# Lecture 4: Consumer Choice

September 19, 2023

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2. UN #2 due next week (Lecture 5) and we will discuss in class
3. Happy to see you in office hours – use scheduler
4. Any questions or outstanding issues?

# How What You're Learning is Policy-Relevant

## Ripped from Headlines presentation(s)

As a reminder, next week

| Finder | Presenter |
|---|---|
| Yolanda H-A | Arizona R. |
| Bridget M. | Eric W. |

# This Week's Ripped From the Headlines

| Finder | Presenters |
|---|---|
| Kari H. | Annie T. |
| Eric W. | Rebecca R. |

# Today: Shift to Consumers' Problem

- Until now
  - Supply and demand equilibria
  - And policy choices that impact equilibrium outcomes
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- Until now
  - Supply and demand equilibria
  - And policy choices that impact equilibrium outcomes
  - Graphs with $P$ and $Q$ axes
- Next two classes focus on how economists think about consumer choices
- Today
  - Lay out consumer decision
  - Graphs with good $X$ and good $Y$ axes
- Lecture 5
  - Use consumer framework to understand responses to price changes and income changes
  - Review Use Numbers # 2

# Why Do We Study the Consumer's Problem?

- Build up to the demand curve from first principles
- Understand consumer choices
- Clearly illuminate areas where policy can act
- Illustrate welfare consequences of policy choices
- Understand intuition of constrained maximization

# Also Learn How Economists Think

- All decisions involve trade-offs
- Problems where agents try to do the best they can subject to constraints
- Called constrained minimization or maximization problems

# Where We Are Going

1. Consumer preferences and utility
2. Indifference curves
3. Budget constraints
4. Optimization

# Utility

# Assumptions about Consumer Preferences

1. Completeness and Rankability
   - You can rank all your consumption choices
   - For two bundles $A$ and $B$, you always either
     - prefer $A$ to $B$
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   - If $A$ is preferred to $B$, and $B$ to $C$, then $A > C$
4. The more you have of a particular good, the less of something else you are willing to give up to get more of that good

# What is Utility?

Overall satisfaction or happiness

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Overall satisfaction or happiness

- Measured in utils!
- This framework allows us to describe what consumption or habits make you happier than other consumptions or habits
- It's not a tool for comparing across people

# Some Example Utility Functions

Most general $U = U(X, Y)$

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They can take many forms, such as

- $U = U(X, Y) = XY$
- $U = U(X, Y) = X + Y$
- $U = U(X, Y) = X^{0.7}Y^{0.3}$

# Marginal Utility

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$$MU_X = \frac{\Delta U(X,Y)}{\Delta X}\left(= \frac{\partial U}{\partial X}\right)$$

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Following our assumptions, what is generally true about marginal utility of $X$ as consumption of $X$ increases?

# Basics of Marginal Utility

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- Marginal utility of second 64 GB?
- 10 additional utils

# Utility and Comparisons

- Ordinal: we can rank bundles from best to worst
- Not cardinal: we cannot say how much one bundle is preferred to another in fixed units
- We cannot make interpersonal comparisons

No other assumptions on utility apart from the four preference assumptions.

# Indifference Curves

# Indifference Curves, or What You Like

# Indifference Curve Plan

1. What they are
2. Why they have the shape they do
3. Math for describing the trade-offs indifference curves describe
4. Substitutes and complements

# Describing Your Utility

- Let $i$ denote a bundle of goods, so $i \in \{1, 2, 3, ....\}$
- An indifference curve is a set of bundles $(X_i, Y_i)$ where $U(X_i, Y_i)$ is the same for any $i$

# Describing Your Utility

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- An indifference curve is a set of bundles $(X_i, Y_i)$ where $U(X_i, Y_i)$ is the same for any $i$
- Suppose a consumer has two bundles, $(X_1, Y_1)$ and $(X_2, Y_2)$
- Consumer is indifferent when $U(X_1, Y_1) = U(X_2, Y_2)$

# Working Up to an Indifference Curve

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# Why Can We Draw Indifference Curves?

- Because of the assumptions we made at the beginning about preferences: completeness and rankability
- All bundles have a utility level and we can rank them

# Indifference Curves Level and Slope

What does "more is better" tell us?

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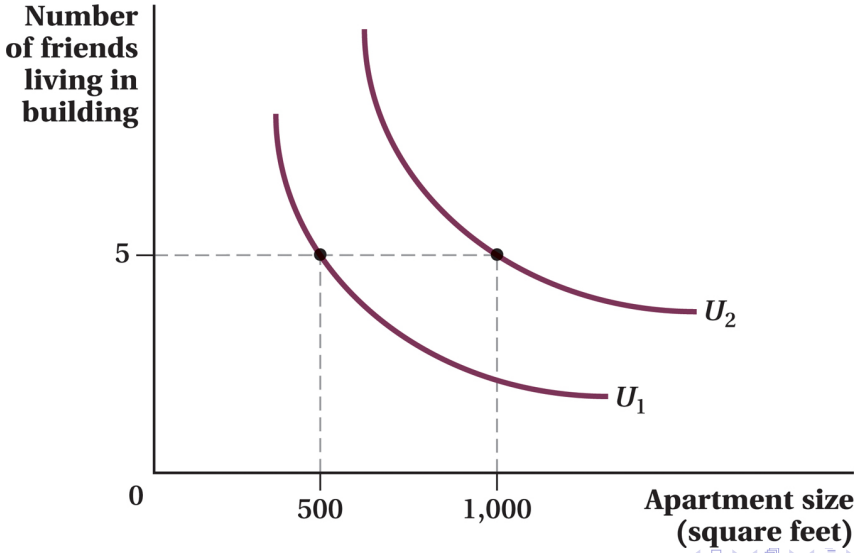
What does "more is better" tell us?

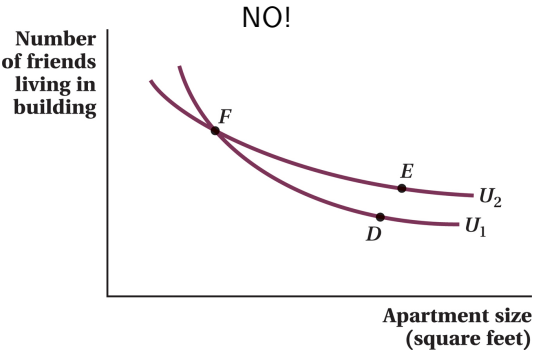
- That higher indifference curves give more utility
- Curve must have a negative slope
  - Suppose that you increase your consumption of $X$
  - "More is better" $\rightarrow$ you are happier
  - To be equally happy as before, you should give up some $Y$

# More Utility on Curves Farther From Origin



# Indifference Curve Shape

- Curves never cross
  - it would violate transitivity
- Curves are U-like (convex) with respect to the origin
  - Comes from assumption about diminishing marginal utility
  - Your willingness to trade off differs along the curve



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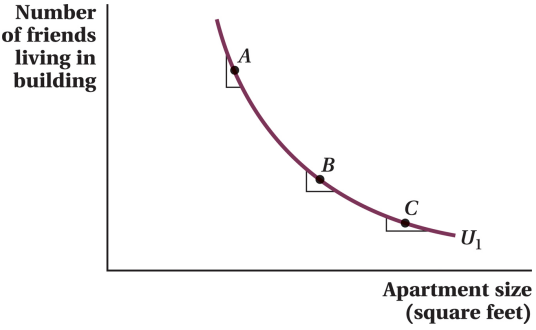
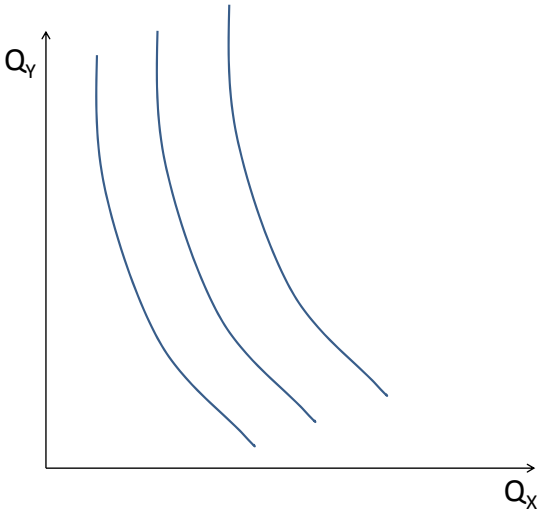
- We know that you are equally happy anywhere along the indifference curve
- So what changes as you move along the curve?
  - you are trading off $X$ and $Y$
  - the rate at which you trade them off tells us how much you value them



# When the curve is steep, what are you willing to give up more of?



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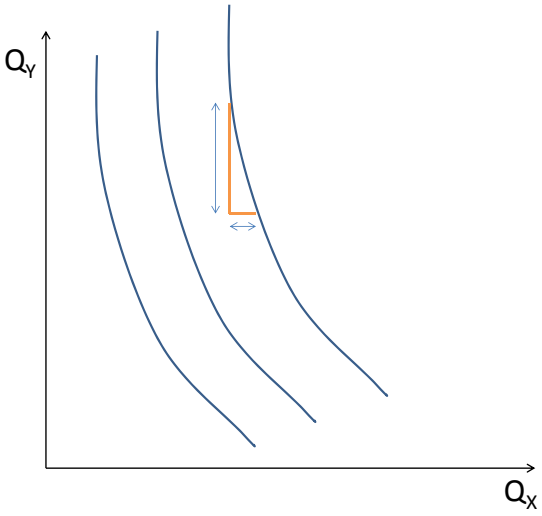

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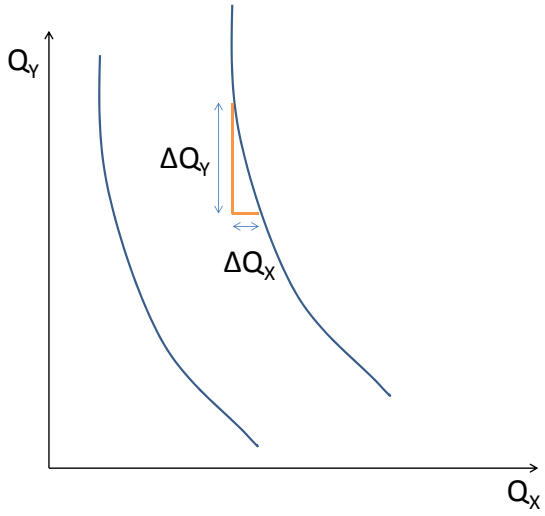

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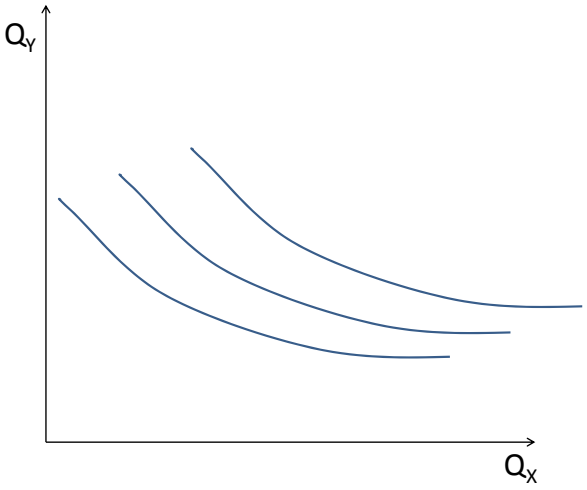

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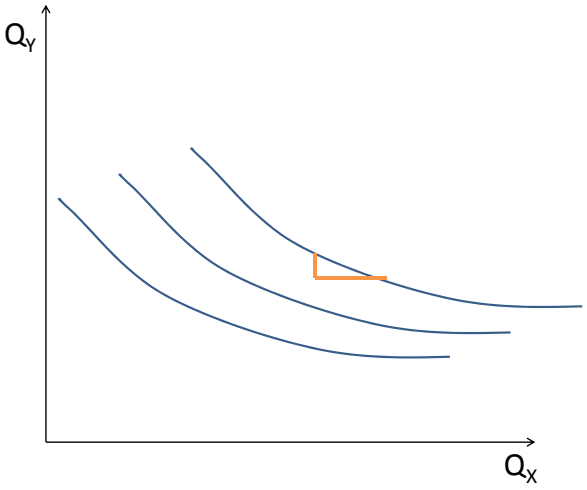

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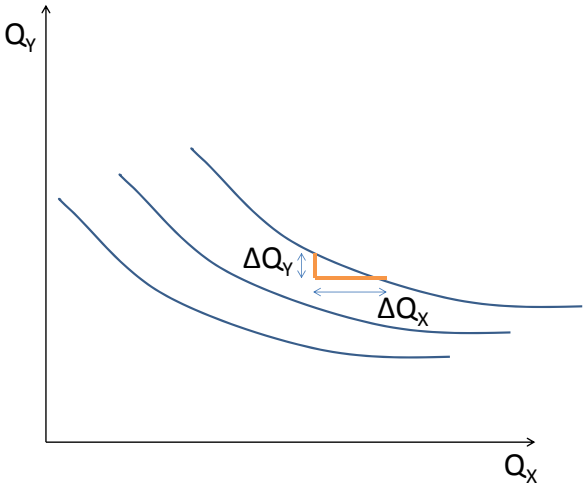

# Quantifying the Trade-off in the Indifference Curve

- How much of $X$ are you willing to give up for $Y$?
- **Marginal Rate of Substitution** is the trade-off
- Define

$$MRS_{XY} = (-1) * \frac{MU_X}{MU_Y}$$

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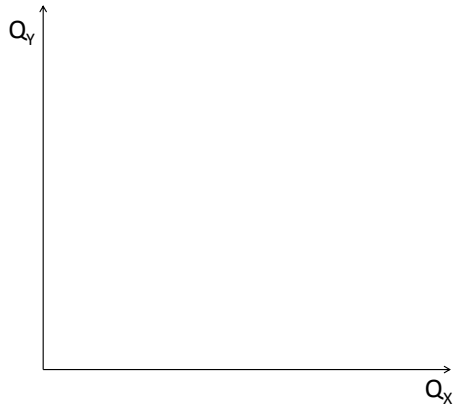
- Is it the same everywhere on the curve? Not necessarily.
- If you want a derivation, see the textbook!

# Indifference Curves for Perfect Complements

Work with your neighbor!

- Suppose we have two goods that are perfect complements
- $X$ and $Y$ being perfect complements means each is useless without the other
- What do the indifference curves look like?
- We write this utility as $U = \min\{aX, bY\}$



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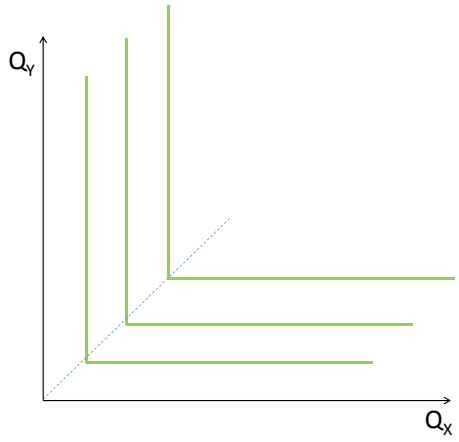

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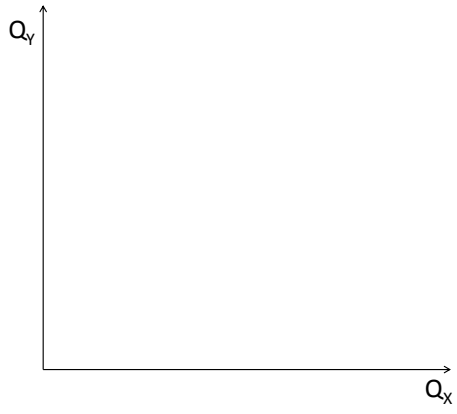

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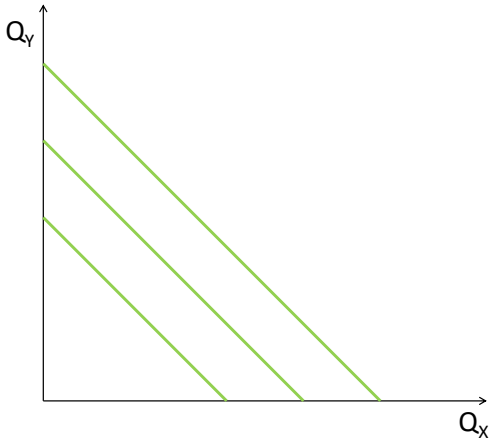
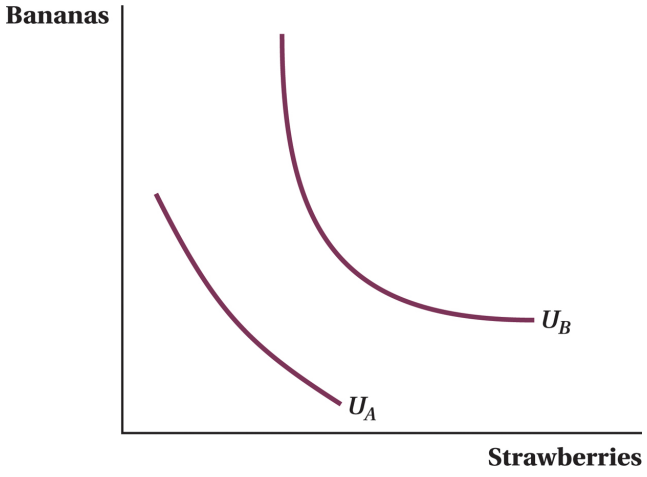


# Curves May Change Shape as Consumption Increases



# How Algebra Tells Us About Substitutes and Complements

In which equation(s) are $X$ and $Y$ substitutable? in which are they complementary?

- $U = U(X, Y) = XY$
- $U = U(X, Y) = X + Y$
- $U = U(X, Y) = X^{0.7}Y^{0.3}$

# Budget Constraint

# Budget Constraint, or What You Can Afford

# Budget Constraint Plan

1. Define
2. Draw
3. Find slope

# Budget Constraint Assumptions

1. Each good has a fixed price and infinite supply
2. Each consumer has a fixed amount of income to spend
3. The consumer cannot save or borrow

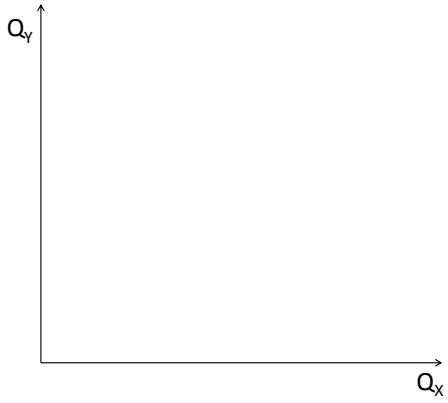
# Defining the Budget Constraint

Budget constraint:

$$I = P_X Q_X + P_Y Q_Y$$

- **feasible bundle** $\equiv$ combinations of $X$ and $Y$ that the consumer can purchase with his income
- **infeasible bundle** $\equiv$ all the combinations the consumer is just too poor to get

# Drawing the Budget Constraint




What if you spend all your money on $X$ or all your money on $Y$?

- If you spend it all on $X$

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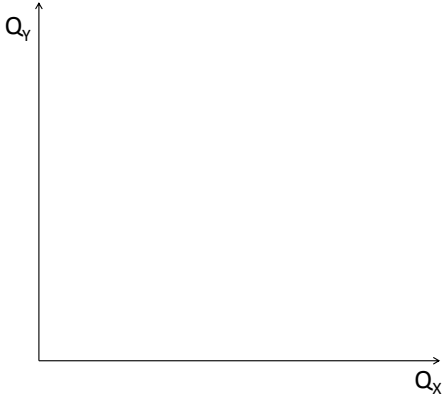


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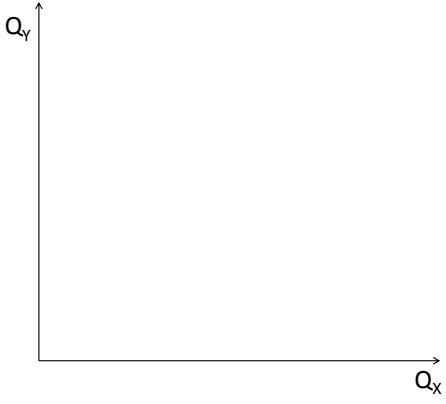


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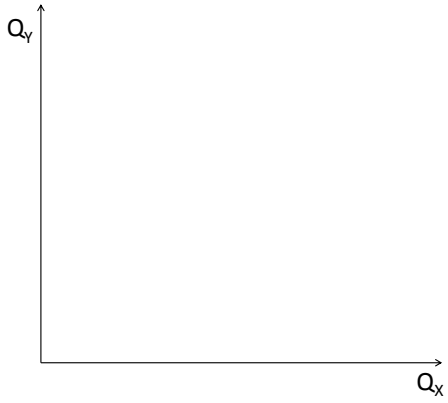


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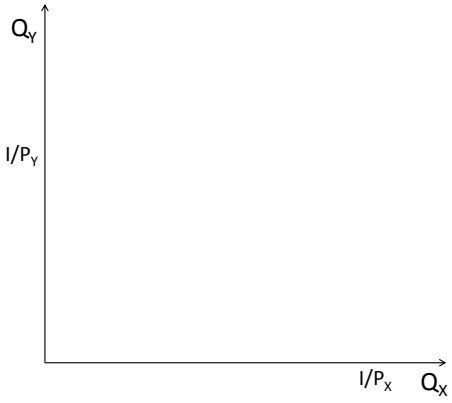


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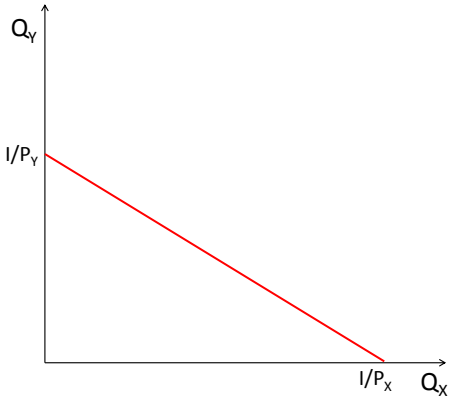


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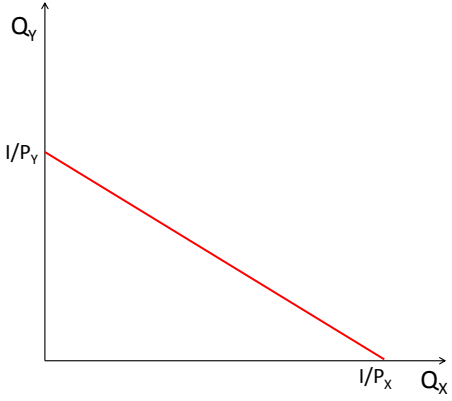


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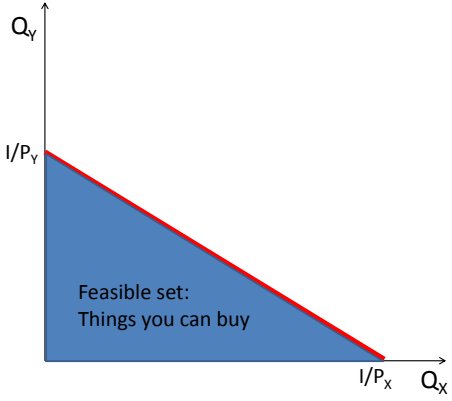
What points are feasible to purchase?

# Drawing the Budget Constraint

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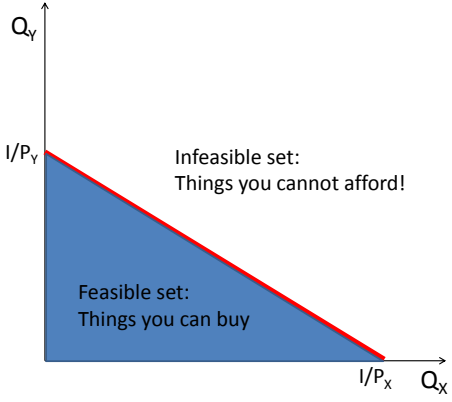


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# Slope of the Budget Constraint

Algebra of the slope: Write $Q_Y = f(Q_X)$

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$$\begin{aligned} I &= P_X Q_X + P_Y Q_Y \\ P_Y Q_Y &= I - P_X Q_X \\ Q_Y &= \frac{I}{P_Y} - \frac{P_X Q_X}{P_Y} \\ Q_Y &= -\frac{P_X}{P_Y} Q_X + \frac{I}{P_Y} \end{aligned}$$

So an additional unit of $Q_X$ requires you to give up $\frac{P_X}{P_Y}$ of $Q_Y$

# What Two Things Affect the Position of the Budget Constraint?

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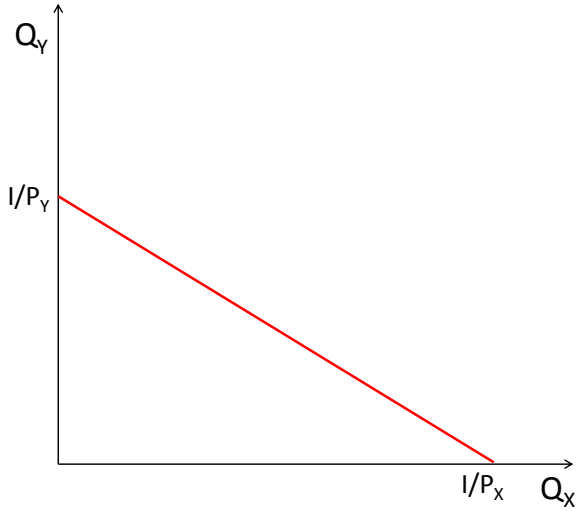
Prices and Income

# What Happens if the Price of $Y$ Decreases?



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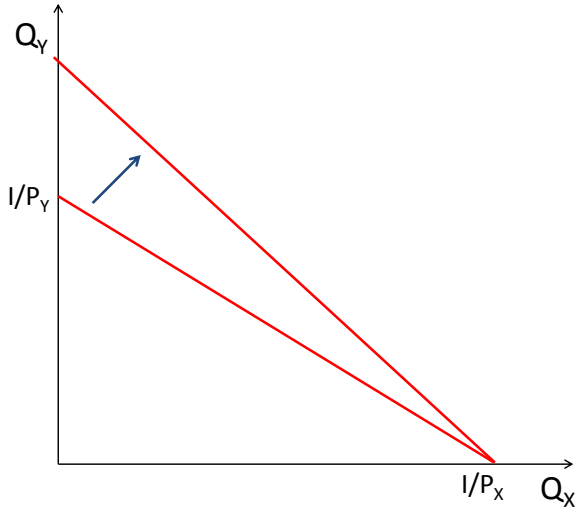

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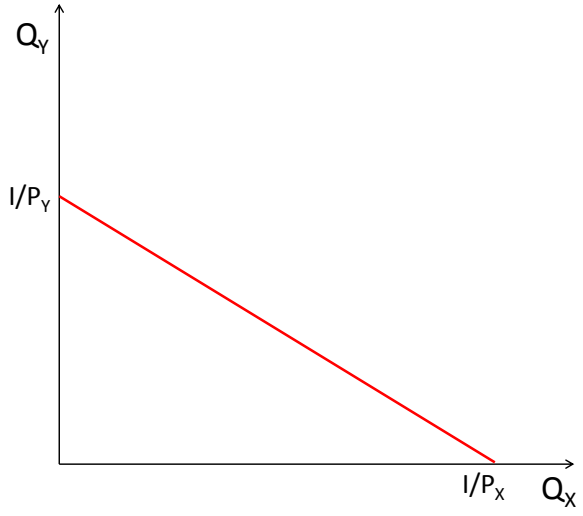

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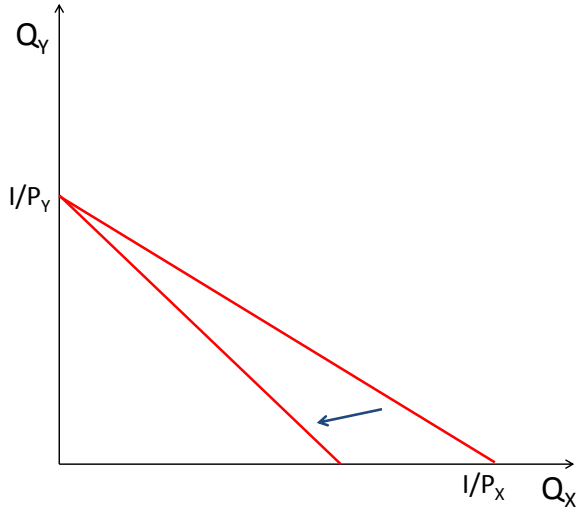

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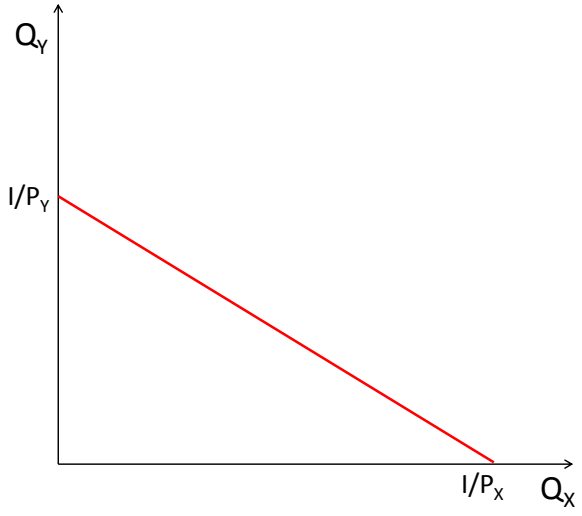

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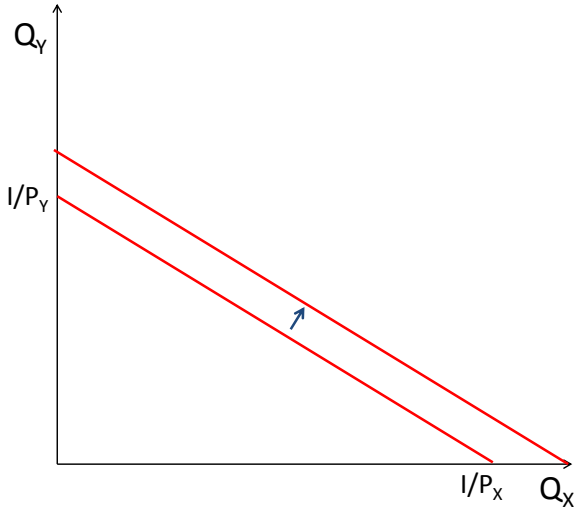

# Budget Constraint Changes, In Sum

- Things that change the slope
  - Change in prices, $P_X$ or $P_Y$
- Things that don't change the slope, but move the line in and out
  - Change in income

# Optimizing

# Optimizing, or The Best You Can Do, Given What You Like and What You Can Afford

# How to Be As Happy as Possible

- Maximize your utility given your budget constraint
- Can this person get the level of utility drawn on the indifference curve given his budget constraint?

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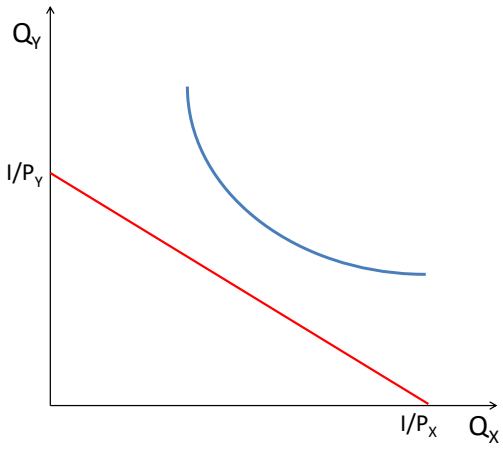

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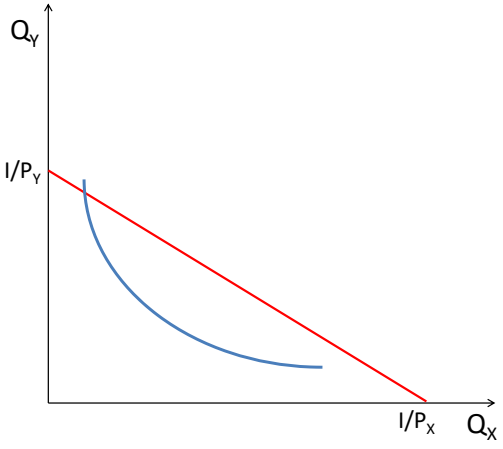

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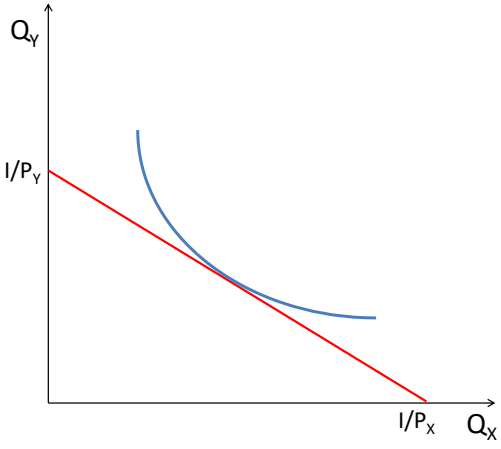

# Algebra of Utility Maximization

- Utility is maximized, given the budget constraint, when the slope of the indifference curve is tangent to the budget constraint
- tangency $\rightarrow$ equality

$$MRS_{XY} = -\frac{P_X}{P_Y}$$

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- One of the few formulae you need to memorize

# When Are You Optimizing?

By definition

- if $MRS_{XY} = P_X/P_Y$ you are optimizing
- if $MRS_{XY} \neq P_X/P_Y$ you are **not** optimizing*

* unless you are at a corner solution, where you consume only one good

# In-Class Problem

Set-up

- Sarah gets utility from soda (S) and hotdogs (H)
- Her utility function is $U = S^{0.5}H^{0.5}$
- Therefore
  - $MU_S = 0.5\frac{H^{0.5}}{S^{0.5}}$
  - $MU_H = 0.5\frac{S^{0.5}}{H^{0.5}}$
- Sarah's income is \$12
- Price of soda is \$2
- Price of hotdogs is \$3

Questions

1. Write the equation for Sarah's budget constraint
2. Draw Sarah's budget constraint
3. Write the marginal rate of substitution in terms of $H$ and $S$
4. What amount of sodas and hotdogs makes Sarah happiest, given her budget constraint? (Recall that you have two equations and two unknowns.)

# Answer to In-Class Problem, 1 of 2

- We have two unknowns (optimal $H$ and $S$), so we need two equations to solve for them
- Equation 1: From the information about income and prices, we can write a budget constraint

$$\begin{aligned} I &= P_S S + P_H H \\ 12 &= 2S + 3H \end{aligned}$$

- Equation 2: We know that at equilibrium $-MRS_{H,S} = -\frac{P_H}{P_S}$, or $-MRS$ is equal to the slope of the budget constraint.

$$\begin{aligned} -MRS_{S,H} &= -\frac{P_S}{P_H} \\ \frac{MU_S}{MU_H} = \frac{0.5H^{0.5}S^{-0.5}}{0.5S^{0.5}H^{-0.5}} &= \frac{2}{3} \\ \frac{H}{S} &= \frac{2}{3} \end{aligned}$$

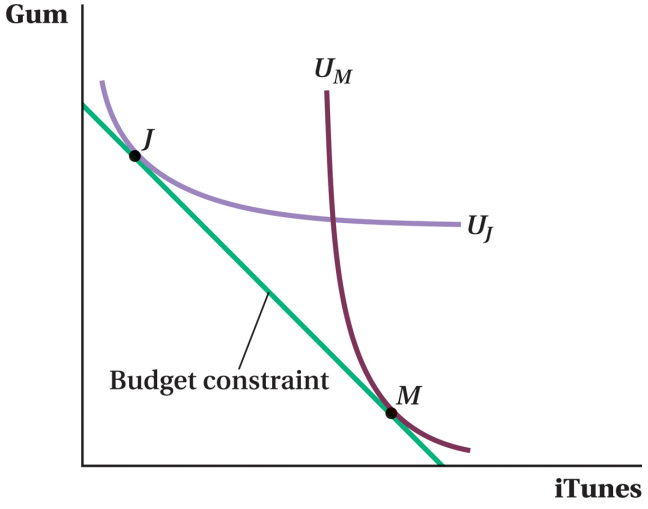
# Answer to In-Class Problem, 2 of 2

Now we have two equations and two unknowns. From Equation 2, we know that $H = \frac{2}{3}S$. We can therefore plus this into the budget constraint:

$$\begin{aligned} 12 &= 2S + 3H \\ 12 &= 2S + 3\frac{2}{3}S \\ 12 &= 2S + 2S = 4S \\ S &= 3 \end{aligned}$$

If $S = 3$, then $12 = 2 * 3 + 3H$, which means that $6 = 3H$, or $H = 2$. And Sarah has spent all her money.

# A Usual Maximization of Utility s.t. Budget Constraint



# What We Did This Class

1. Preferences and utility
2. Indifference curves – what you like
3. Budget constraint – what you can afford
4. Optimization – the best you can do given what you like and can afford

# The Big Ideas

- Utility
- What you like: indifference curves
- What you can afford: budget constraint
- The best you can do given these two: optimization

# Next Class

- Read Chapter 5
  - Omit income Engel curves from 5.1
  - Skip 5.3 entirely
- Turn in Use Numbers 2 of 3