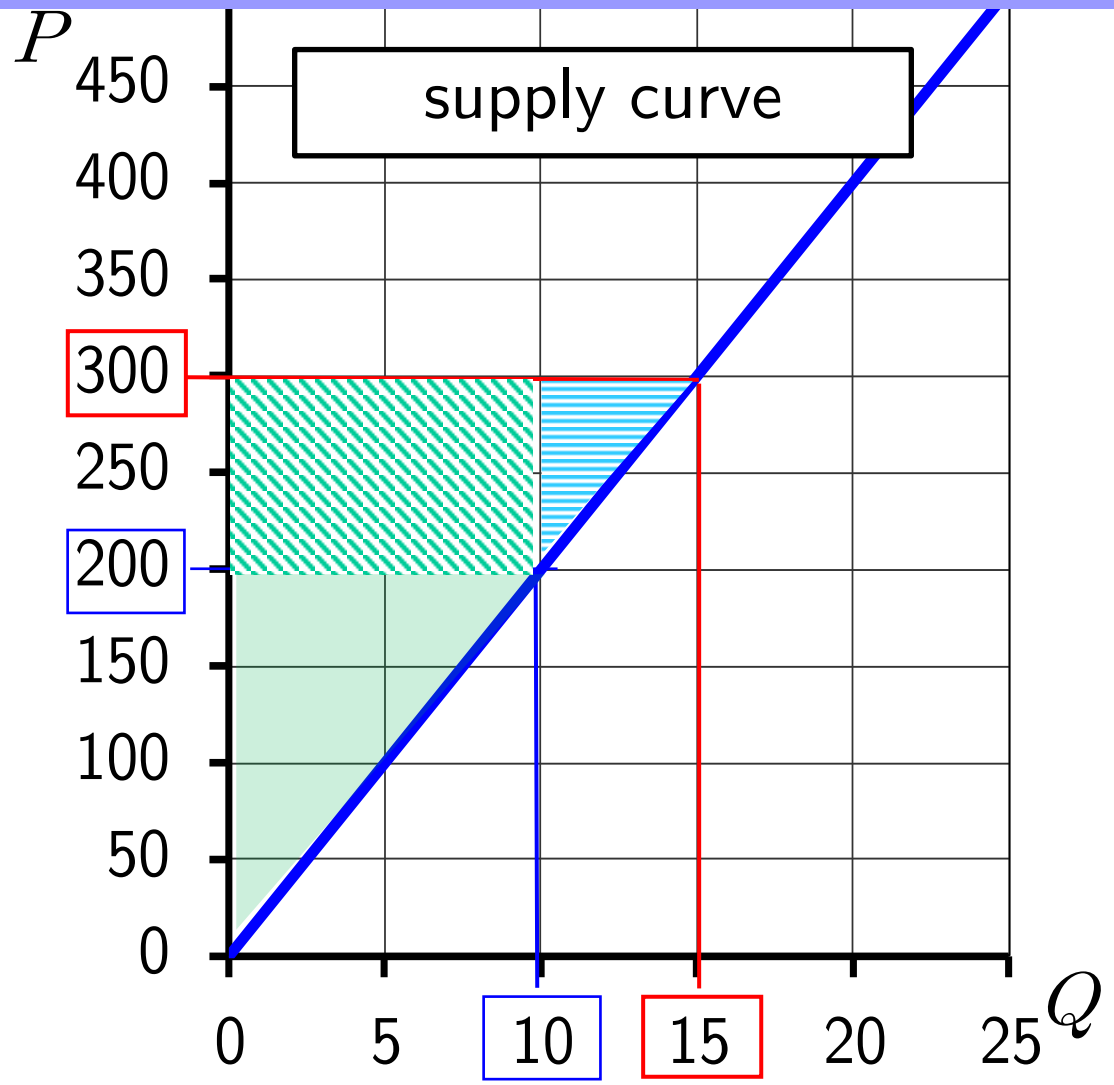
A. At $Q = 10$, marginal cost = \$200

B. $PS = ½ \times 10 \times \$200 = \$1{,}000$

**P** rises to \$300.

C. **PS** on additional units sold
$= ½ \times 5 \times \$100 = \$250$

D. Increase in **PS** on initial 10 units
$= 10 \times \$100 = \$1{,}000$



# The Benevolent Social Planner

- The benevolent social planner
  - Hypothetical character: an all-knowing, all-powerful, well-intentioned dictator
- Wants to maximize the economic well-being of everyone in society
- Evaluate market outcomes
  - Cares about efficiency and equality

# The Benevolent Social Planner

- Allocation of resources – desirable?
- Decentralized (in a market economy)
  - Determined by interactions of many self-interested buyers and sellers
- Total surplus – measure of society's well-being
  - To consider whether the market's allocation is efficient

# Market Efficiency

- Total surplus = ***CS*** + ***PS***
- Consumer Surplus =
  Value to buyers – Amount paid by buyers
  - Buyers' gains from participating in the market
- Producer Surplus =
  Amount received by sellers – Cost to sellers
  - Sellers' gains from participating in the market

Total surplus = Value to buyers – Cost to sellers

# Market Efficiency

- Efficiency
- The allocation of resources maximizes total surplus
  - Is the pie as big as possible?
- Equality
- Distribute economic prosperity uniformly among the members of society
  - Every member of society gets an equal slice of the pie?

# Market's Allocation of Resources

Free Market Outcomes:

1. Allocate the supply of goods to the buyers who value them most, as measured by their WTP
2. Allocate the demand for goods to the sellers who can produce them at the lowest cost
3. Produce the quantity of goods that maximizes the sum of consumer and producer surplus
   - Raising or lowering the quantity of a good would not increase total surplus

# Example 5: Evaluating the Market Equilibrium

Market equilibrium:

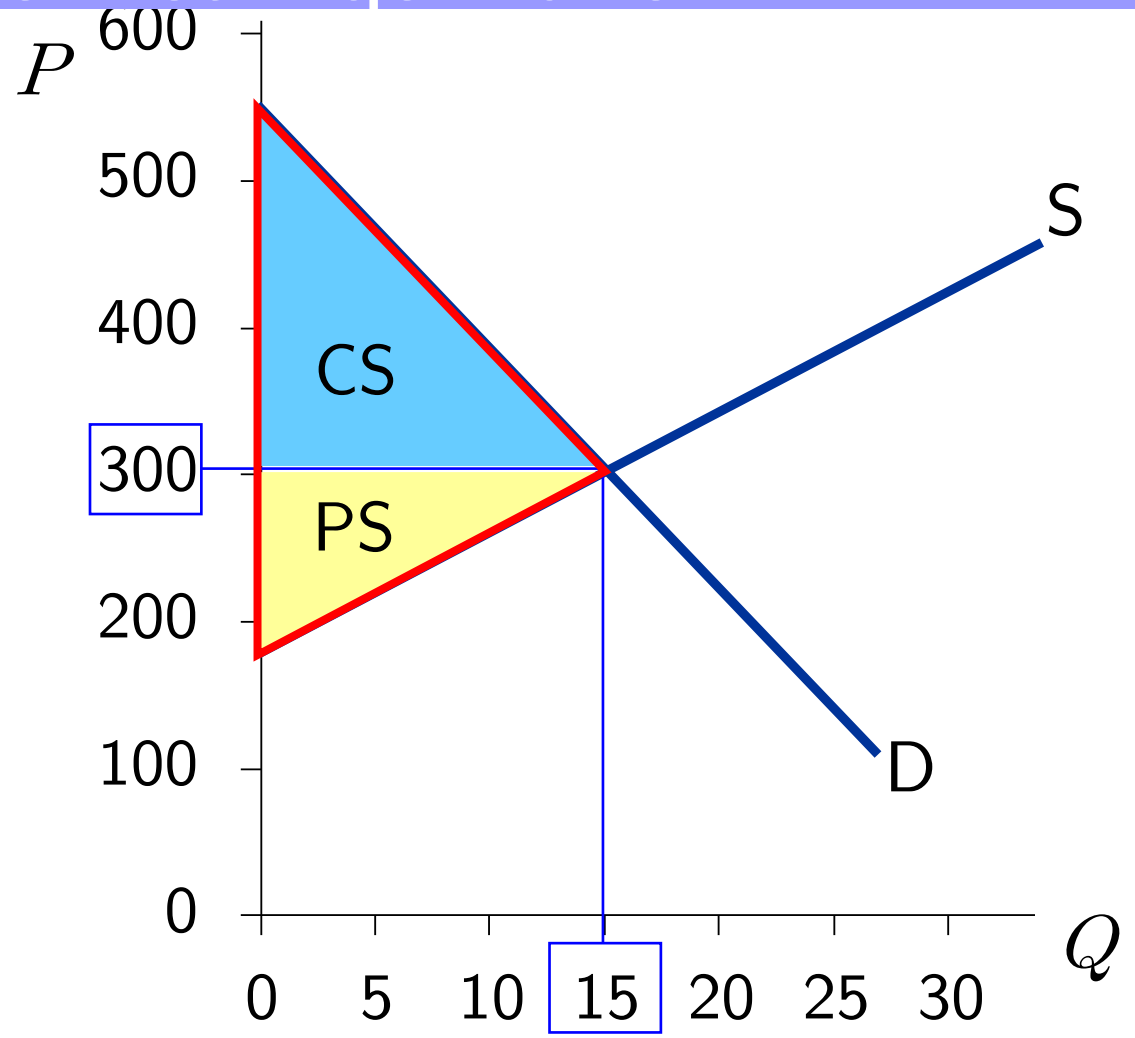
$\boldsymbol{P} = \$300$

$\boldsymbol{Q} = 15$

Total surplus

$= \boldsymbol{CS} + \boldsymbol{PS}$

Is the market equilibrium efficient?

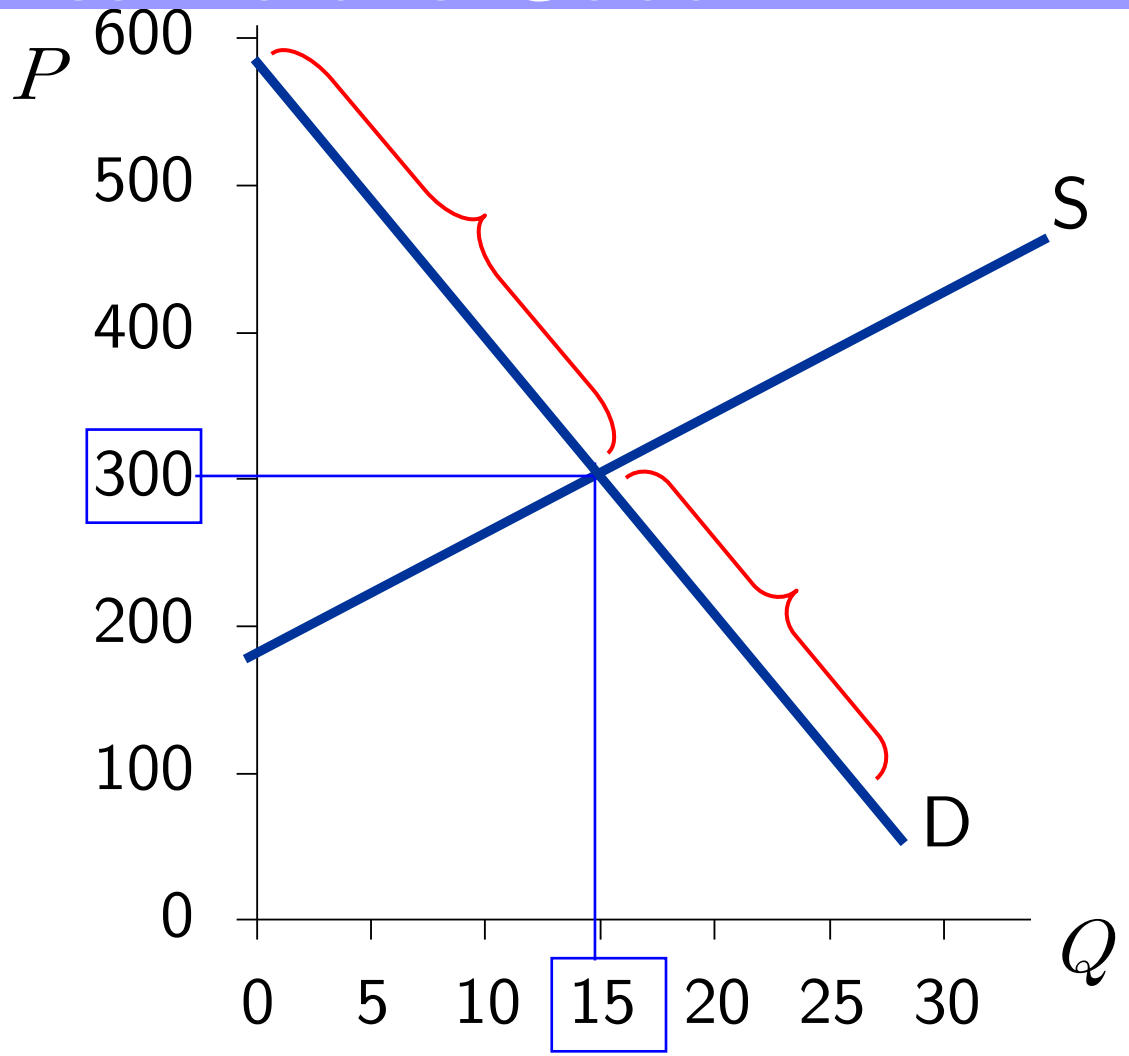


# Example 5A: Which Buyers Consume the Good?

Every buyer whose ***WTP*** is $\geq$ \$300 will buy.

Every buyer whose ***WTP*** is $<$ \$300 will not.

The buyers who value the good most highly are the ones who consume it.

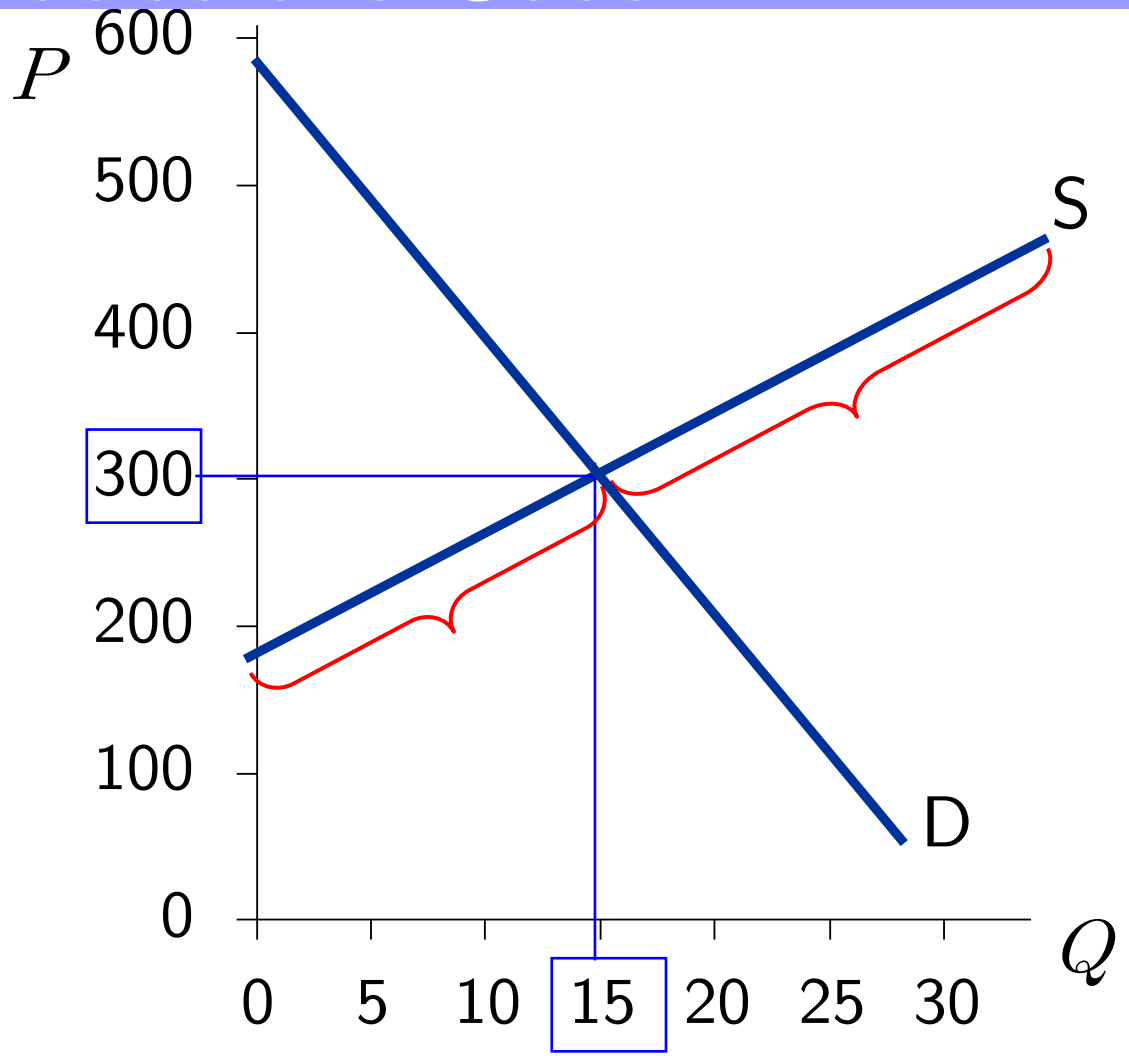


# Example 5B: Which Sellers Produce the Good?

Every seller whose cost is $\leq$ \$300 will produce the good.

Every seller whose cost is $>$ \$300 will not.

The sellers with the lowest cost produce the good.



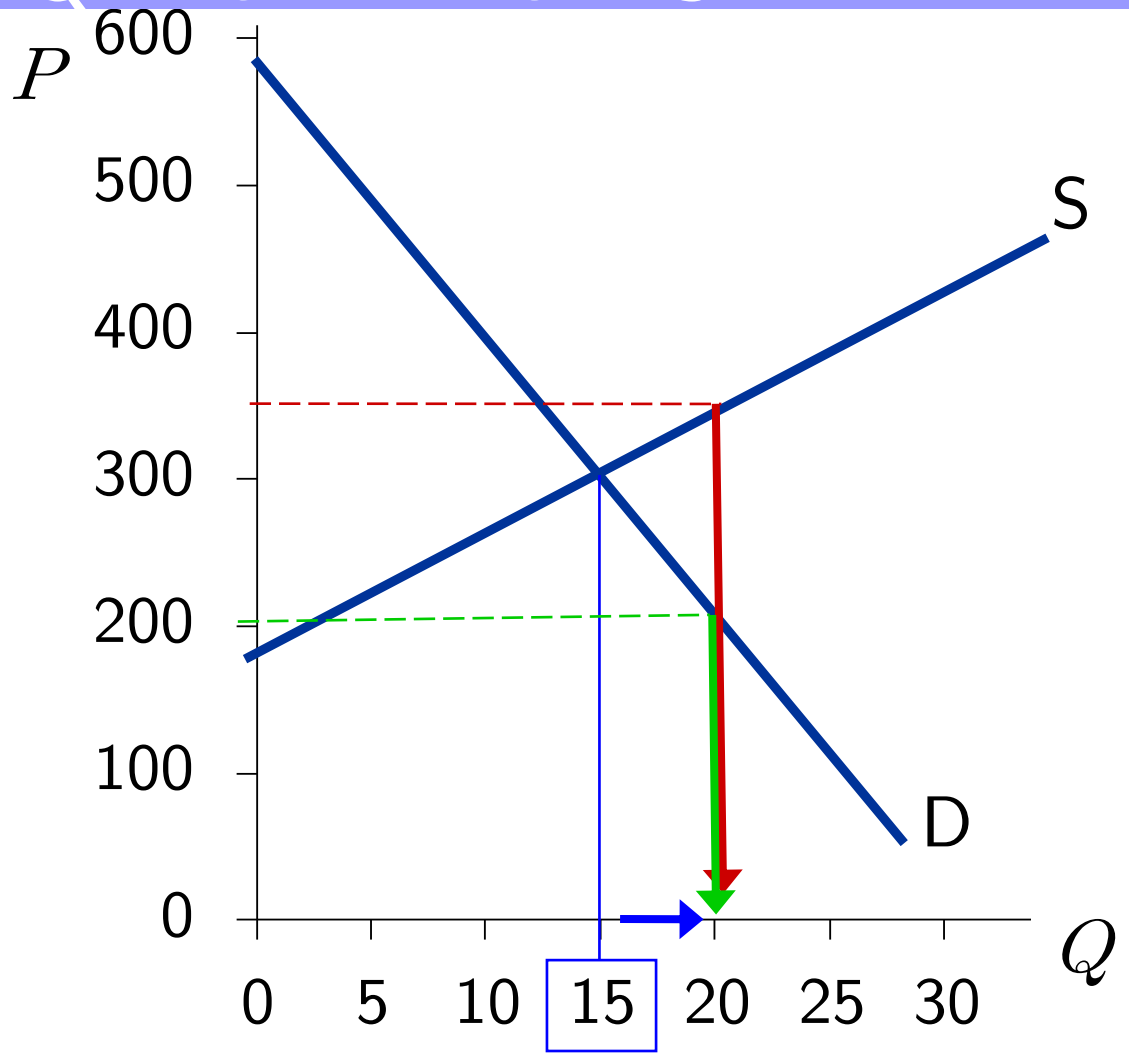
# Example 5C: Does Equilibrium Q Maximize TS?

At $\boldsymbol{Q} = 20$, cost of producing the marginal unit is \$350;

the value to consumers of the marginal unit is only \$200

Hence, can increase total surplus by reducing $\boldsymbol{Q}$.

This is true at any $\boldsymbol{Q}$ greater than 15.



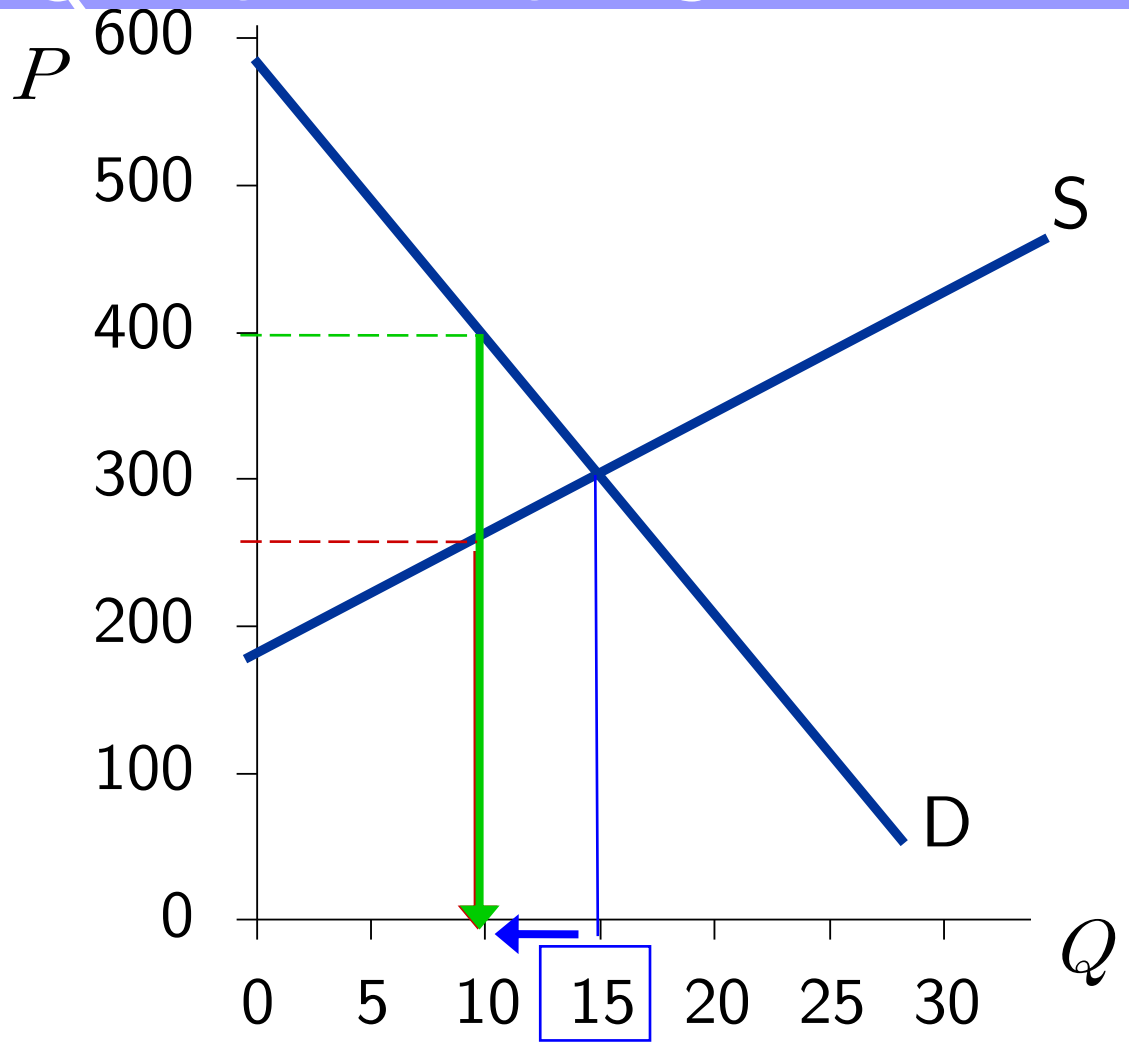
# Example 5C: Does Equilibrium Q Maximize TS?

At $\boldsymbol{Q} = 10$, cost of producing the marginal unit is \$250;

the value to consumers of the marginal unit is \$400

Hence, can increase total surplus by increasing $\boldsymbol{Q}$.

This is true at any $\boldsymbol{Q}$ less than 15.



# Adam Smith and the Invisible Hand

## Passage from The Wealth of Nations, 1776

"It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest.

Every individual... neither intends to promote the public interest, nor knows how much he is promoting it....

He intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention....

By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it."

# Market Efficiency and Market Failure

- Forces of supply and demand
  - Allocate resources efficiently
- Assumptions about how markets work
  1. Markets are perfectly competitive
  2. Outcome in a market matters only to the buyers and sellers in that market
- When these assumptions do not hold
  - "Market equilibrium is efficient" may no longer be true

# Market Efficiency and Market Failure

- Market failures
- Market power: a single buyer or seller (small group) control market prices
  - Markets are inefficient
- Externalities: decisions of buyers and sellers affect people who are not participants in the market at all
  - Inefficient equilibrium - from the standpoint of society as a whole

# Ask The Experts

## Supplying Kidneys

- "A market that allows payment for human kidneys should be established on a trial basis to help extend the lives of patients with kidney disease."
  - Do you Agree or Disagree?
  - Do you think Economists Agree or Disagree?

Source: IGM Economic Experts Panel, March 11, 2014

slido

Do you "Agree" or "Disagree"?
“A market that allows payment for human kidneys should be established on a trial basis to help extend the lives of patients with kidney disease.”

ⓘ Start presenting to display the poll results on this slide.

slido

Do you think Economists Agree or Disagree?
“A market that allows payment for human kidneys should be established on a trial basis to help extend the lives of patients with kidney disease.”

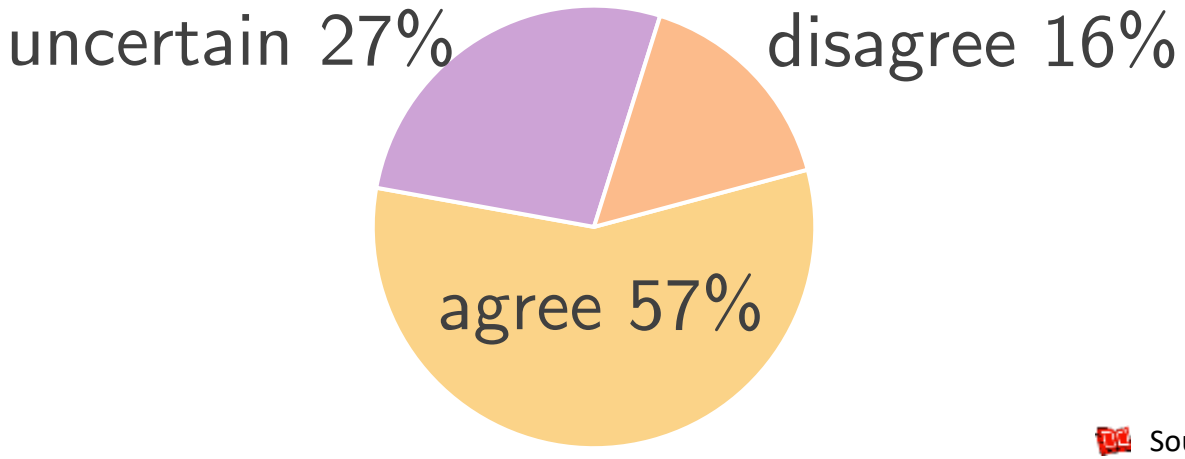
ⓘ Start presenting to display the poll results on this slide.

# Ask The Experts

## Supplying Kidneys

- "A market that allows payment for human kidneys should be established on a trial basis to help extend the lives of patients with kidney disease."

What do economists say?




Source: IGM Economic Experts Panel, March 11, 2014

# Think-Pair-Share

## Some years ago, The Boston Globe ran the headline...

"How a Mother's Love Helped Save Two Lives." The mom couldn't donate a kidney to her son (not compatible).

Hospital's solution: the mom donates one of her kidneys to a stranger, her son moves to the top of the kidney waiting list.

A. What do you know about the market for kidneys?
B. Is the current situation efficient? Is it fair?
C. What would happen with the efficiency of the market if people were allowed to sell/buy kidneys?

slido

What do you know about the market for kidneys?

ⓘ Start presenting to display the poll results on this slide.

slido

Is the current situation efficient? Is it fair?

ⓘ Start presenting to display the poll results on this slide.

slido

What would happen with the efficiency of the market if people were allowed to sell/buy kidneys?

ⓘ Start presenting to display the poll results on this slide.

# The Guardian Posted a Touching Album of...

- postings on streets around hospitals offering to sell organs.
  - Advertise blood type: A, B, O...
  - Guardian: Kidneys for sale

  - Wiki: Kidney trade in Iran

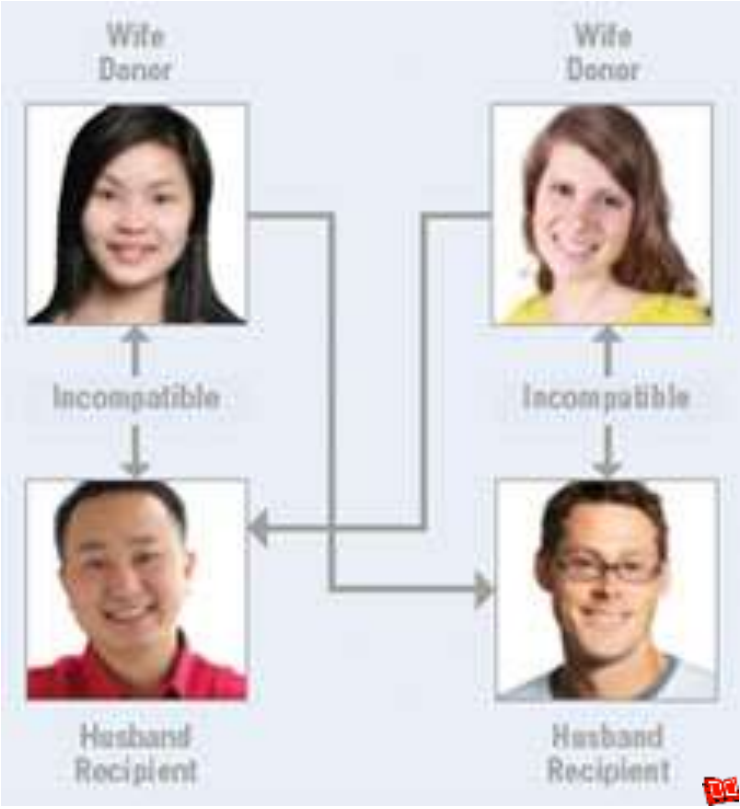
# Even If Selling Organs is Not Allowed...

- Should we ban ALL organ exchanges
  - (even without monetary transfers)?
  - Such as: UCLA Kidney Exchange Program

Kidney SWAP(配對交換捐贈):

  - Paired Donor Exchange Transplantation

- When a donor and a recipient cannot match (blood type, etc.), they can exchange with another pair with similar problems
  - What about 3-way-exchange?



# SWAP Allowed? Why Not Chain Reaction?

- Chain Transplantation, Kidney Chain (連鎖捐贈)：
- Altruistic donor gives to a recipient, whose relative donates to a 2nd recipient, whose relative donates...

# 「肝肝相連到天邊」

## 60 Lives, 30 Kidneys, All Linked

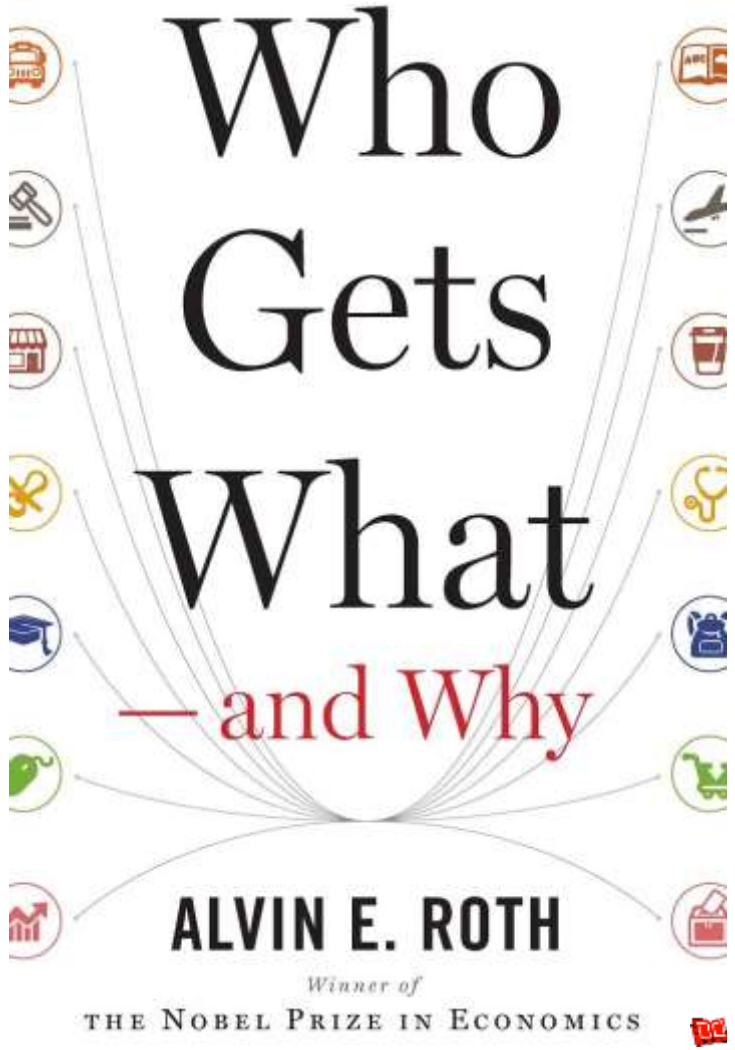
From Start to Finish
A donation by a Good Samaritan, Rick Ruzzamenti, upper left, set in motion a 60-person chain of transplants that ended with a kidney for Donald C. Terry Jr., bottom right.

(2012/2/18 New York Times)

# Market Design (Prizing Winning Idea 2012)

- Both in the Lab and Field
- Alvin E. Roth (Stanford)

  (Keynote of 2013 ESA North American Meeting, Santa Cruz)



# Chapter in a Nutshell

- Consumer Surplus: buyers' willingness to pay for a good minus the amount they actually pay
  - Measures the benefit buyers get from participating in a market
  - Area below the ***D*** curve and above ***P***
- Producer Surplus: amount sellers receive for their goods minus their costs of production
  - Measures the benefit sellers get from participating in a market
  - Area below ***P*** and above the ***S*** curve

# Chapter in a Nutshell

- An allocation of resources that maximizes total surplus is said to be efficient
  - Policymakers are concerned with the efficiency, as well as the equality, of economic outcomes.
- Equilibrium of ***S*** and ***D*** maximizes total surplus
  - The invisible hand of the marketplace leads buyers and sellers to allocate resources efficiently.
- Markets do not allocate resources efficiently in the presence of market failures (market power or externalities)

# Chapter 7: Efficiency and Welfare

- Consumer Surplus + Producer Surplus
  = Total Surplus (maximized at Equilibrium)
- Efficiency vs. Equality

- Homework:
  - Mankiw, Ch.7, Problem 6, 7, 9-11
- Additional Questions:
  - True or False. If consumers buy 1,000 heads of lettuce per week, and if the price of lettuce falls by $1 per head, then the consumer surplus will increases by $1,000.

# Chapter 7: Challenge Questions/ex-Midterm

- Old Midterm (retired):
  - 2008 - (Multiple Choice Q6-Q7)
  - 2010 - Essay C
  - 2013 - (True/False Q8)
- 2017 - Essay B3
- 2018 - Essay A5

# Video for Self-Study

## Chapter 6: Price Control and Taxation

- Markets are good? Price control is bad!
- Taxation forms a wedge between $P_b$ and $P_s$

- Homework:
  - Mankiw, Ch. 6, Problem 3, 5, 7-10
- Additional Questions:
  - True or False. A price ceiling on wheat would cause the price of bread to fall.
  - True or False. iPhone 13 contain A15 CPUs made by TSMC. If Apple made its own CPUs, iPhone 13 would be cheaper.

# Video for Self-Study

## Chapter 6: Challenge Questions/ex-Midterm

- OLD midterm (retired):
  - 2009 - (Multiple Choice Q11)
  - 2010 - (True/False Q6-Q8)
  - 2012 - (True/False Q3-Q4)
  - 2013 - (True/False Q6-Q7)
- 2016 - Part C
- 2017 - Part D
- 2018 - Part A1, A6
- 2019 - Part B1, B3

slido

# Audience Q&A Session

ⓘ Start presenting to display the audience questions on this slide.

# Copyright Disclaimer

| No. | Work | Copyright | Author / Source |
|---|---|---|---|
| 1 | Page 1, 7, 8, 22, 23, 25, 26, 28, 40, 41, 43, 44, 60, 61, 64, 65, 66, 70 | | Slido - Audience Interaction Made Easy<br>This work is used subject to the fair use doctrine of the Taiwan Copyright Act Article 46, 52 and 65 by GET. |
| 2 | | | Wikipedia Etching created by Cadell and Davies (1811), John Horsburgh (1828) or R.C. Bell (1872).<br>https://zh.wikipedia.org/wiki/File:AdamSmith.jpg<br>This work is in the public domain in its country of origin and other countries and areas where the copyright term is the author's life plus 100 years or fewer. |
| 3 | | | IGM Economic Experts Panel, June 19, 2012.<br>This work is used subject to the fair use doctrine of the Taiwan Copyright Act Article 46, 52 and 65 by GET. |
| 4 | | | Iranians 'turn to selling their organs to make ends meet' \| Daily Mail Online<br>https://www.dailymail.co.uk/news/article-7482799/Iranians-turn-selling-organs-make-ends-meet.html<br>This work is used subject to the fair use doctrine of the Taiwan Copyright Act Article 46, 52 and 65 by GET. |
| 5 | | | Kidney Swap - UCLA Kidney Exchange Program - Los Angeles, CA<br>https://www.uclahealth.org/transplants/kidney-exchange/kidneyswap<br>This work is used subject to the fair use doctrine of the Taiwan Copyright Act Article 46, 52 and 65 by GET. |

# Copyright Disclaimer

| No. | Work | Copyright | Author / Source |
|---|---|---|---|
| 6 | | | Kidney Swap - UCLA Kidney Exchange Program - Los Angeles, CA<br>https://www.uclahealth.org/transplants/kidney-exchange/kidneyswap<br>This work is used subject to the fair use doctrine of the Taiwan Copyright Act Article 46, 52 and 65 by GET. |
| 7 | | | Lives Forever Linked Through Kidney Transplant Chain 124 - The New York Times<br>https://www.nytimes.com/2012/02/19/health/lives-forever-linked-through-kidney-transplant-chain-124.html<br>This work is used subject to the Term of Service and the fair use doctrine of the Taiwan Copyright Act Article 46, 52 and 65 by GET. |
| 8 | | | Who Gets What — and Why: The New Economics of Matchmaking and Market Design \| HMH Books<br>https://www.hmhbooks.com/shop/books/who-gets-what-and-mdash-and-why/9780544705289<br>This work is used subject to the fair use doctrine of the Taiwan Copyright Act Article 46, 52 and 65 by GET. |
| 9 | | | This work is licensed by Joseph Tao-yi Wang for the use of General Education TW ONLY. The copyright belongs to the above mentioned licensor(s). |
| | | | |