

Lesson 1. Introduction

1 Overview

- **Economics** is the study of how society manages its scarce resources
- In particular, economists study
 - how people make decisions – e.g. how much they work, what they buy, how much they save
 - how people interact with each other – e.g. how buyers and sellers determine the price of a good
 - how forces and trends affect the wealth and resources of society as a whole – e.g. unemployment rate, growth in average income
- **Mathematics** allows us to study problems in economics with rigor, generality, and simplicity
- This course will cover various mathematical topics essential to the study of economics

2 Today

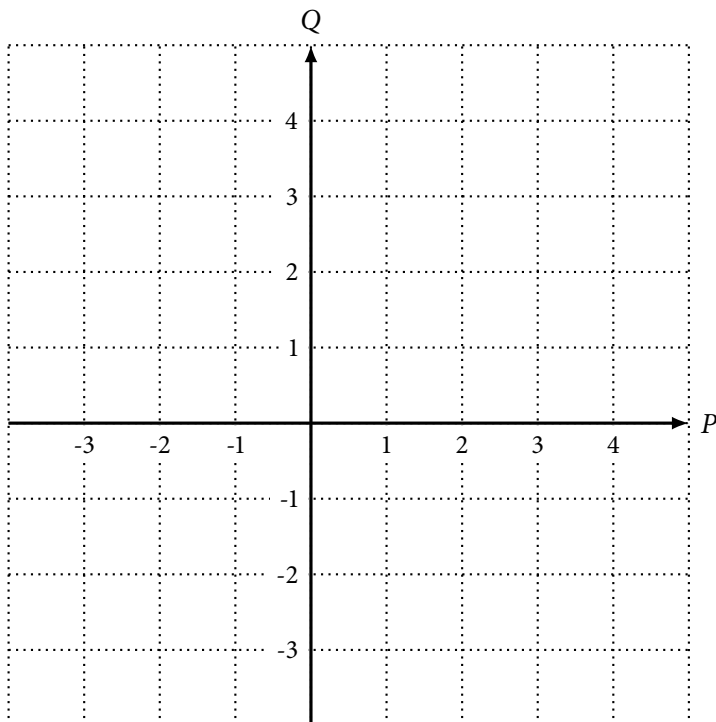
- An example: an economic model for partial market equilibrium

3 Warm up

Example 1. On the axes below, draw the following equations and label the points of intersection.

$$Q = 4 - 2P$$

$$Q = -1 + P$$



4 What is an economic model?

- An **economic model** is a set of **variables** and a set of **relationships** (e.g. equations) between them representing some economic process
- Models are typically abstractions of the real world
- Even a rough representation of the economic process we want to study can give us good insights
 - “All models are wrong, but some are useful.” –George Box, statistician

5 What is an equilibrium?

- **Equilibrium** is a state where economic forces (e.g. supply and demand) are balanced, and in the absence of external influence, the values of these economic forces will not change
- In other words, equilibrium is a situation characterized by a lack of tendency to change
- Careful! An equilibrium is not necessarily desirable!
 - e.g. underemployment equilibrium resulting from an overqualified workforce

6 Constructing a model for partial market equilibrium

- Let's consider a market with only one commodity
- Variables:

- Assumptions:

- Standard market equilibrium condition: excess demand is zero

- Quantity demanded is determined by: $Q_d = 4 - 2P$
Does this make sense? Why?

- Quantity supplied is determined by: $Q_s = -1 + P$
Does this make sense? Why?

- Putting this all together, we have our equilibrium model:

$$\begin{aligned} Q_d &= Q_s \\ Q_d &= 4 - 2P \\ Q_s &= -1 + P \end{aligned} \tag{A}$$

- Solution to (A):

7 Generalizing the model

- Instead of using specific numbers to define the relationships between Q_d and Q_s , we can use **parameters** to write a general partial market equilibrium model:

 (B)

\Rightarrow As P increases, Q_d and Q_s

- We can find a solution to (B) through substitution:

- Does this solution match with our first equilibrium model?

- For what values of a, b, c, d does this solution make sense?
 - Equilibrium price must be positive

- Equilibrium quantity must be positive

8 A nonlinear model for partial market equilibrium

- In our previous models, the quantity demanded and the quantity supplied were **linear** in the price
- What if the quantity demanded was instead **quadratic** in the price, like in the model below?

$$\begin{aligned} Q_d &= Q_s \\ Q_d &= 4 - P^2 \\ Q_s &= -1 + 4P \end{aligned} \tag{C}$$

Example 2. Find a solution to equilibrium model (C) algebraically. *Hint.* Use the quadratic formula.

Example 3. Find a solution to equilibrium model (C) graphically by drawing Q_d and Q_s as a function of P .

