# An Introduction to Economics

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# Consumer Theory

- Theory of consumer behavior at the individual level
- What can the agent purchase?
- What does the agent want to purchase?
- What do their choices reveal?

# Motivating Example

- You enter a supermarket looking to make several purchases for the upcoming weeks. You've been to this store many times, and have a pretty good idea of what they have in stock.
- What factors influence the bundle of goods that you leave the supermarket with?
- What do these purchases reveal about your preferences?

# Budget Sets

- What *can* the consumer purchase?

- What determines this?

# Budget Sets (2)

- Not related to the consumer's preferences
- Determined only by their prices and wealth

# Budget Set

**Definition**

An agent's **budget set** consists of all of those bundles that the agent can purchase.

# Budget Set: Example

- You go to the store to buy grapes and almonds.
- You've allocated \$15 to make these purchases.
- Grapes cost \$3 per pound
- Almonds cost \$5 per pound
- What combinations of grapes and almonds are you able to purchase with \$15?

# Budget Set: Expression

- You have unit prices $p_g = 3$ for grapes and $p_a = 5$ for almonds.
- You have wealth of 15.
- Mathematically, the budget set are those combinations of grapes ($x_g$) and almonds ($x_b$) such that:

$$p_g x_g + p_a x_a \leq w$$

  and with $x_g \geq 0$ and $x_a \geq 0$
- What does this look like graphically?

# Budget Set: Example (2)

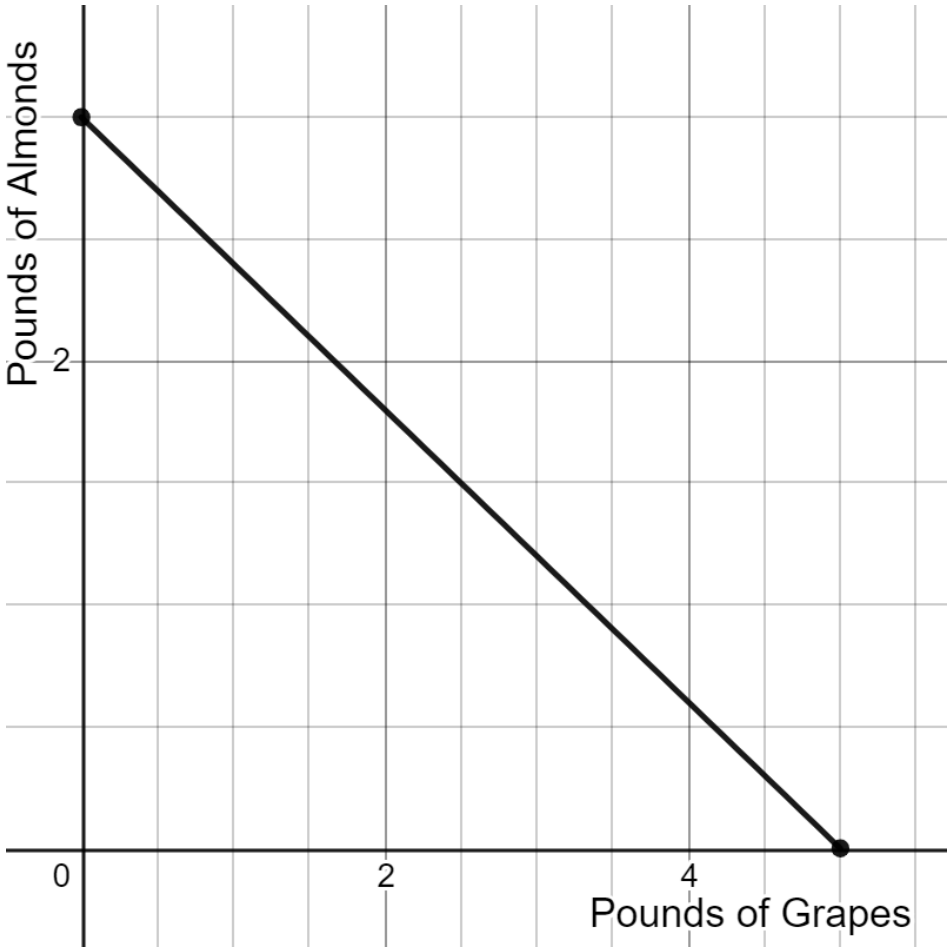



Figure 1: Your budget set

# Example: Changing Wealth

- Suppose now that you've committed to spending \$30 on almonds and grapes.
- How does this affect your budget set?

# Example: Changing Wealth (2)

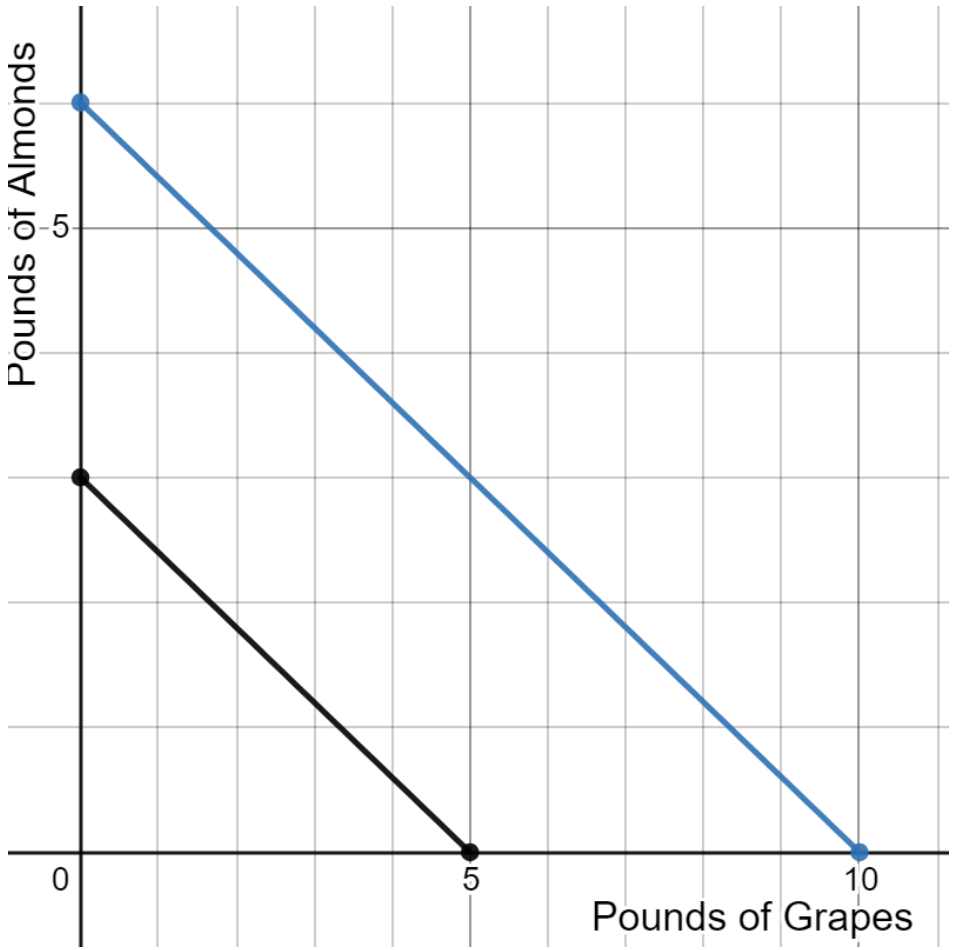



Figure 2: Your new budget set (blue)

# Example: Changing Prices

- Suppose that you still want to allocate \$15 to grapes and almonds.
- Suppose now that the price of almonds rises to \$10 per pound.
- How does this affect your budget set?

# Example: Changing Prices (2)

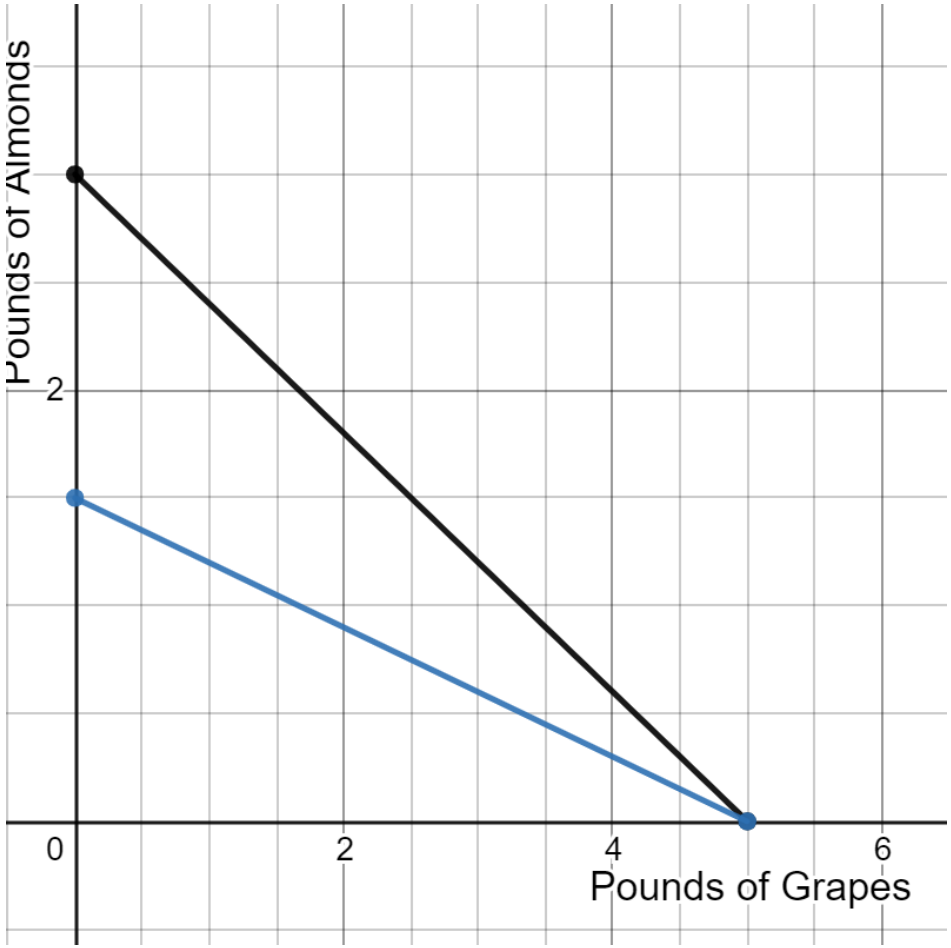



Figure 3: Your new budget set (blue)

# Preferences

- We saw: What choices can agents make?
- Question: What choice will an agent make from among them?
- Answer: What are their preferences?

# Preferences (2)

**Definition**

An agent's **preferences** describe how they rank different bundles of goods.

- Does the agent prefer 2 pounds of grapes and 2 pounds of almonds to 3 pounds of grapes and 1 pound of almonds?
- What should your preferences satisfy?

# Preferences (3)

Preferences often satisfy the following properties:

- Monotonicity: More is better
- Transitivity: If I prefer bundle A to bundle B, and bundle B to bundle C, then I should prefer bundle A to bundle C.
- Completeness: I can compare any two bundles and say which one I prefer.

# Utility

- When preferences are well-behaved, we can represent them using a function!

**Definition**

An agent's **utility function** indicates how the agent values a bundle of goods.

- When the *utility* of bundle A is higher than the *utility* of bundle B, the agent *prefers* bundle A to bundle B.

# Marginal Utility

- When we can represent a person's preferences using a utility function, we can reason about how they value an additional unit of a good.

**Definition**

The **marginal utility** is the additional benefit that the agent obtains from receiving one additional unit of a good or service.

- How much do you value an additional pound of grapes?
- Does it depend on how many grapes you already have?
- Does it depend on how many almonds you already have?

# Diminishing Marginal Utility

- We typically assume that marginal utility is *diminishing* in a good or service.
- The more grapes that you have, the less you will value an additional pound of grapes.
- Marginal utility may decrease slowly, or very quickly.

# Indifference Curves

- An agent is **indifferent** between two bundles if they rank them equally (they don't strictly prefer one over the other)
- With a utility function, the bundles that you're indifferent between all give you the same utility!
- What are the bundles that give you the same level of utility? Can we visualize them?

# Indifference Curves: Example

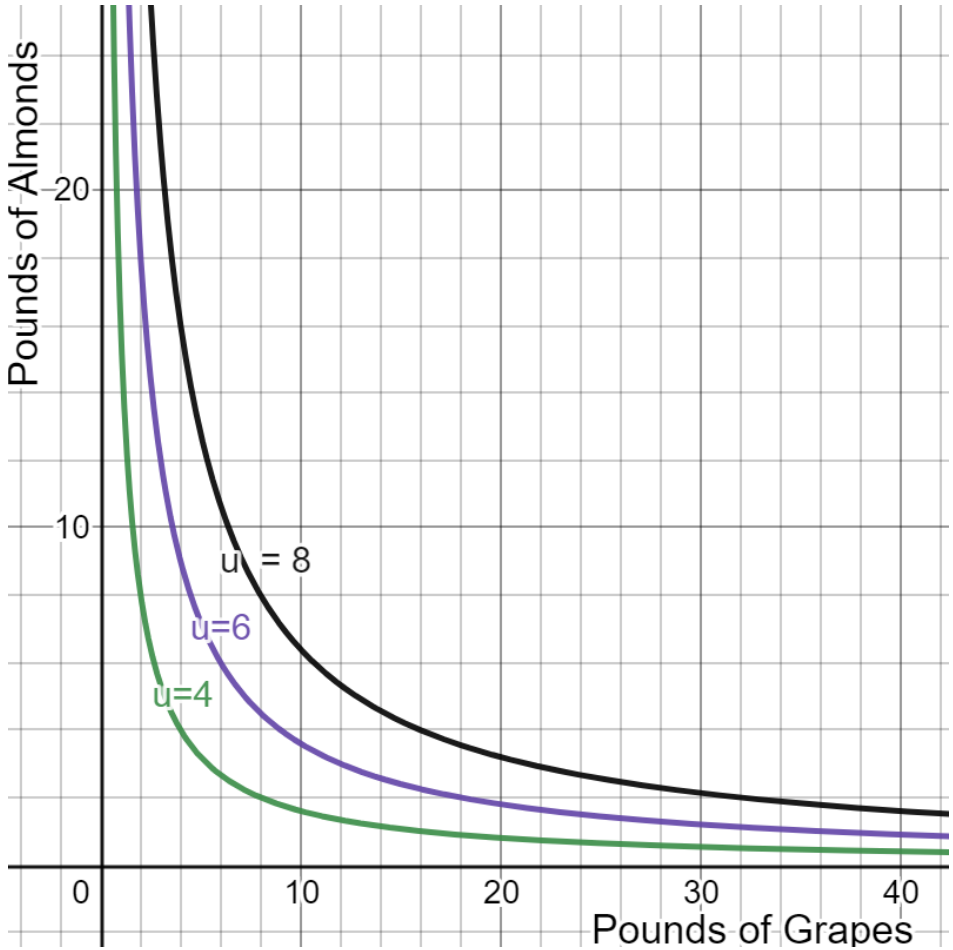



Figure 4: Indifference Curves

# Indifference Curves: Properties

- Monotonicity: More is better (bundles more "northeast" are better)
- Diminishing Marginal Utility: Indifference Curves are bowed inward
- There are an infinite number of them, only 3 of them are shown in the last figure.

# Marginal Rate of Substitution

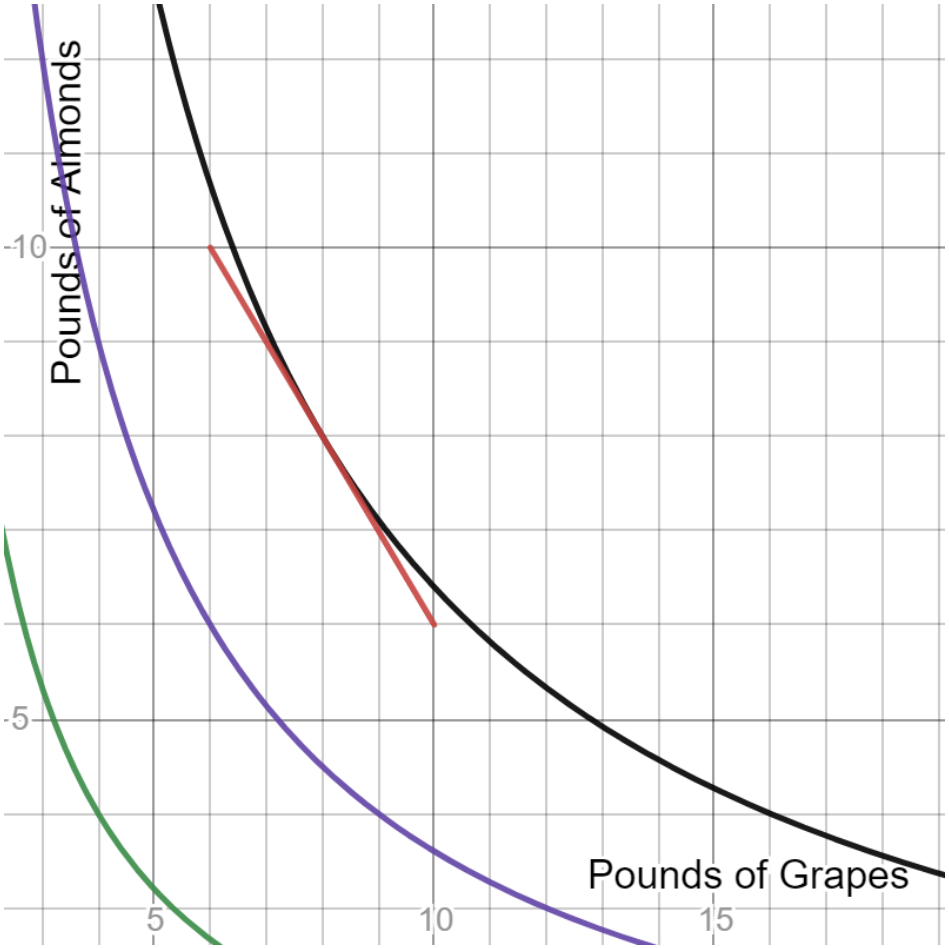



Figure 5: Slope at the point (8,8): The red tangent line

# Marginal Rate of Substitution (2)

- At the point (8,8), what is the slope of the indifference curve?
- Question: If we get $\Delta X$ pounds grapes with $\Delta X$ very small , how many pounds of almonds $\Delta Y$ must we give up to have the same utility?
- We need to use the marginal utility at this point!
- Answer:

$$MU_X \cdot \Delta X = -(MU_Y \cdot \Delta Y)$$

- Our value of getting $\Delta X$ grapes is $MU_X \cdot \Delta X$
- In order to get the same utility, we need to give up an amount of almonds $\Delta Y$ so that this equation holds.

# Marginal Rate of Substitution

## Definition

The **marginal rate of substitution (MRS)** at a point $(X, Y)$ describes the rate at which you would trade good $X$ for good $Y$ in order to have the same utility.

- Remember, your marginal utilities depend on the bundle!
- The marginal rate of substitution is equal to the ratio of marginal utilities of the two goods at the point $(X, Y)$.
- $MRS = \frac{MU_X}{MU_Y}$
- Using the equation from the previous page:

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

# Marginal Rate of Substitution (2)

- The last equation was:

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

- MRS = -(slope of indifference curve)
- Notice that indifference curves have a decreasing slope as we increase $X$.
- The marginal rate of substitution is decreasing as we receive more of good $X$.
- Interpretation: With higher $X$, we're willing to give up more and more $X$ for the same amount of $Y$.

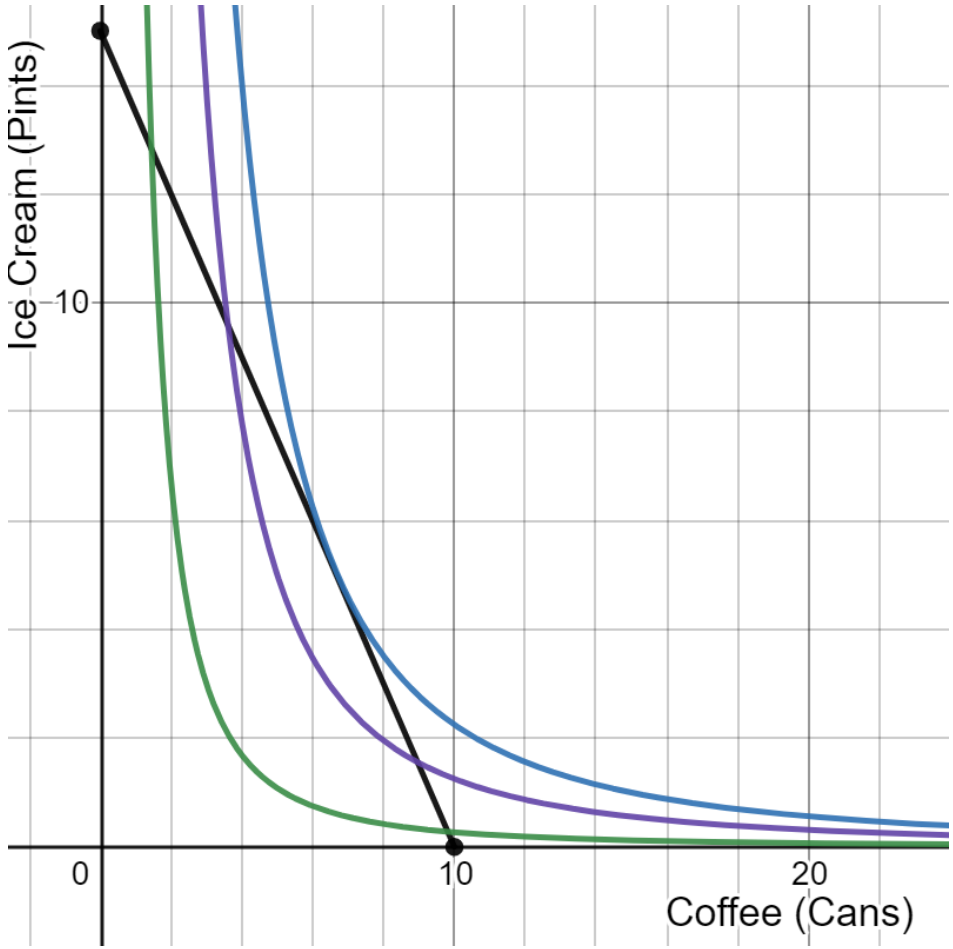
# Consumer Problem: Ingredients

- What can the agent choose? Depends on:
  - Prices
  - Wealth
- What does the agent want? Depends on:
  - Preferences and utility
- What does the agent choose?
  - Bundles on the highest indifference curve

# Consumer Problem: Example

- Suppose that you've allocated \$60 to purchase ice cream and coffee.
- Ice cream costs \$4 per pint
- Coffee costs \$6 per can
- What does your budget constraint look like?

# Consumer Problem: Example (2)



# Consumer Problem: Solution

- Choice: Blue curve meets budget set
- Principle: Spend *all* of your money (Walras' Law)
- At this point: Budget set is tangent to the indifference curve
- Slope of the indifference curve is equal to the slope of the budget set at this point!
- So:

$$(MRS) := \frac{MU_x}{MU_y} = \frac{P_x}{P_y}$$

# Why it Works: Bang-Per-Buck

- Previous equation can be rearranged to:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

- Marginal utility per dollar (bang-per-buck) is equal across goods!

# Non-solutions

- Let's suppose that:

$$\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$$

- Your marginal utility per dollar of good $x$ is higher than good $y$
- Then you should purchase more of good $x$ and less of good $y$ [1]
- Recall that marginal utility is decreasing, so:

$$\frac{MU_x}{P_x} \downarrow \quad , \quad \frac{MU_y}{P_y} \uparrow$$

[1] It really helps to think about it when prices are equal

# Consumer Problem: Example (3)

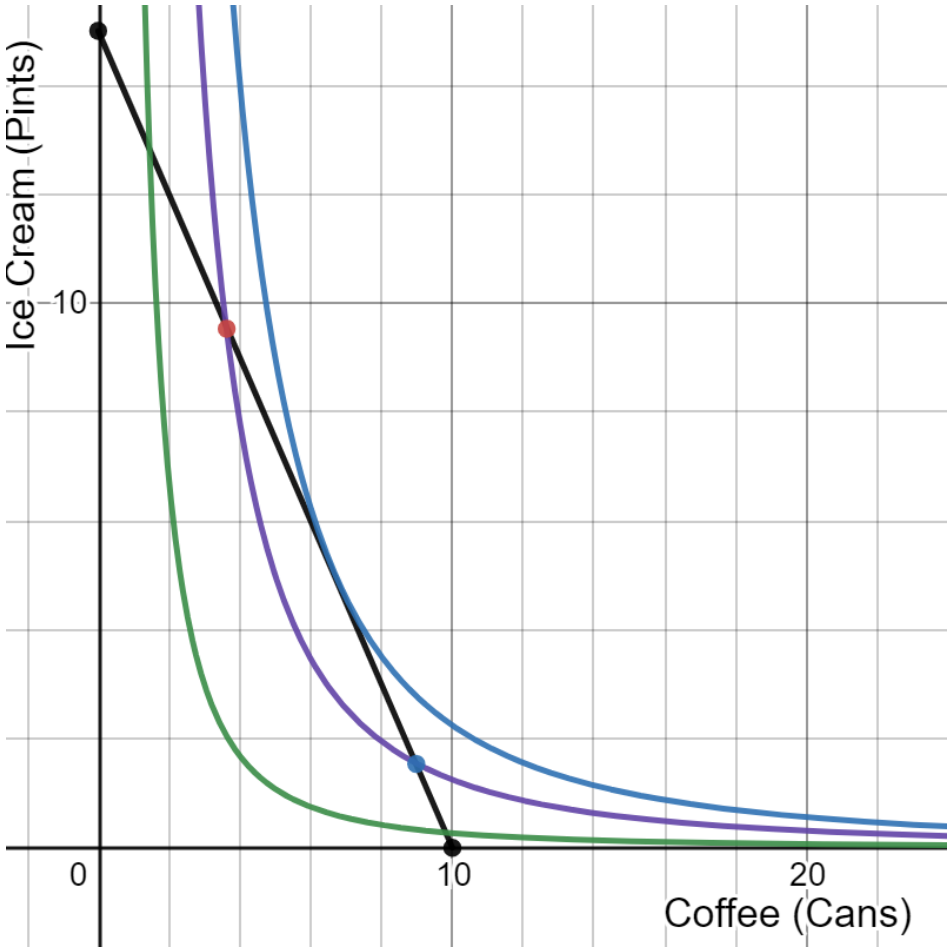



Figure 6: How does bang-per-buck compare at the red and blue points?

# Consumer Problem: Example (4)

- At the red point: Consuming a lot of ice cream, very little coffee
  - Marginal utlity of ice cream diminishes as we have more of it
  - Bang-per-buck of ice cream is lower than that of coffee
  - Marginal rate of substitution is greater than price ratio
- At the blue point: Consuming a lot of coffee, very little ice cream
  - Opposite of the red point
  - Bang-per-buck of ice cream is higher than that of coffee
  - Marginal rate of substitution is lower than price ratio

# Example: Perfect Substitutes

- Two goods are perfect substitutes when they serve the exact same role for you
- Marginal utility of each doesn't depend on your bundle!
- Utility function is $u(X, Y) = aX + bY$
- Utility function is linear $\Rightarrow$ indifference curves are straight lines
- Leads to a very particular solution to consumer problem
- Bang-per-buck principle doesn't apply

# Example: Perfect Substitutes (2)

- See whiteboard!

# Example: Perfect Complements

- Two goods are perfect complements if they only provide benefits when used together
- Utility function takes the form of a minimum:

$$u(X, Y) = min\{aX, bY\}$$

- If $aX > bY$, getting more of good $X$ doesn't improve your utility
- What do your indifference curves look like?

# Example: Perfect Complements (2)

- See whiteboard!