Econ 201: Introduction to Economics Analysis

September 18 Lecture: Basic Theory of Consumer Behavior

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Daily Far Side

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Preview of this class session

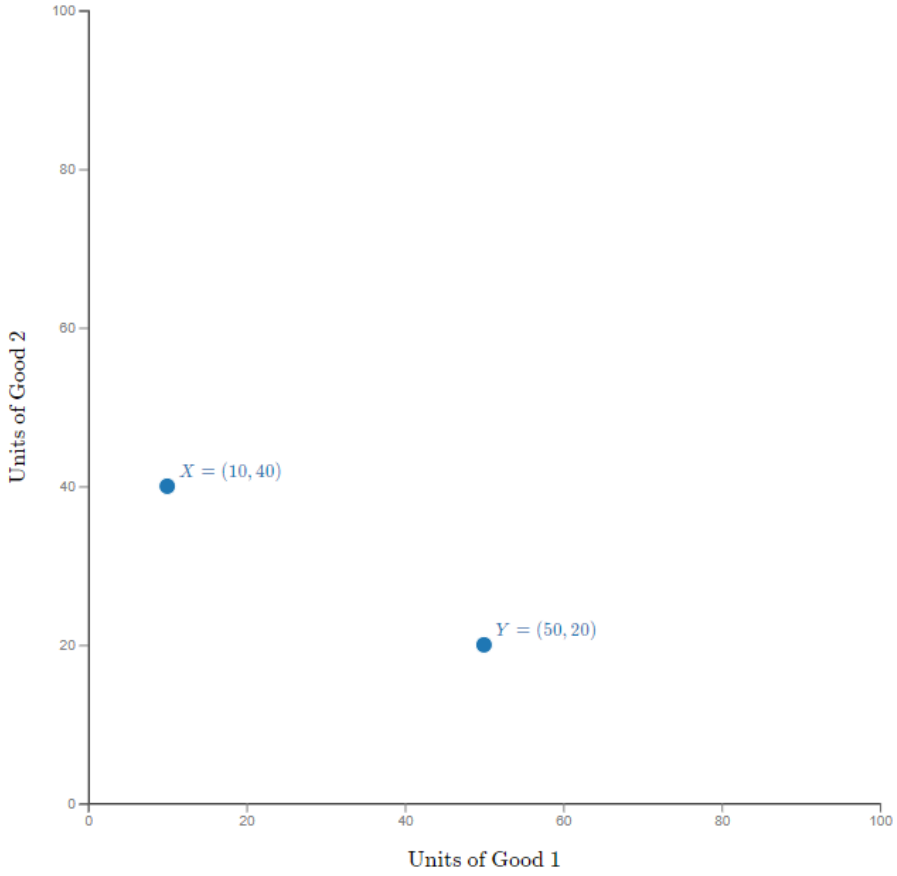
- Economists often rely on utility maximization to model consumer behavior
- We use utility functions and indifference curves to describe household preferences
- A budget constraint defines the household's opportunity set
- Households choose the most preferred point within the opportunity set

How we model consumer behavior

- Separate into two parts:
  1. **Preferences**: What combinations of goods (consumption "bundles") does consumer prefer to others?
     - We represent these by an "indifference map"
  2. **Opportunity set (constraint)**: What bundles are attainable given market prices and consumer's income?
     - We represent by a budget constraint
- **Constrained optimization** problem
  - Consumer chooses most preferred bundle within opportunity set
- We analyze graphically; Econ 313 uses calculus to solve these problems and others

Choice space

- Consumption "bundle"
  - Combination of amounts of all of the available goods and services
  - We restrict to two at a time so we can put on a graph (can generalize mathematically)
- Example: Asparagus (Good 1) and broccoli (Good 2)
  - Positive quadrant (including axes) is the "choice space"
  - Any point in the choice space is a possible consumption choice with sufficient income



https://www.econgraphs.org/graphs/micro/consumer_theory/budget_set/bundles

Modeling preferences

What does the consumer like?

Behavioral assumptions

- **Completeness and rankability**
  - Any pair of bundles X and Y can be ranked with either:
    - X is preferred to Y
    - Y is preferred to X
    - or consumer is indifferent between them
  - Ranking = "utility"
- **Transitivity**:
  - If X is preferred to Y, and Y is preferred to Z, then X is preferred to Z
- **Non-satiation**
  - More of a good increases utility
  - If it didn't, the good wouldn't be scarce
- **Diminishing "marginal utility"**
  - Eventually, additional units are wanted less

Cardinal vs. ordinal utility

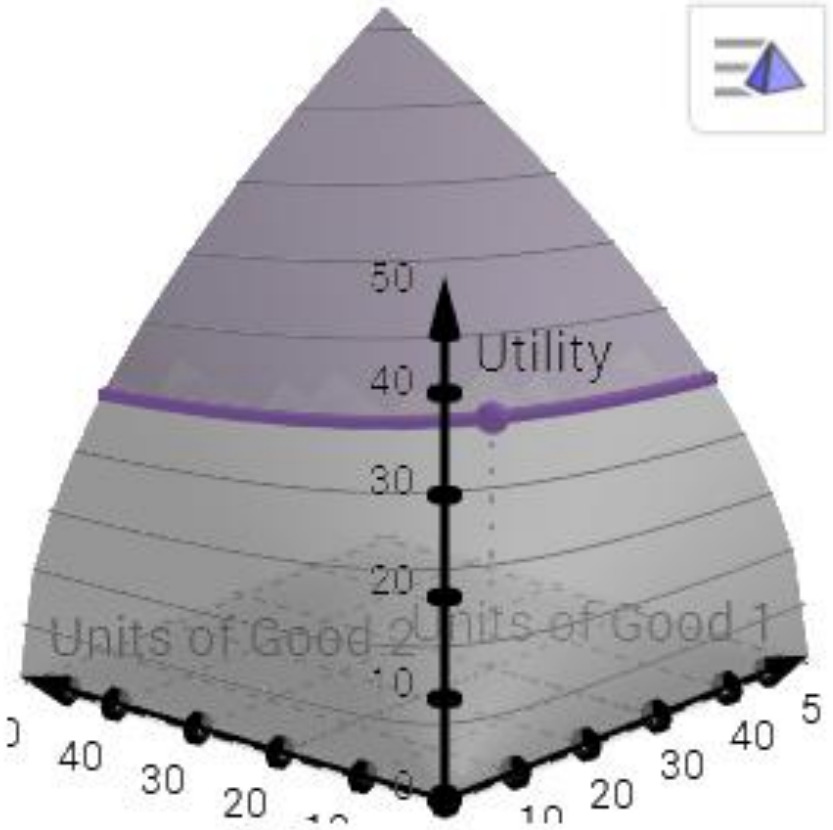
- **Cardinal utility**: Attach number to each utility level
  - Utility function $U = U(A, B)$
  - Three dimensional function with height U being the amount of utility
  - "Marginal utility" = additional utility from one more unit of A

$$MU_A = \frac{\Delta U}{\Delta A}$$

- **Ordinal utility**: Only ranking is known
  - This is all we really need
  - We will use "**indifference curves**" to show preferences between pairs of goods

Indifference map

- Imagine cardinal **utility mountain** in three dimensions
  - In diagram, utility is upward, amount of asparagus (1) is away to right, and amount of broccoli (2) is away to the left
  - Utility is increasing with more 1 or 2
- We use "**counter lines**" on mountain to reduce to two dimensions
  - Purple line shown is at fixed level of utility
  - Every point on contour line has same elevation (utility)



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Indifference map

- Counter lines in three dimensions = **indifference curves** (ICs) in two dimensions
  - Purple indifference curve in bottom diagram corresponds to purple contour line on mountain in top diagram
- ICs are combinations of goods 1 and 2 that give same utility (consumer is indifferent)
  - Note that there are (infinitely) many ICs
- Preference direction
  - The mountain rises moving away (higher 1 and 2)
  - Shaded points are preferred to *X*
  - Is there a peak (bliss point)?
    - Not in the relevant range, so we usually ignore

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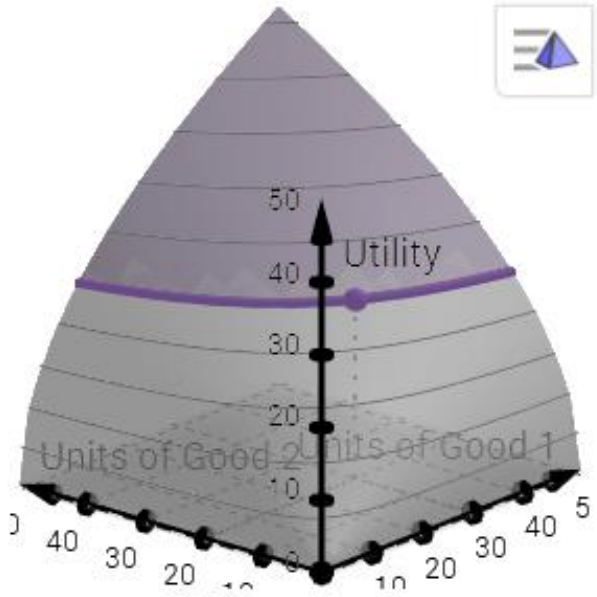

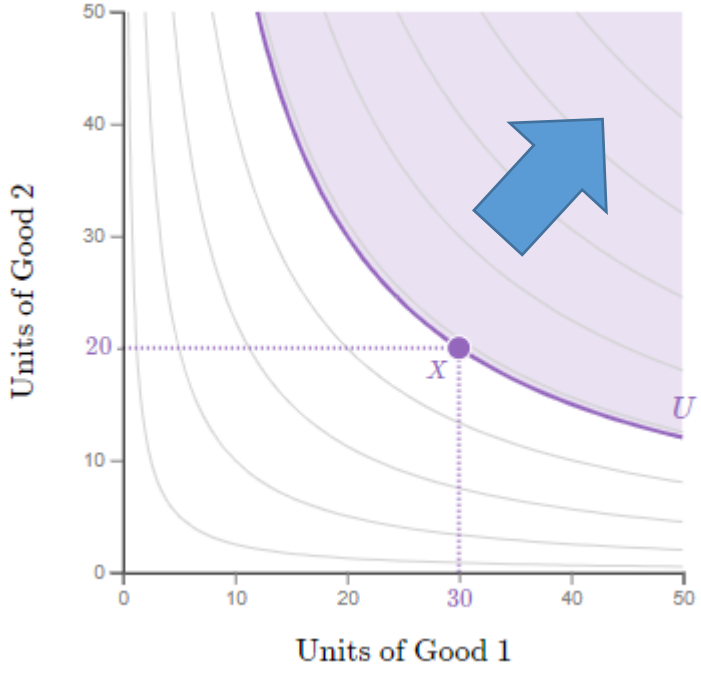

Properties of indifference maps

- Every point in the choice space is **on exactly one indifference curve**
  - Every point on the mountain has exactly one altitude
  - For simplicity, we rule out vertical cliffs
- Indifference curves **cannot intersect**
  - If they did, then one point would have two different utility levels (altitudes on mountain)
  - This could only happen if we have satiation where consumer is exactly indifferent toward having more of one or both goods
  - In that case, the good is not scarce and we are mainly interested in allocation of scarce goods

Indifference curves and substitution

- Some pairs of goods are "**complements**" because consuming one makes the other more desirable
  - Bread and butter, cars and fuel, Zoom and Webcams, grass and lawnmowers, etc.
- Others are "**substitutes**" because more of one means you don't want the other
  - Pizza and pasta, iPhones and Android, coffee and tea, cars and buses, etc.
- Indifference curves are **flatter for goods that are more substitutable**
- Next slide shows how indifference map changes as the pair of goods moves from close substitutes to strong complements

Substitutes → complements

- How does indifference map change as X and Y change from close substitutes to strong complements?

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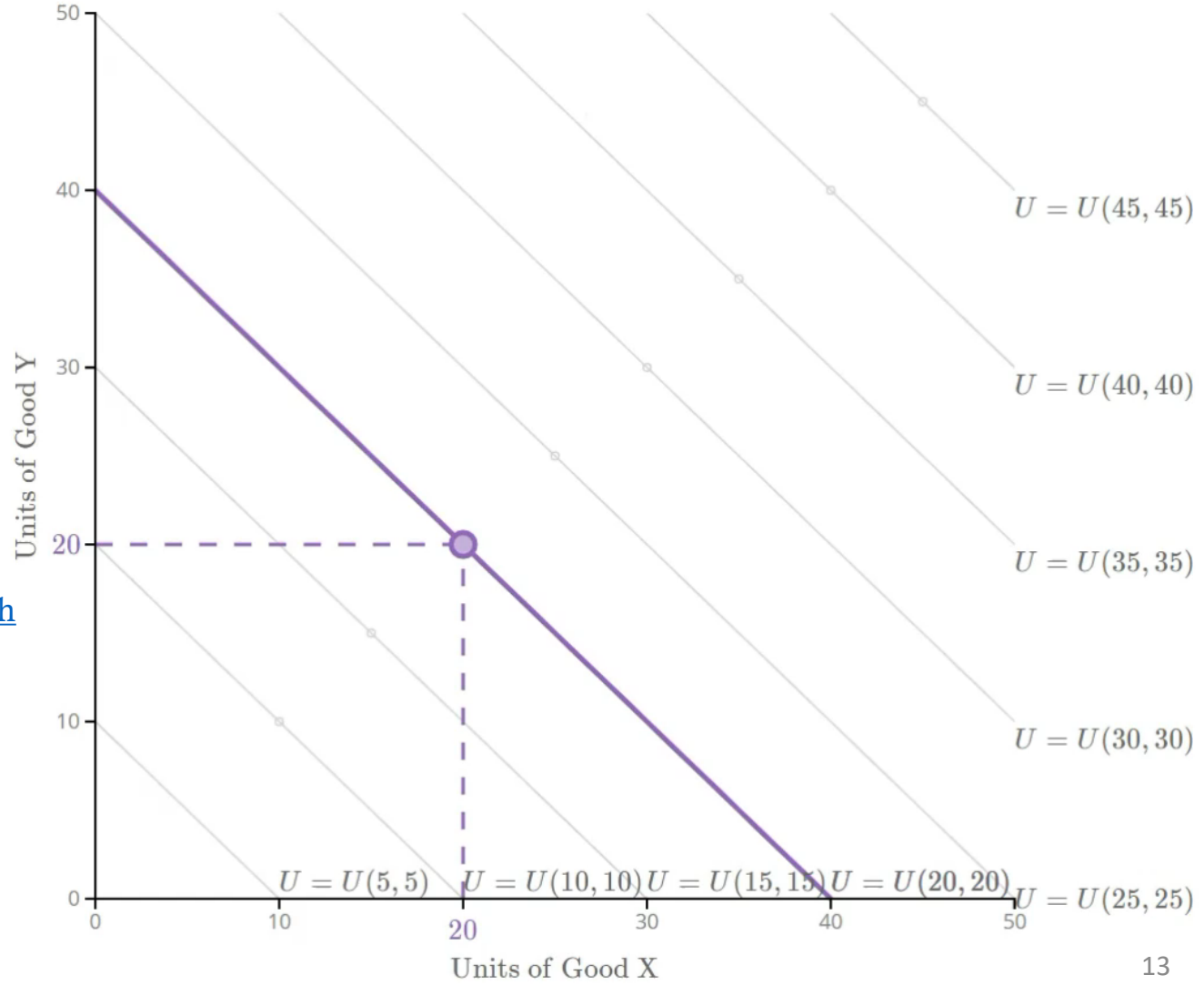
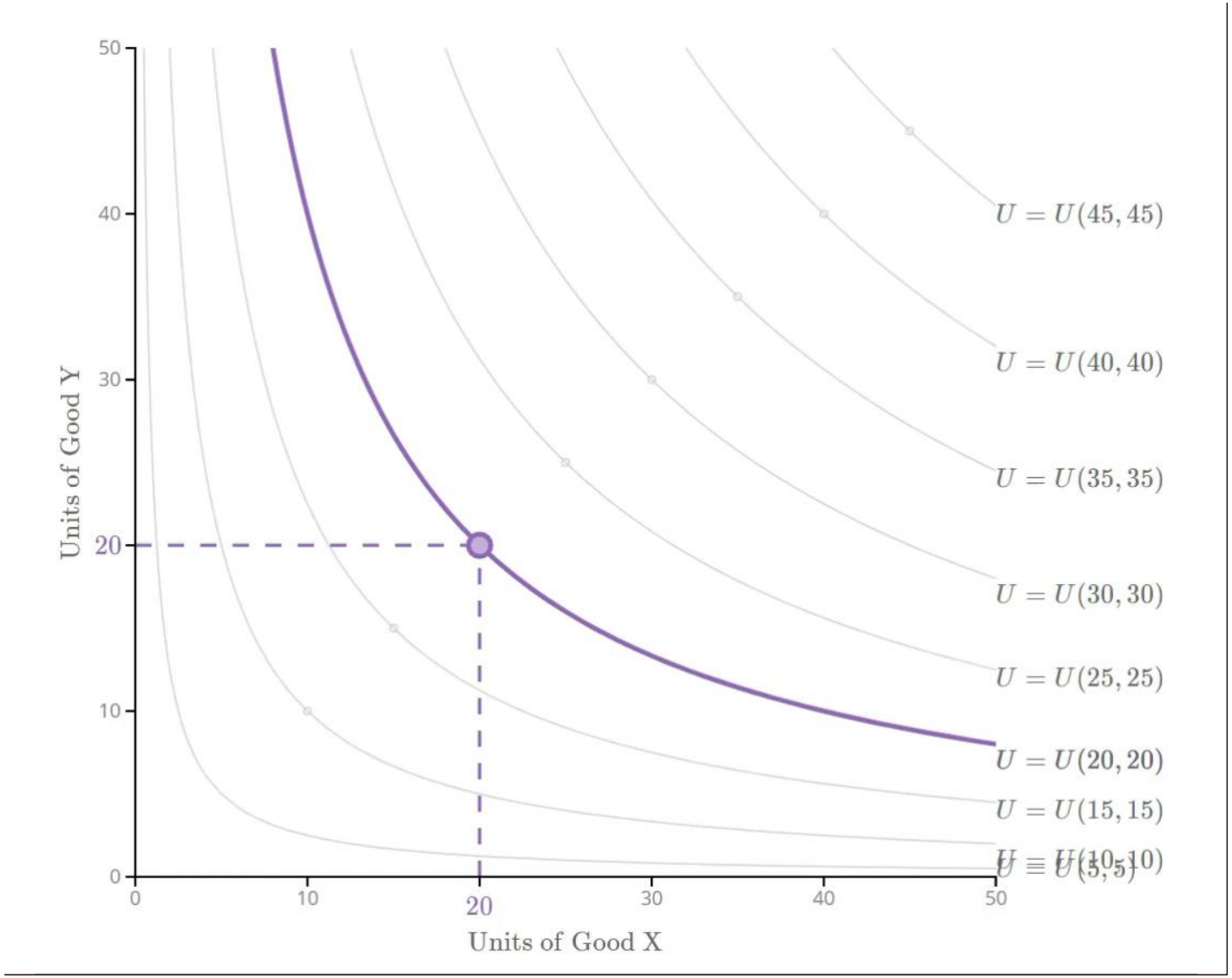


One good strongly preferred

- What if consumer really likes X and doesn't care much about Y?
- Shape of indifference curves will now require large change in Y to increase utility, but a smaller change in X



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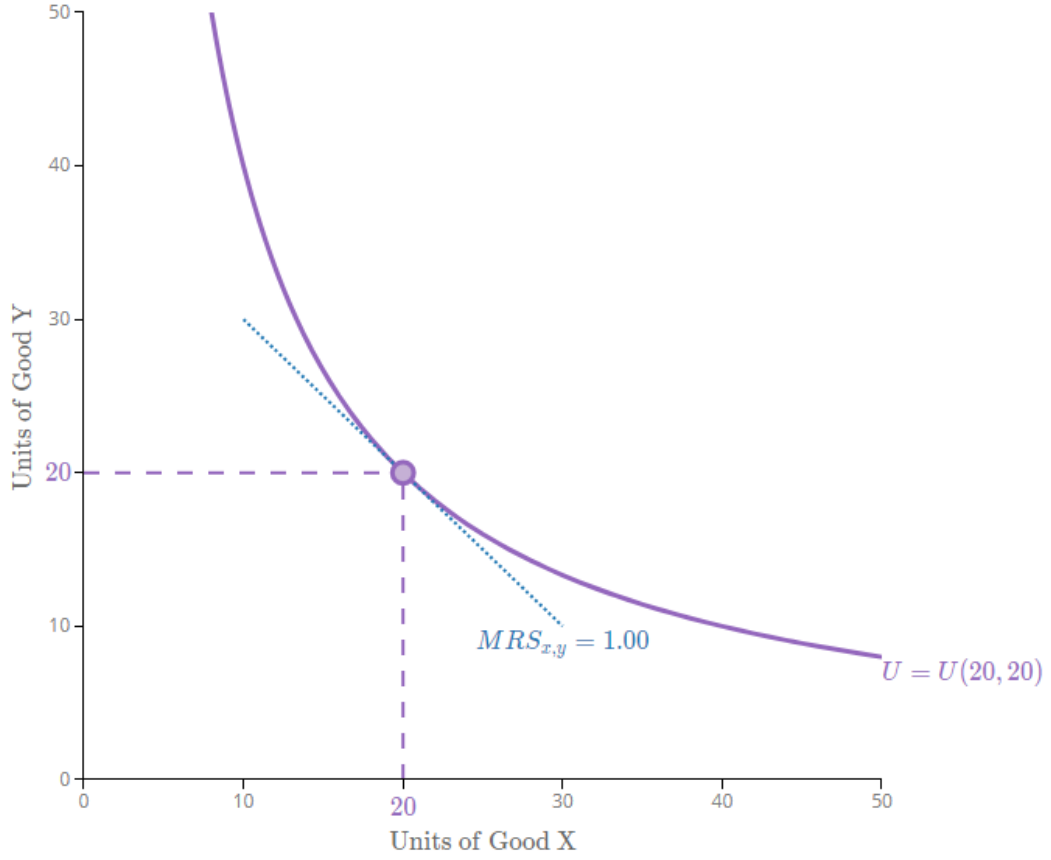
Marginal rate of substitution

- MRS measures the consumer's willingness to sacrifice Y to get more X
  - MRS_{XY} = – slope of indifference curve

$$= -\frac{\Delta Y}{\Delta X} = \frac{MU_X}{MU_Y} = \frac{\Delta U / \Delta X}{\Delta U / \Delta Y}$$

  - "I'll give up this much Y to get 1 more X"
- Law of diminishing MRS: Indifference curves usually get flatter as we move down to right
  - Once I have a lot of X, I won't give up as much Y to get more



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Opportunity sets

What consumption bundles can consumer afford?

Budget constraint

- Consumer has fixed income I and is a price taker: Choose X and Y such that cost of goods is less than or equal to income

$$P_X X + P_Y Y \leq I$$

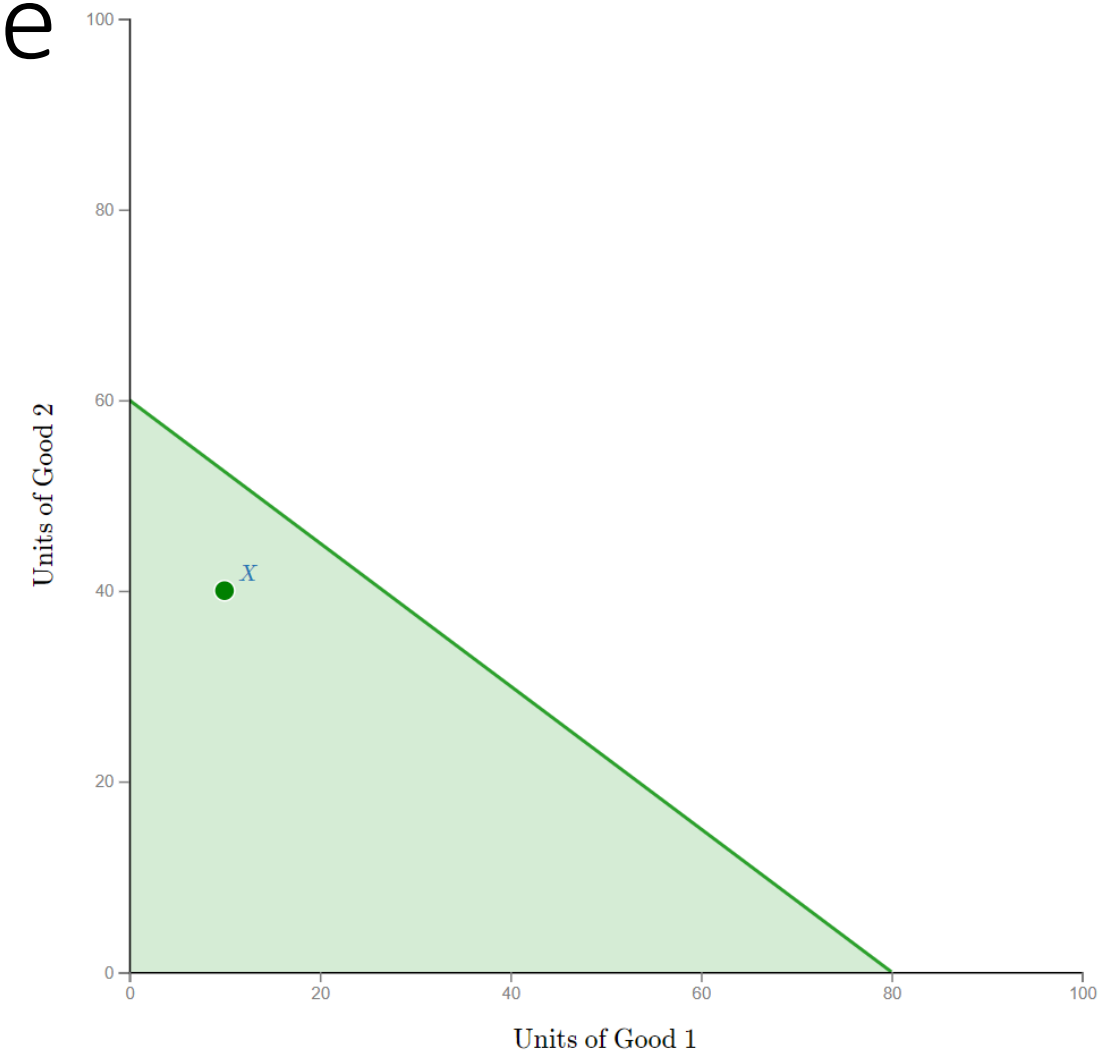
  - Solve for Y: $Y \leq \frac{I}{P_Y} - \frac{P_X}{P_Y} X$

- **Budget constraint** is boundary (= rather than <):
  - Straight line
  - Slope = $-P_X/P_Y$
  - Vertical intercept = I/P_Y
- **Opportunity set** is triangle defined by budget constraint

Budget constraint example

$$P_X X + P_Y Y \leq I \qquad Y \leq \frac{I}{P_Y} - \frac{P_X}{P_Y} X$$

- Example: $I = 240$, $P_X = 3$, $P_Y = 4$
  - Spend all 240 on X: buy $240/3 = 80$
  - Spend all 240 on Y: buy $240/4 = 60$
  - These are the intercepts
- Slope $= -P_X/P_Y = -\,¾$
- Point X in diagram *is* affordable for consumer because it lies inside her opportunity set



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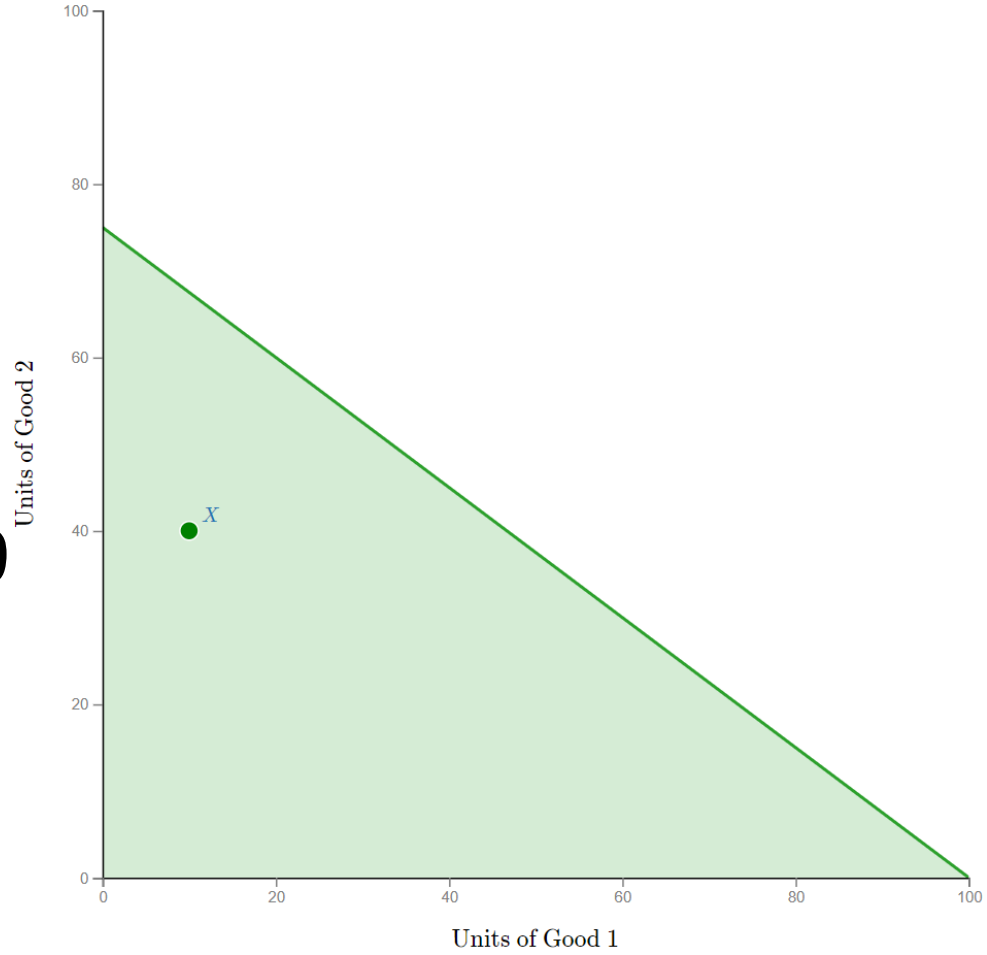
Income change and budget constraint

- An **increase in income** increases intercept but doesn't change slope
- Parallel shift to the right
- Points that were previously outside opportunity set are now inside
- Example: Income rises from 240 to 300
  - Spend all 300 on X: buy $300/3 = 100$
  - Spend all 300 on Y: buy $300/4 = 75$
  - Slope is still $-\frac{3}{4}$



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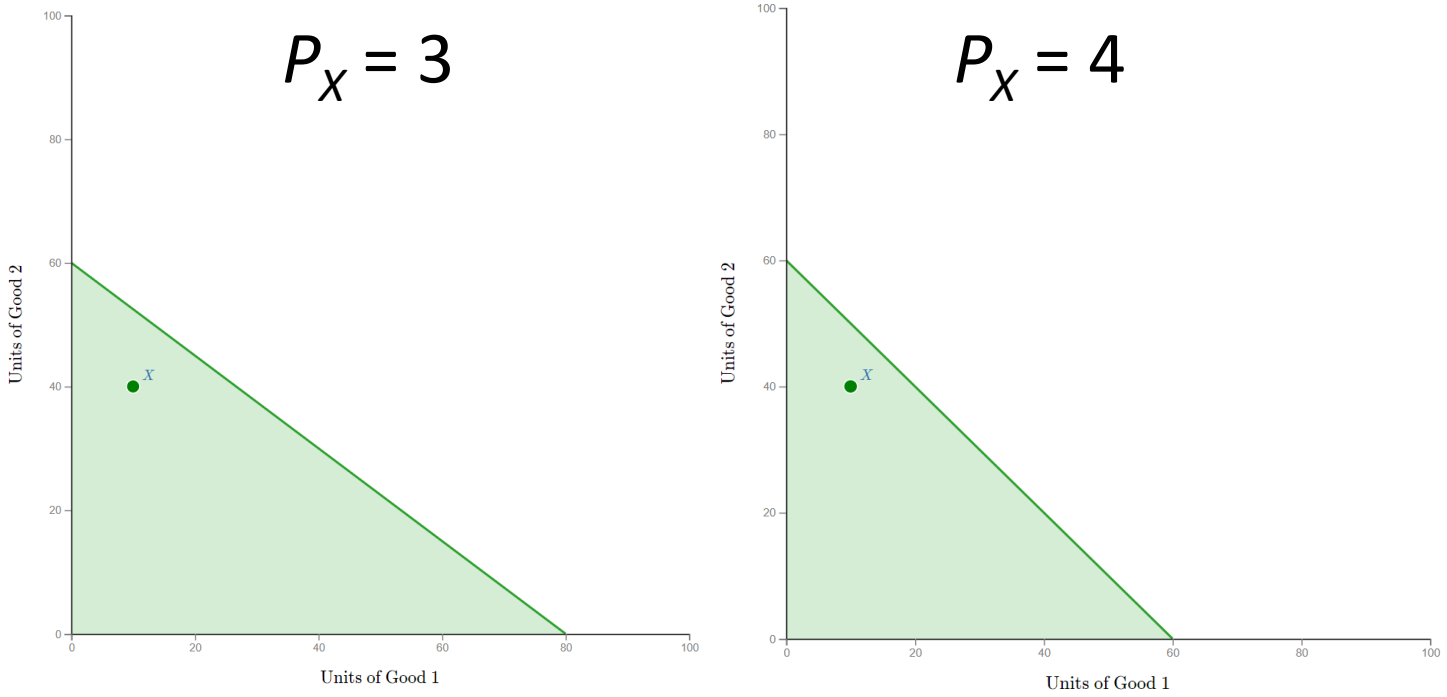
Price changes and budget constraint (1)

Increase in price of X
from 3 to 4

- Constraint gets steeper: Slope is now $-P_X/P_Y = -4/4 = -1$
- Horizontal (X) intercept moves left to $240/4 = 60$
- Vertical (Y) intercept unchanged at $240/4 = 60$



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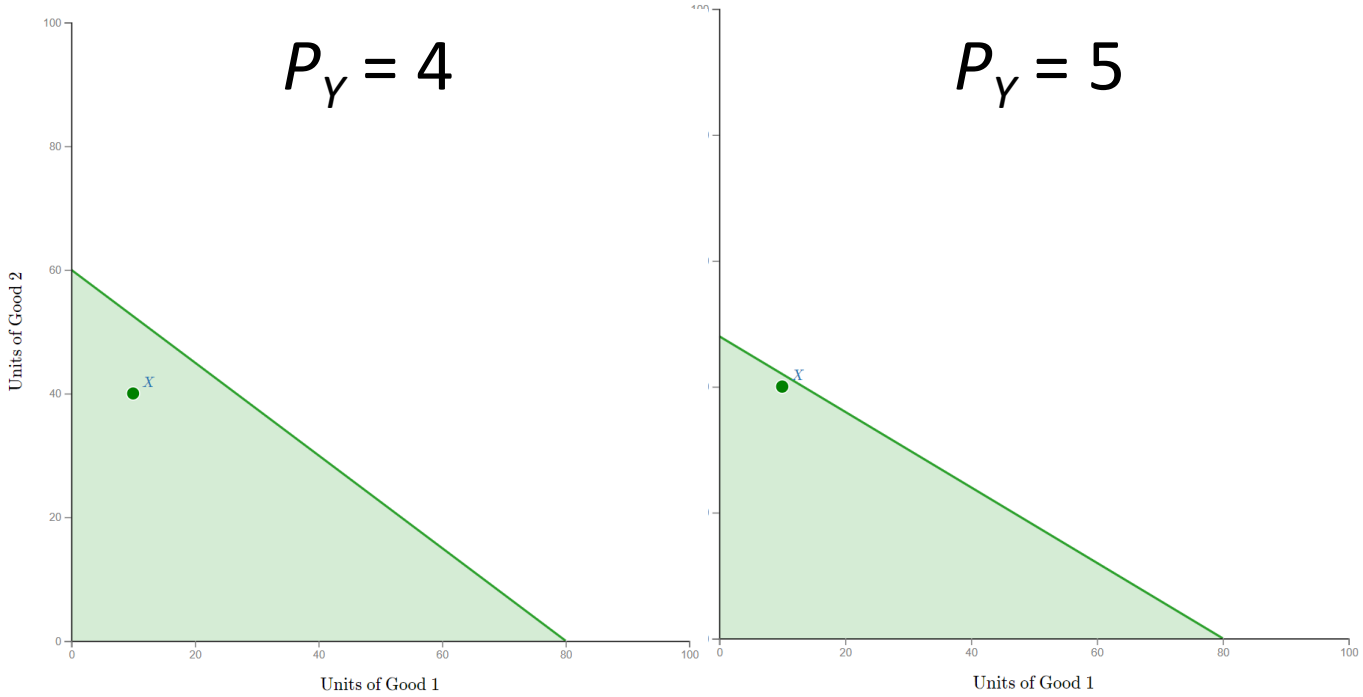
Price changes and budget constraint (2)

Increase in price of Y from 4 to 5 (with price of X = 3)

- Constraint gets flatter: Slope is now $-P_X/P_Y = -3/5 = -0.6$
- Horizontal (X) intercept unchanged at 240/3 = 80
- Vertical (Y) intercept falls to 240/5 = 48



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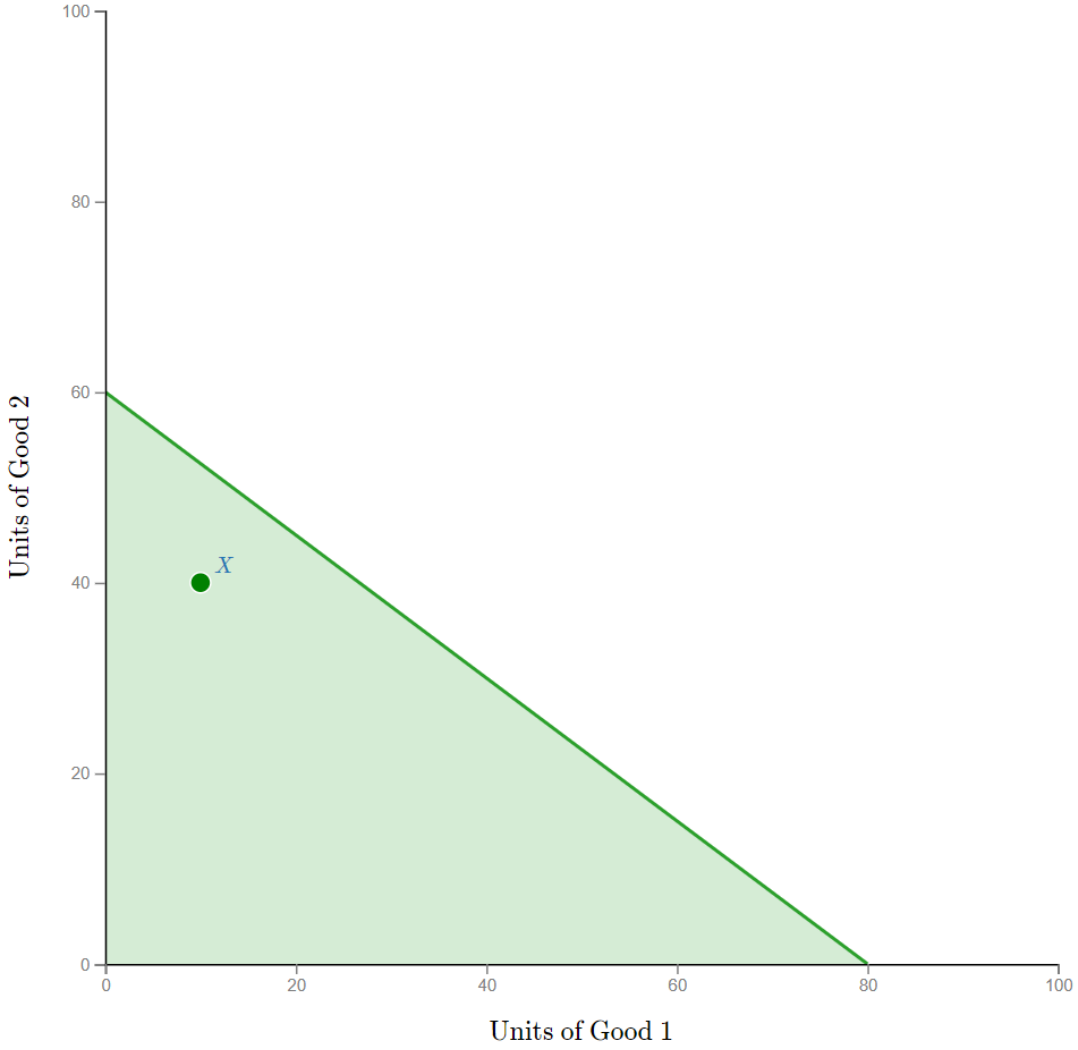
Price changes and budget constraint (3)

If **income and all prices increase or decrease proportionally**: no change in constraint

- Income doubles from 240 to 480
- Price of X doubles from 3 to 6
- Price of Y doubles from 4 to 8
- Still can buy 480/6 = 80 of X or 480/8 = 60 of Y with entire income
- No "money illusion" here



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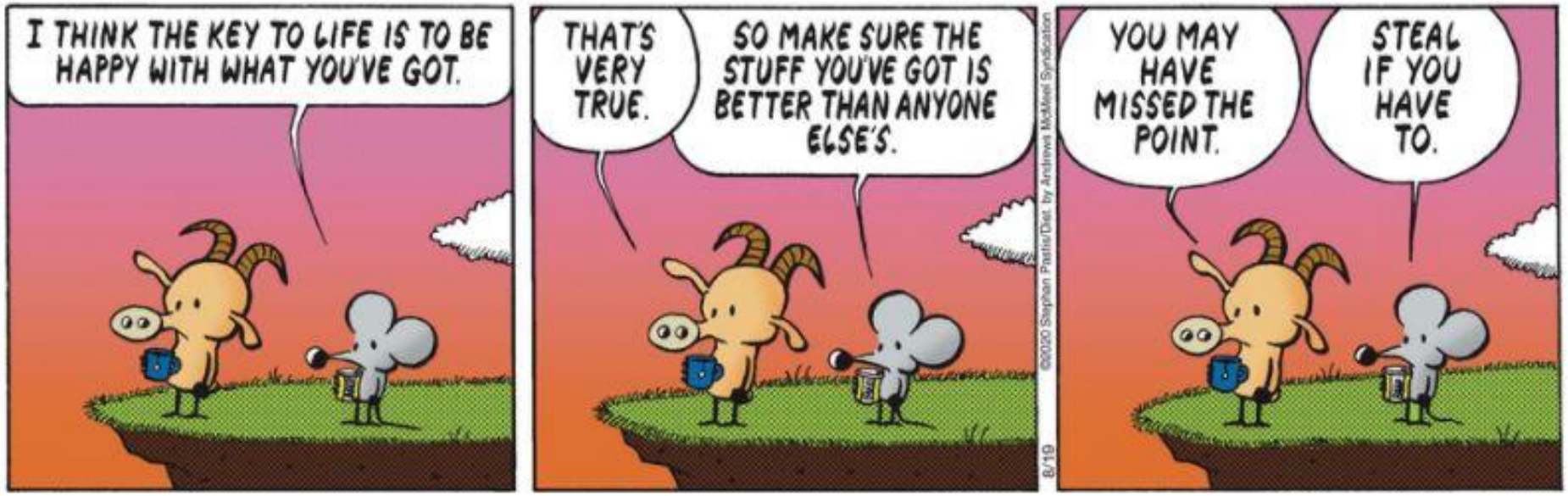
Nonlinear budget constraint?

- Slope of constraint $= -P_X/P_Y$
- Could this be different for different amounts of X and Y?
  - Not if the consumer is a price taker
- But maybe if there are more complex pricing schemes:
  - "Buy one get one half off"
  - Quantity discounts (12 for price of 10)
  - Overtime pay for workers
- Problem Set #3 will have examples

Review

- We model consumer choice by mapping preferences and the opportunity set
- Preferences of any consumer are represented by an indifference map
- Opportunity set is bounded by the budget constraint

Daily diversion: Is this what we're assuming?



Individuals who behave according to the strict assumptions of utility maximization are often called *Homo economicus*. Is Rat being *Rattus economicus*? If this is how consumers behave, why doesn't our economy break down with rampant theft and crime (or does it)? We'll discuss …

What comes next?

- In Monday's class, we consider how changes in income and prices affect consumer equilibrium
- The case of the day for Monday explores income and substitution effects in the context of a tax change
- We have now covered almost all of the material needed to complete Problem Set #3, which is due next Wednesday