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Perfect Competition:

Partial Equilibrium

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Agenda

- Previously: Role of markets
  - Exchange allows specialization
  - But requires coordination
- Now:
  - Study market exchange
  - Theory of perfect competition
  - What role do prices have?

Perfect competition

- Q: What characterizes a market with perfect competition?
  - Large number of buyers and sellers
    - Thus: individual buyers and sellers cannot affect price
  - Firms maximize profits; consumers maximize utility
  - All producers have access to the same technology
  - Goods homogenous
  - Buyers know the quality

Perfect competition

- Q: Possible examples
  - Organized commodity markets
    - Q: Wholesale electricity (Nord pool)
      - Sufficient number of sellers?
    - Q: Wholesale wheat, coffee, sugar, gold, …
      - Probably
  - Organized financial markets
    - Q: Stock exchange
      - Rationality? Information?

Partial equilibrium

- Study one market at the time
  - price
  - quantity produced by each firm
  - quantity consumed by each consumer
- Q: Why one market at the time?
  - Simplicity

Partial equilibrium

- Partial equilibrium analysis is okay
  - for **predictions** if
    - prices in all other markets are constant, no matter what happens in our market
  - for **welfare analysis** if (in addition)
    - prices in all other markets reflect "costs and values"

Partial equilibrium

- Steps
  - Demand
    - Consumer demand
    - Market demand
  - Supply
    - Firm supply
    - Market supply
  - Equilibrium
    - Price
    - Market quantity
    - Individual quantities

Demand

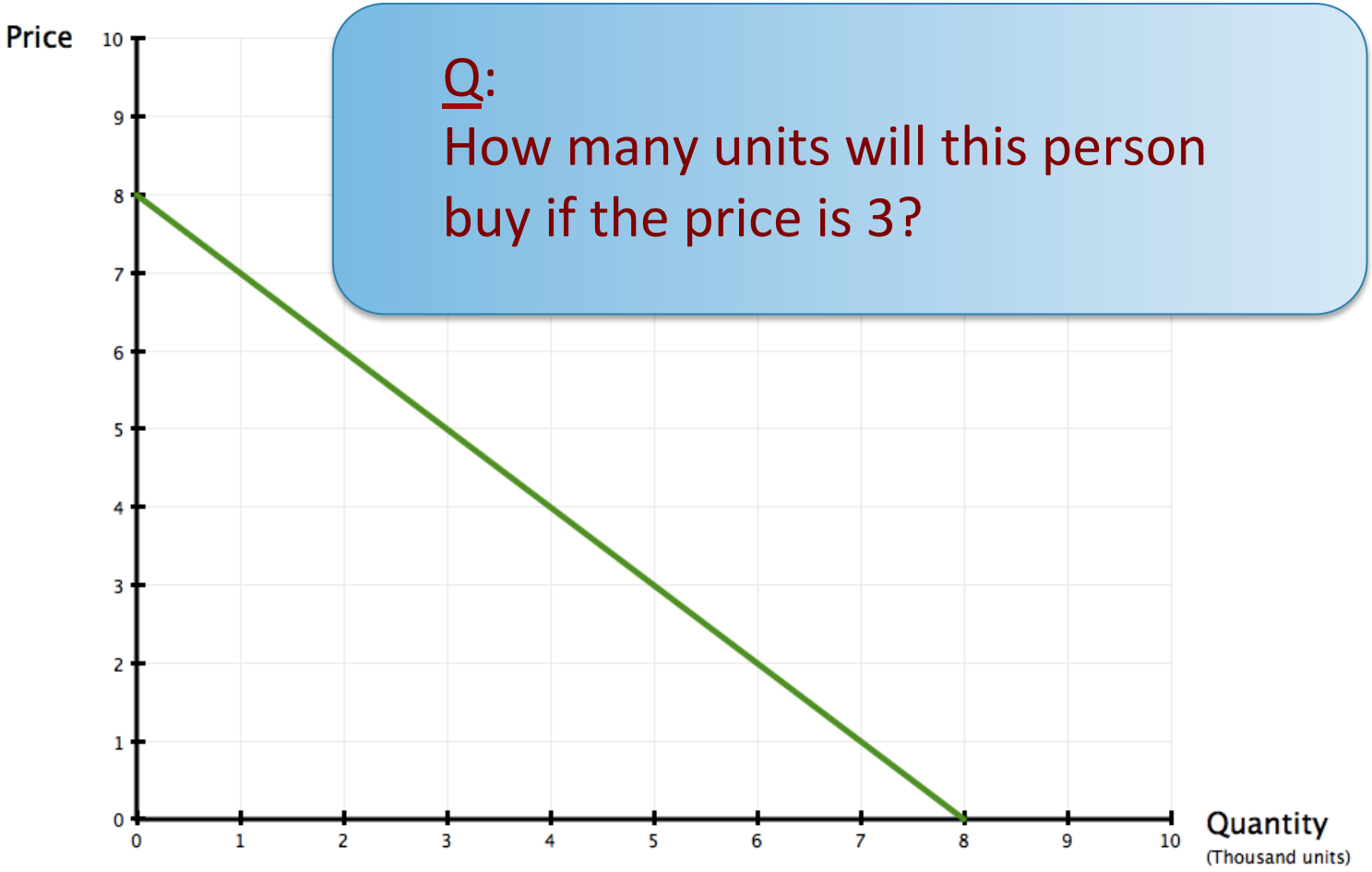
Individual demand

- Q: Define individual demand function
  - Describes
    - how many units an individual will buy of a particular good
    - during some time period
    - for every possible price
    - taking all other prices as given

Individual demand

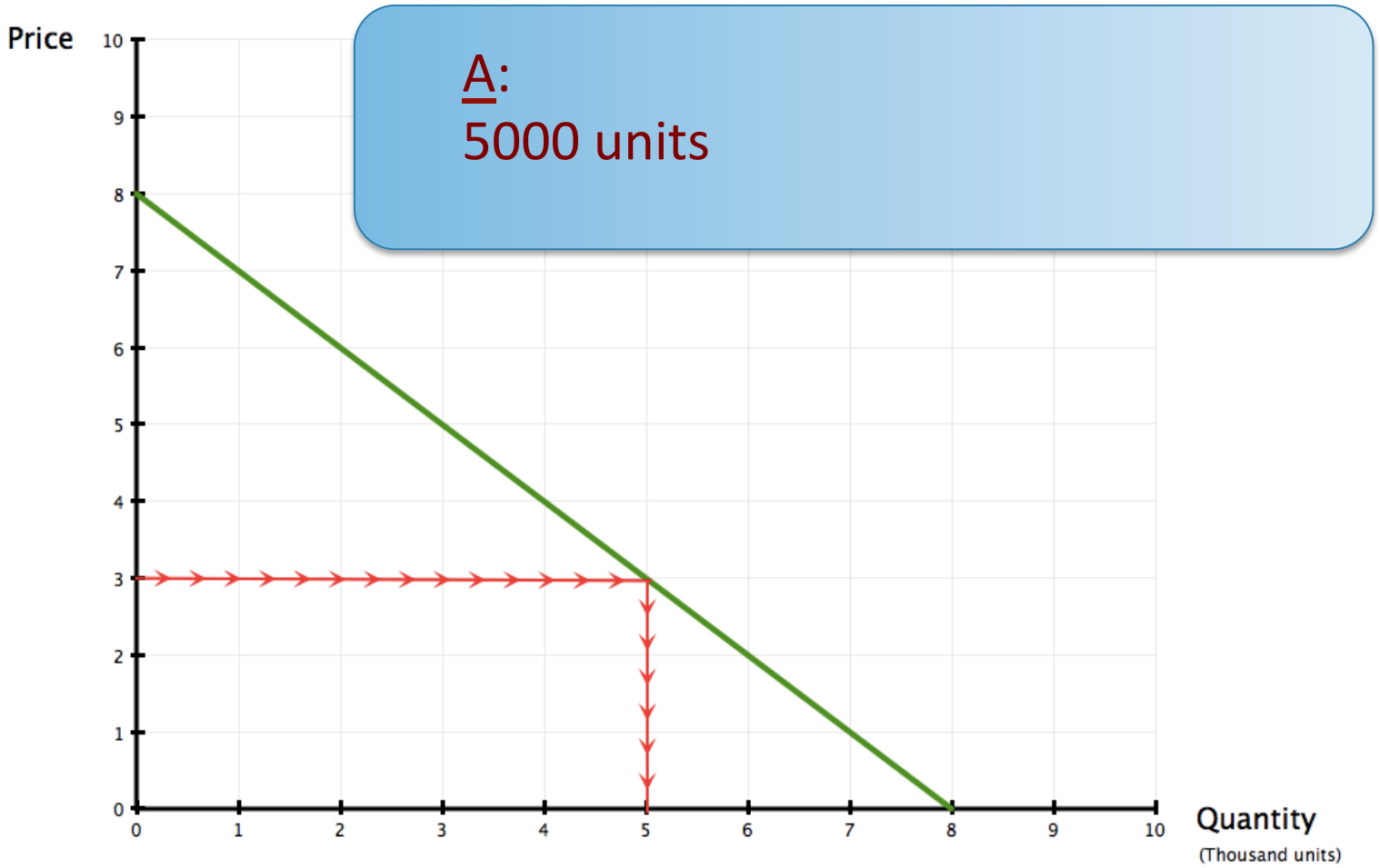
- Q: Define *quantity* demanded
  - The number of units the individual will buy at a *given* price
- Notice the difference
  - Function = a rule assigning a single quantity for every price
  - Function = "list of values"

Example: Linear demand



Q:
How many units will this person buy if the price is 3?

Example: Linear demand

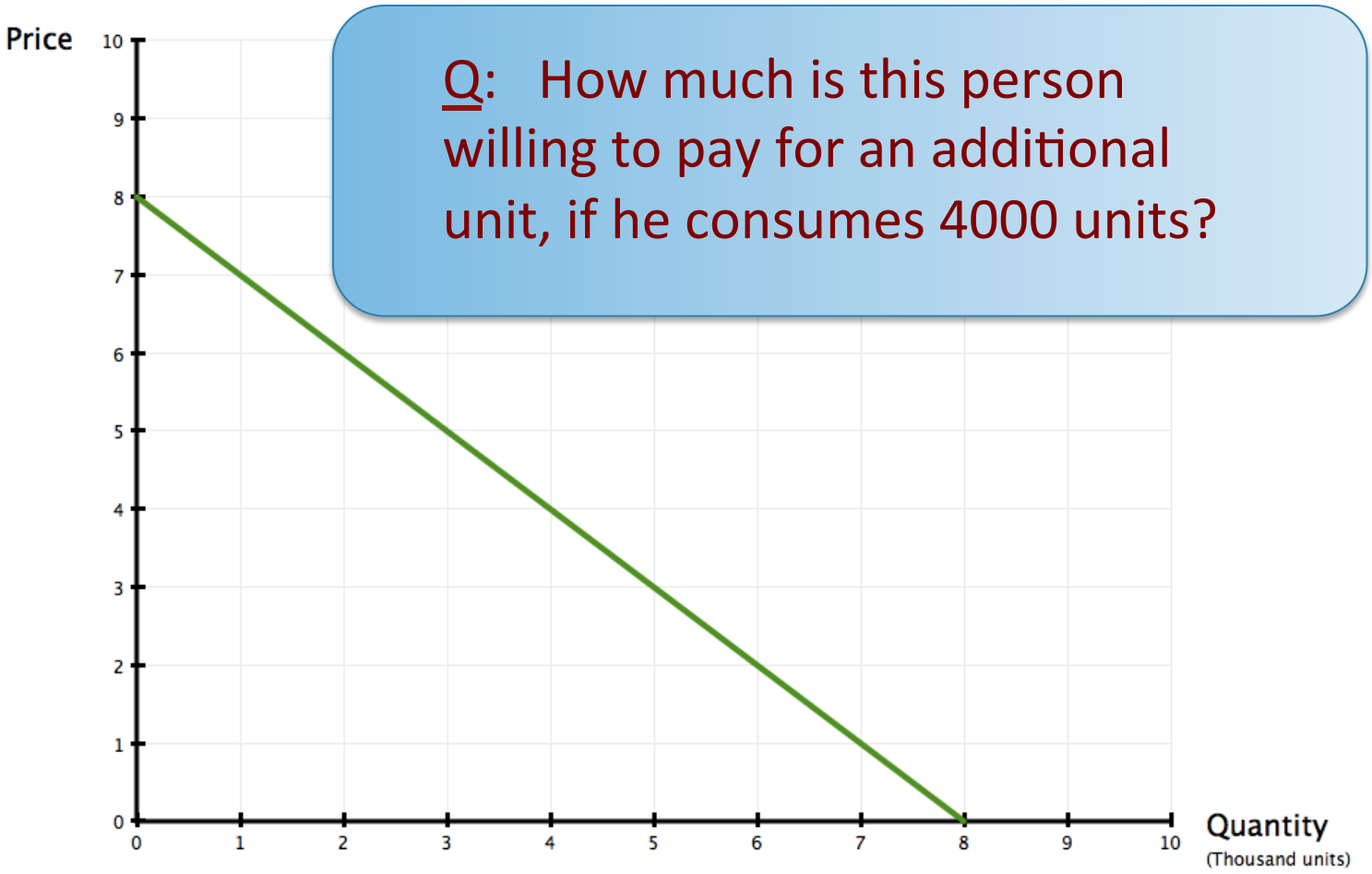


A:
5000 units

Inverse demand

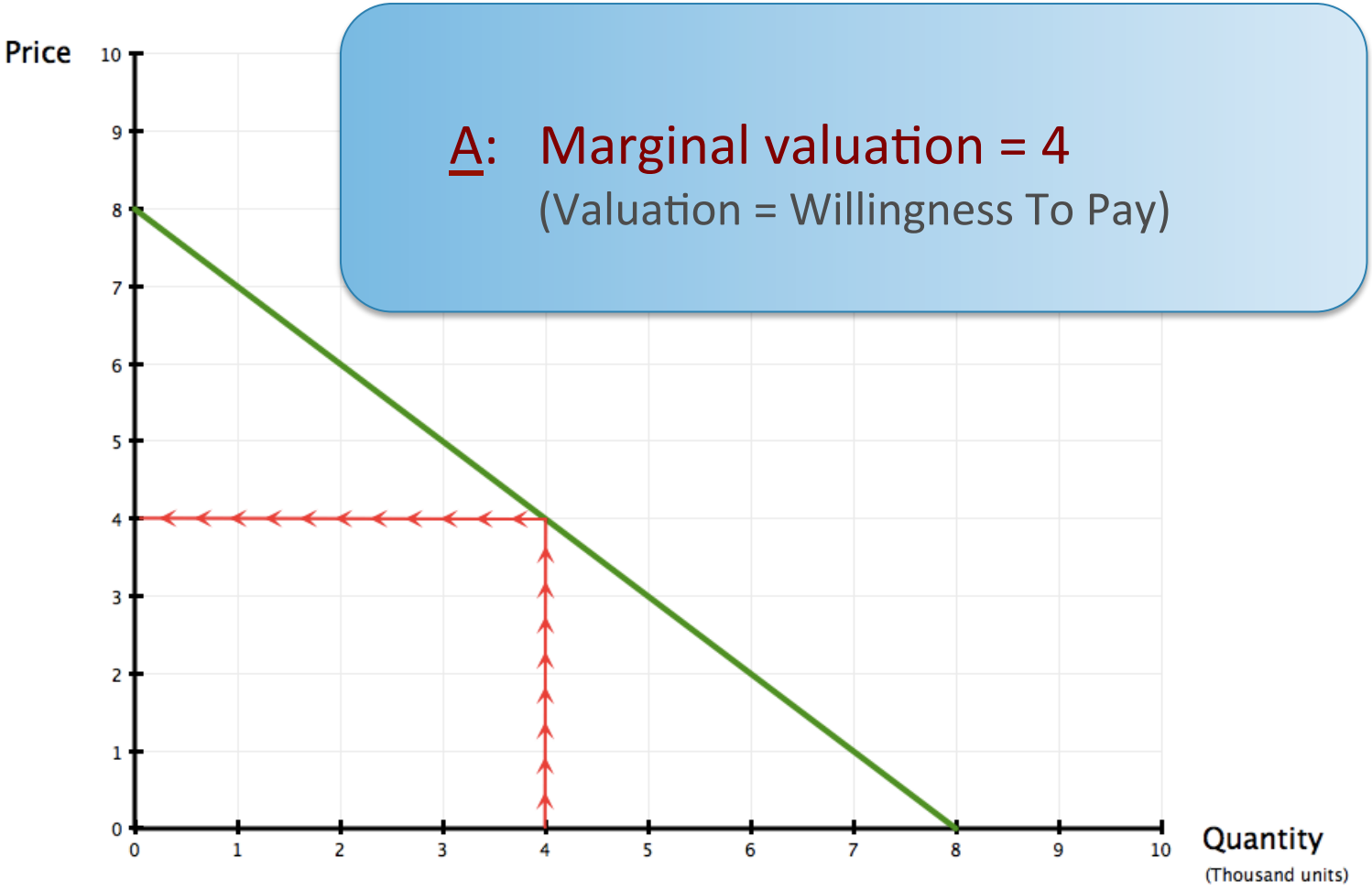
- Q: Define *inverse* demand function (for individual)
  - Describes
    - how much the person is *willing to pay*
    - for one additional unit (= marginal valuation),
    - for any possible level of consumption

Example: Linear demand



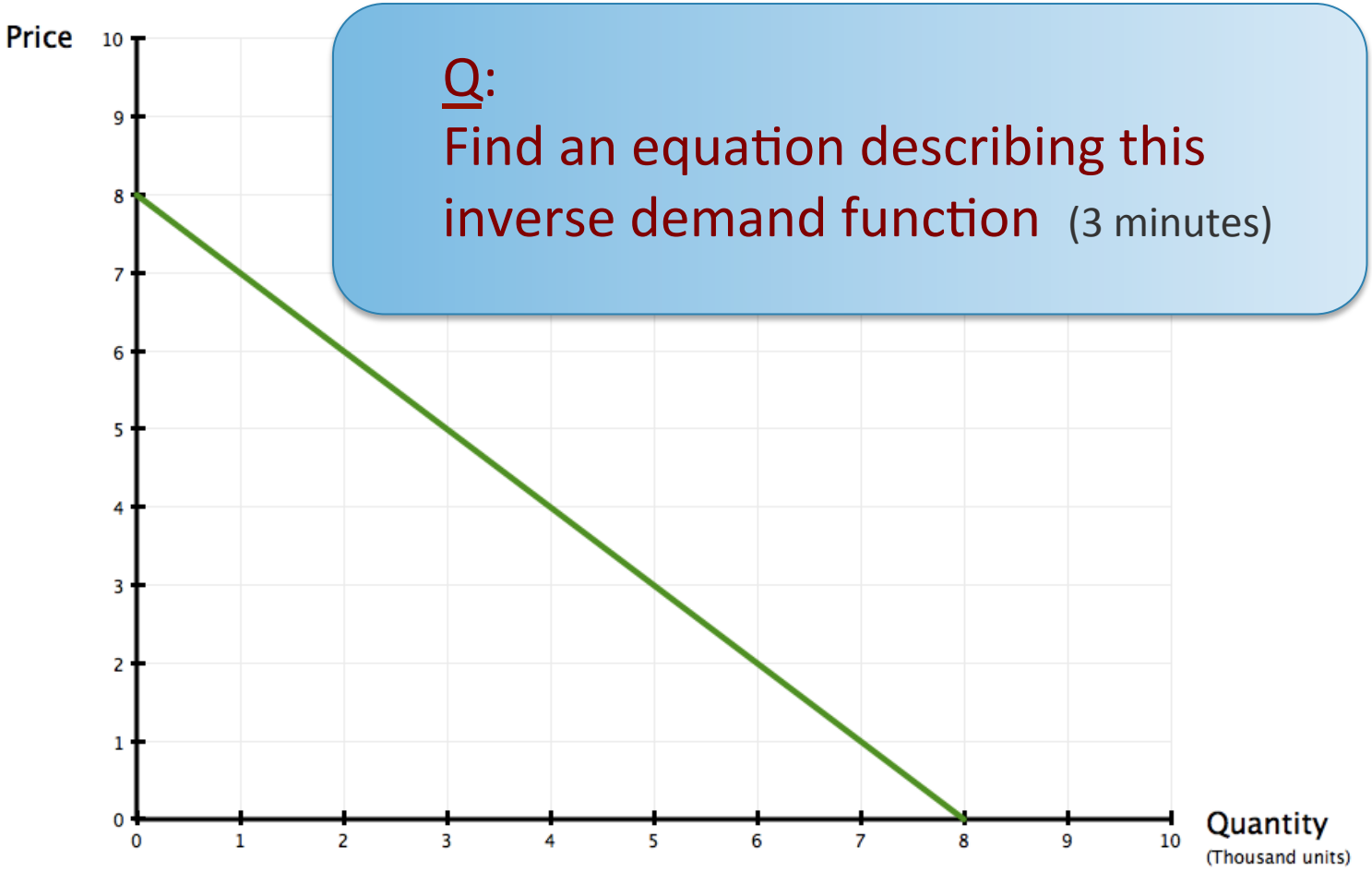
Q: How much is this person willing to pay for an additional unit, if he consumes 4000 units?

Example: Linear demand



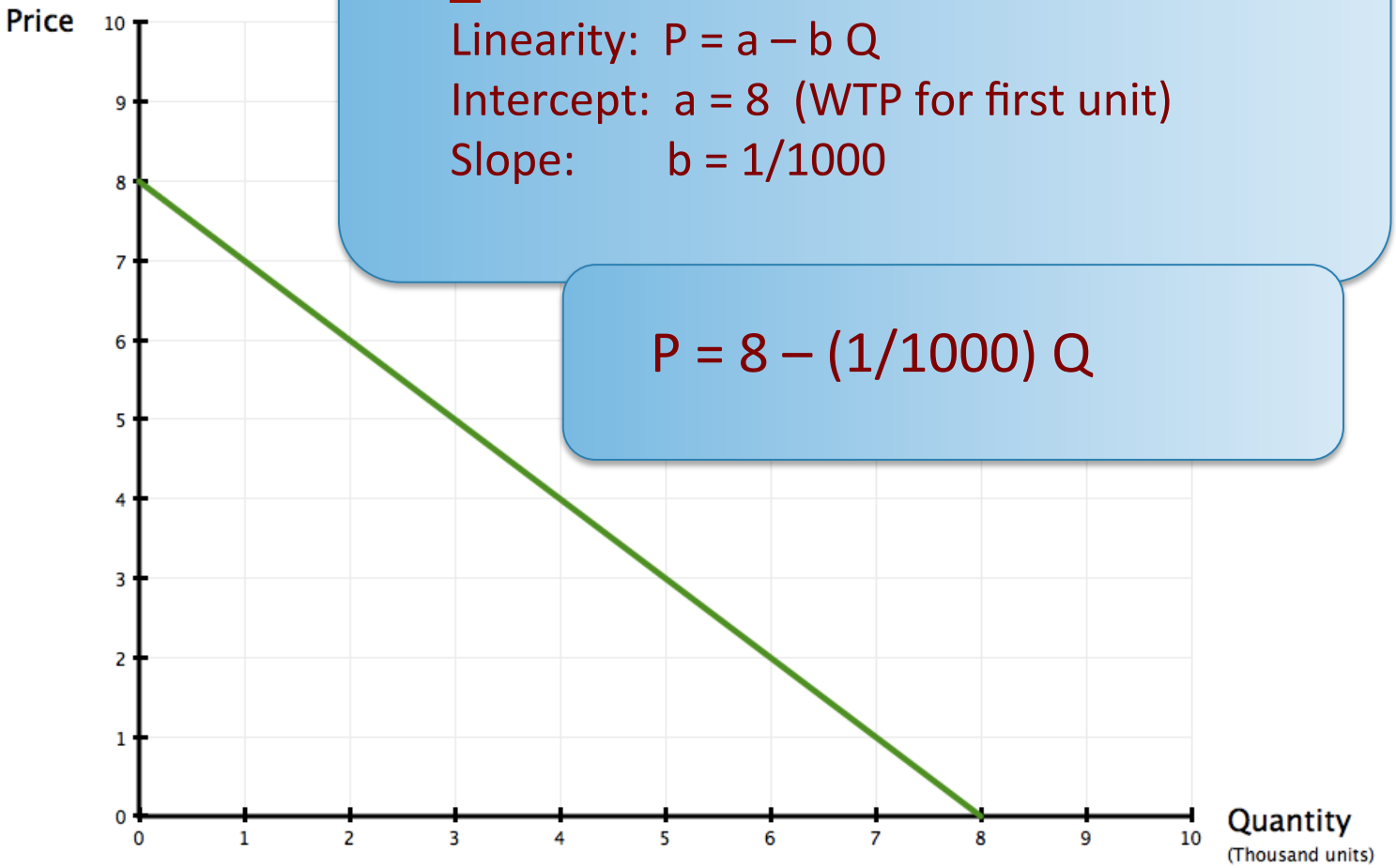
A: Marginal valuation = 4
(Valuation = Willingness To Pay)

Example: Linear demand



Q:
Find an equation describing this inverse demand function (3 minutes)

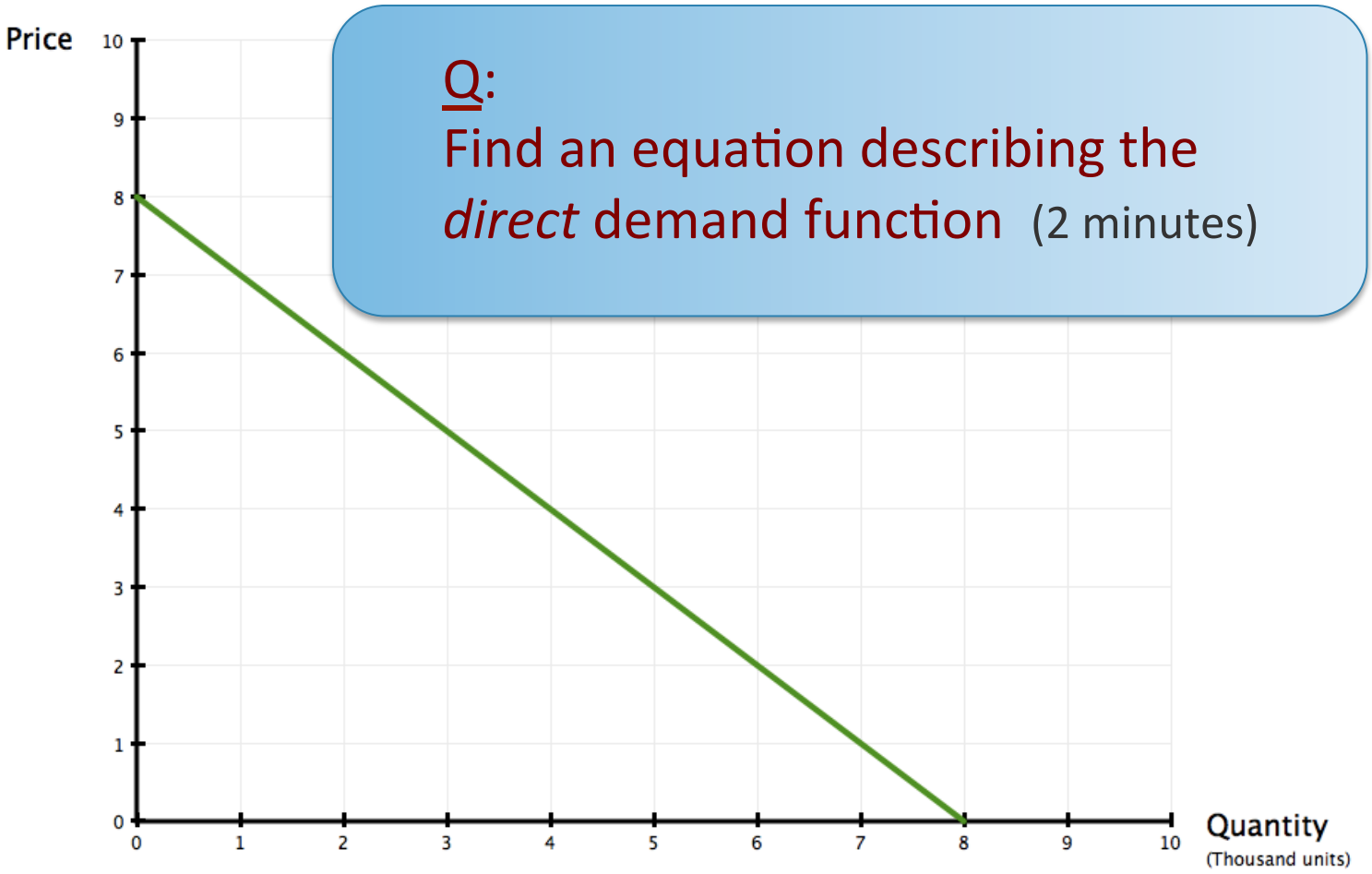
Example: Linear demand



A:
Linearity: P = a – b Q
Intercept: a = 8 (WTP for first unit)
Slope: b = 1/1000

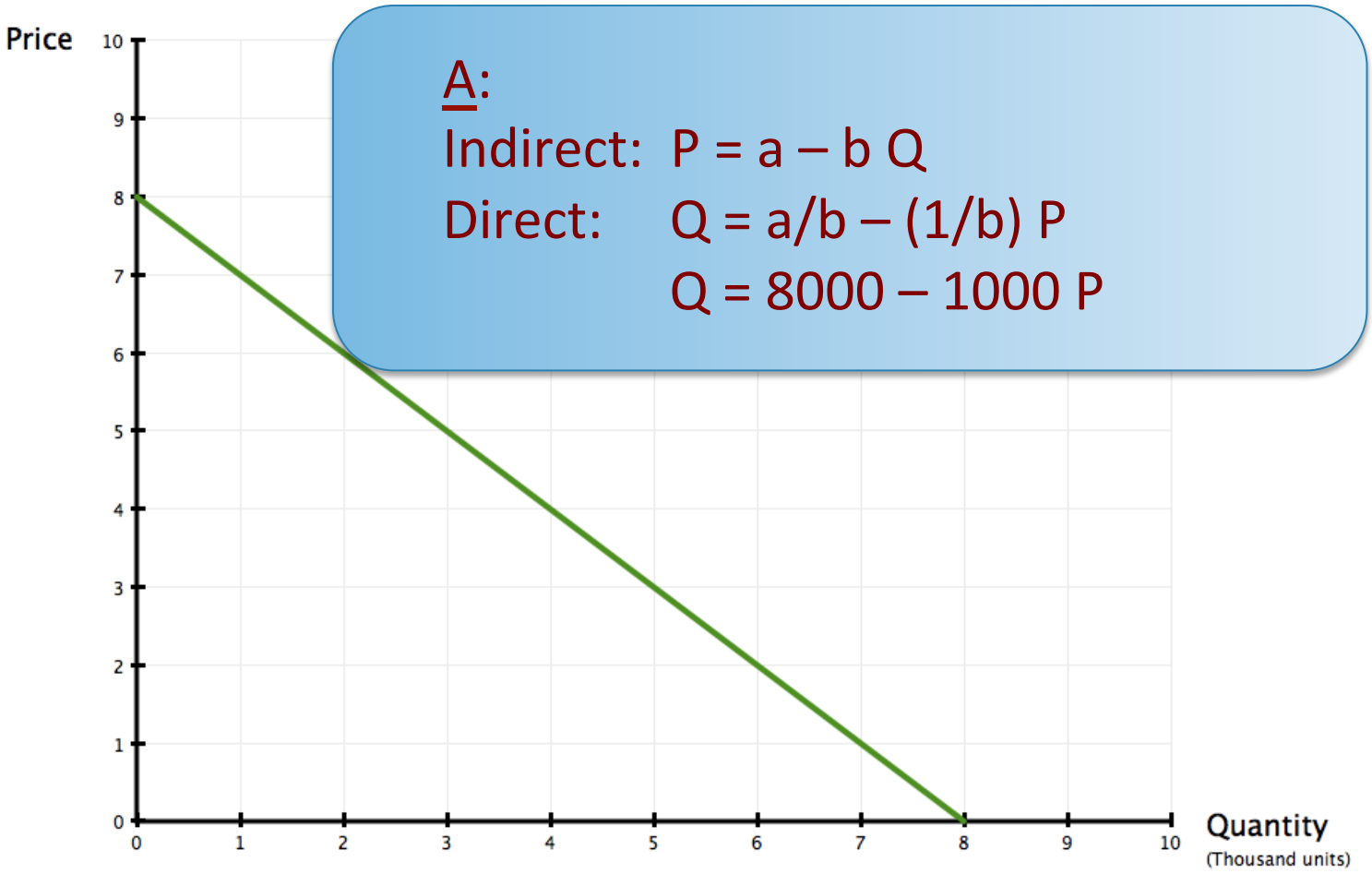
P = 8 – (1/1000) Q

Example: Linear demand



Q:
Find an equation describing the *direct* demand function (2 minutes)

Example: Linear demand



A:

Indirect: $P = a - b\,Q$

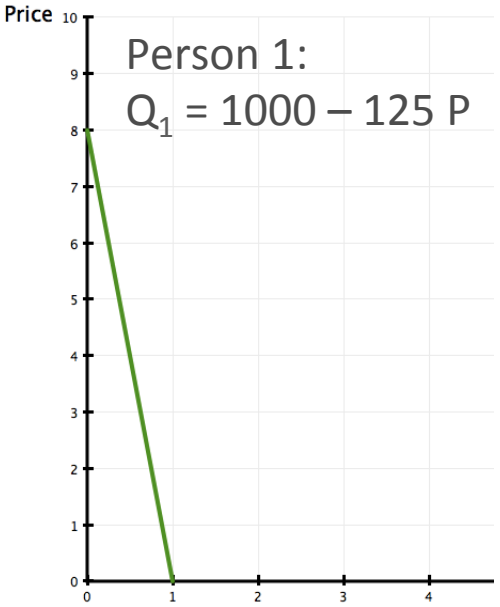
Direct: $Q = a/b - (1/b)\,P$

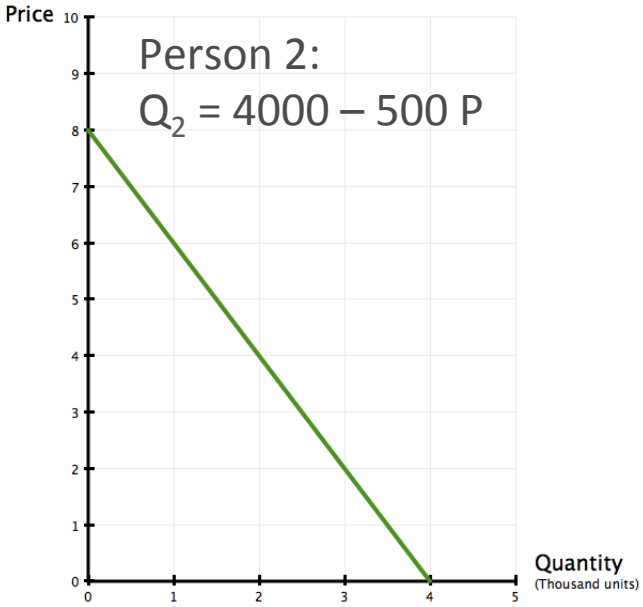
$Q = 8000 - 1000\,P$

Market demand

- Q: Define *market* demand
  - Describes
    - how many units all consumers wish to buy *in total*
    - in a certain geographical area
    - during a certain time period
    - for every possible price
    - taking all other prices as given

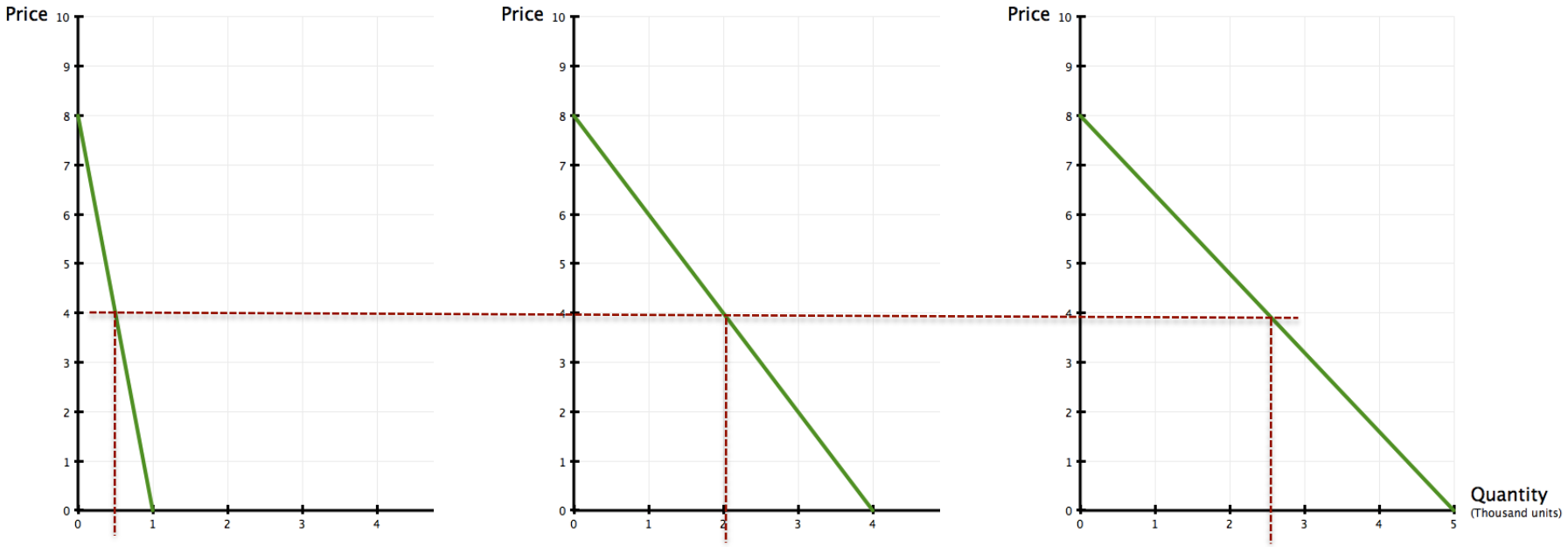
Example: Linear demand





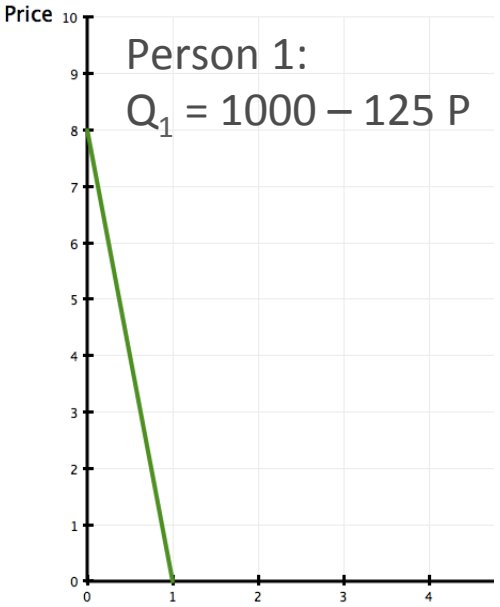
Q:
Derive market demand graphically
(3 minutes)

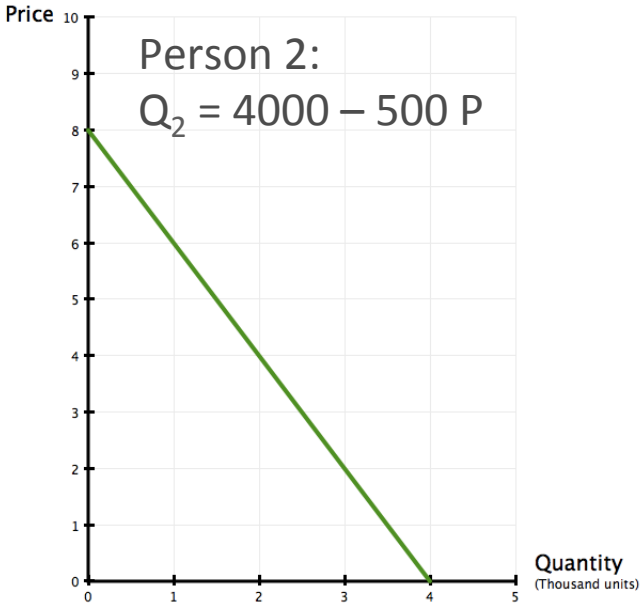
Example: Linear demand



Horizontal summation
-sum quantities
-at every price

Example: Linear demand



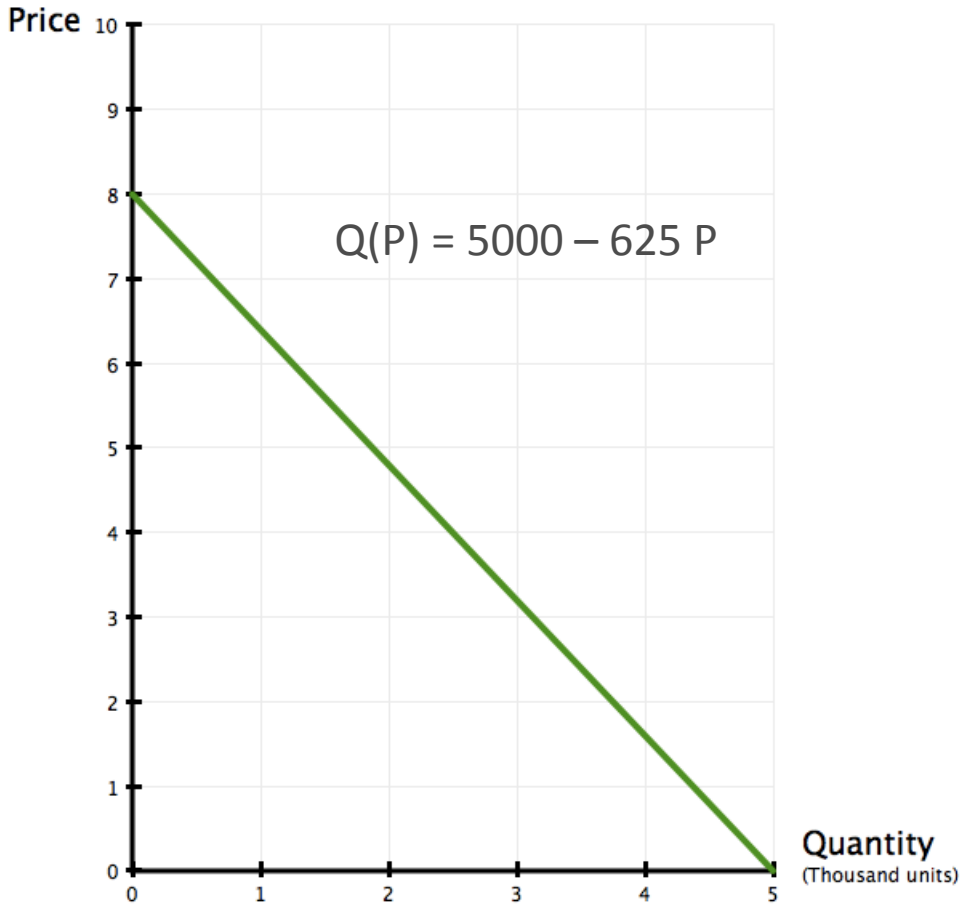


Q:
Derive market demand algebraically
(2 minutes)

Market demand

- Market demand is the sum of individual demands, for every possible price
  - $Q(P) = Q_1(P) + Q_2(P)$
  - $Q(P) = (1000 – 125\ P) + (4000 – 500\ P)$
  - $Q(P) = 5000 – 625\ P$

Example: Linear demand



Market demand

- Q: Derive market demand
  - There are m identical consumers
  - Individual demand is $Q_i(P) = a - b\,P$
  - (4 minutes)
- Answer
  - $$Q(P) = \sum_{i=1}^{m} Q_i(P) = \sum_{i=1}^{m} (a - b \cdot P) = m \cdot (a - b \cdot P) = m \cdot a - m \cdot b \cdot P$$

Market demand

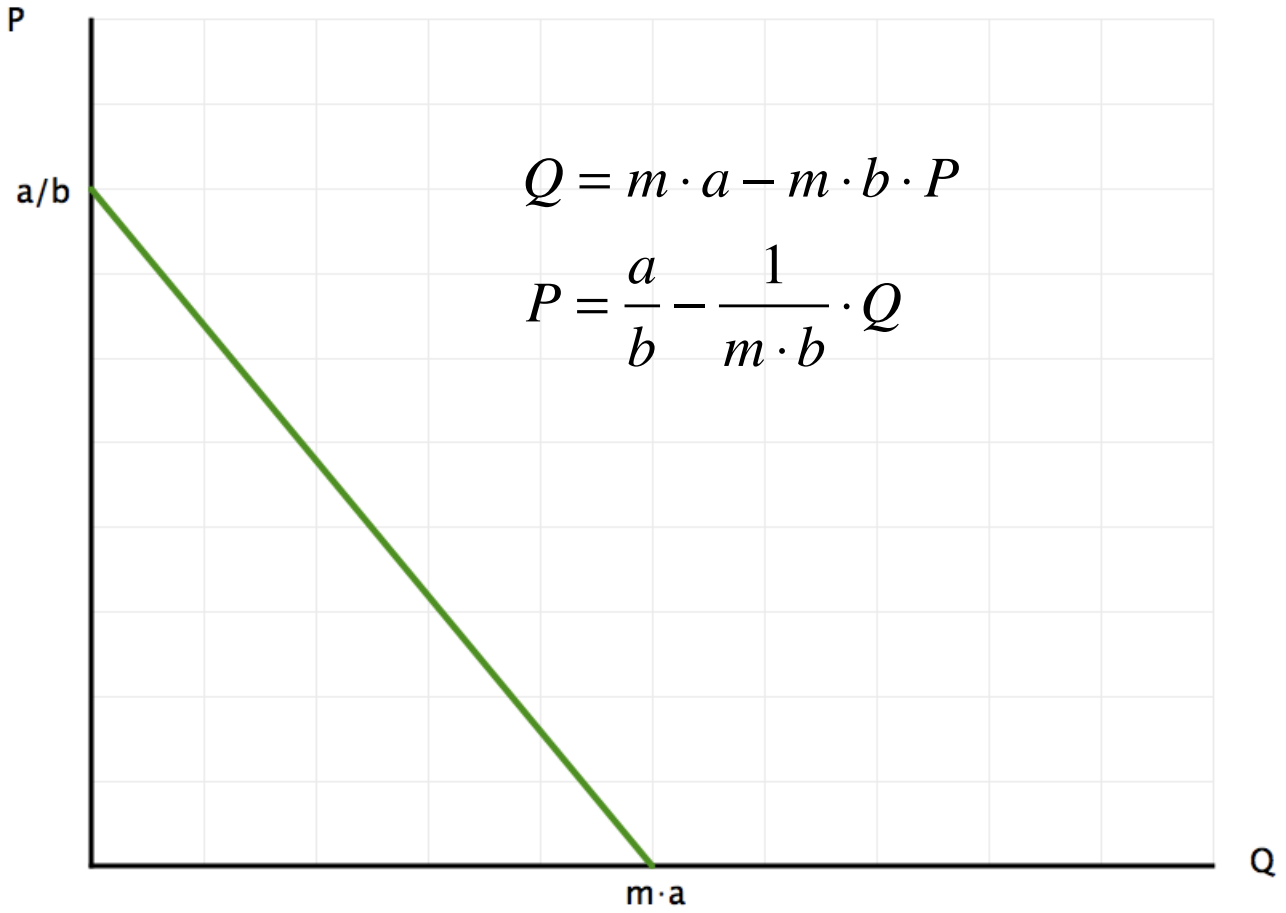
- Q: Derive *indirect* market demand
  - There are m identical consumers
  - Individual demand is $Q_i(P) = a - b\,P$
  - (2 minutes)
- Answer
  - $$Q = m \cdot a - m \cdot b \cdot P$$

    $$P = \frac{a}{b} - \frac{1}{m \cdot b} \cdot Q$$

Market demand

- Q: Market demand function $Q = m \cdot a - m \cdot b \cdot P$
  - Show market demand in a figure
  - What is the consumers' willingness to pay for the first unit of the good?
  - How is demand changed when the number of consumers is increased?
  - (4 minutes)

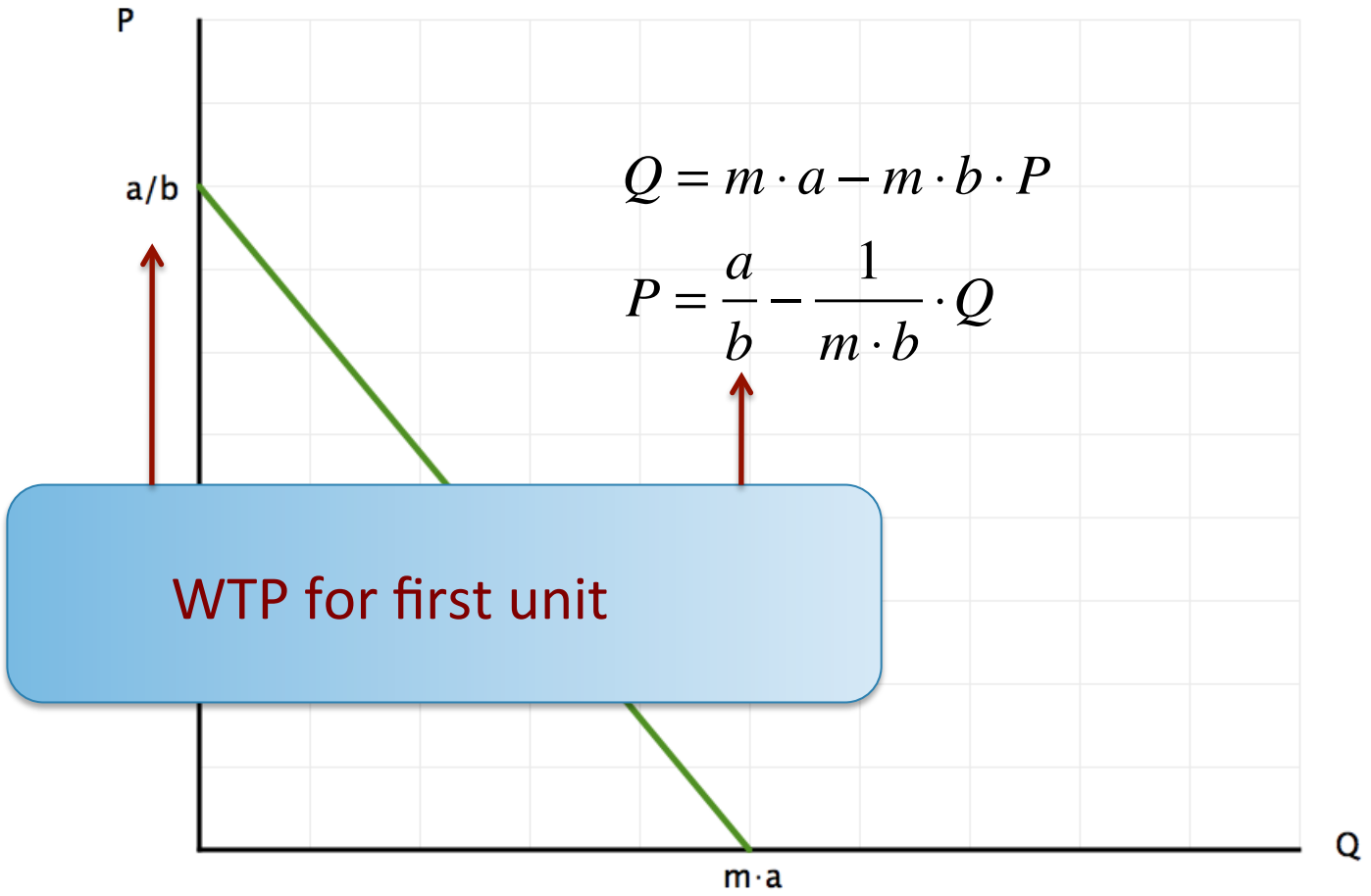
Market demand



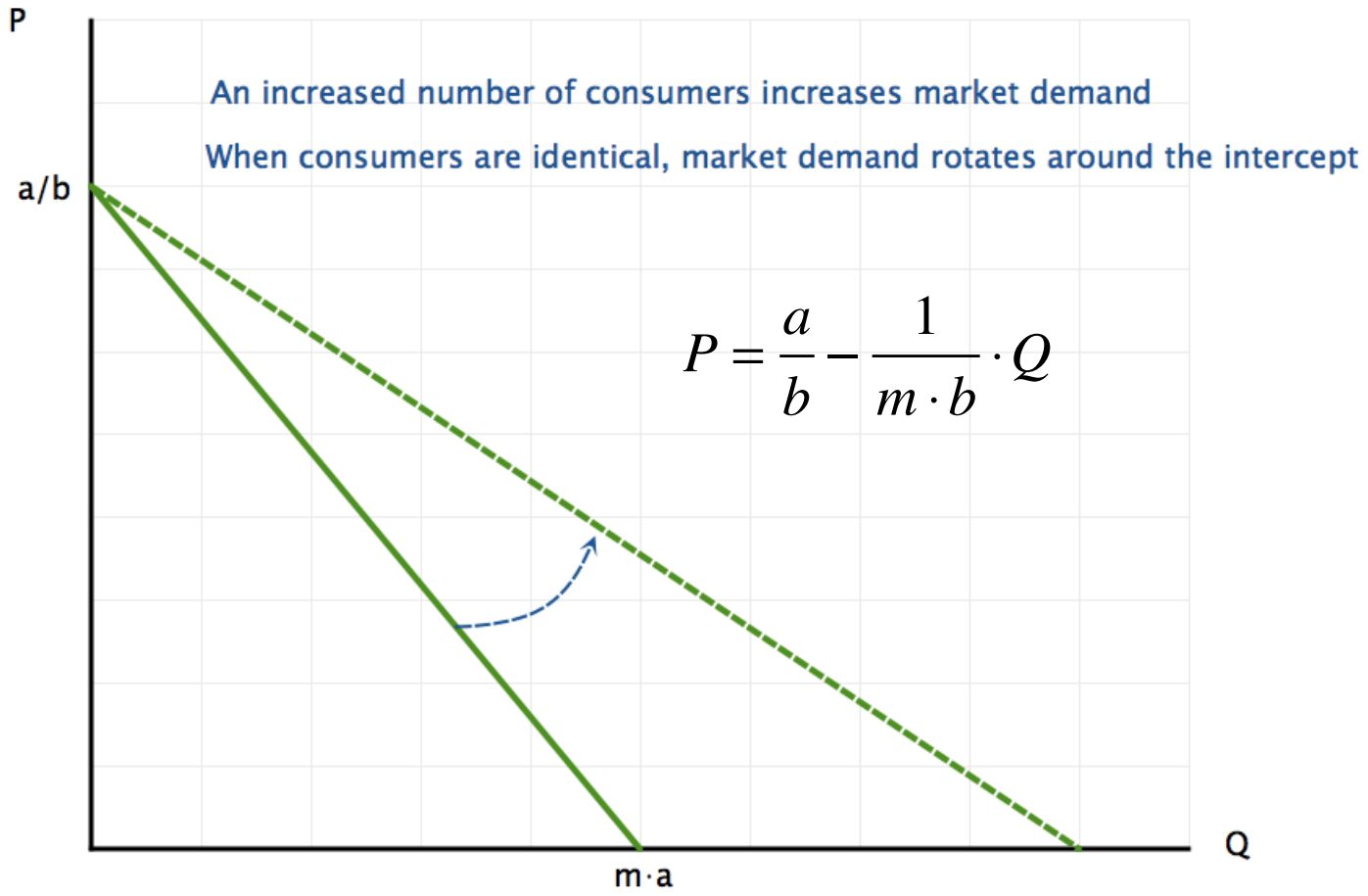
$$Q = m \cdot a - m \cdot b \cdot P$$

$$P = \frac{a}{b} - \frac{1}{m \cdot b} \cdot Q$$

Market demand



Market demand



Supply
(Short run)

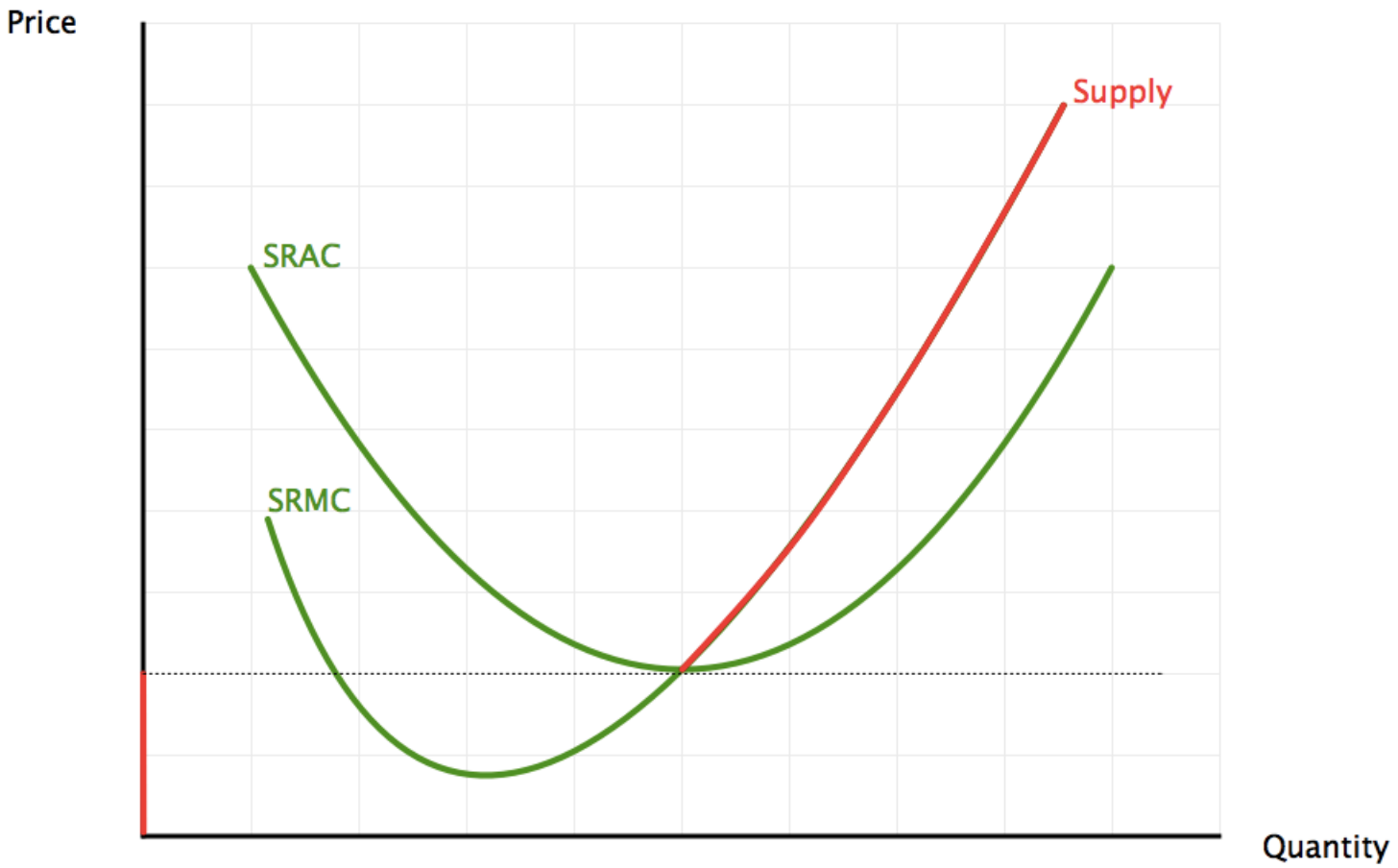
Firm supply

- Q: What do we mean by short run?
  - Firms cannot adjust their physical capital (e.g. number of machines)
  - No entry

Firm supply

- Q: How much will individual firm produce?
  - $P = SRMC_i(Q_i) \Rightarrow Q_i = S_i(P)$
  - Given that $P > SRAC_i$
- Q: Why?
  - If P > MC, the cost of producing an extra unit is lower than the revenues => producing an extra unit increases profits
  - If P < SRAC, better to stop producing. Variable profit negative, despite doing our best

Firm supply



Firm supply

- What is cost?
  - European governments offered electricity companies a number of *free* CO_2-emission rights.
  - Current emission rights value around €13 per unit on the market.
  - Question: should electricity producers take the price of their freely obtained emission rights into account in computing production costs (and setting their final consumer prices)?
- Answer
  - The electricity producer's opportunity cost of its inventory of emission rights is the revenues that could be earned by selling them on the market
  - It does not matter that they were given for free

Firm supply

- What is cost?
  - A jewelry maker has an inventory of gold he purchased at €25,000 in 2012. Current gold price has gone down, however, to €20,000.
  - Question: What is the jewelry maker's cost of using his inventory of gold?
- Answer
  - The jewlery maker's opportunity cost of its inventory of gold is the revenues that could be earned by selling the gold on the market today
  - It does not matter what he paid in the past

Firm supply

- What is cost?
  - Samhall is a government owned company providing services, such as cleaning streets
  - Samhall mainly employs people with disabilities who would otherwise be unemployed.
  - Question: What is the government's cost of "cleaning streets"
- Answer
  - Cost to government
    - wage minus unemployment benefits and taxes
    - could have been used for eg helth care

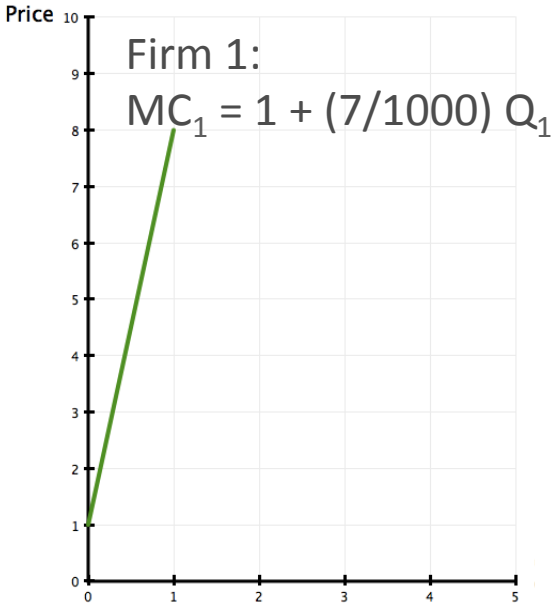
Firm supply

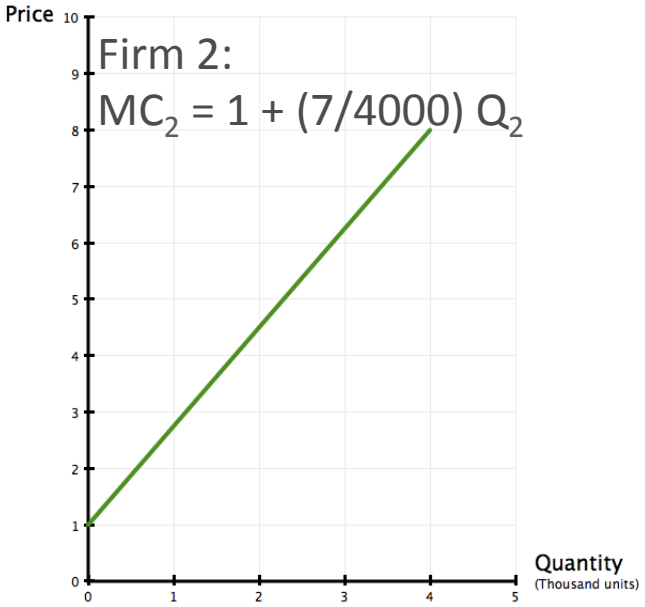
- Q: Define opportunity cost?
  - Value of input in best alternative use

Market supply

- Q: Define *market* supply
  - Describes how many units all firms wish to sell *in total*
  - for every possible price
  - during a certain time period
  - in a certain geographical area
  - taking all other prices as given

Example: Linear supply





Q:

- Derive market supply graphically

-Compute: How much is sold if P = 6

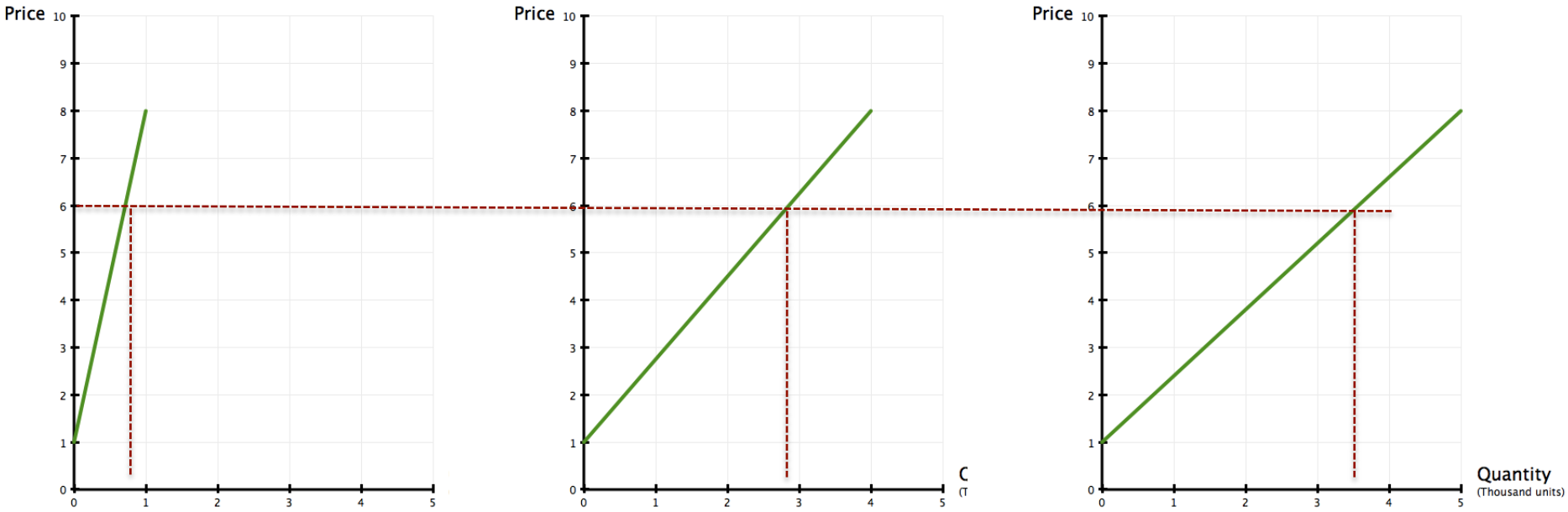
-(4 minutes)

Example: Linear supply

Horizontal summation
-sum quantities
-at every price

$$S(P) = \sum_{i=1}^{n} S_i(P)$$

Example: Linear supply



At P = 6:

$6 = 1 + (7/1000)\, Q_1 \Leftrightarrow 5000/7 = Q_1$

$6 = 1 + (7/4000)\, Q_2 \Leftrightarrow 20000/7 = Q_2$

$Q_1 + Q_2 = 25000/7 \approx 3500$

Equilibrium

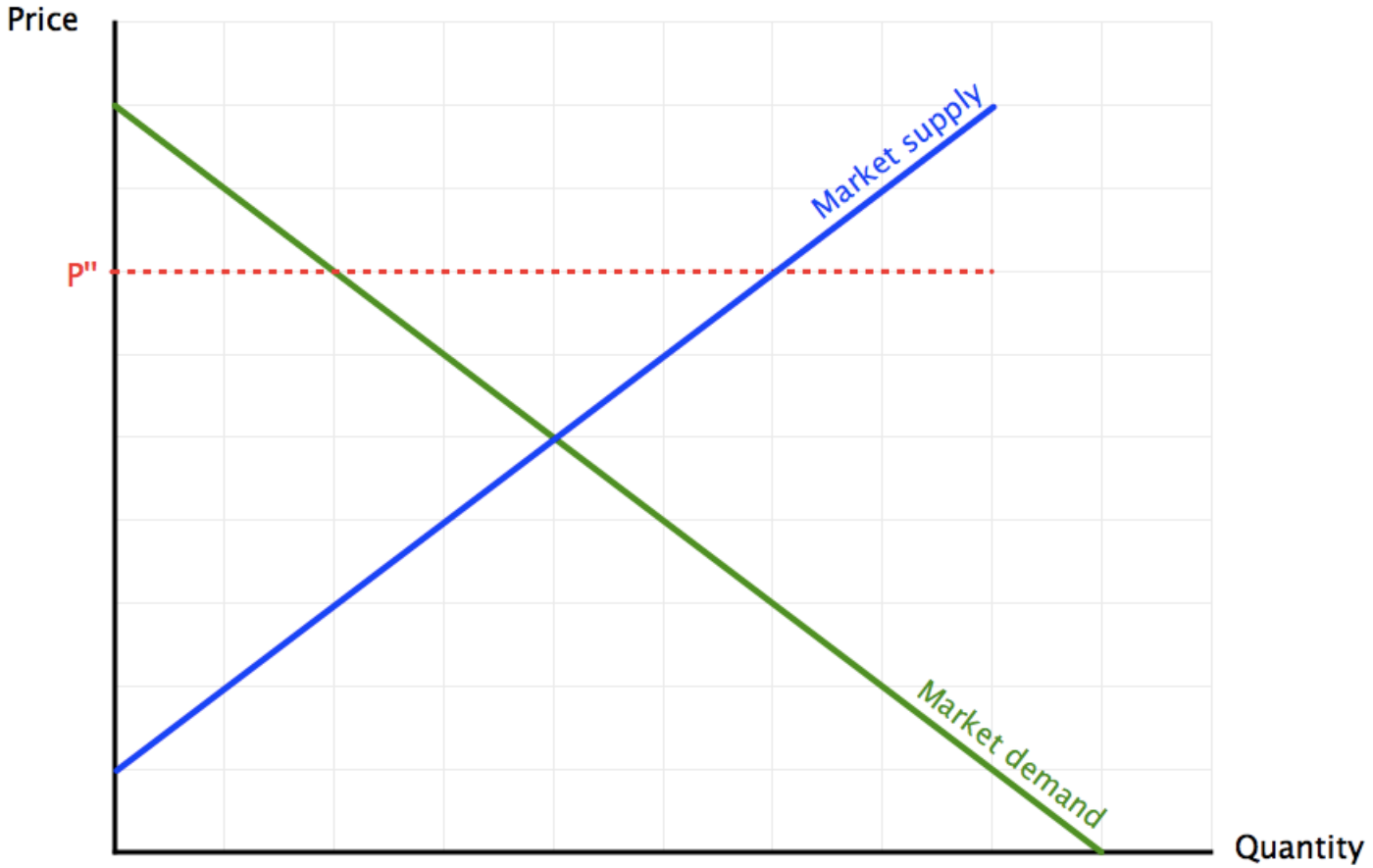
Short run; Partial

Equilibrium

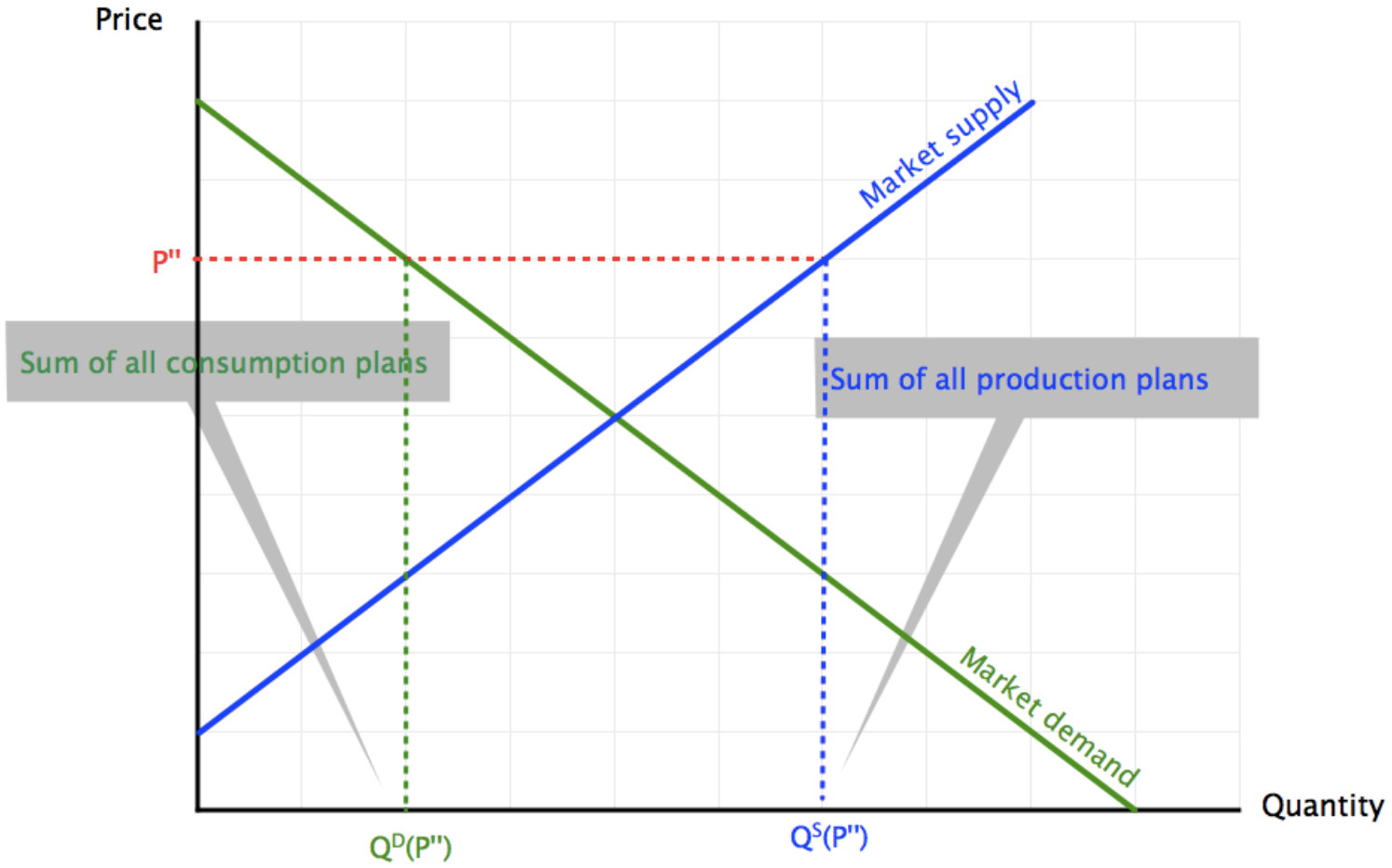
- Q: Define *Equilibrium*
  - A *price* such that
  - All agents' plans can be realized at the same time
- Q: What plans?
  - All consumers can buy what they wish to buy at that price
  - All firms can sell what they wish to sell at that price

Q: Explain why P'' is not an equilibrium price

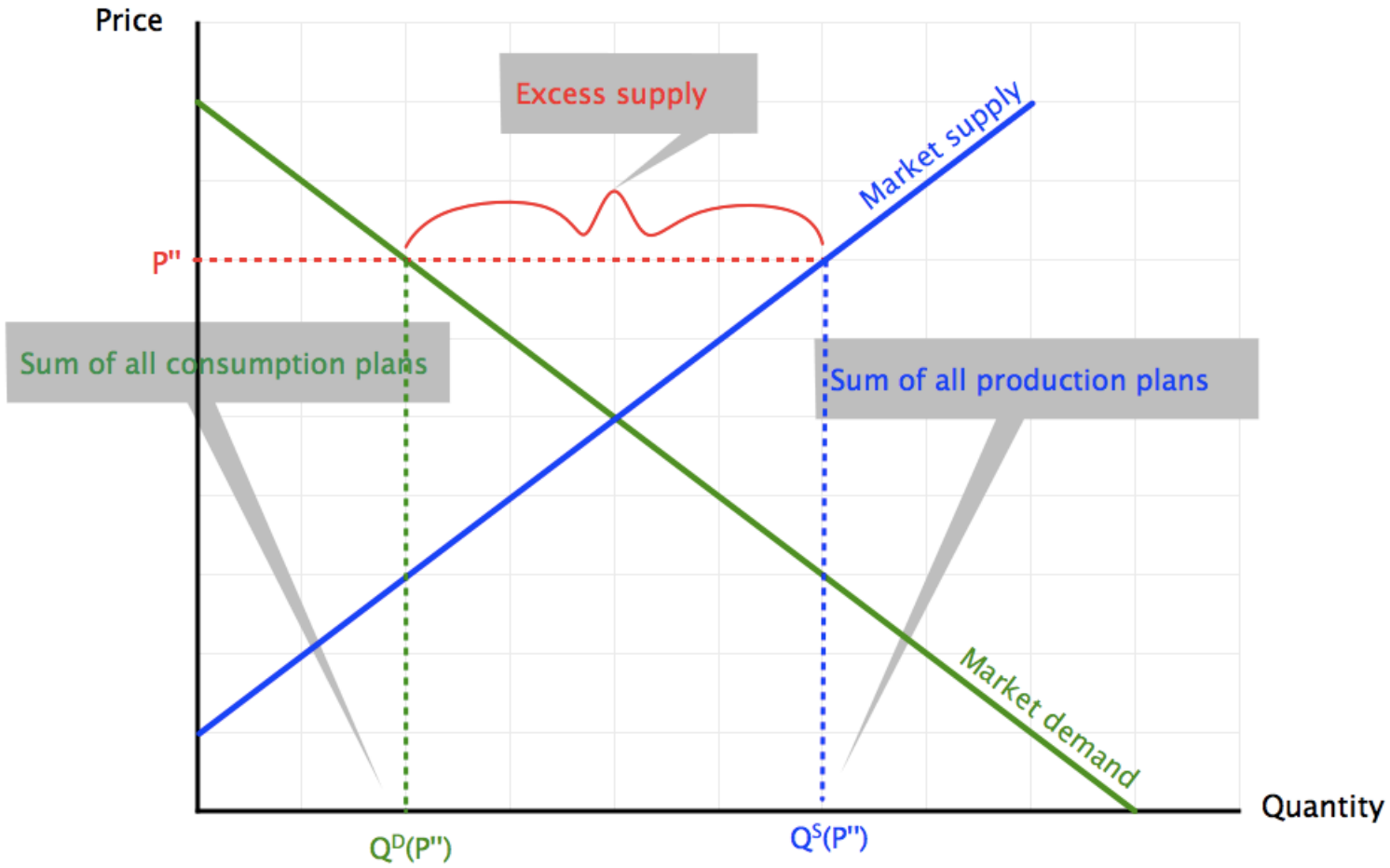
- Use definition



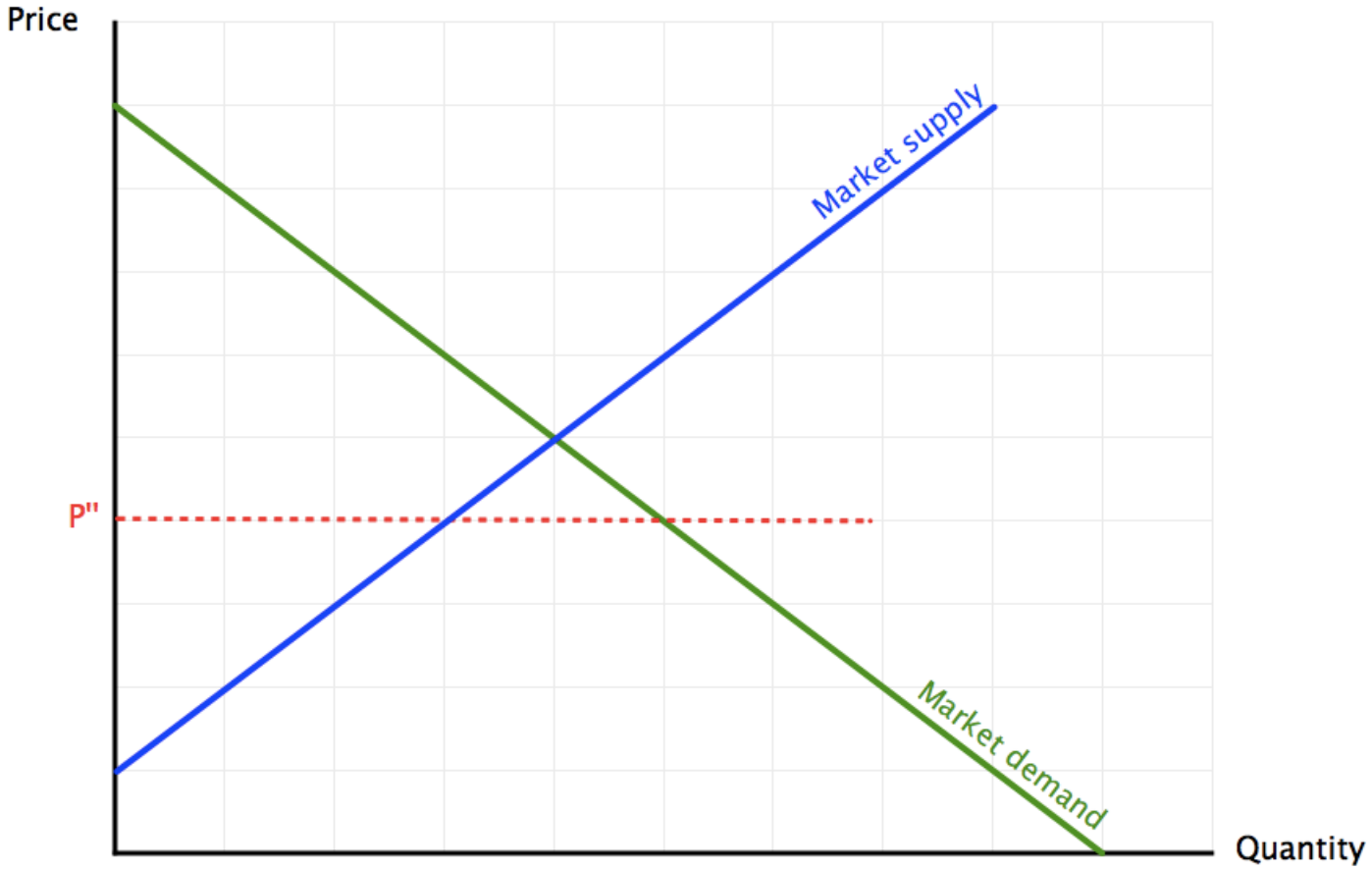
Equilibrium



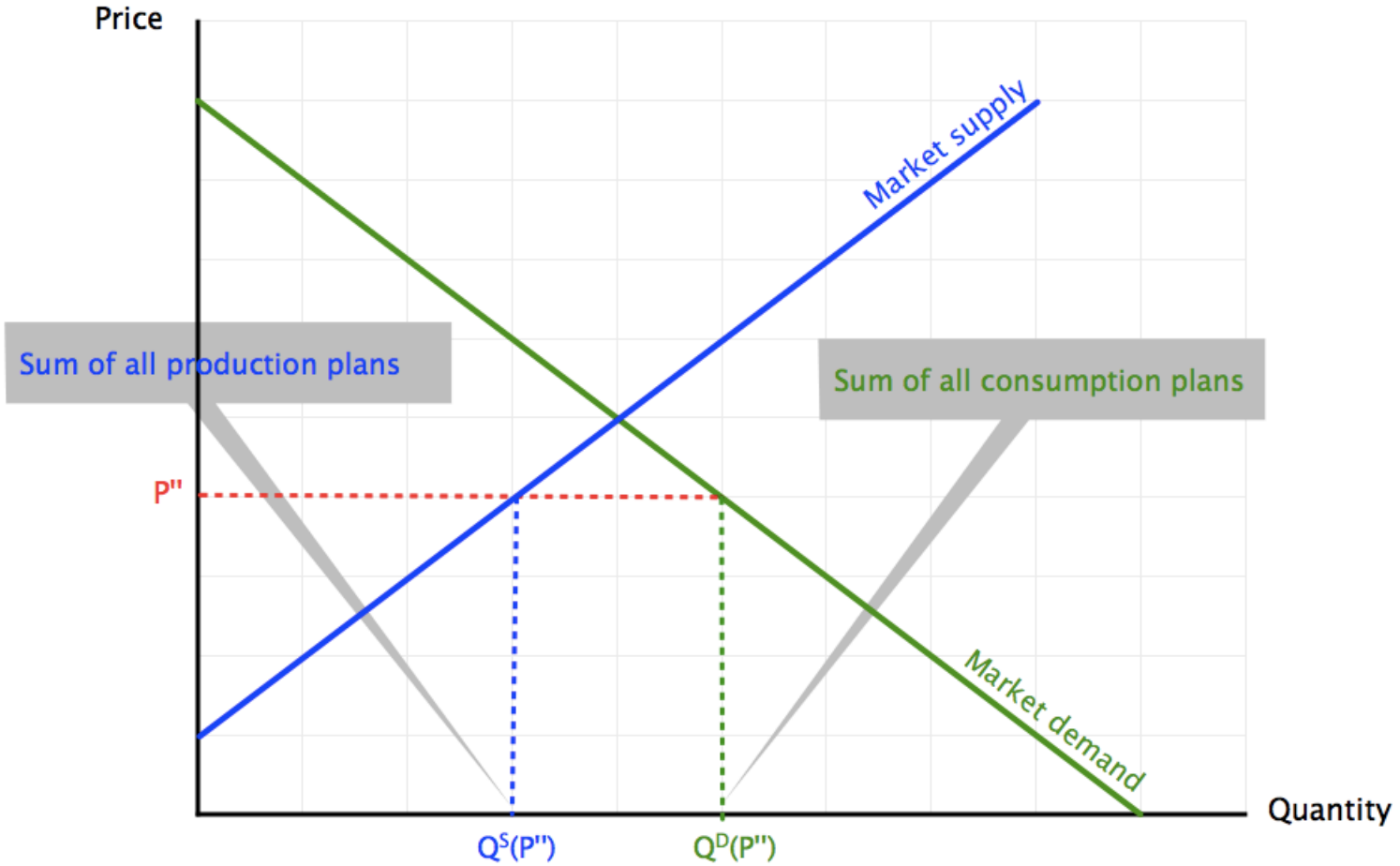
Some firms
must change their plans



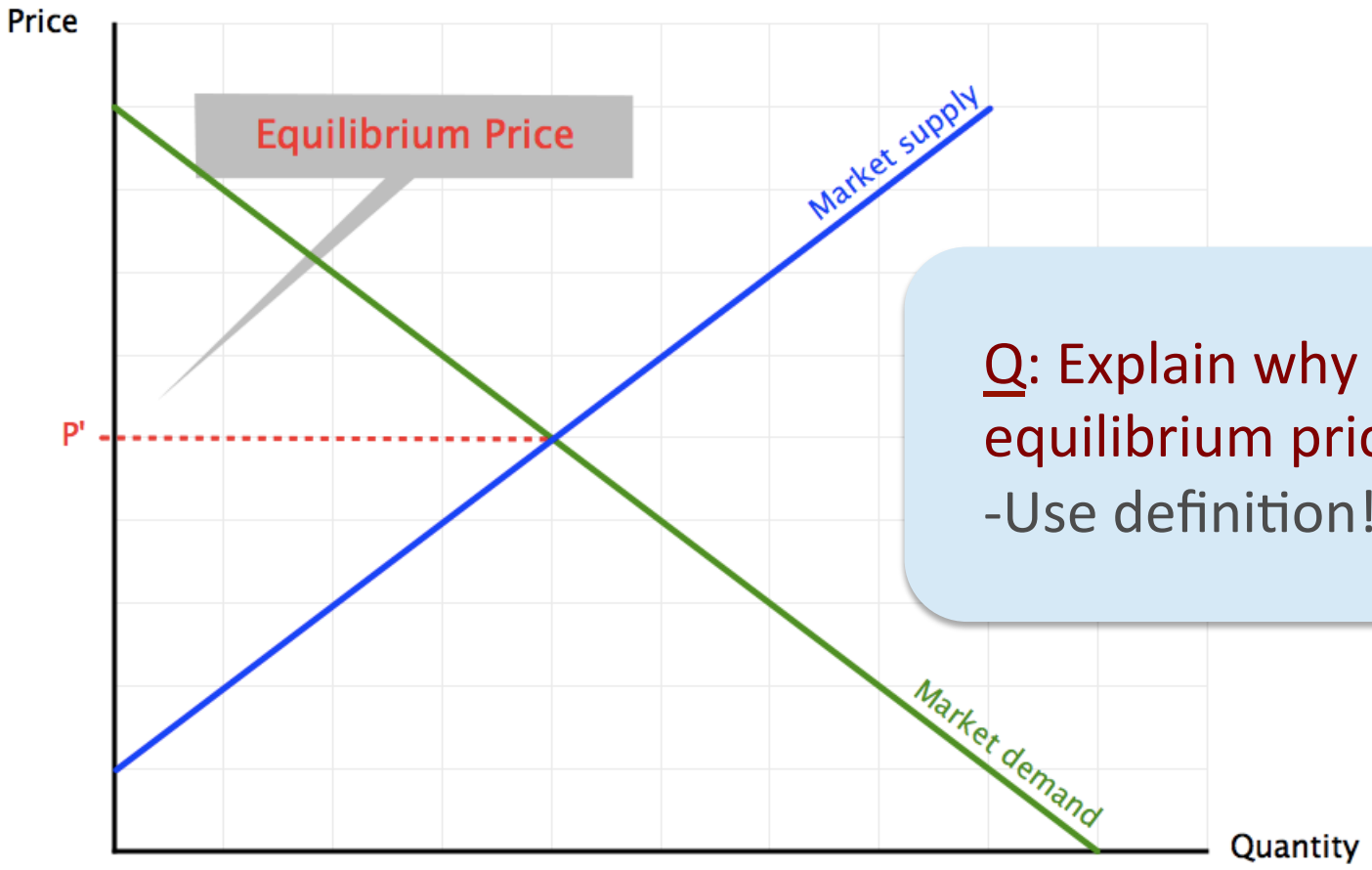
Q: Explain why P'' is not an equilibrium price
- Use definition



Excess demand: $Q^S < Q^D$
Some consumers
must change their plans

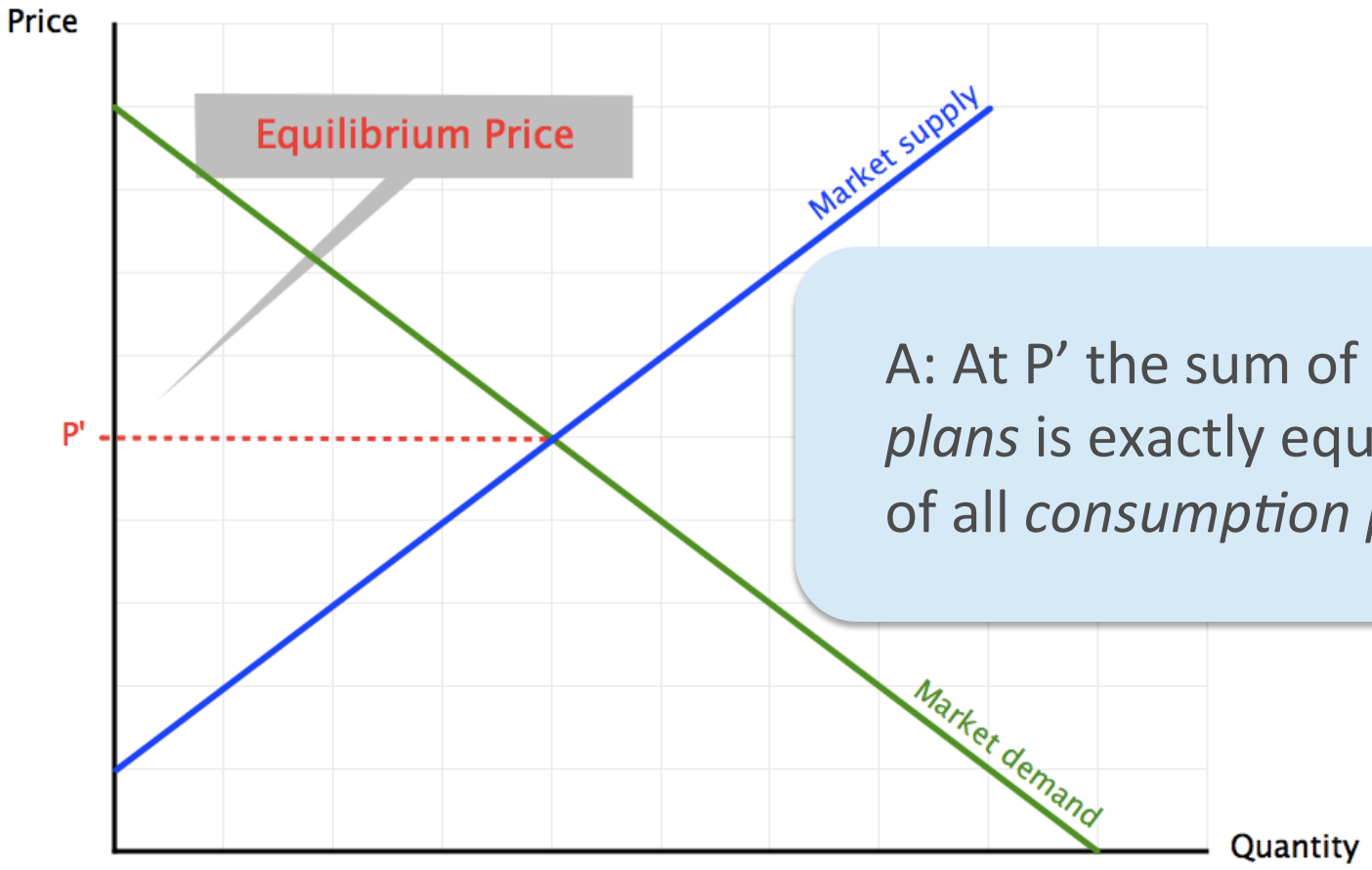


Equilibrium



Q: Explain why P' is the equilibrium price
-Use definition!

Equilibrium



A: At P' the sum of all *production plans* is exactly equal to the sum of all *consumption plans*

Equilibrium

- Q: Compute the equilibrium price (4 min)
  - Demand: $Q^D(P) = a - b\,P$
  - Supply: $Q^S(P) = c + d\,P$
- Solution
  - Equilibrium: A price such that all plans consistent $\Leftrightarrow Q^D(P) = Q^S(P)$
  - $a - b\,P = c + d\,P$ (one equation in one unknown)
  - Solve: $P^* = (a - c)/(b + d)$

Equilibrium

- Q: Compute the equilibrium quantity (3 min)
  - Demand: $Q^D(P) = a - b\,P$
  - Supply: $Q^S(P) = c + d\,P$
- Solution
  - Equilibrium quantity: $Q^* = Q^D(P^*) = Q^S(P^*)$
  - Substitute: $Q^* = a - b\,P^*$ where $P^* = (a-c)/(b+d)$
  - $Q^* = a - b\,[(a-c)/(b+d)]$
  - Simplify: $$Q^* = \left(\frac{d}{b+d}\right)a + \left(\frac{b}{b+d}\right)c$$

Equilibrium

- Q: Compute the cost of supplying on additional unit of this good (2 min)
- Solution
  - Marginal cost = equilibrium price

Equilibrium

- Q: Compute equilibrium price and quantity (4 min)
  - Inverse demand: $P = \alpha - \beta Q$
  - Inverse supply: $P = \gamma + \delta Q$
- Solution
  - Short-cut: "Supply-price" and "demand-price" must be equal
  - $\alpha - \beta Q = \gamma + \delta Q$ (one equation in one unknown)
  - Solve: $Q^* = (\alpha - \gamma)/(\beta + \delta)$
  - $P^* = \alpha - \beta Q^* = \alpha - \beta (\alpha - \gamma)/(\beta + \delta) = \ldots$

Justification for equilibrium?

- So far
  - We have defined what we mean by equilibrium
  - We want to use this idea to make predictions about real world markets

Justification for equilibrium?

- An example when it did not work

Justification for equilibrium?

Johnny Carson
American TV-host ("The Tonight Show") & comedian

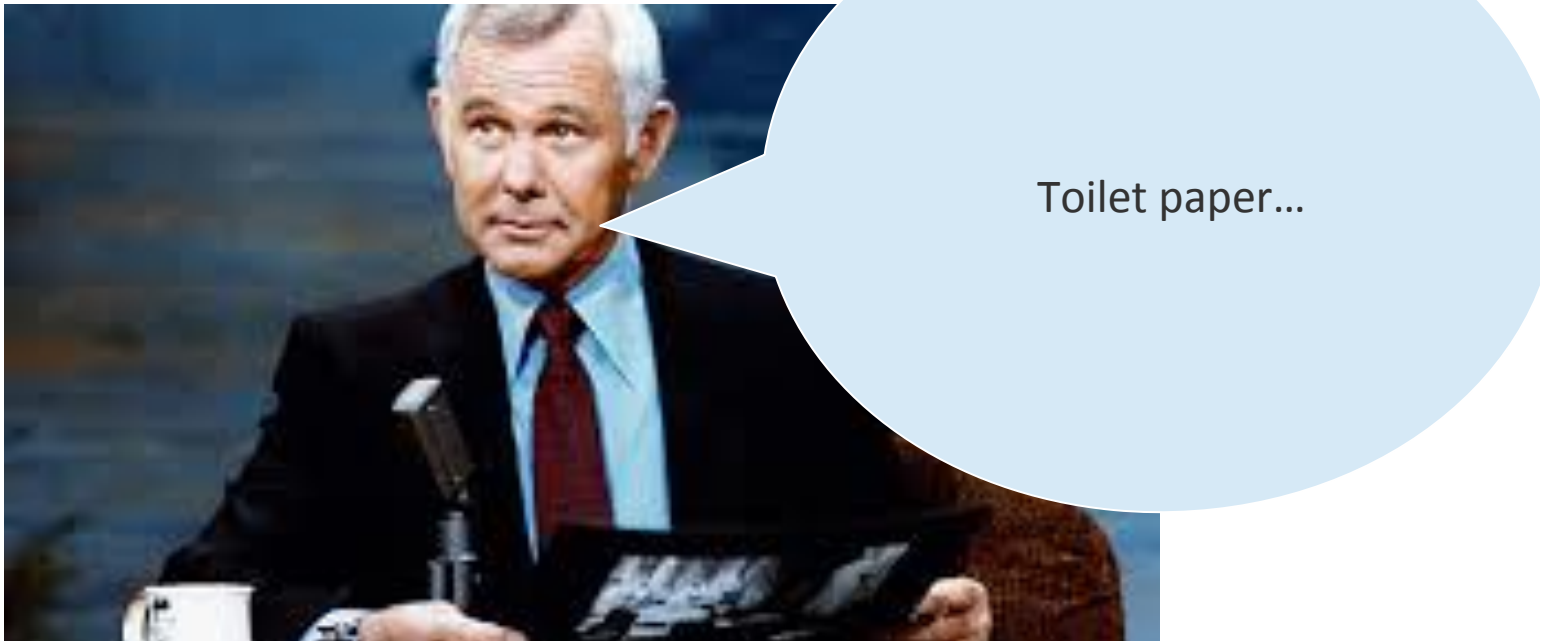
Justification for equilibrium?

December of 1973

Johnny Carson
American TV-host ("The Tonight Show") & comedian

Justification for equilibrium?

December of 1973



Johnny Carson
American TV-host ("The Tonight Show") & comedian

Justification for equilibrium?

December of 1973

Johnny Carson
American TV-host ("The Tonight Show") & comedian

Justification for equilibrium?

Americans went out and bought up all toilet paper they could find

Justification for equilibrium?

Supermarkets tried to ration it, but without success.

By noon the next day, all the nation's supermarkets were sold out.

Justification for equilibrium?

After several days of toilet paper shortages due to this hysteria,

Johnny Carson
American TV-host ("The Tonight Show") & comedian

Justification for equilibrium?

But shelves were almost always empty =>

=> whenever some would come in, people would buy it all and hoard it

Justification for equilibrium?

This toilet paper shortage lasted three weeks.

Justification for equilibrium?

- Expressed differently

  If people expect shortage or price increases, demand today increases

  … a form of speculation demand …

  … which may create shortage and price increases increasing demand even further ….

  … creating a vicious circle

Justification for equilibrium?

- Conclusion:
  - If people don't trust that prices are in equilibrium (i.e. believe they can buy as much as they wish)
  - The price system may fail to coordinate

Justification for equilibrium?

– http://youtu.be/UZLjUEBuUQY

Justification for equilibrium?

- Related (more common?) phenomena
  - Price regulation => small excess demand => people start to hoard => big excess demand (common in Soviet Union)
  - Bubbles in asset markets (with flexible prices)
    - People expect a price to increase
    - Increase their demand (speculation)
    - Causes price to increase, confirming beliefs
    - May cause expectations for further price increases …

Justification for equilibrium?

- Question for next lecture
  - Is there any reason to believe that markets are in equilibrium?