

# EE211

# PRINCIPLES OF MICROECONOMICS

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Topic 6:

The Theory of Consumer Choice

# Topics

- Utility Theory (Cardinal Approach)
  - Utility
  - Marginal utility
  - Law of diminishing marginal utility
- Indifference Curve Theory (Ordinal Approach)
  - Indifference curve
  - Marginal rate of substitution
  - Budget line
  - Consumer equilibrium
- Demand curve derivation
- Applications

# Part I: Utility Theory (Cardinal Approach)

- **Utility** is the *satisfaction* or *well-being* that a consumer receives from *consuming some good or service*.
  - Economists assume that, in making their choices, consumers are motivated to maximize their utility.
- **Total utility** is the total satisfaction resulting from consumption of a given commodity by a consumer.
- **Marginal utility** is the *additional satisfaction* obtained by a consumer from consuming one *additional unit* of a commodity.
  - $MU_x = \frac{\Delta U}{\Delta X}$

# Example: Utility Schedules

Number of Coffee Tom Drinks per day	Tom's Total Utility	Tom's Marginal Utility
0	0	
1	30	
2	50	
3	65	
4	75	
5	83	
6	89	

# Example: Utility Graphs

- Total Utility

***TU***



- Marginal Utility

***MU***



Total utility rises, but marginal utility decreases, as consumption rises.

# Diminishing Marginal Utility

- ***Law of diminishing marginal utility***

“The utility that any consumer derives from *successive* units of a particular product consumed over some period of time *diminishes* as total consumption of the product increases, if the consumption of all other products is unchanged.”

# Maximizing Utility

- The consumer's decision:

A **utility-maximizing consumer** allocates expenditures so that the **utility obtained from the last dollars** spent on each product is equal.

Mathematically,

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

Alternatively,

$$\frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

# Example

- Suppose you are buying Good X for \$1 each and Good Y for \$3 each, and the marginal utility of each good is the following.

# of X	$MU_x$	$MU_x / P_x$
1	30	
2	20	
3	15	

# of Y	$MU_y$	$MU_y / P_y$
1	60	
2	51	
3	45	

How many units of goods X and Y should you buy in order to maximize your utility?

# Part II. Indifference Curve Theory (Ordinal Approach)

- There is **no** numerical value attached to consumer's utility.
- Instead, consumer is asked which bundle is preferred to which.
- **Indifference curve** shows consumption bundles that give the consumer the same level of satisfaction.
- With 2 products  $X$  and  $Y$ , a bundle is represented by a point in diagram.

# Example: Indifference Curve

Bundle	Pepsi	Pizza
A	30	5
B	18	10
C	13	15
D	10	20
E	8	25
F	7	30

*Pepsi*



*Pizza*

# Assumptions

- Given any 2 bundles  $A$  &  $B$ , the consumer's preference is assumed to be exactly one of the followings:
  1.  $A$  is preferred to  $B$  ( $A \succ B$ ).
  2.  $B$  is preferred to  $A$  ( $B \succ A$ ).
  3.  $A$  &  $B$  are indifferent ( $A \sim B$ ).
- Consumer is assumed to be **rational**.
  - More is preferred to less.
  - If  $A \succ B$  and  $B \succ C$ , then  $A \succ C$ .

# Marginal Rate of Substitution

- **Marginal rate of substitution (MRS)** is the rate at which a consumer is willing to trade one good for another.
- Also, it is the slope of the indifference curve.
  
- Basic assumptions of indifference curve theory:
  1. The algebraic value of the MRS between two goods is always negative.
  2. The MRS is diminishing (i.e. any indifference curve becomes flatter as the consumer moves downward and to the right along the curve).

# Example: Indifference Curve & MRS

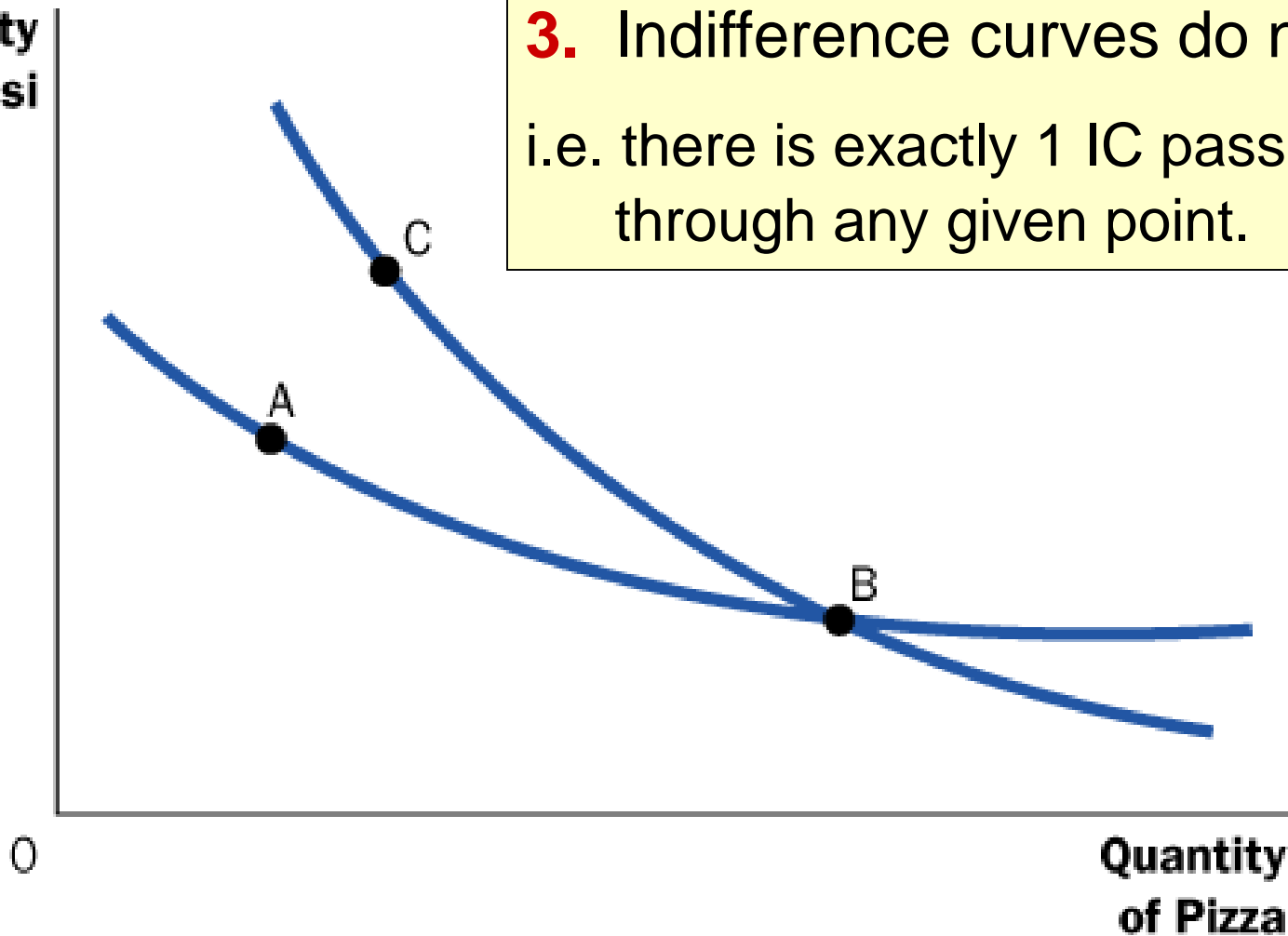
Bundle	Pepsi	Pizza
A	30	5
B	18	10
C	13	15
D	10	20
E	8	25
F	7	30

Change	Change in Pepsi	Change in Pizza	MRS
A→B			
B→C			
C→D			
D→E			
E→F			



# Properties of Indifference Curve

Quantity  
of Pepsi

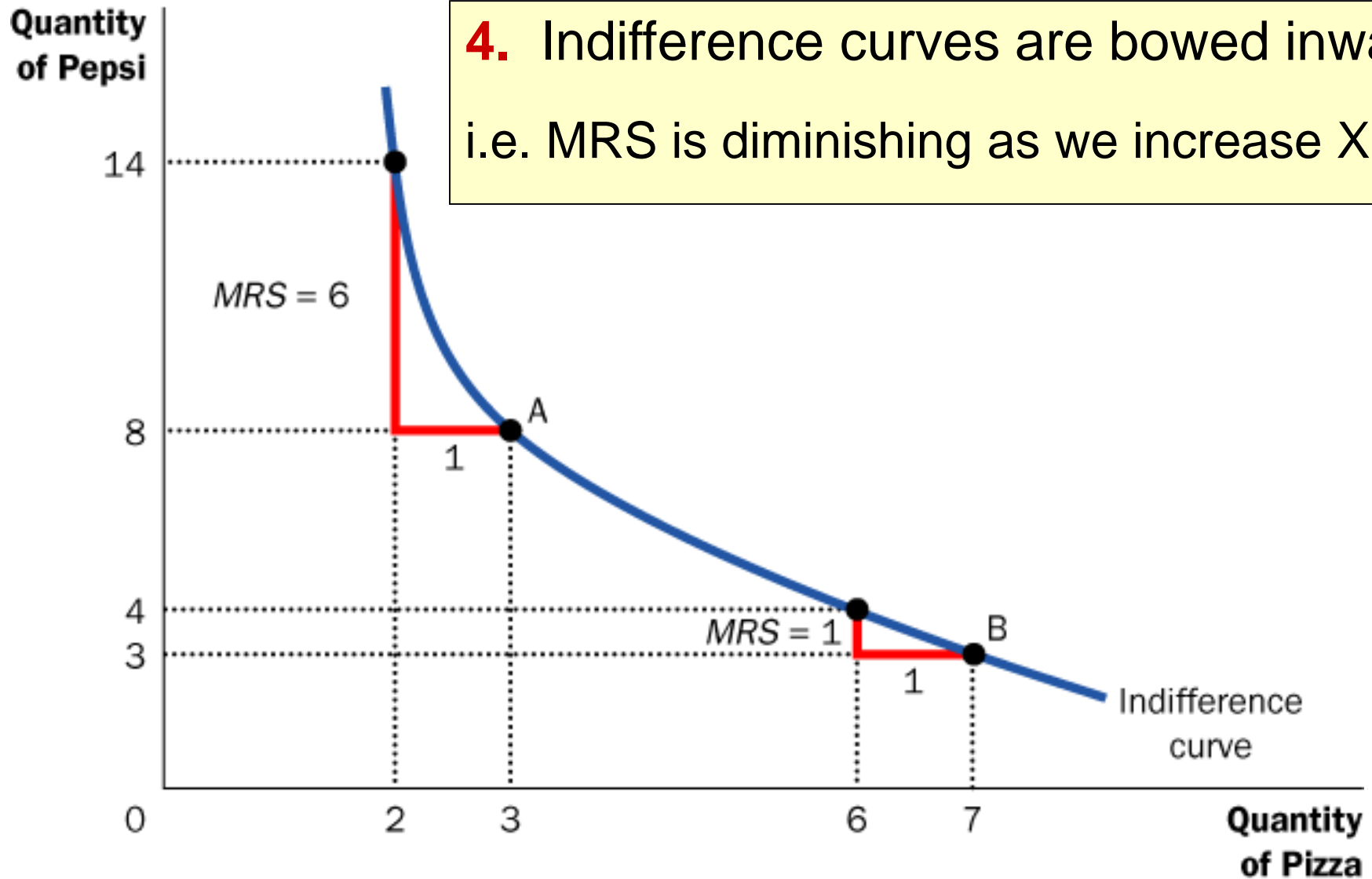


**3.** Indifference curves do not cross.  
i.e. there is exactly 1 IC passing  
through any given point.

0

Quantity  
of Pizza

# Properties of Indifference Curve

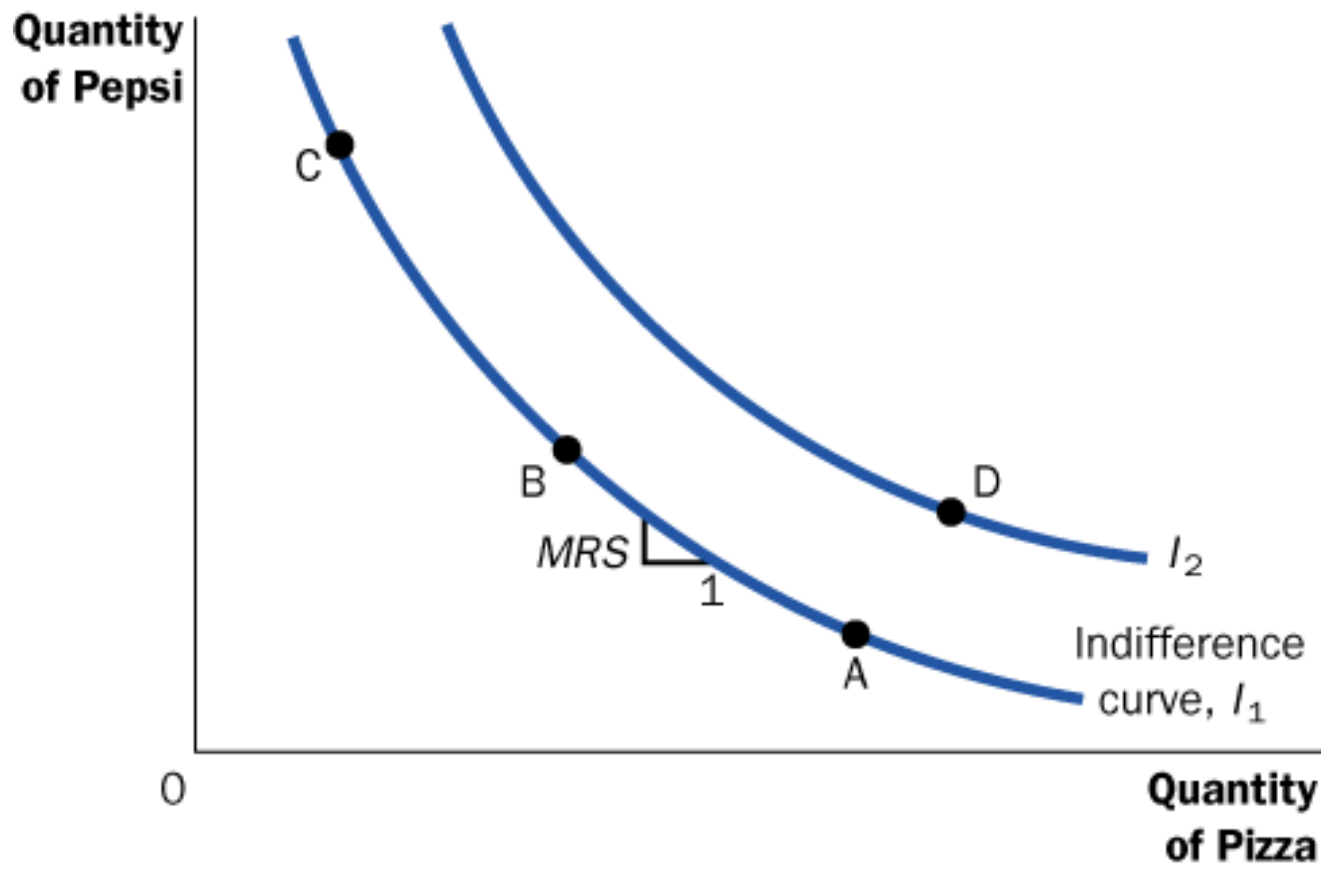


# Extreme Case: Perfect Substitutes

# Extreme Case: Perfect Complements

# Part III. Consumer's Equilibrium

- Recall: **Indifference curve** shows consumption bundles that give the consumer the same level of satisfaction.



# Extra Notes on Indifference Curve (1)

- **MRS is the slope of the indifference curve**, and MRS is diminishing (in absolute value) as X increases.
- At any point on indifference curve, the **slope is  $\frac{\Delta Y}{\Delta X}$** .
- As the consumer consumes more X and reduces consumption of Y, her utility changes by:

$$\Delta X > 0 \rightarrow \Delta U_x \approx MU_x \times \Delta X$$

$$\Delta Y < 0 \rightarrow \Delta U_y \approx MU_y \times \Delta Y$$

- But on the an indifference curve, the utility is the same:

$$\Delta U = \rightarrow \Delta U_x + \Delta U_y = 0$$

# Extra Notes on Indifference Curve (2)

- So,

$$\Delta U_x = -\Delta U_y$$

$$MU_x \Delta X \approx -MU_y \Delta Y$$

$$\rightarrow \frac{\Delta Y}{\Delta X} \approx -\frac{MU_x}{MU_y}$$

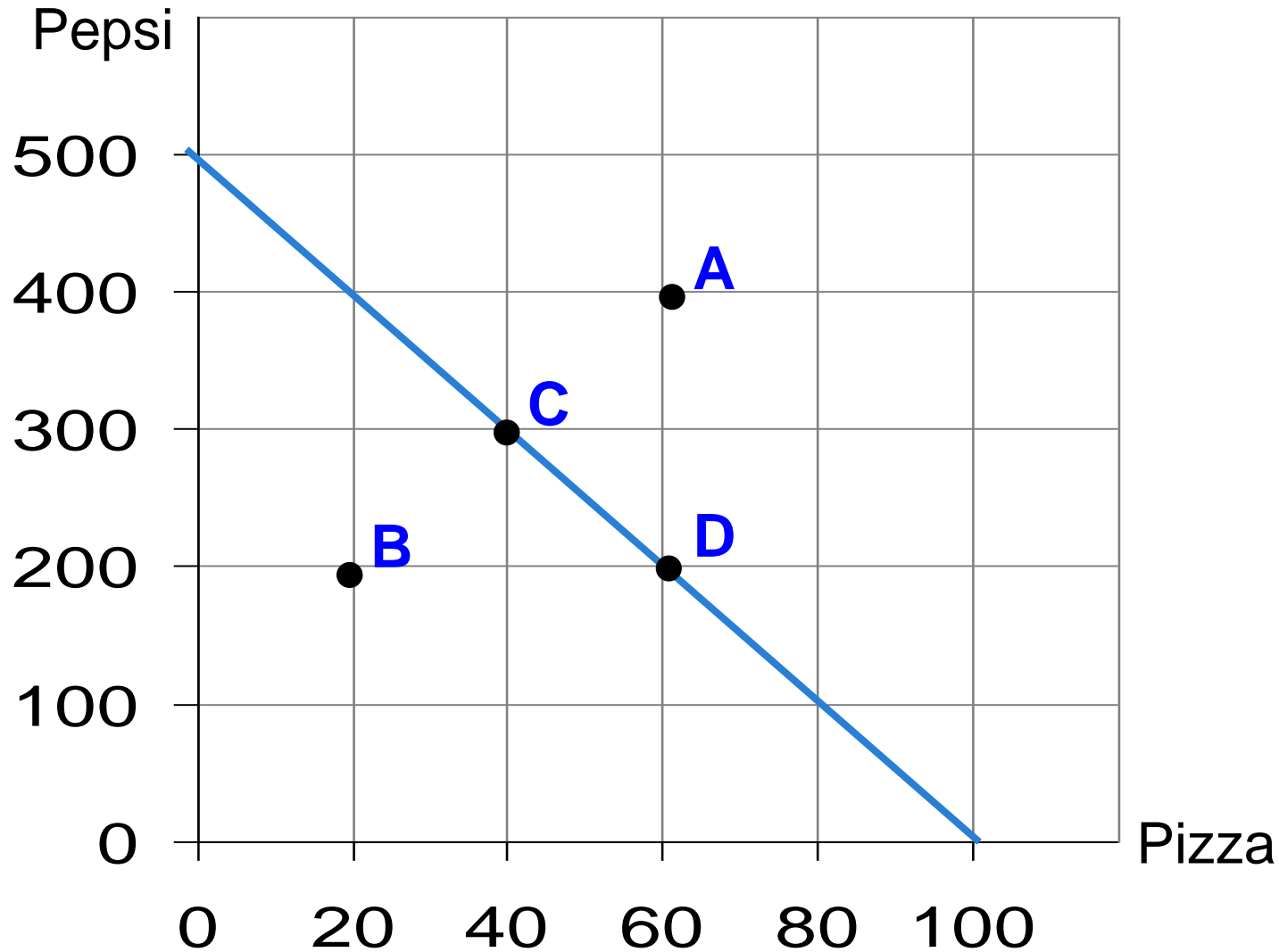
$$\rightarrow \frac{dY}{dX} = -\frac{MU_x}{MU_y} : \text{MRS}$$

# Budget Constraint

- **Budget constraint (or budget line):** the limit on the consumption bundles that a consumer can afford.
  - It shows all combinations (bundles) of the two goods that the consumer can afford to buy.
- Consider the case of 2 goods: Pizza (X) and Pepsi (Y). Suppose  $P_x = \$10$ ,  $P_y = \$2$ , and budget (B) = \$1000.
- The budget line can be written as:

$$P_x X + P_y Y = B$$

# Graph: Budget Constraint



# Slope of the Budget Constraint

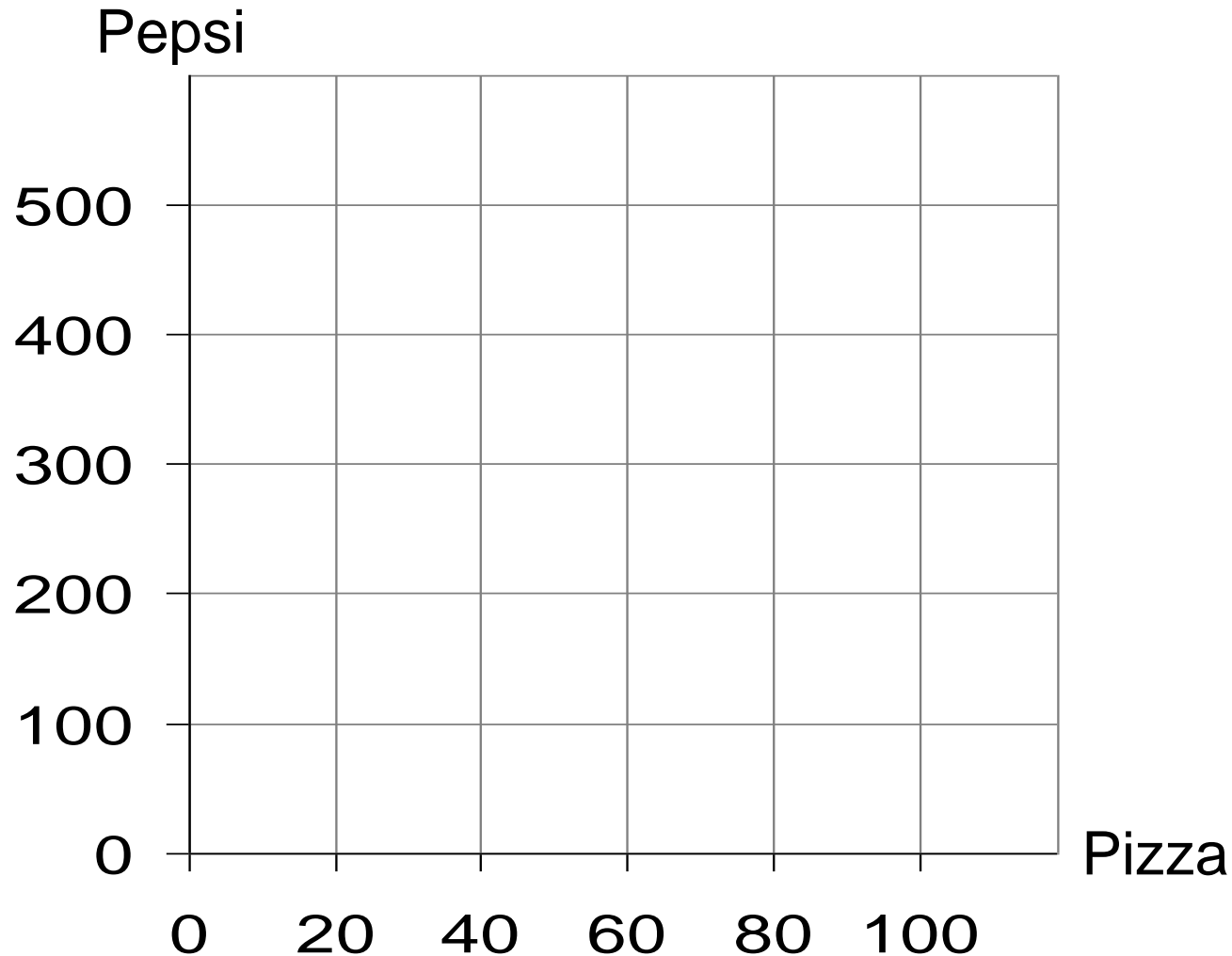
- The **slope of the budget constraint** equals:
  - the rate at which the consumer can trade Pepsi for pizza
  - the opportunity cost of pizza in terms of Pepsi
  - the relative price of pizza.

That is:

$$\textit{Slope of Budget line} = -\frac{P_x}{P_y}$$

# Change in Budget Constraint: Higher Income

- Suppose budget increases to \$1200.



# Consumer's Problem: Optimization

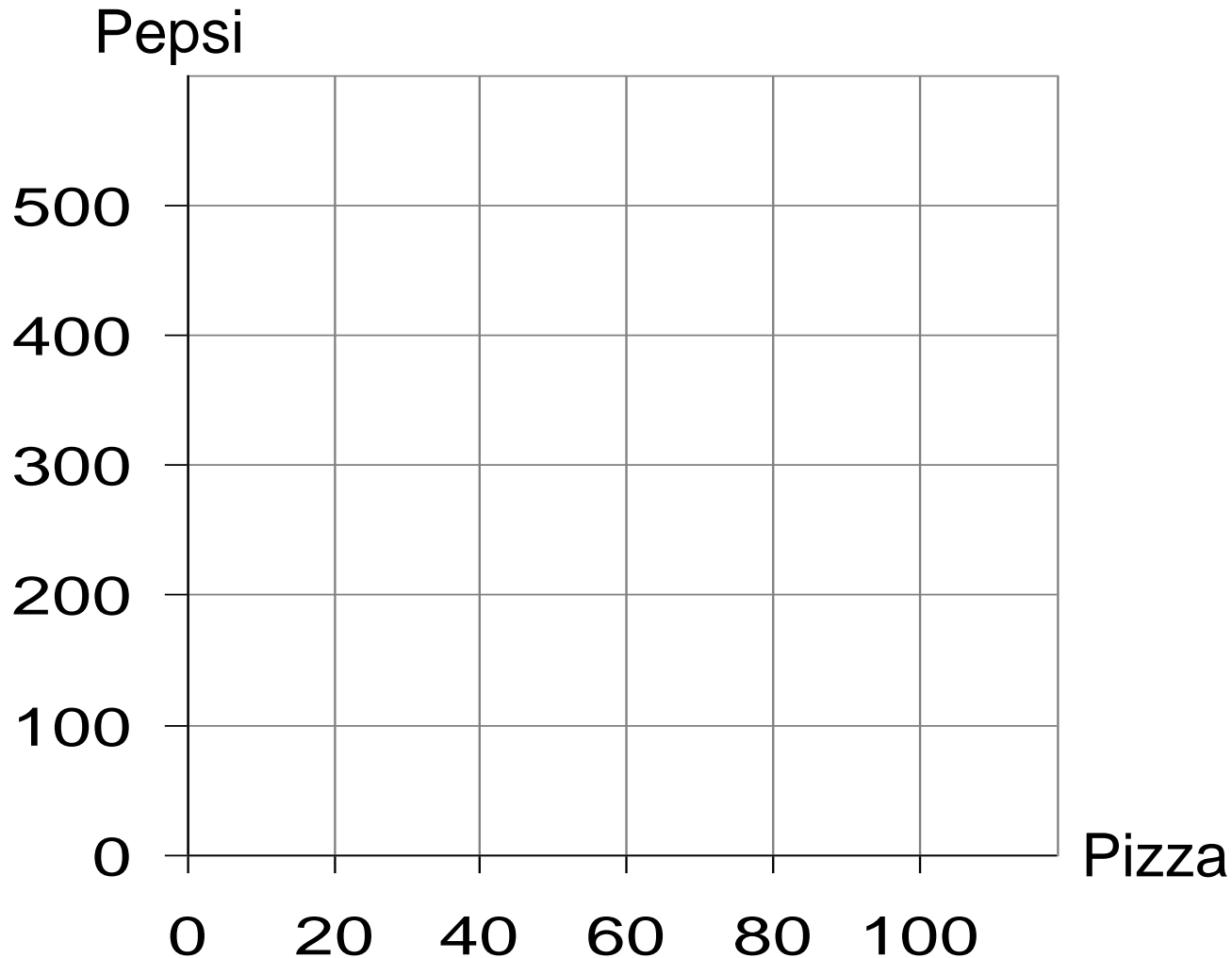
- Consumer's problem is to maximize his/her utility (i.e. satisfaction) under the budget constraint.
- The **optimal bundle** is at the point where the budget constraint touches the highest indifference curve.
  - i.e., the indifference curve and budget constraint have the same slope.
- Since the slope of IC is the MRS and the slope of the budget constraint is the relative price, the optimal bundle

is where:

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

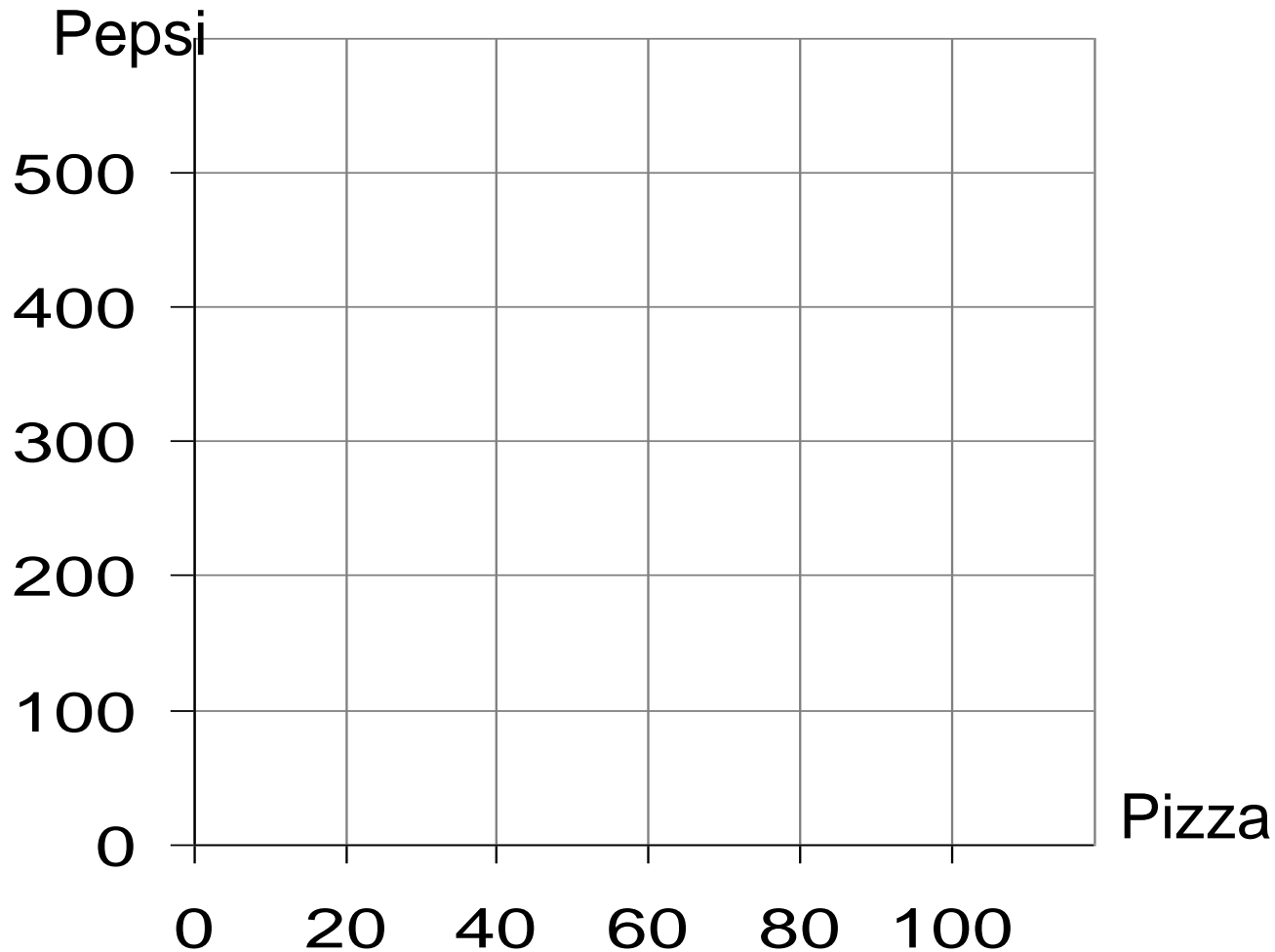
# Change in Budget Constraint: $P_x$ changes.

- Suppose  $P_x$  increases from \$10 to \$12.5.

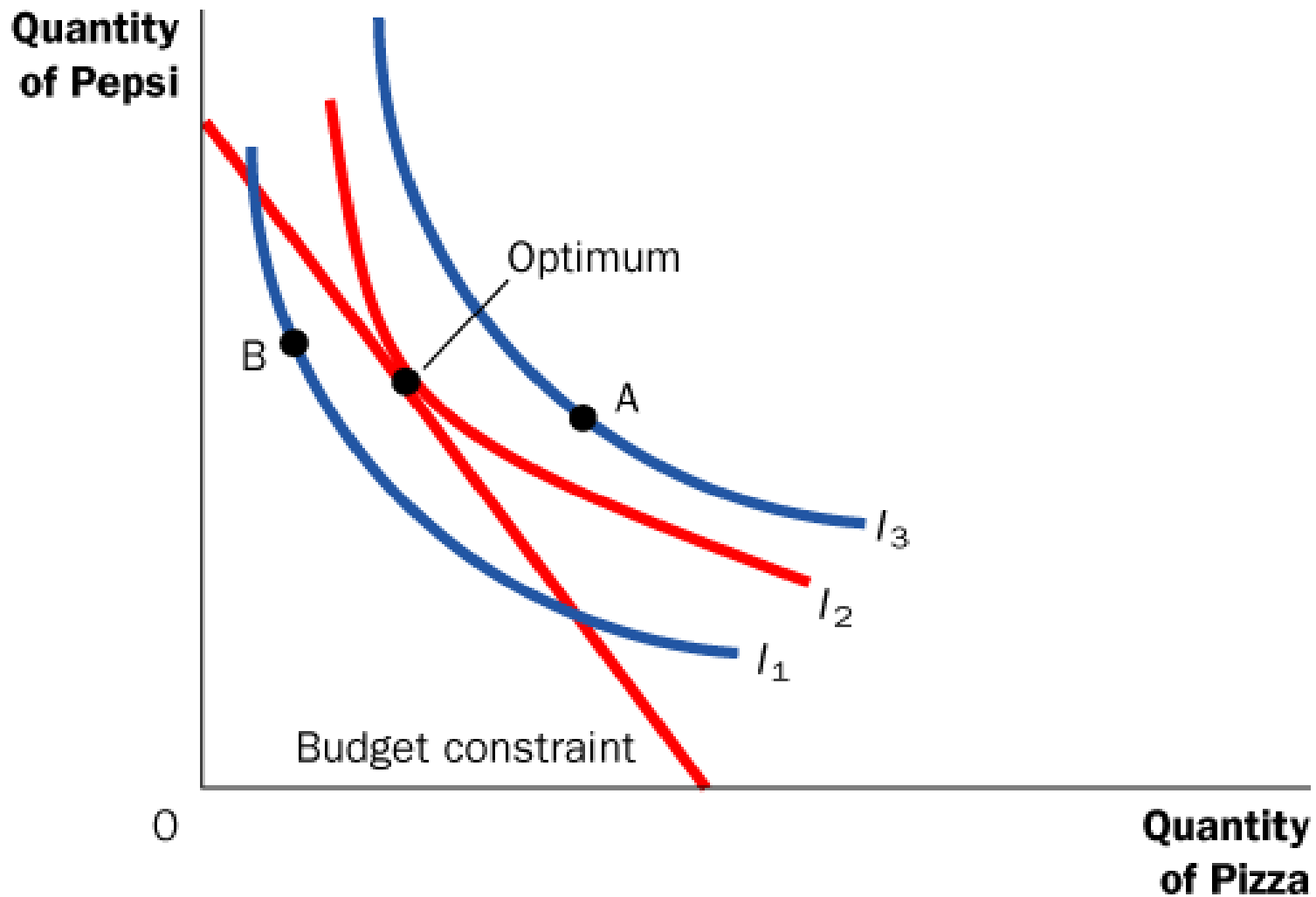


# Change in Budget Constraint: $P_x$ & $P_y$ change by the same proportion.

- Suppose  $P'_x = \$12.5$  and  $P'_y = \$2.5$ .

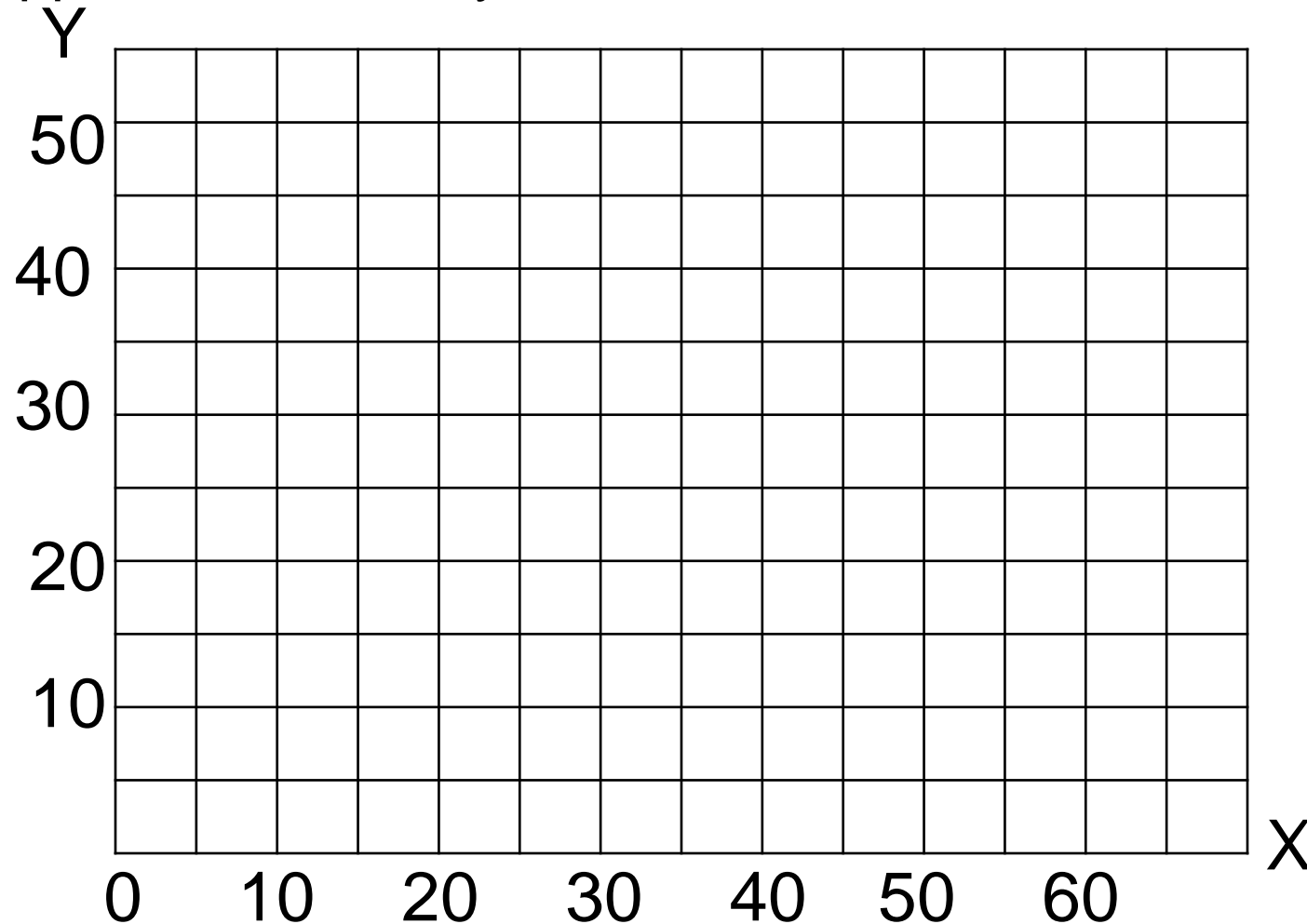


# Graph: Consumer's Optimal Choice



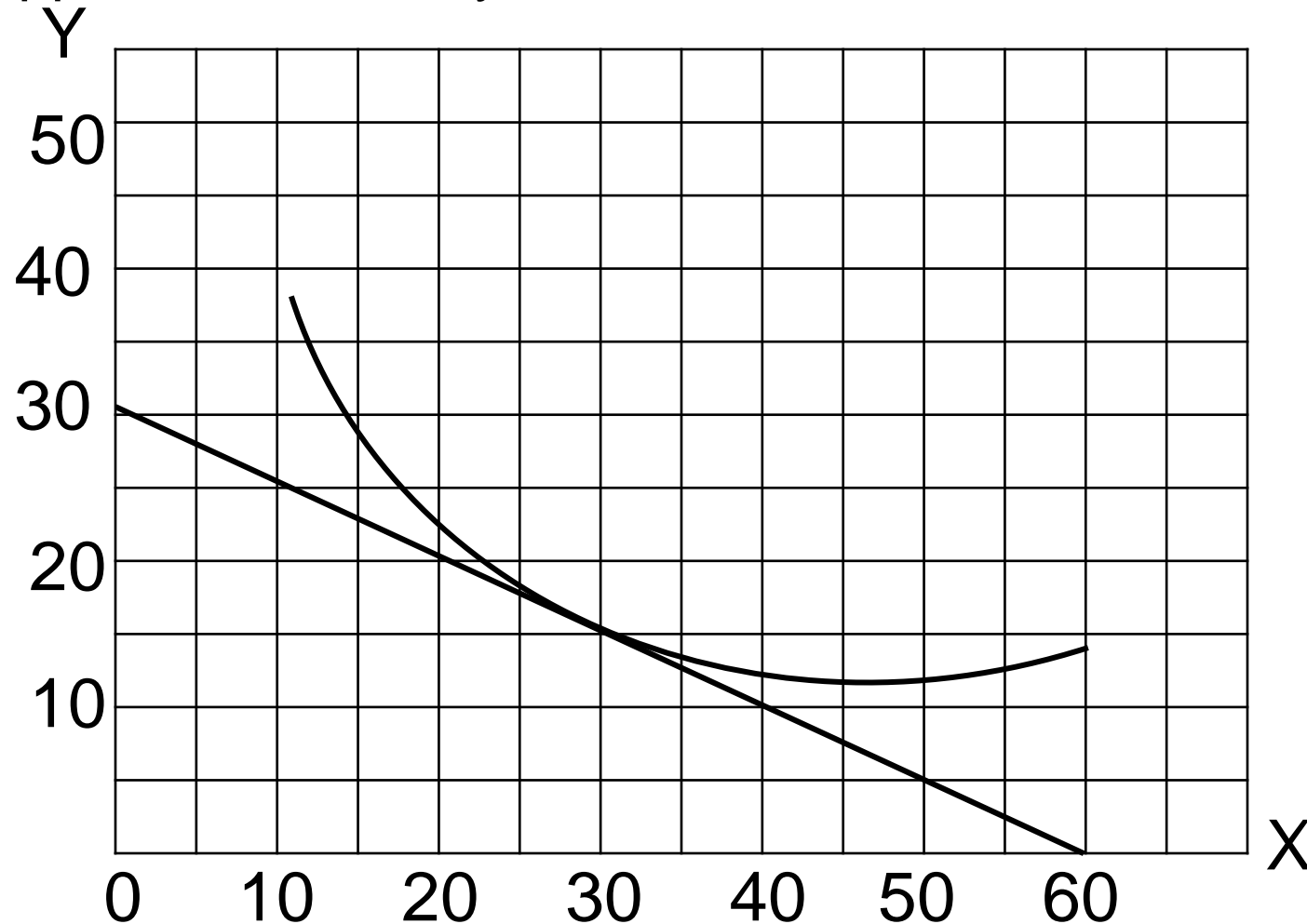
# Example: Optimization

- Suppose  $P_x = \$2$ ,  $P_y = \$4$ , and  $B = 120$ .



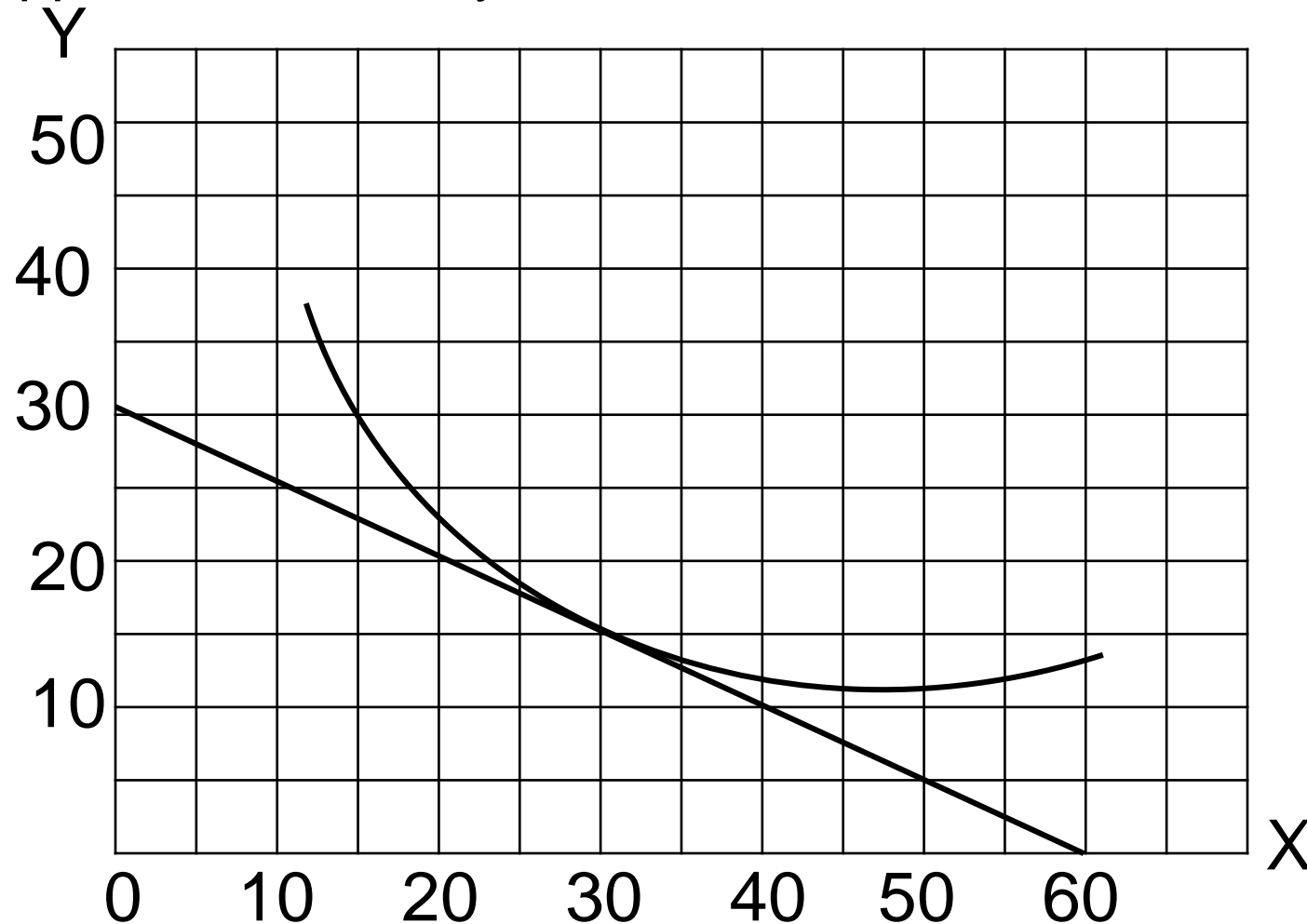
# Example: Effect of Income Increase

- Suppose  $P_x = \$2$ ,  $P_y = \$4$ , and  $B = 150$ .



# Example: Effect of Income Reduction

- Suppose  $P_x = \$2$ ,  $P_y = \$4$ , and  $B = 90$ .

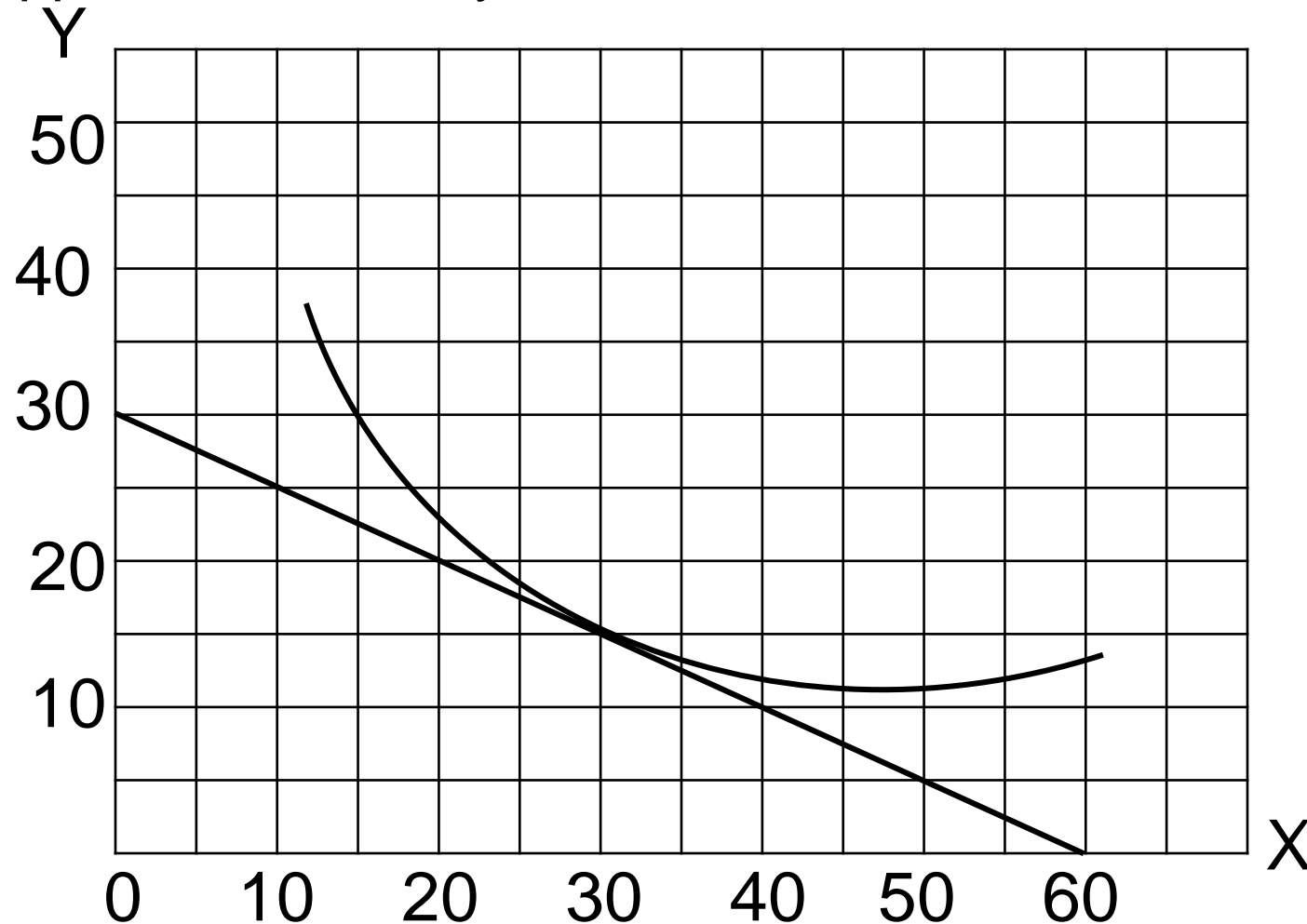


# Income Consumption Curve (ICC)

- A change in income, *ceteris paribus*, will shift the consumer's budget constraint.
- For each level of income, there will be a utility maximizing points where IC is tangent to the relevant budget line.
- **Income Consumption Curve (ICC)** is the line that connects all the utility-maximizing points for different levels of income, given prices  $P_x$  and  $P_y$  constant.
- I.e. , ICC shows how the consumer's purchases react to a change in money income with relative prices being held constant.

# Graph: ICC

- Suppose  $P_x = \$2$ ,  $P_y = \$4$ , and  $B = 90, 120, 150$ .

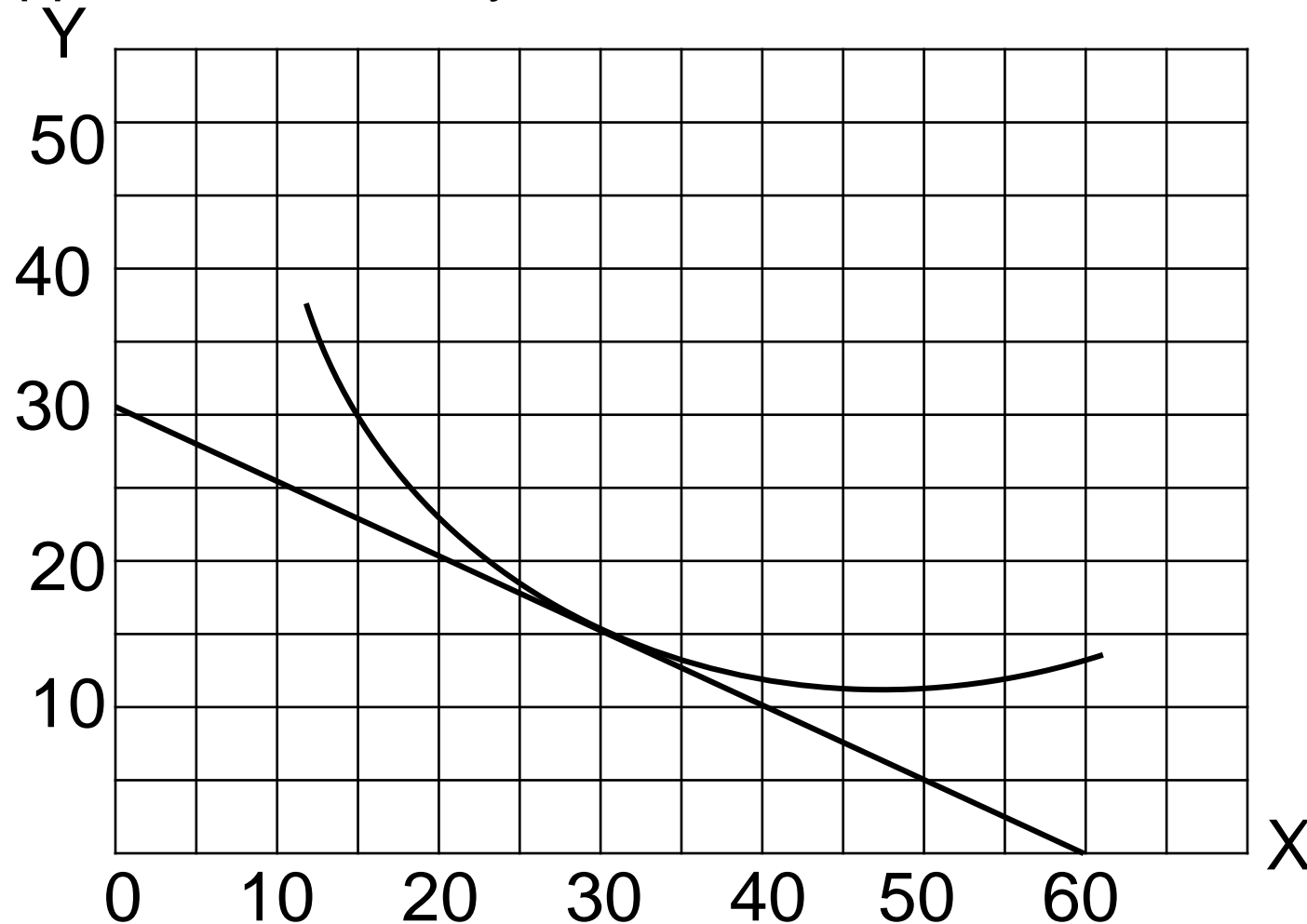


# Exercise: Inferior good

- Suppose  $X$  is a normal good but  $Y$  is an inferior good.
- Use a diagram to show the effects of an increase in income on the consumer's optimal bundle of  $X$  and  $Y$ .

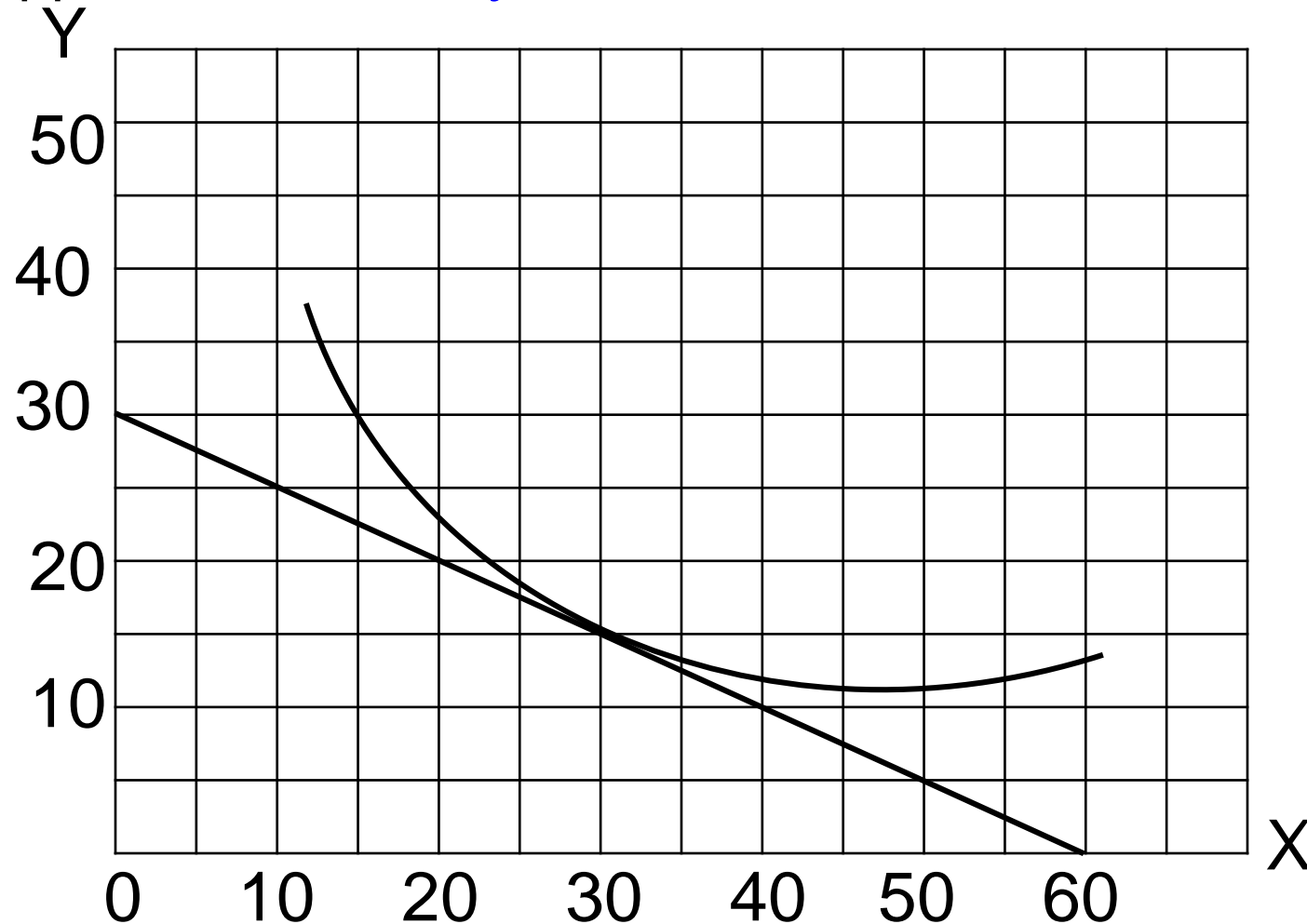
# Example: Effect of Price Change (1)

- Suppose  $P'_x = \$3$ ,  $P_y = \$4$ , and  $B = 120$ .



# Example: Effect of Price Change (2)

- Suppose  $P_x = \$2$ ,  $P'_y = \$6$ , and  $B = 120$ .

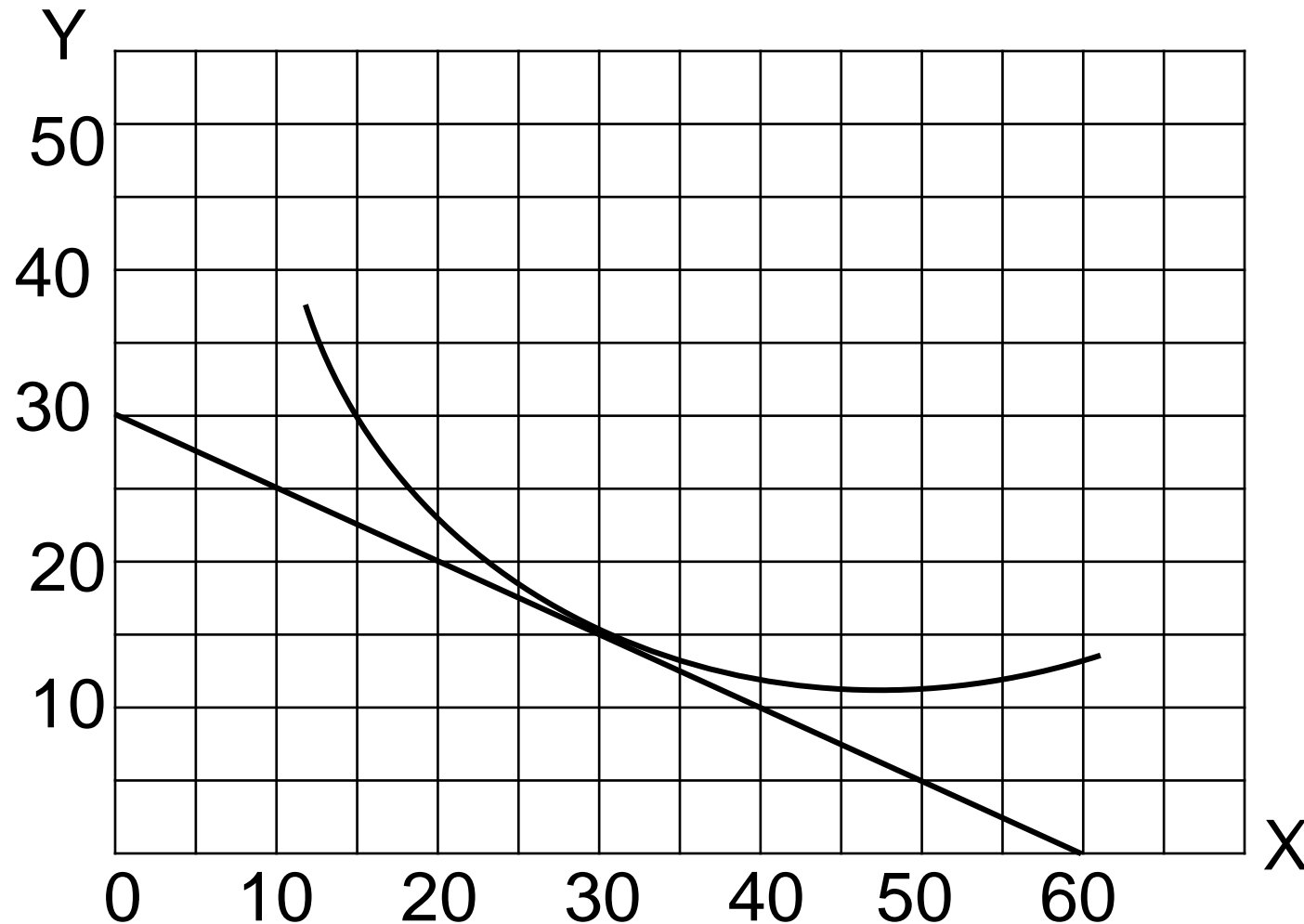


# Price Consumption Curve

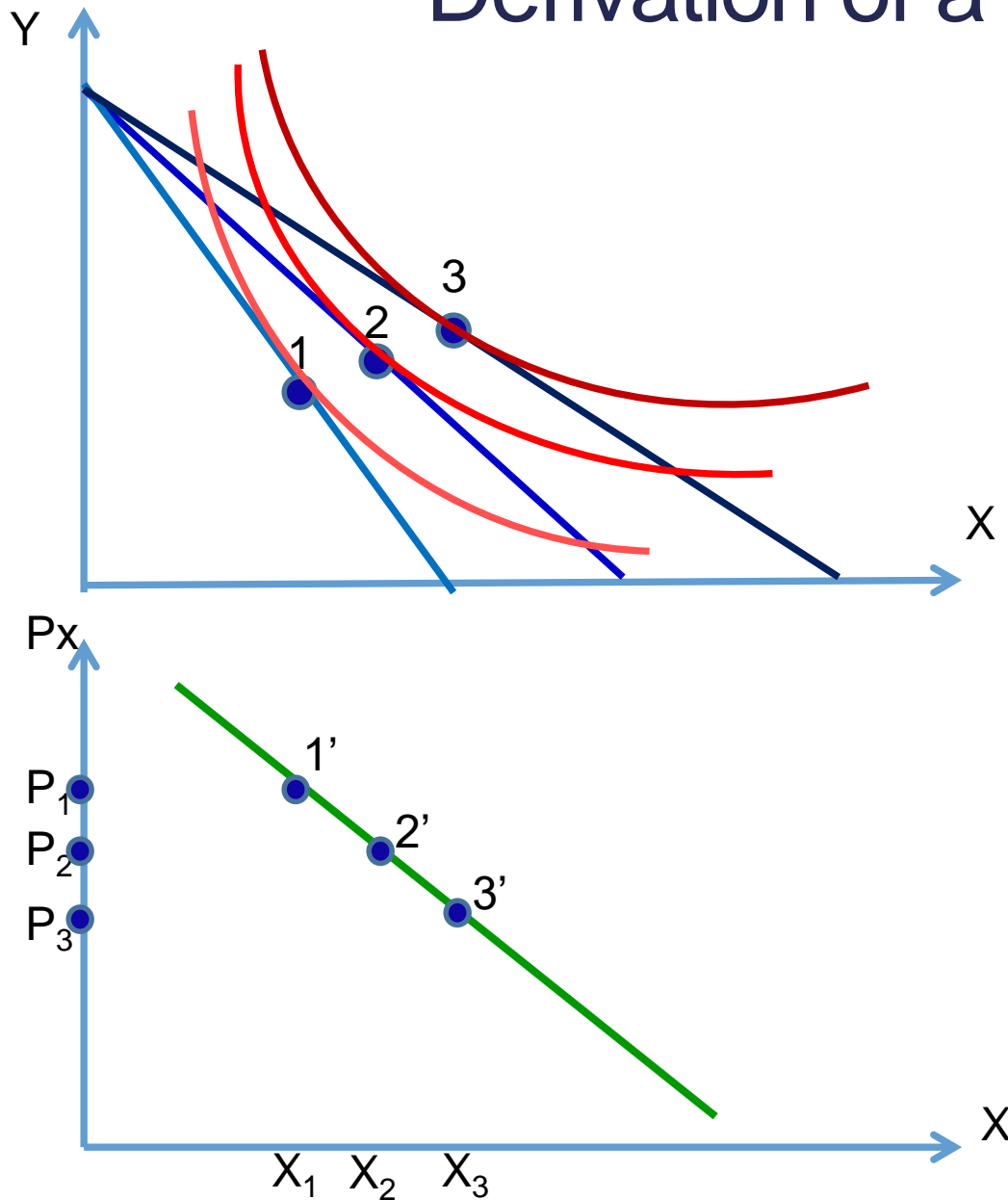
- A change in relative prices of two goods changes the slope of the budget constraint.
- Suppose  $P_x$  changes while  $P_y$  is constant. For each  $P_x$ , there is a different utility-maximizing consumption bundle.
- **Price Consumption Curve (PCC)** is the line that connects all the utility-maximizing points for different  $P_x$ 's, given income and  $P_y$  constant.
- I.e. , PCC shows how the consumer's purchases react to a change in one price with income and other prices being held constant.

# Graph: PCC

- Suppose  $P_x = \$2, \$3, \$4$ ,  $P_y = \$4$ , and  $B = 120$ .



# Derivation of a Demand Curve



# Income and Substitution Effects

- A fall in  $P_x$  has two effects:

## Substitution effect

- Change in  $X$  due to change in relative price with *real income unchanged*
- A fall in  $P_x$  makes  $Y$  more expensive relative to  $X$ , causing consumer to buy more  $X$  and less  $Y$

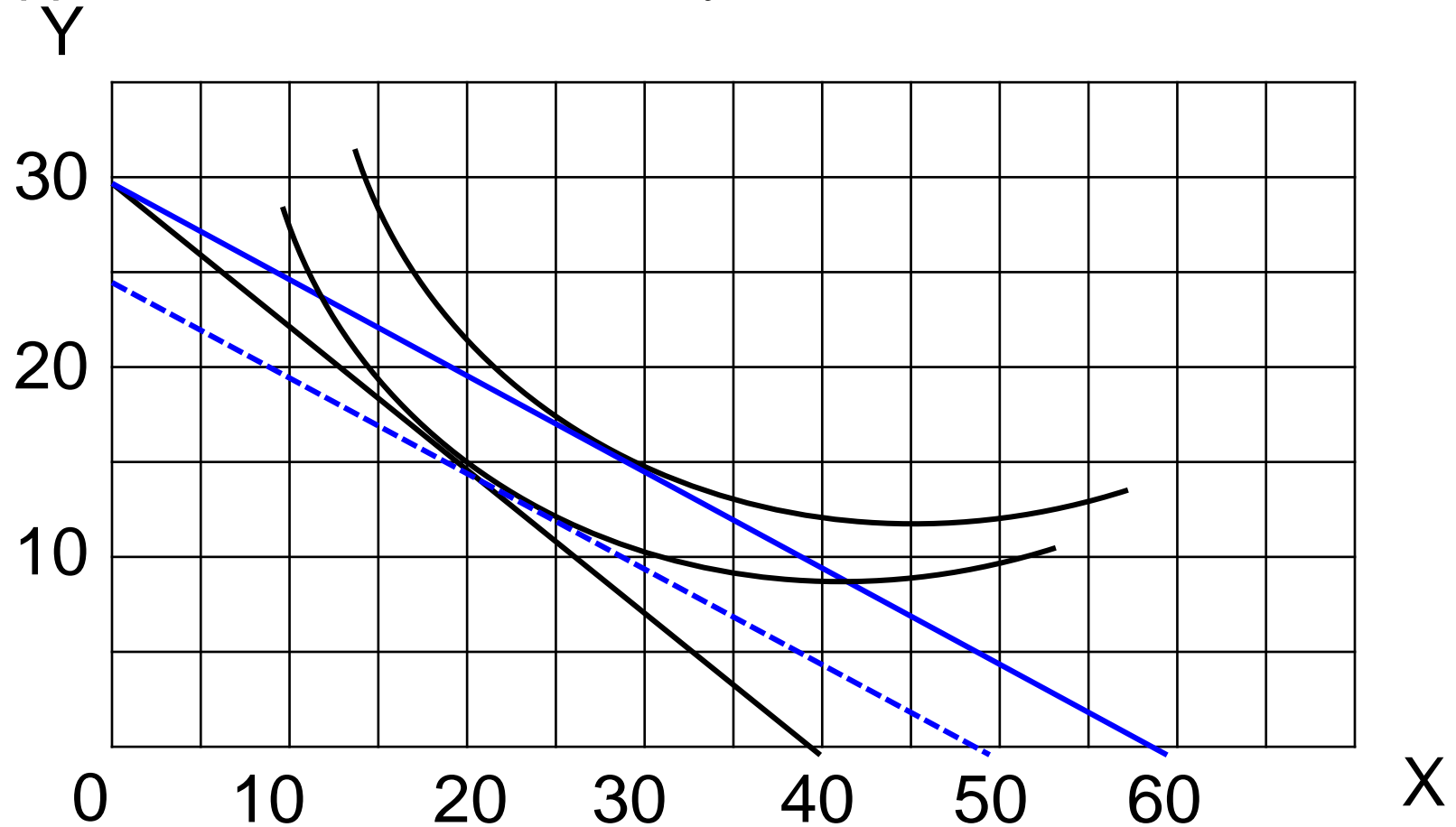
(Note: Real income is kept unchanged by staying on the original IC.)

## Income effect

- Change in  $X$  due to change in real income
- A fall in  $P_x$  increases the consumer's purchasing power, allowing him to reach a higher IC

# Graph

- Suppose  $P_x = \$3$ ,  $P'_x = \$2$ ,  $P_y = \$4$ , and  $B = 120$ .



# Applications:

- Giffen good
- Subsidy
- Vouchers
- Work & leisure
- Intertemporal consumption