Chapter 3

A Consumer's Constrained Choice

Main Concepts

- Preferences
- Utility
- Budget Constraints

Preferences

- Consumer decisions are very complex!
    - Why do you buy what you buy?
- To understand consumer choice, economists use the concept of preferences
- Economics assumes people are making choices that lead to (what they think will be) their most desirable feasible outcome
- We assume 5 properties hold

5 Properties of Preferences

- Completeness
    - Consumers **must** be able to compare two different bundles of goods and either:
        1. Prefer the 1st bundle
        2. Prefer the 2nd bundle
        3. Be indifferent between the two
    - “I don’t know” not allowed!

5 Properties of Preferences

- Transitivity
    - Same in economics as mathematics
    - If a consumer prefers Bundle A to Bundle B and also prefers Bundle B to Bundle C, then she **must** prefer Bundle A to Bundle C
    - Intuition says violations don't make sense
    - **Note**: no violation if consumer is indifferent to all three bundles

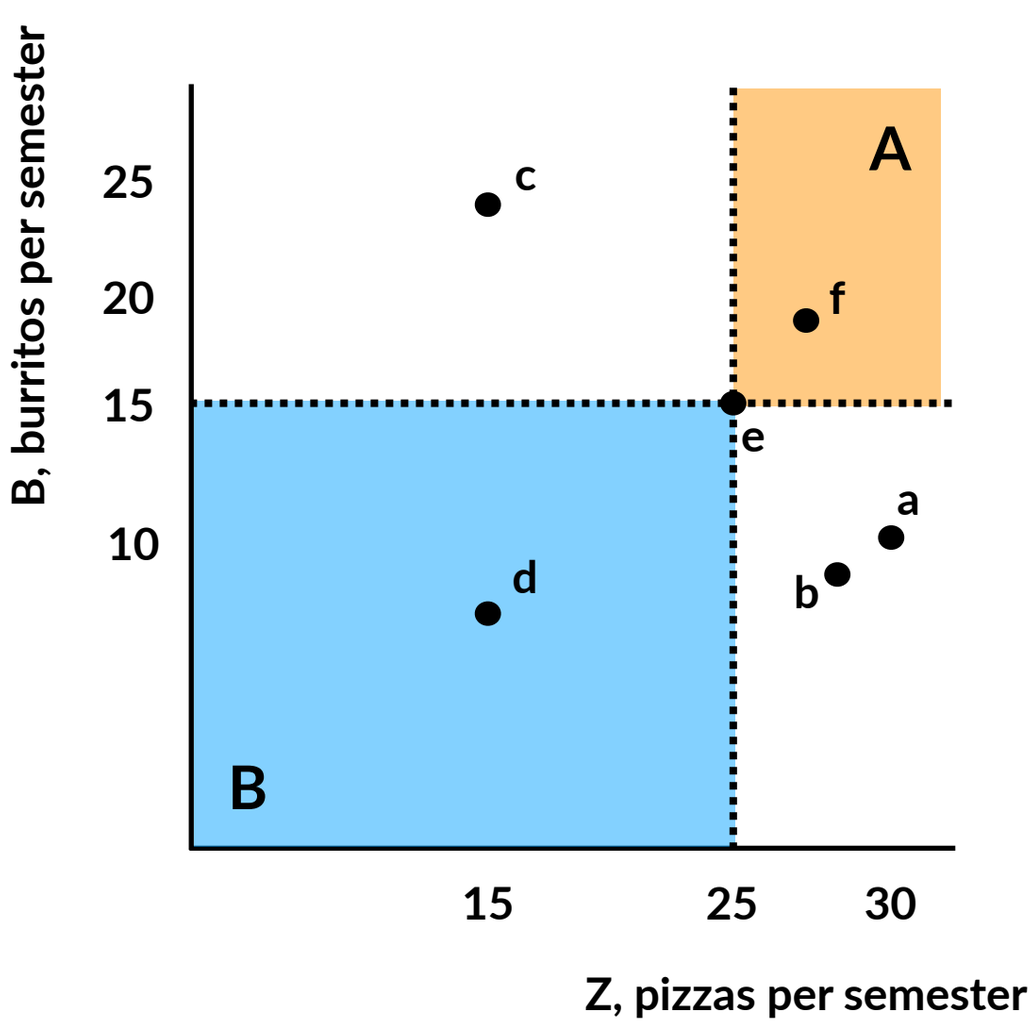
5 Properties of Preferences

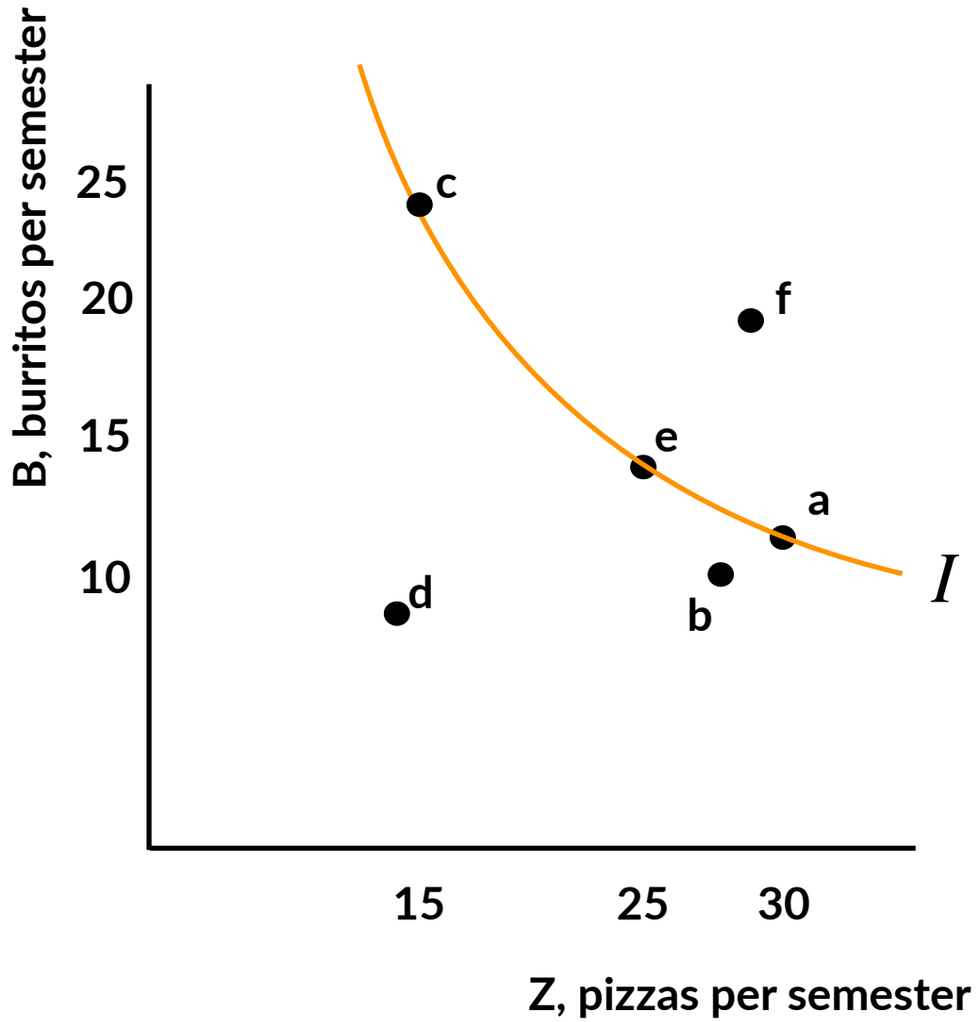
- More is Better
    - *Ceteris paribus*, consumers prefer more to less
    - Also known as “non-satiation”
    - Holds only for economic “goods,” not economic “bads” (e.g. pollution)
    - A related point: **free disposal and the ability to consumer over time**

5 Properties of Preferences

- Convexity
    - Consumers prefer averages to extremes or balanced bundles
    - Example: a consumer prefers
        - 10 apples to 10 bananas, and 10 oranges to 10 bananas
        - Convexity guarantees that the same consumer will prefer a bundle with 5 apples and 5 oranges to a bundle with 10 bananas
    - This is NOT the same as guaranteeing the consumer will prefer 5 apples and 5 oranges to 10 apples
    - Continuity and convexity provide analytical ease, but not as solidly grounded in economic theory or empirical evidence as others

Bundles of Pizzas and Burritos



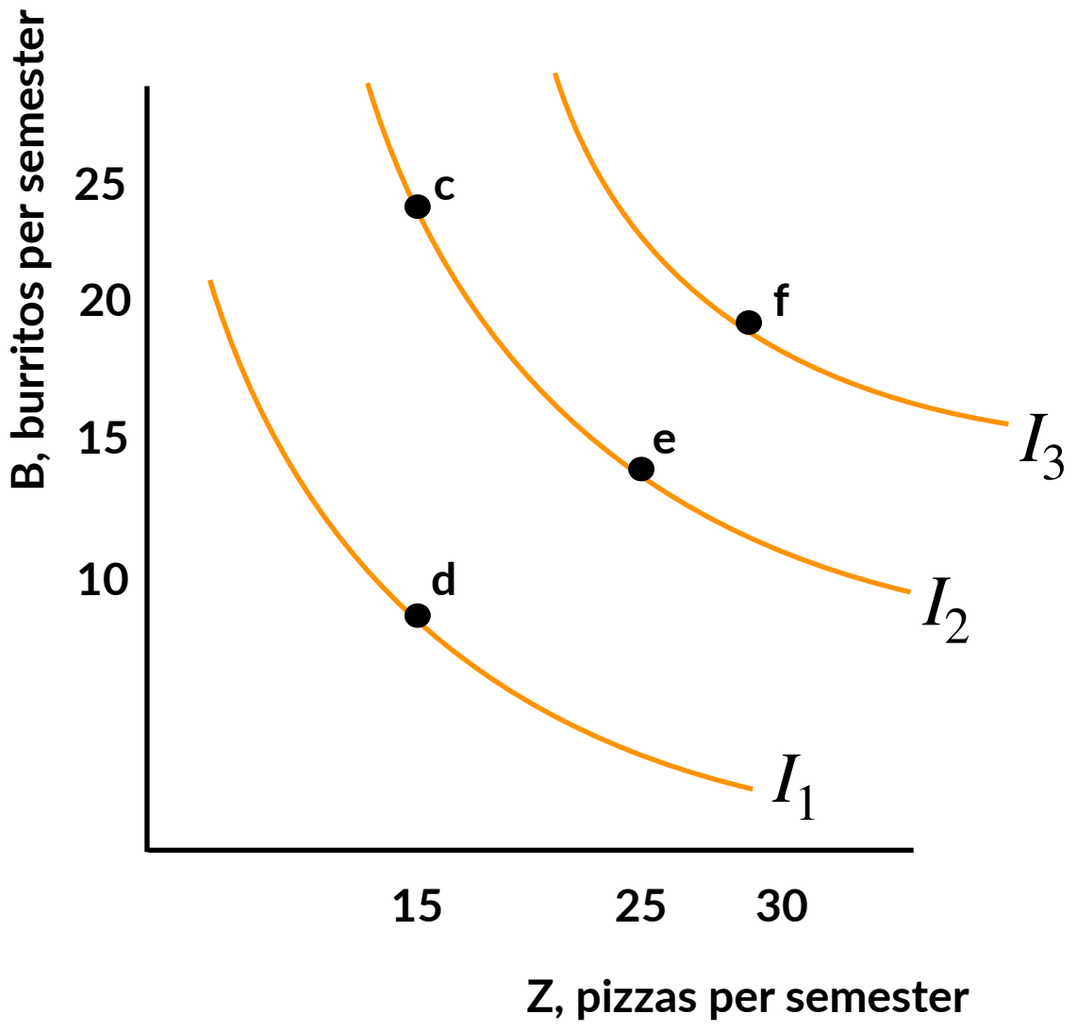


Preference Maps: Indifference Curves

- We define a set of all bundles of goods that consumers view as being equally desirable as an **indifference curve**
    - Consumers are indifferent between any outcome on an indifference curve
- Many of these sets exist
    - In theory, we could learn so much about a consumer's preferences that we could draw the set of every single one of their indifference curves
        - This creates the consumer's **indifference map**

Bundles of Pizza and Burritos

- Because preferences are convex:
  - Have to give up more burritos to get an extra pizza the more burritos they have



5 Properties of Indifference Curves

1. Bundles on indifference curves farther from the origin are preferred to those closer to the origin

2. There exists an indifference curve through every possible bundle

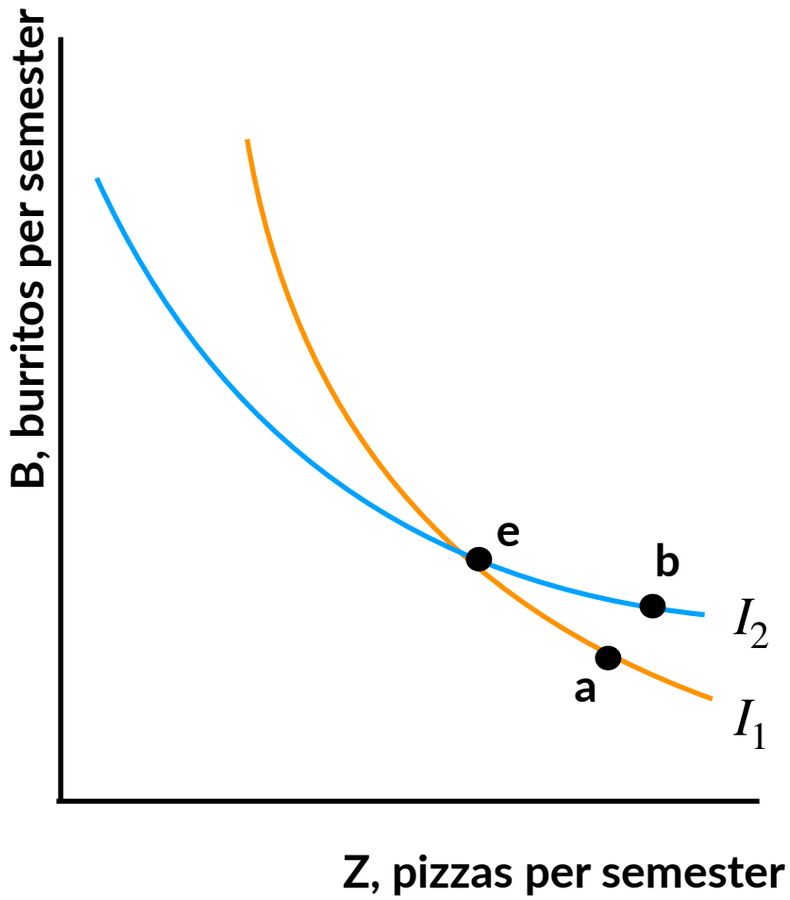
3. Indifference curves cannot cross

4. Indifference curves must slope downward

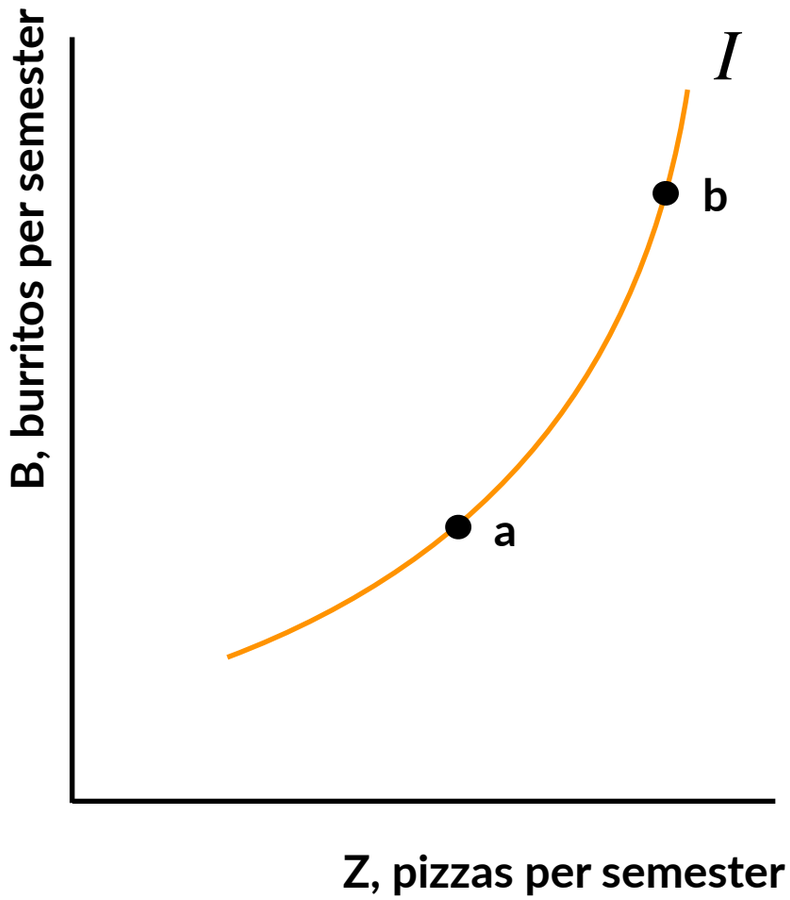
5. Indifference curves can’t have “thickness"

Impossible Indifference Curves

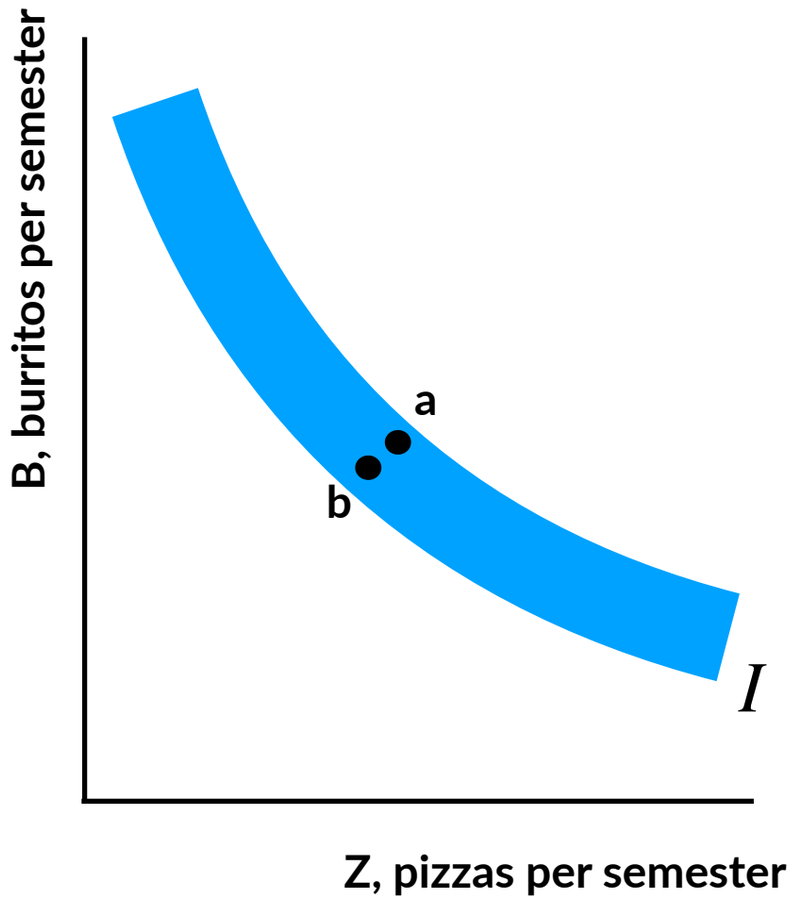
(a) Crossing



(b) Upward Sloping



(c) Thick



Preferences and Utility

- Utility reflects an individual's wellbeing, happiness, satisfaction, etc.
- Conceptualized using a **utility function**
    - A mathematical tool that maps consumption bundles for every possible combination of goods into numerical values
- Ordinal, not cardinal: shows order, not magnitude
        - A utility of 4 is only larger than a utility of 2, NOT twice the amount of utility
- Relates to indifference curves because all bundles on the same indifference curve must produce the same level of utility

Indifference Curves and Substitution Between Goods

- An individual's utility function dictates the manner in which they are willing to substitute between different goods, holding their utility constant
    - Move along and between indifference curves

Shapes of Indifference Curves

- The **slope** (derivative) of an indifference curve shows the rate at which a consumer is willing to give up a good in order to get more of another — called the **marginal rate of substitution (MRS):**

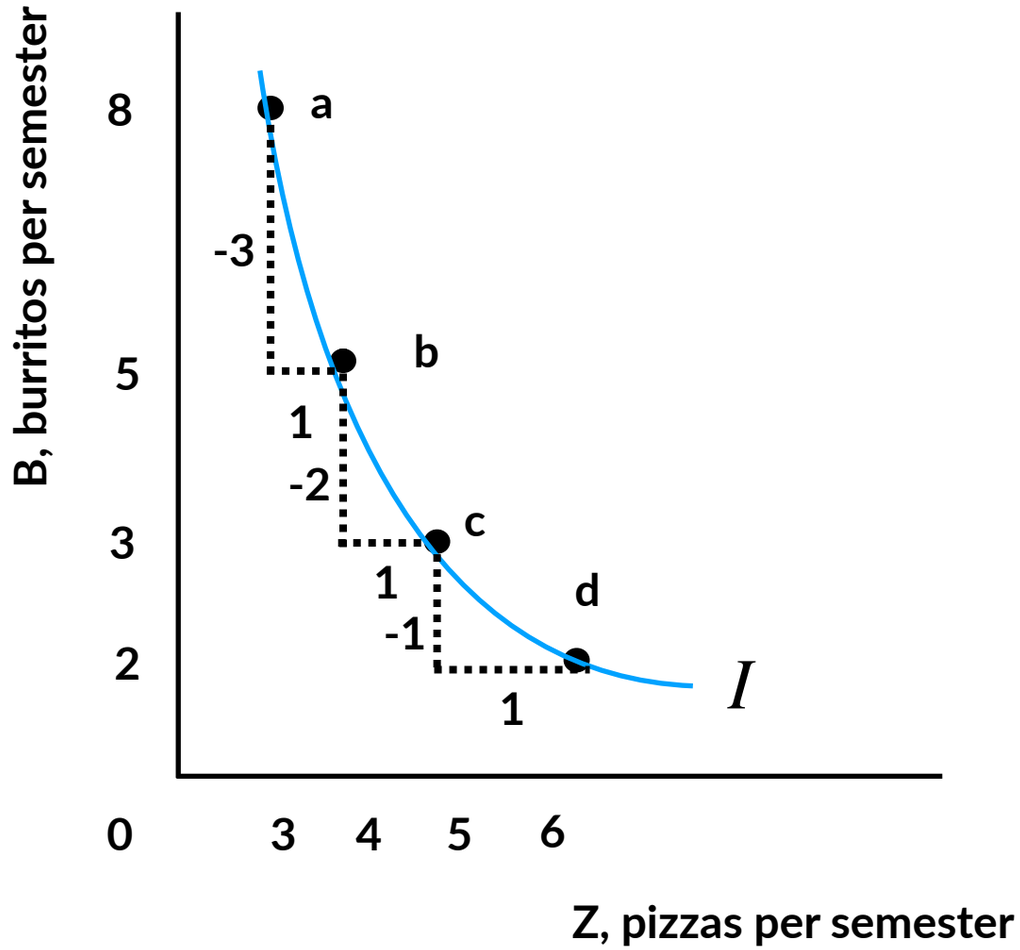
$$MRS = \frac{\Delta A}{\Delta B}$$

- The MRS must be negative

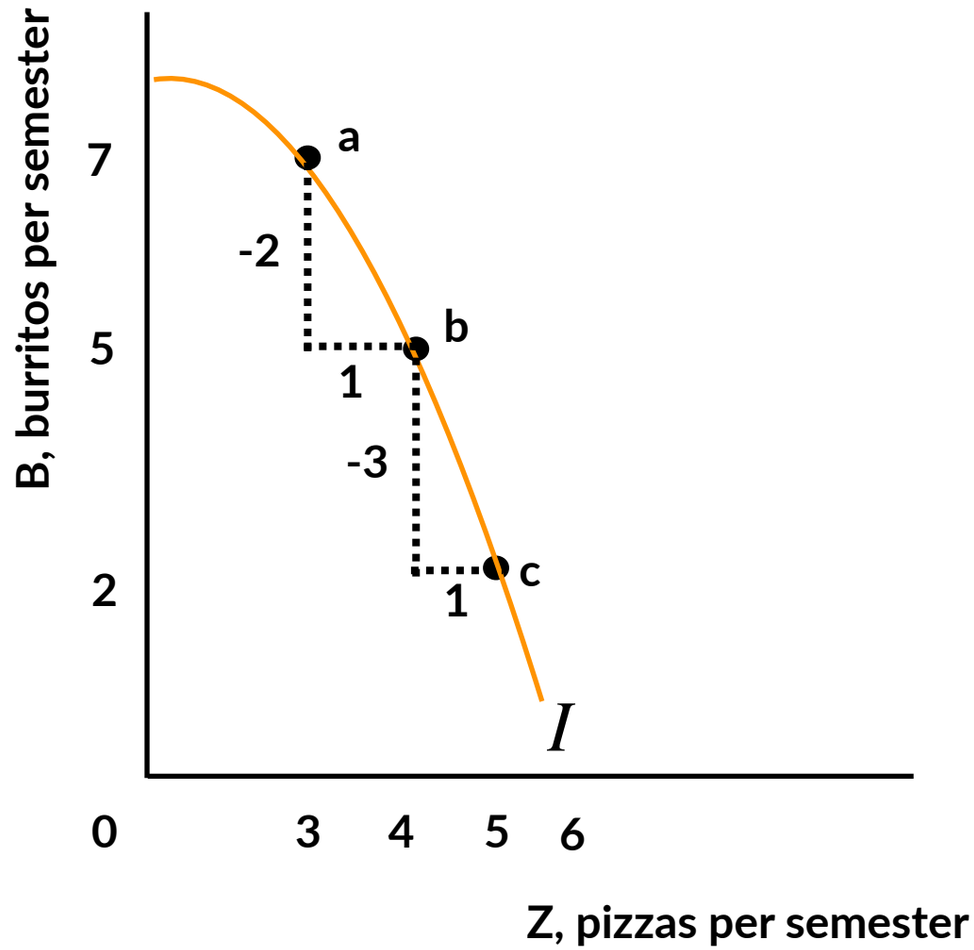
- The MRS (slope/derivative) typically changes along the indifference curve

Marginal Rate of Substitution: Which is Normal?

(a) Indifference Curve Convex to the Origin

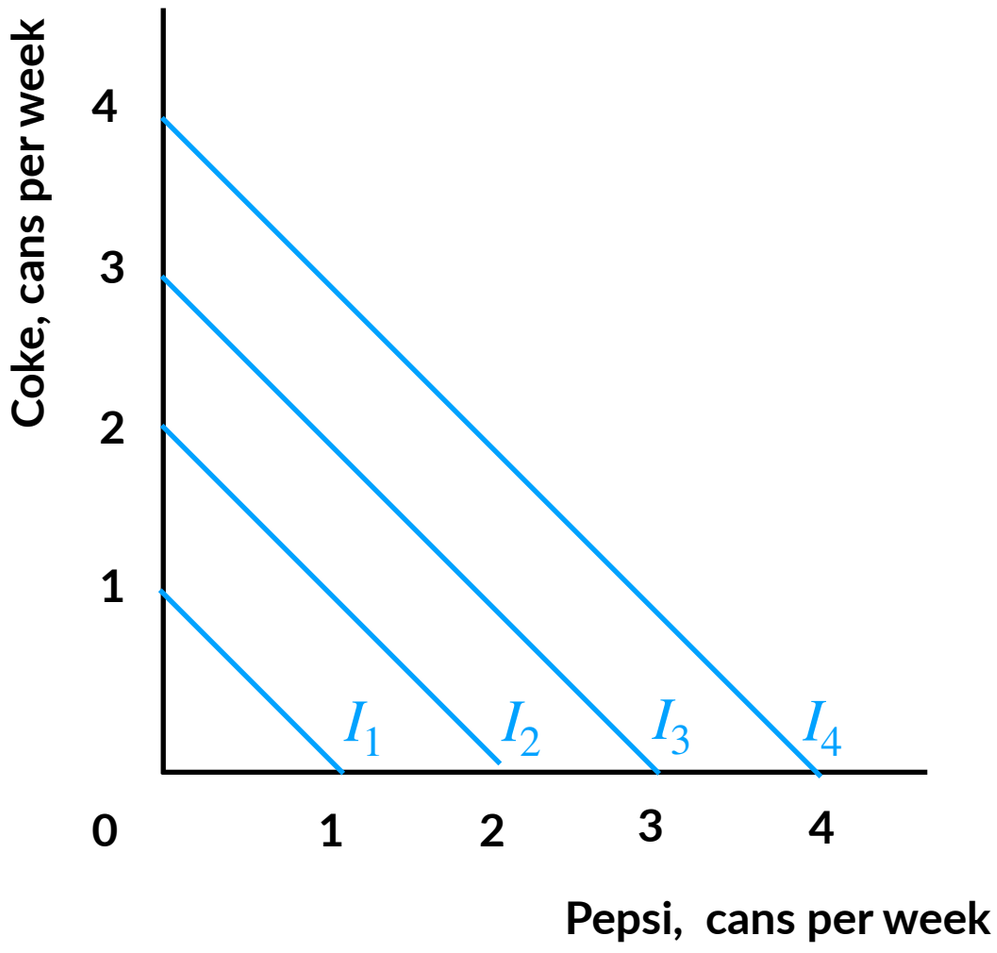


(b) Indifference Curve Concave to the Origin

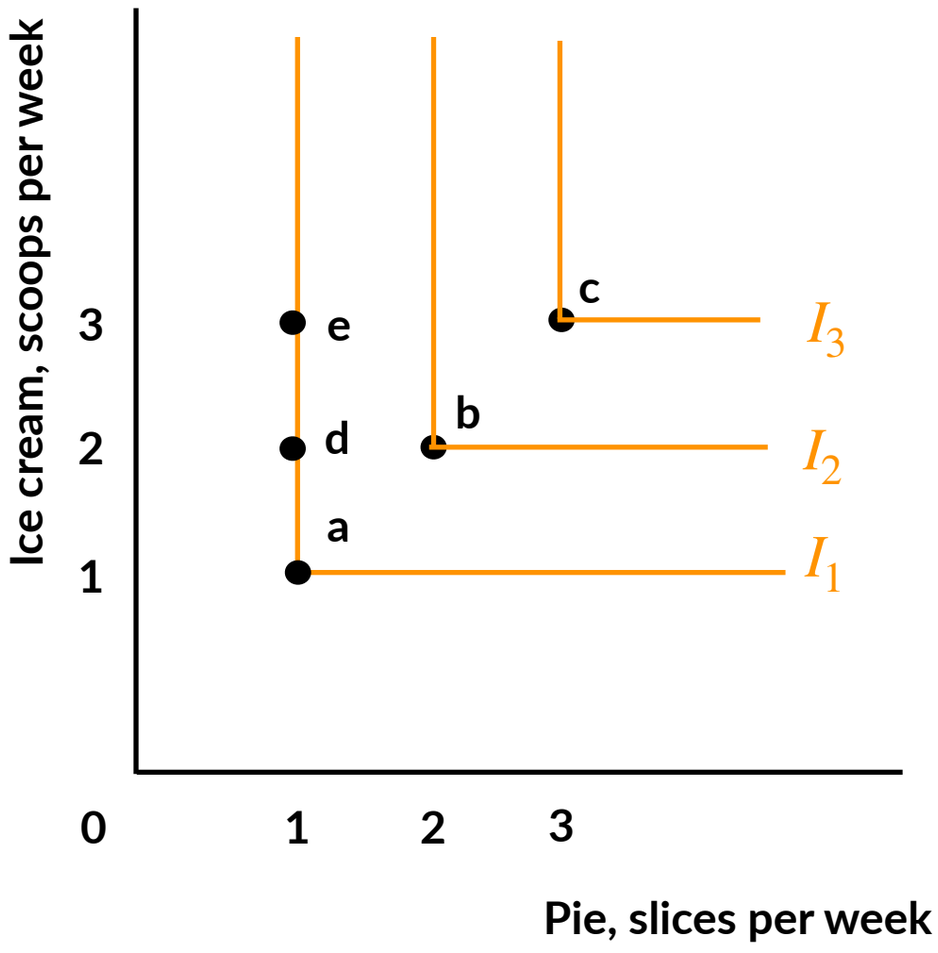


Strange Utility Functions: Perfect Substitutes and Complements

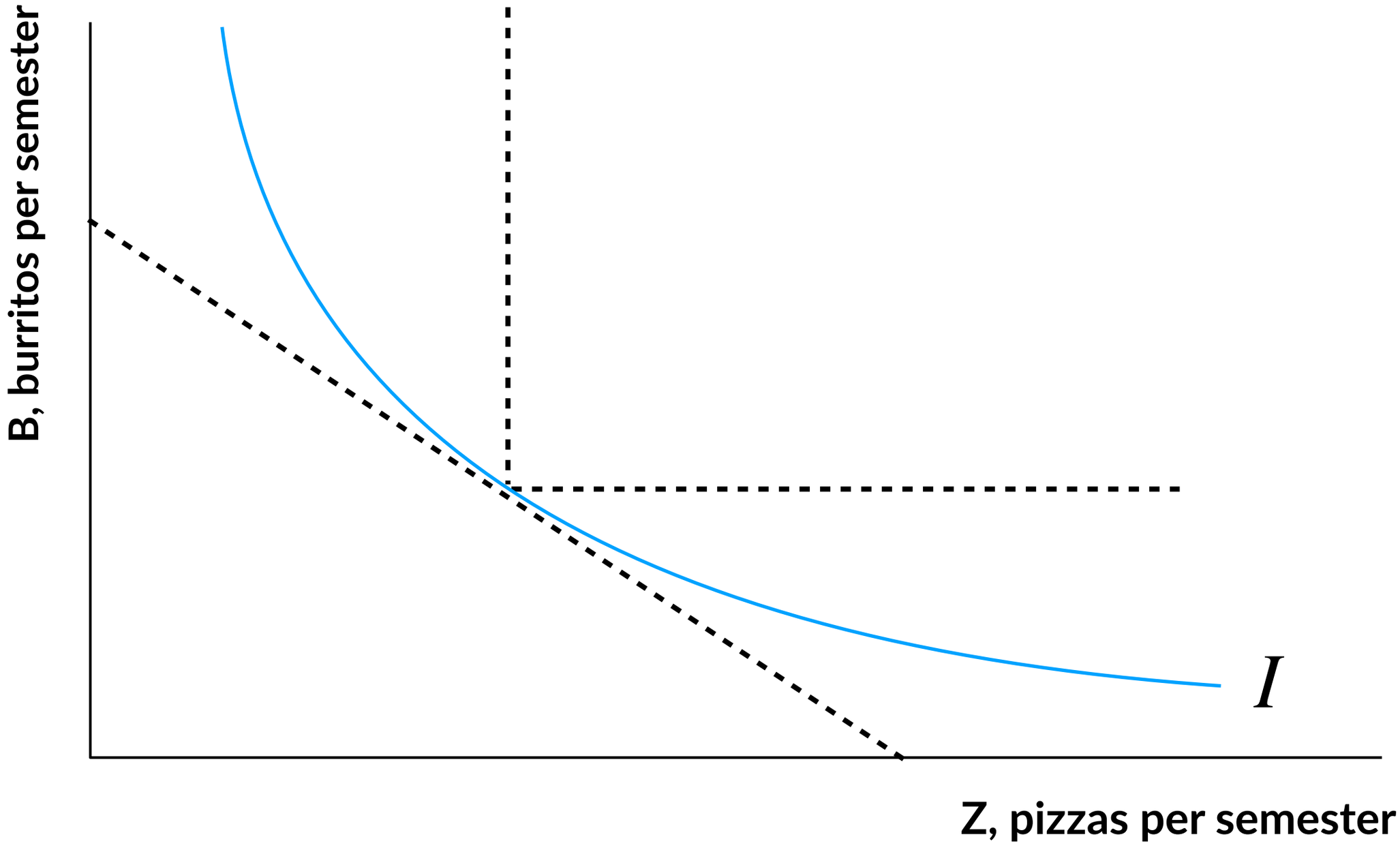
(a) Perfect Substitutes



(b) Perfect Complements



Imperfect Substitutes



Marginal Utility

- Economic thinking is marginal thinking
- Marginal utility: the additional utility from consuming the next unit of a good
    - If you've eaten 3 ice cream cones, how much utility will a 4th cone give beyond what you had after eating the 3rd cone
- This is taken from the slope of the utility function
- Technical: Intervals and instantaneous rates of change

$$MU_{ic} = \frac{\Delta U}{\Delta ic} = \frac{\delta U}{\delta ic}$$

Marginal Utility Example

$$U = xy^2$$

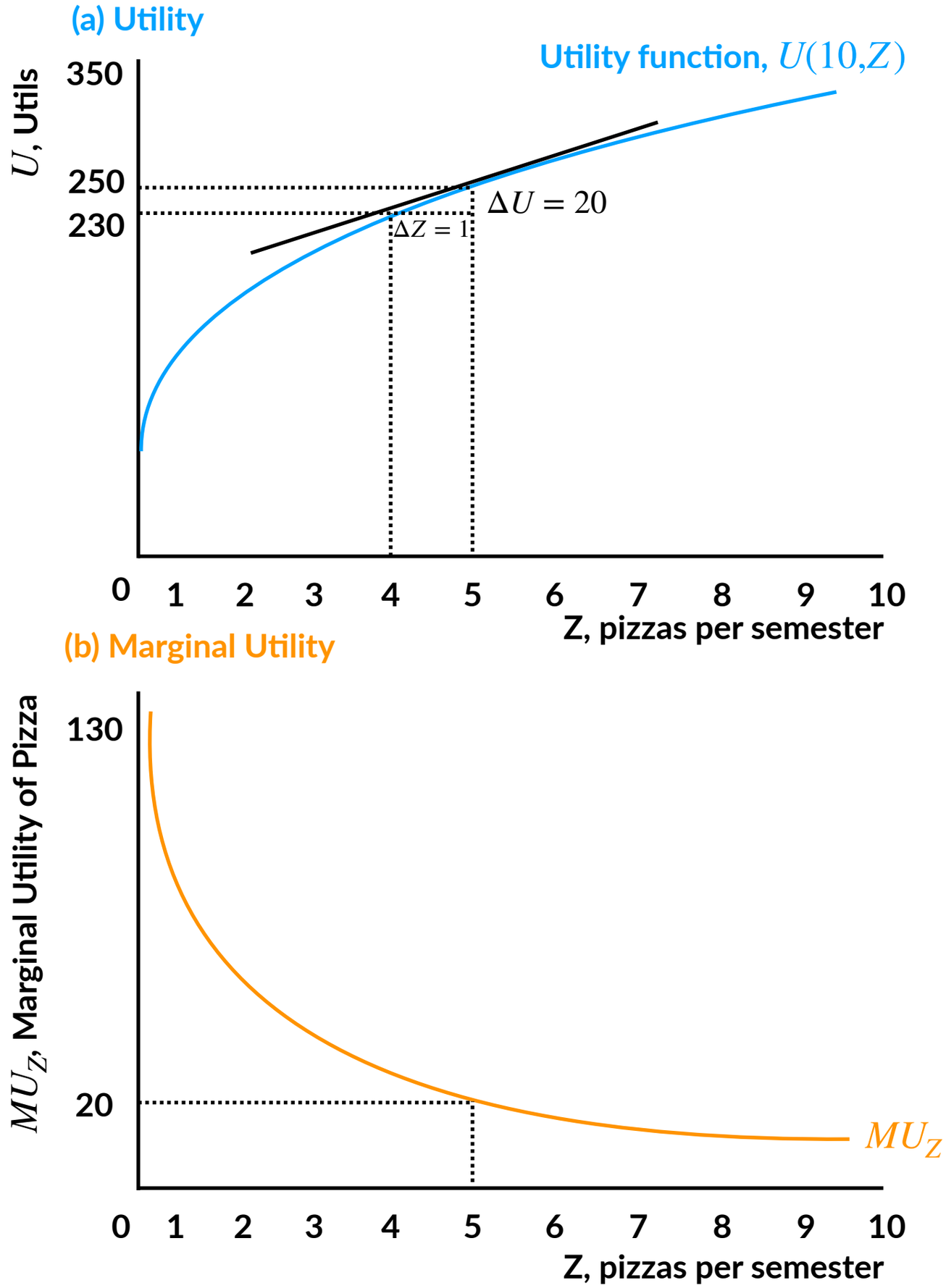
$$MU_x = y^2$$

$$MU_y = 2xy$$

Check that underlying preferences are complete, transitive, and monotonic for $U = 144$

x	y	xy^2
8	4.24	143.8
4	6	144
3	6.93	144.07
1	12	144

Utility, Marginal Utility, and Diminishing Marginal Returns



Marginal Utility Extension

- Imagine a person who only derived utility from food f and their utility function was:

$$U = 50 + 10f + 3f^2 - f^3$$

- What is the marginal utility function?
- What is the marginal utility of the 3rd unit? The 4th?
- Could a person's utility function actually look like this in reality? Would it violate any properties?

Marginal Utility Connected to Marginal Rate of Substitution

- We said MRS was the slope of the indifference curve and it tells us how the marginal utilities of each good relate to one another

$$MRS = \frac{\Delta A}{\Delta B} = -\frac{MU_B}{MU_A} = -\frac{\delta U/\delta q_b}{\delta U/\delta q_a}$$

- Intuition: if you give up some of good A to get more of B, your utility will rise from extra B but fall from loss of A

- The gain/loss in utility will guide the consumer's willingness to substitute between A and B

Consumer Choice and Budget Constraints

- Preferences and utility only begin to help us understand how people make choices
- Question: If Lil Nas X takes his horse to commute, does that mean he derives more utility from that vehicle than he would from any other vehicle?
    - Why?

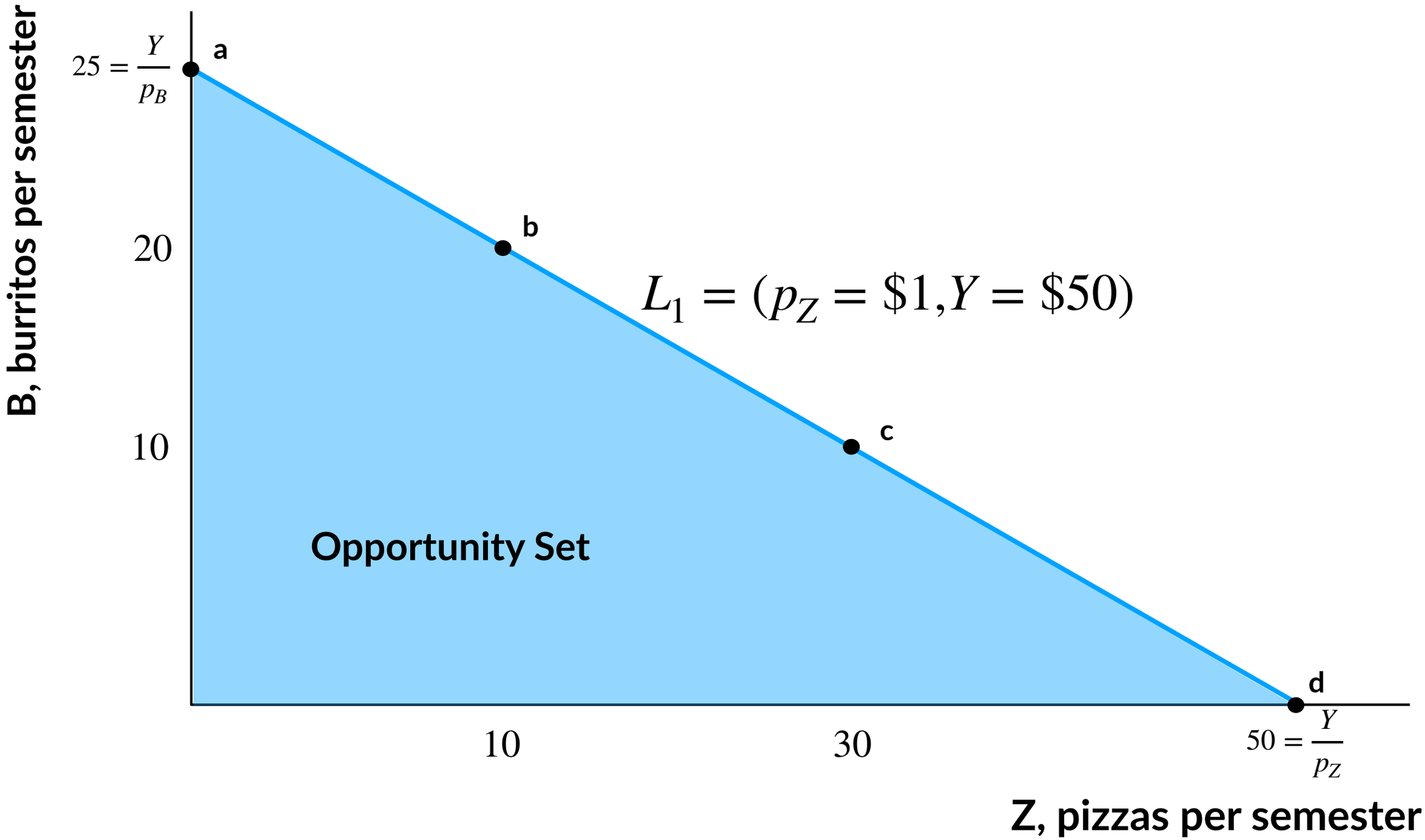
The Budget Constraint

- The monetary resources we have dictate the degree to which we can consume goods and services
- We will ignore savings and investments for simplicity, only spend what you make
- Imagine a simple economy with two goods: pizza Z and burritos B

$$(p_B \times B) + (p_Z \times Z) = Y$$

- Assume $p_B = \$2$ and $p_Z = \$1$

Budget Constraint



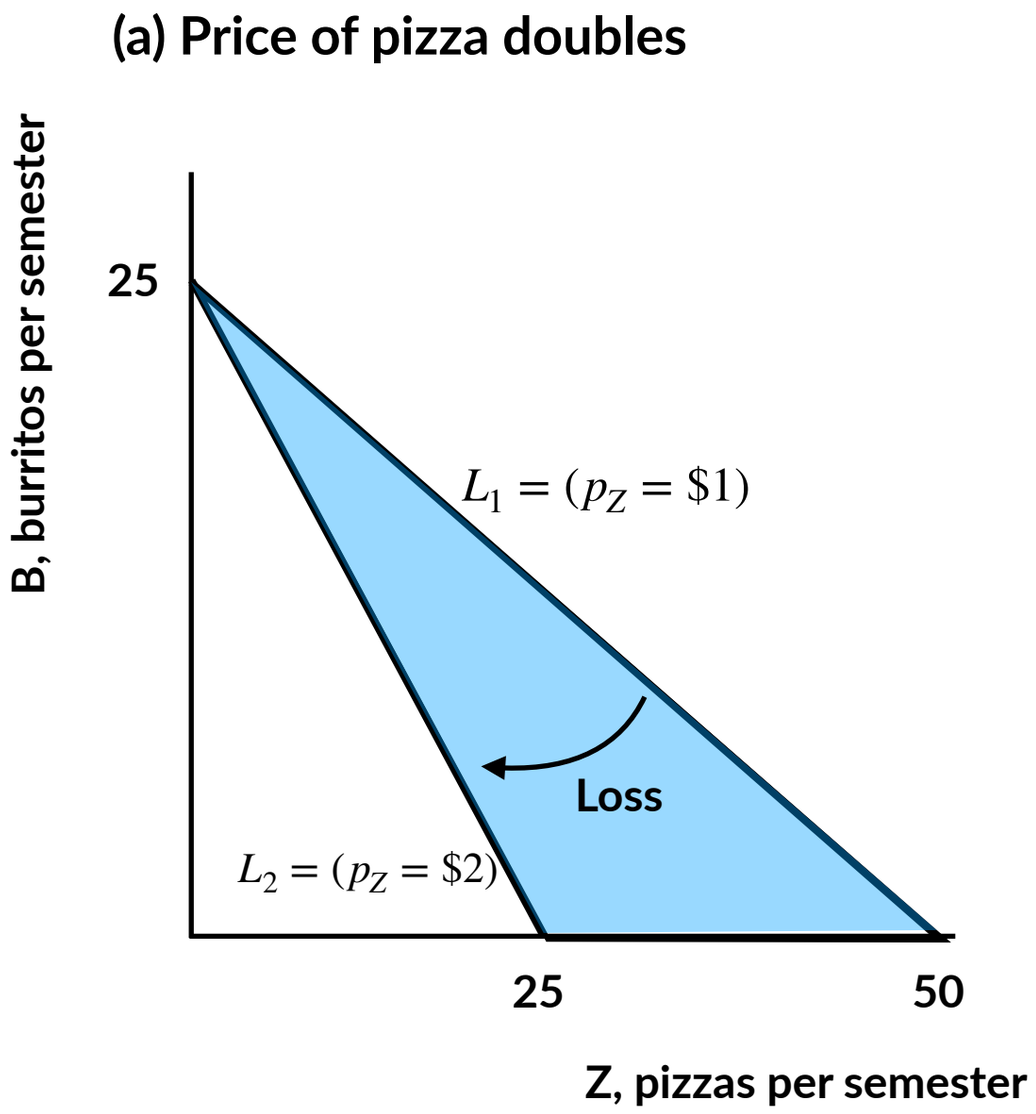
Marginal Rate of Transformation

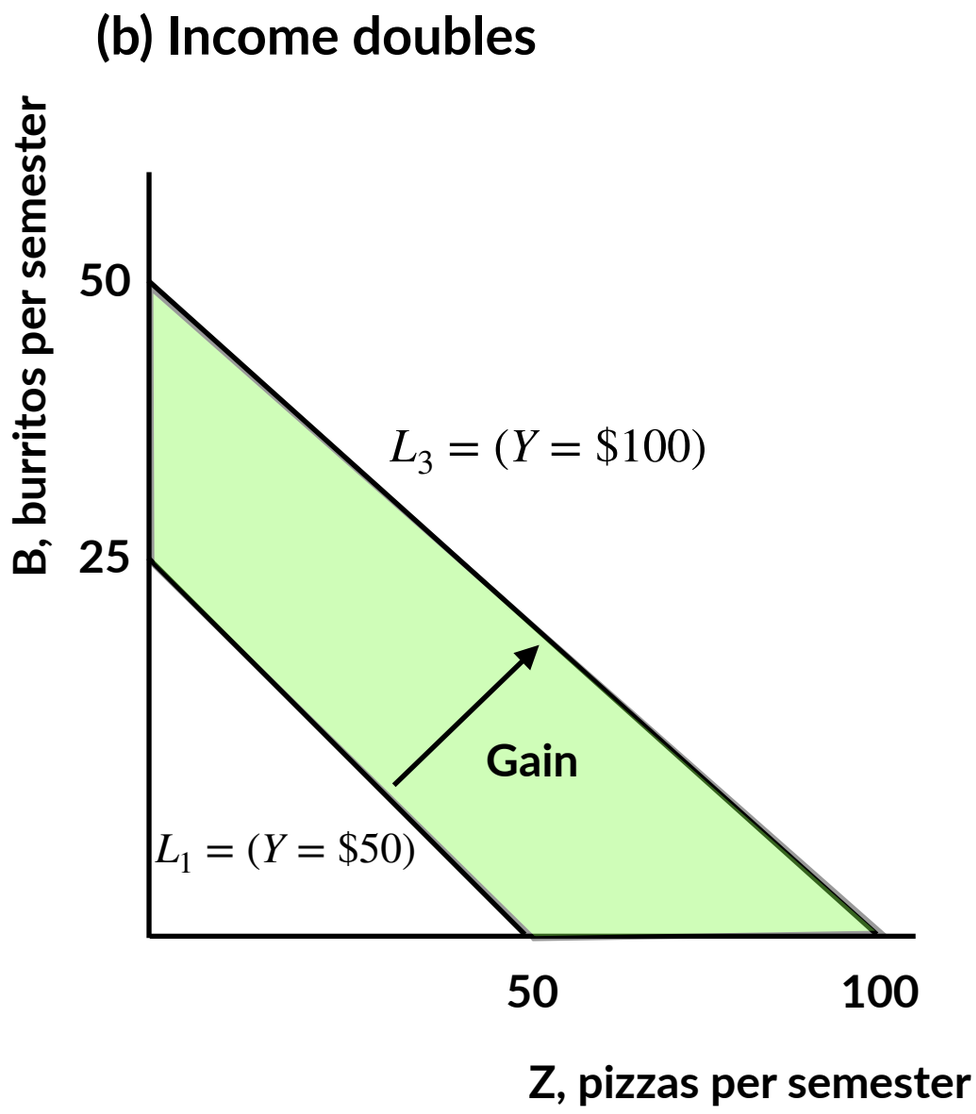
- The slope of the budget constraint shows the rate at which prevailing prices allow the consumer to transform one good into another by changing their purchases

$$MRT = \frac{\Delta A}{\Delta B} = -\frac{P_B}{P_A}$$

- The slope is the negative of the price ratio
- **Helpful hint: the price of the good on the horizontal (x-axis) always goes on the top of the ratio**
- Terminology note: many texts just call this the price ratio, not the MRT. It will also come up later when we talk about the supply side

Changes in the Budget Constraint: Price Induced and Income Induced





Useful Fact!

- Unlike the MRS which varied as we went along different points of the indifference curve, MRT is a constant!

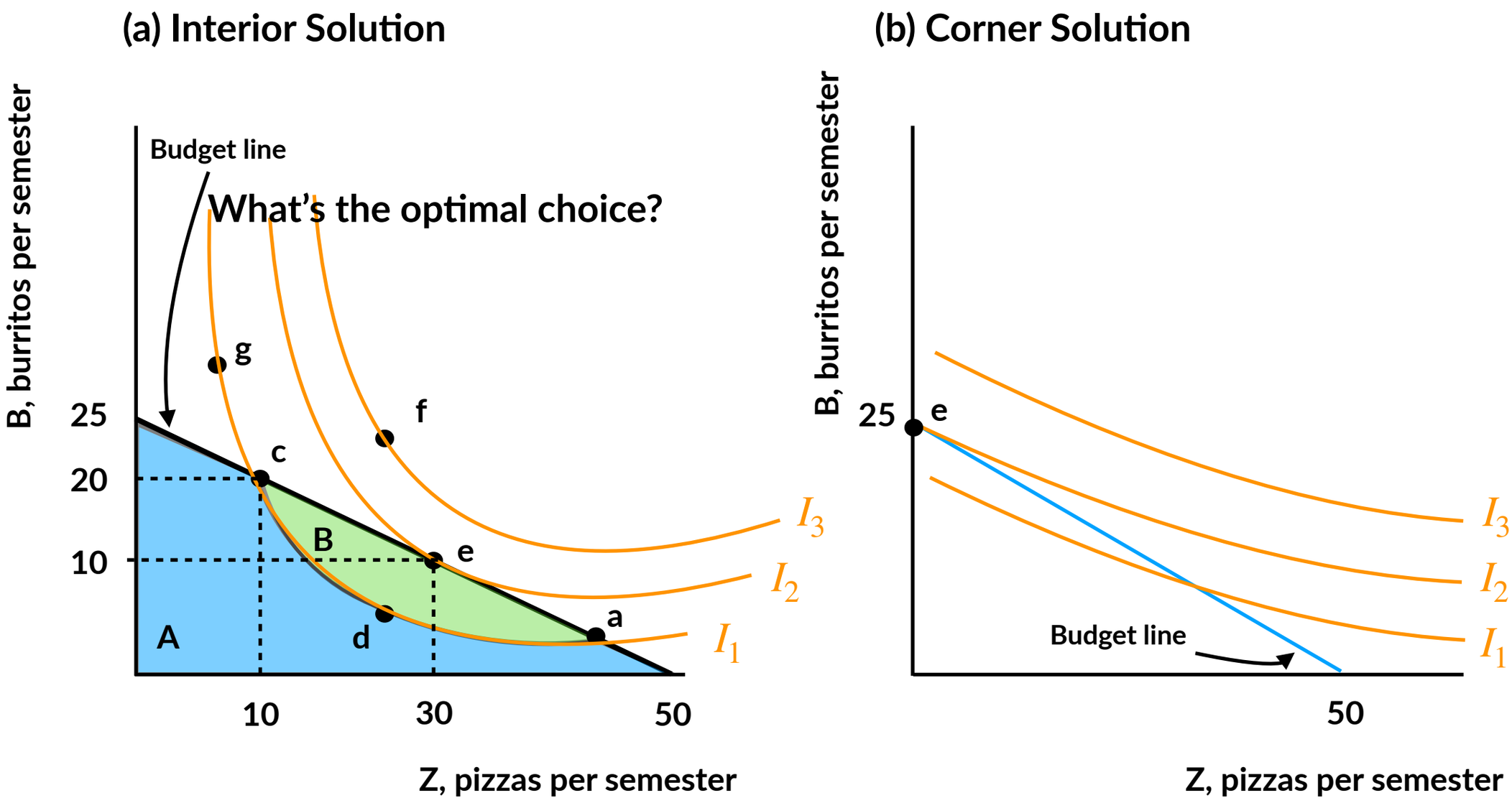
- What do you think would happen when we combined these two concepts?

Optimal Consumer Choices Under Constraints

- Our intuition is simple: the consumer wants to select the bundle of goods that maximizes their utility, **given their budget constraint**

- Put another way, they want to move out to the highest possible indifference curve until they can't because they are outside their opportunity set

Consumer Maximization



Interior Solutions: Finding the Optimal Choice

- **Interior Optimum**: the optimal consumption basket is at a point where the indifference curve is just **tangent** to the budget line

- A **tangent** to a function is a straight line that has the same slope as the function

  - Therefore:

$$MRS_{x,y} = \frac{MU_x}{MU_y} = \frac{P_x}{P_y}$$

- The rate at which the consumer would be willing to exchange X for Y is the same as the rate at which they are exchanged in the marketplace

Interior Solutions

- With an interior solution, the optimal choice involves positive amounts of both goods
    - Indifference curve will be tangent to the budget constraint and have the same slope

$$MRS = -\frac{MU_A}{MU_B} = -\frac{p_A}{p_B} = MRT$$

$$\frac{MU_A}{p_A} = \frac{MU_B}{p_B}$$

- Think about how these equations represent the market and the consumer simultaneously
    - What parts relate to each?

Example: Sean's Utility for Wine and Whiskey

- Sean has $405 each year to spend on wine and whiskey
- Wine costs $3 per glass and whiskey costs $2 per glass
- Sean has a utility function of: $U = WV^2$ where W is glasses of whiskey and V is glasses of wine per year

1. Write out the budget constraint
2. Derive a function showing the marginal utility with respect to W, MU_W
3. Derive a function showing the marginal utility with respect to V, MU_V
4. Solve for the Marginal Rate of Substitution (MRS)
5. Solve for the Marginal Rate of Transformation (MRT)
6. Solve for the optimal consumption bundle

Corner Solutions

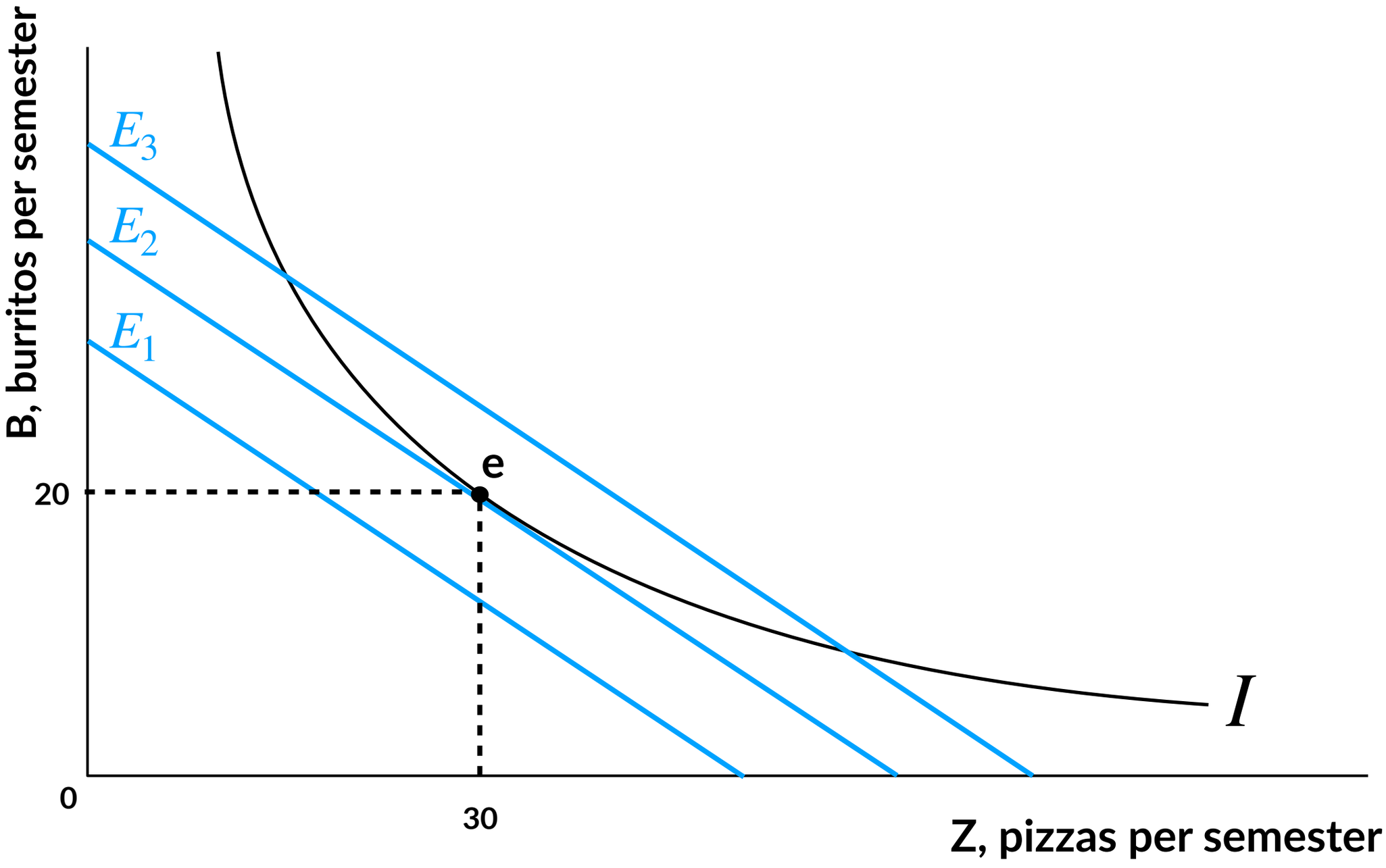
- In many cases, consumers will not purchase any of a particular good
- With a corner solution, optimal choice involves consuming only one good
  - All the previous equality conditions do not have to hold – just need $\frac{MU_x}{p_x} > \frac{MU_y}{p_y}$ to choose X
- Even though this happens all the time for individual consumers, less interesting/precise information comes from these outcomes on an aggregate level, don't focus on them

Utility Maximization from Different Vantage Point

- We can pose the consumer's problem from a different perspective if we think about expenditure minimization

- All the same equilibrium conditions hold if we think about how a consumer would seek a given/fixed level of utility associated with one of their indifference curves

Minimizing Expenditure



The Lagrangian Method

- An alternative way to solve the optimization problem

- Embeds the consumer's income and prices of the products into a single equation

- Finds the solution to a constrained utility maximization problem — constraint is the budget