

Microeconomics, Module 3, Consumers Behavior

Illustrative Test Questions

(The attached PDF file has better formatting.)

Question 3.1: Indifference Curves

Which of the following is the same for all points on an indifference curve?

- A. The level of satisfaction obtained from consumption.
- B. The prices faced by consumers.
- C. The consumer's income.
- D. Level of satisfaction and prices, but not income.
- E. Level of satisfaction, prices, and income.

Answer 3.1: A

An indifference curve means the consumer is indifferent between any two points on the curve.

Items B and C: Product prices and the consumer's income affect the budget line, not the indifference curve.

Question 3.2: Properties of Indifference Curves

Which of the following is not a property of indifference curves representing a consumer's tastes between bread and wine?

- A. Every combination of bread and wine is on one and only one indifference curve.
- B. No two indifference curves cross.
- C. The indifference curves are downward sloping.
- D. The indifference curves are concave.
- E. The indifference curves reflect the marginal utility of goods.

Answer 3.2: D

The indifference curves for bread and wine are convex, since both goods provide utility to the consumer. Indifference curves are concave only if one of the axes is an economic *bad*, not an economic good.

Question: If we use the terms *concave upward* and *concave downward*, which is convex?

Answer: The term *concave* means *concave downward*; the phrase *concave upward* means *convex*.

Question: What an example of a downward sloping, convex curve?

Answer: For most numerical problems, we use curves like $X * Y = K$, where K is a constant, and X and Y are the quantities of the two goods.

- A downward sloping curve has a negative first derivative: $Y = K/X \Rightarrow \partial Y/\partial X = -K/X^2$.
- A convex curve has a positive second derivative: $\partial^2 Y/\partial X^2 = +2K/X^3$.

Question: Why must the curve be convex?

Answer: Let the two goods be bread and wine, for which an indifference curve is $B \times W = 16$.

The following points all lie on this indifference curve:

<i>Bread</i>	<i>Wine</i>	Δ <i>Wine</i>	<i>Utility</i>
1	16.00		16
2	8.00	8.00	16
3	5.33	2.67	16
4	4.00	1.33	16
5	3.20	0.80	16
6	2.67	0.53	16
7	2.29	0.38	16
8	2.00	0.29	16
16	1.00	1.00	16

- If the consumer has only 1 loaf of bread, he is hungry, and he is willing to give up 8 flasks of wine to get a second loaf of bread.
- If the consumer has 7 loaves of bread, he has as much bread as he can eat, but only 2 flasks of wine. To get another loaf of bread, he willing to give up only 0.29 flasks of wine.

The convex indifference curve is the same concept as decreasing marginal utility.

Question 3.3: Marginal Values

If the marginal value of a loaf of bread is half a flask of wine, then

- A. Half a flask of wine makes the consumer better off than one loaf of bread.
- B. The consumer is indifferent about trading one loaf of bread for half a flask of wine.
- C. Wine provides half as much satisfaction to the consumer as does bread.
- D. The consumer's optimum contains twice as much bread as wine.
- E. The market price of bread is half the market price of wine.

Answer 3.3: B

Question: From the previous question, it seems that the marginal utility of a good depends on how much of the good the consumer now has.

Answer: Correct; the marginal utility depends on two items: (i) the tastes of the consumer and (ii) how much of the good the consumer now has.

Illustration: Suppose Jacob likes bread but doesn't care much for wine, and Rachel likes wine but doesn't care much for bread. One is tempted to say that Jacob's marginal utility of bread in terms of wine is greater than Rachel's. Yet if Jacob now has 10 loaves of bread and only a few drops of wine, and Rachel has 10 flasks of wine but only a few crumbs of bread, Jacob may exchange more bread for a cup of wine than Rachel does.

Question: That's a nice illustration, but I don't presume it is realistic. If someone likes bread more than wine, he or she would generally exchange less bread for a cup of wine.

Answer: If consumers are at their optimal consumption points, their indifference curve is tangent to their budget line. The slope of the budget line depends on the market prices of the two goods, which does not differ by consumer, so the slopes of their indifference curves at their equilibrium points does not differ. The upshot is that all consumers have the same marginal utility of bread in terms of wine if they are all at their

optimal consumption points.

Question 3.4: Constant Marginal Value

If the consumer's marginal value is constant, then

- A. There is no optimum purchase for the consumer.
- B. The consumer's indifference curves are concave instead of convex.
- C. The consumer's indifference curves are straight lines.
- D. The possibility of corner solutions is eliminated.
- E. Utility maximization occurs anywhere along the budget line.

Answer 3.4: C

The marginal value is the slope of the indifference curve; if the marginal value is constant, the indifference curve is a straight line.

Question: We said above that indifference curves are convex; how can they be straight lines?

Answer: In practice, indifference curves are not straight lines; this question is heuristic only.

If the marginal value of a flask of wine is four loaves of bread and the consumer has \$100:

- If the price is \$2 for a loaf of bread and \$10 for a flask of wine, the consumer buys 50 loaves of bread and no wine (corner solution).
- If the price is \$2 for a loaf of bread and \$5 for a flask of wine, the consumer buys 20 flasks of wine and no bread (corner solution).
- If the price is \$2 for a loaf of bread and \$8 for a flask of wine, any combination of bread and wine gives the same utility (statement E).

Question 3.5: Slope of the Budget Line

Good X is on the horizontal axis and good Y is on the vertical axis in the consumer-choice diagram. P_X denotes the price of good X, P_Y denotes the price of good Y, and I is the consumer's income. The slope of the budget line is

- A. $-P_X / P_Y$
- B. P_X / P_Y
- C. P_Y / P_X
- D. I / P_X
- E. I / P_Y

Answer 3.5: A

Question: How do we choose which good is on the vertical axis and which is on the horizontal axis?

Answer: In practice, the good in question is on the horizontal axis and the vertical axis is a basket of *all other goods*. The final exam questions use two goods, such as bread and wine, and they explicitly say which one is on the vertical axis.

Question 3.6: Steepness of Budget Line

Good X is on the horizontal axis and good Y is on the vertical axis in the consumer-choice diagram. Which

of the following can make the budget line steeper?

- A. A rise in the consumer's income.
- B. A rise in the consumer's marginal value of X in terms of Y.
- C. A rise in the consumer's marginal value of Y in terms of X.
- D. A rise in the price of good X.
- E. A rise in the price of good Y.

Answer 3.6: D

Question: Does a rise in the price of X mean that inflation causes the price of X to be \$11 instead of \$10?

Answer: Inflation is a monetary phenomenon; it affects the purchasing power of the dollar (or other currency unit, such as Yen or Euro), not the prices of goods. Prices are in real terms, or the price of X in terms of units of Y. Suppose X costs \$10 in 20X7 and \$11 in 20X8.

- If the dollar price of Y rises from \$5 to \$6.00, the price of X has *decreased*.
- If the dollar price of Y rises from \$5 to \$5.25, the price of X has *increased*.

For this question, a decline in the (relative) price of Y means the same as a rise in the (relative) price of X.

Question 3.7: Optimizing Welfare

Suppose the consumer spends all of his or her income. If P_X / P_Y is larger than the marginal value of X in terms of Y, the consumer

- A. Will be better off if he purchases more X and less Y.
- B. Will be better off if he purchases more Y and less X.
- C. Will be better off if he purchases more of both goods.
- D. Cannot make himself better with any change in his purchases.
- E. Has an incentive to work more and buy more of goods X and Y.

Answer 3.7: B

P_X / P_Y is the negative of the slope of the budget line; the marginal value of X in terms of Y is the negative of the slope of the indifference curve. At the equilibrium point, the slope of the budget line equals the slope of the indifference curve, since the two curves are tangent. Since the slopes are not equal here, the consumer is not at the optimal point (the equilibrium point).

To see if the consumer should buy more of X or more of Y, let's use a numerical example.

Suppose the price of a loaf of bread is \$2 and the price of a flask of wine is \$1, and the consumer would exchange one loaf of bread for one flask of wine. The consumer can buy one less loaf of bread and one more flask of wine and have the same overall utility. But the consumer has gained a dollar, since the one less loaf of bread saves \$2 and the one more flask of wine costs \$1. With the extra dollar, the consumer can buy another flask of wine and have more total utility.

Question: Does this only work for consumers who are indifferent between bread and wine, or for consumers who prefer wine to bread? What about consumers who much prefer bread to wine?

Answer: The consumer's preference depend on how much bread and wine he now has. Even a consumer who much prefers bread to wine may be indifferent between them if he already has 10 loaves of bread and only 1 flask of wine. We should not speak about absolute preferences, for two reasons:

- The preference for wine in terms of bread depends on how much wine and bread the consumer now has.

- Units of wine and bread are not comparable. A consumer may prefer a large loaf of bread to a small flask of wine but a large flask of wine to a small loaf of bread.

For most economic relations, we use elasticities, which are unit-less; we discuss these later.

Question 3.8: Marginal Value

If Jacob's marginal value of bread is 50¢ per loaf, then

- Jacob places a value of 50¢ on his last loaf of bread.
- Jacob will not buy any bread unless the price is lower than 50¢ per loaf.
- Jacob is willing to pay an average of 50¢ per loaf of bread.
- Jacob is willing to trade away all his bread in exchange for 50¢ per loaf.
- Jacob's utility increases by 50¢ when he buys a loaf of bread.

Answer 3.8: A

The marginal value is the value of the last unit, the last loaf of bread. By decreasing marginal utility, if the last loaf of bread is worth 50¢, each previous loaf is worth more than 50¢.

Question 3.9: Corner Solutions

Suppose bread is on the horizontal axis and wine is on the vertical axis. Consider a corner solution in which the consumer buys only wine and no bread. At this optimum, the relative price of bread in terms of wine

- Is strictly less than the marginal value of bread in terms of wine.
- Is less than or equal to the marginal value of bread in terms of wine.
- Is equal to the marginal value of bread in terms of wine.
- Is greater than or equal to the marginal value of bread in terms of wine.
- Is strictly greater than the marginal value of bread in terms of wine.

Answer 3.9: D

The budget line can be steeper than the indifference curve at a corner solution. If the price of bread in terms of wine were less than the marginal value of bread in terms of wine, the consumer would exchange some of the wine for bread.

Question: Are corner solutions common?

Answer: Suppose Leah doesn't drink alcohol; she spends all her income on bread.

Question 3.10: Indifference curves and Consumer's Optimum

A consumer's indifference curves are downward sloping, but they are concave (bowed away from the origin) instead of convex, because the two goods are economic *bads* (they are harmful, like pollution or taxes). What can be said about the consumer's optimum?

- The consumer's optimum is always a corner solution in this situation.
- The consumer's optimum does not exist, because there is no tangency in this situation.
- The consumer's optimum is at the tangency between the indifference curve and the budget line, and the indifference curve lies below the budget line.
- The consumer's optimum is at the tangency between the indifference curve and the budget line, and the indifference curve lies above the budget line.
- The consumer has two optima: one at the tangency and one at a corner solution.

Answer 3.10: C

Question: We said that indifference curves are convex, not concave; what's happening here?

Answer: The indifference curve is downward sloping and convex if the two goods are desired by the consumer; it is downward sloping and concave if neither good is desired.

Suppose the two items on the indifference curve are air pollution and water pollution, which are measured by number of particles per cubic meter of air or water. Small amounts of pollution are hardly noticeable; moderate amounts are tolerable; large amounts ruin the quality of life.

A consumer may be indifferent among may be indifferent among the following baskets:

<i>Air Pollution</i>	<i>Water Pollution</i>
0	130
50	120
80	110
100	100
110	80
120	50
130	0

This curve is concave, not convex.

The budget line is the price of curtailing pollution. The units of air pollution and water pollution are the units of pollution-reducing devices that we buy. For this illustrative test question, assume that each unit has the same effect. These units might be exhaust filters placed on cars or water filters placed in streams.

For economic goods, we want to be on the highest indifference curve. For economic bads, we want to be on the lowest indifference curve.

The optimal point is the point of tangency between the indifference curve and the budget line, but this budget line lies above the indifference curve.

Question: Graphically, what are we doing?

Answer: When we shift from an economic good (like bread and wine) to an economic bad (like air and water pollution), we flip the indifference curve.

- If the economic good or bad is along the vertical axis, we flip the indifference curve up-side down.
- If the economic good or bad is along the horizontal axis, we flip the indifference curve right to left.

Flip a downward sloping, convex curve twice – upside-down and right to left – makes it downward sloping and concave.

Question: What if we have one economic good and one economic bad? An example is amount of insurance along the horizontal axis (an economic good) and premium along the vertical axis (an economic bad).

Answer: We flip the indifference curve up-side down. Downward sloping and convex becomes upward sloping and concave.

Question: Why is this important for actuaries?

Answer: You will use indifference curve analysis for later actuarial exams and perhaps at work. The horizontal axis is the amount of coverage, which is an economic good. The vertical axis is the premium for the policy, which is an economic bad. The intuition for indifference curve analysis is explained by Landsburg, but the slope and concavity of the lines change.

Question 3.11: Changes in Relative Prices

Recently, the price of bread has risen from \$4 to \$6 per loaf and the price of wine has fallen from \$8 to \$6 per flask, while Rachel's income has stayed fixed at \$48 per week. After the prices change, Rachel changes her buying habits and starts buying 4 loaves of bread and 4 flasks of wine weekly. We can conclude that

- A. Rachel is indifferent about the price changes.
- B. Rachel is worse off after the price changes.
- C. Rachel is better off after the price changes.
- D. Rachel may be worse off, better off, or indifferent after the price changes.
- E. Rachel may be better off or indifferent after the price changes, but not worse off.

Answer 3.11: B

Before the price change, Rachel could have bought 4 loaves of bread and 4 flasks of wine weekly, but she chose to buy some other combination. Her utility after the price change is lower than her utility before the price change.

Question: The mathematics is not hard, but I don't see the intuition; what is happening here?

Answer: In an economy with two goods, a change in prices that is not the same for both goods causes a relative price increase for one good and a relative price decrease for the other good.

Let B be the basket of goods bought before the price change and B' be the basket of goods bought after the price change. One of three scenarios is true: the consumer can afford

1. both B and B' before the price change but only B' after the price change.
 2. both B and B' after the price change but only B before the price change.
 3. only B before the price change and only B' after the price change.
- In scenario 1, the consumer is better off before the price change.
 - In scenario 2, the consumer is better off after the price change.
 - In scenario 3, we can't say if the consumer is better off or worse off.

Question 3.12: Inflation Indices

If an economist uses consumers' 1980 purchases to track increases in the cost of living between 1980 and 2000, then increases in the cost of living will be

- A. Accurately measured.
- B. Overstated.
- C. Understated.
- D. Overstated if inflation is positive; otherwise understated.
- E. Overstated if inflation is negative; otherwise understated.

Answer 3.12: B

The Laspeyres index overstates inflation, assuming consumers buy more a good when its relative price falls and less of a good when its relative price rises. Whether inflation is positive or negative depends on growth in the money supply and other macroeconomic factors, not the relative prices of goods. The final exam does not ask you to compute Laspeyres and Paasche indices, but you must know the qualitative aspects.

Question: The solution says that “the Laspeyres index overstates inflation, assuming consumers buy more a good when its relative price falls and less of a good when its relative price rises.” The Landsburg text does not have this qualification; why not?

Answer: The law of demand says that consumers buy more a good when its relative price falls and less of a good when its relative price rises. This statement should always be true.

Question 3.13: Income Tax and Head Tax

Consider a head tax and an income tax that generate the same tax bill for the consumer. Which tax causes the greater reduction in the consumer’s welfare?

- A. The head tax.
- B. The income tax.
- C. The two taxes have the same effect on the consumer’s well being.
- D. Either tax could cause the greater reduction in welfare, depending on the consumer’s tastes for leisure and income.
- E. Either tax could cause the greater reduction in welfare, depending on the consumer’s elasticities for leisure and income.

Answer 3.13: B

The income tax distorts the marginal value of leisure vs consumption; the head tax does not.

Question: Is this saying that consumers prefer a head tax to an income tax? That is not true. A head tax (or poll tax) is the same for all citizens, whereas an income tax depends on earnings. If the total tax collected is the same, high income earners prefer the head tax and low income earners prefer the income tax. This is even more true if the income tax is progressive.

Answer: Landsburg makes the following comparison:

- Determine the tax each person would pay under an income tax. Suppose the income tax is 60% of earnings. An physician providing cosmetic surgery and making \$400,000 a year would pay \$240,000 in tax; a cab driver making \$20,000 a year would pay \$12,000 in tax. Let us suppose that we can estimate the tax each person would pay.
- Instead of the income tax, we say to the physician: “You will pay \$240,000 in tax this year, no matter how much you earn,” and we say to the cab driver: “You will pay \$120,000 in tax this year, no matter how much you earn.”
- Suppose cosmetic surgery costs \$10,000 and a cab ride costs \$10. With the income tax, the physician kept \$4,000 from every surgery. If an hour of leisure time was worth \$1,000, the physician performed surgeries that took 4 hours or less. With the head tax, the physician keeps \$10,000 from every surgery, and performs surgeries that take 10 hours or less.
- Suppose a cab ride costs \$10. With the income tax, the cab driver kept \$4 from every cab ride. If an hour of leisure time was worth \$10, the cab driver gave rides that took 20 minutes or less. With the head tax, the cab driver keeps \$10 from every cab ride, and gives ride that take an hour or less.

Both the physician and the cab driver are working more, earning more money, and are happier.

Question: How do you know they are happier? They have less leisure time now.

Answer: People work when the earnings are worth more than the leisure time given up. The physician and the cab driver could work the same hours as before and earn the same income. Since they choose to work more, they must be happier working more.

Question: The income tax in this illustration is not progressive; the tax rate is 60% for both the physician and the cab driver. What happens if we use a progressive income tax?

Answer: Nothing in the illustration depends on the tax rate so nothing changes.

Question: Do we see this phenomenon in real life?

Answer: One sees this many ways. But governments depend on taxes, and many people want government programs and hate to see others benefit from tax reductions, so it is politically difficult to reduce tax rates.

The economies of high tax rate countries in Western Europe do poorly, and the economies of low tax rate countries (Hong Kong, Singapore) perform better. High tax rate countries must lower tax rates or eventually lose their competitiveness.

Question 3.14: Indifference Curves

All but which of the following are true regarding indifference curves?

- A. An indifference curve is a locus of points that are equally desirable to the consumer.
- B. Indifference curves for a single consumer cannot cross.
- C. Indifference curves for a single consumer are always parallel.
- D. A single consumer has an infinite number of indifference curves.
- E. Indifference curves for two goods are downward sloping.

Answer 3.14: C

Know the four attributes of indifference curves in A, B, D, and E, and know that indifference curves are not necessarily parallel.

Question 3.15: Budget Lines

All but which of the following are true regarding budget lines?

- A. Points to the left and below the budget line are within the consumer's budget.
- B. The slope of the budget line is the negative of the relative prices of the two goods.
- C. Budget lines for two economic goods slope downward.
- D. Each consumer has an infinite number of budget lines that cover the plane.
- E. All of A, B, C, and D are true.

Answer 3.15: D

Each consumer has a single *budget line* and an infinite number of *indifference curves* that cover the plane.

Question 3.16: Budget lines and Inflation

Suppose all prices and the consumer's income drop 10% because of deflation in the economy. How does the consumer's budget line change?

- A. The budget line shifts upward.
- B. The budget line shifts downward.
- C. The budget line shifts to the right.
- D. The budget line shifts to the left.
- E. The budget line does not change.

Answer 3.16: E

The relative prices of the goods and the real income have not changed.

Question: What are the rules for changes in the budget line and indifference curves?

Answer: If the relative prices of the goods do *not* change, the slope of the budget line does not change. The budget line moves outward (upward, rightward) if the income in real terms increases; it moves inward (downward, leftward) if the income in real terms decreases.

Illustration: A loaf of bread costs \$1.50, a flask of wine costs \$6.00, and income is \$24.

- If a loaf of bread changes to \$2.00 and a flask of wine changes to \$8.00, the slope of the budget line does

not change.

- If income increases to \$30, real income decreases; the budget line moves inward.
- If income increases to \$40, real income increases; the budget line moves outward.

If the relative prices of the goods change, the slope of the budget line changes. If income increases or decreases for each of the goods in real terms, utility increases or decreases.

Illustration: A loaf of bread costs \$1.50, a flask of wine costs \$6.00, and income is \$24.

- If a loaf of bread changes to \$2.00 and a flask of wine changes to \$9.00, wine becomes more expensive in terms of bread and the slope of the budget line changes.
 - If income increases to less than \$32, real income decreases, and the budget line moves inward.
 - If income increases to more than \$36, real income increases, and the budget line moves outward.

If income increases to between \$32 and \$36, we cannot say if real income has increased or decreased, since the new budget line intersects the old budget line.

Question: So we can't say if the consumer is better or worse off?

Answer: The consumer is either better off or worse off, but we need more information to say which occurs. On the final exam, you may be given the basket of goods the consumer buys before and after the price change. Suppose the consumer buys Basket A before the price change and Basket B after the price change.

- If the consumer could have bought Basket B before the price change as well, but instead bought Basket A, the consumer is worse off after the price change.
- If the consumer could have bought Basket A after the price change as well, but instead bought Basket B, the consumer is better off after the price change.

Question: Is one of these two scenarios always possible?

Answer: No; often the consumer could buy Basket A but not Basket B before the price change and Basket B but not Basket A after the price change. To see if the consumer is better off, we must know the exact indifference curve.

Exercise 3.17: Bread and Wine Budget Line

The budget line shows the combinations of bread and wine a consumer can buy. A loaf of bread costs \$2.00, a flask of wine costs \$8.00, and the consumer's income is \$120.



- A. The slope of the budget line is +0.250.
- B. The slope of the budget line is -0.250 .
- C. The slope of the budget line is +4.000.
- D. The slope of the budget line is -4.000 .
- E. None of A, B, C, or D is true.

Answer 3.17: B (The slope is $-P_x / P_y$.)

Exercise 3.18: Bread and Wine Budget Line

The budget line shows the combinations of bread and wine a consumer can buy. A loaf of bread costs \$2.00, a flask of wine costs \$8.00, and the consumer's income is \$120.

Suppose the consumer's income changes to \$160 and the price of a loaf of bread changes to \$1.60. Which of the following is true?

- A. After the change, the consumer buys more bread.
- B. After the change, the consumer buys less bread.
- C. After the change, the consumer buys more wine.
- D. After the change, the consumer buys less wine.
- E. None of A, B, C, or D is true.

Answer 3.18: A

Income increases and the price of bread decreases, so the consumer buys more bread. The consumer may buy more or less wine; we cannot know from the information provided.

Question: Let me see if I understand. Income increases in dollar terms and the price of wine does not change in dollar terms. If wine is a normal good, the consumer buys more wine; if wine is an inferior good, the consumer buys less wine.

Answer: That's not complete; we must also consider the price elasticity of demand for bread and the cross elasticity of demand for the two goods. If the price elasticity of demand for bread is high, the consumer buys more bread when its price declines.

- If bread and wine are substitutes, the more bread the consumer eats, the less he wants wine. The consumer may buy less wine even if wine is a normal good.
- If bread and wine are complements, the more bread the consumer eats, the more he wants to drink wine. The consumer may buy more wine even if wine is an inferior good.

The final exam tests scenarios that can be answered from the definitions of elasticities, types of goods, budget lines, and indifference curves.

Question 3.19: Indifference Curves and Budget Lines

All but which of the following are true regarding indifference curves and budget lines? Assume that the consumer's optimum is *not* a corner solution.

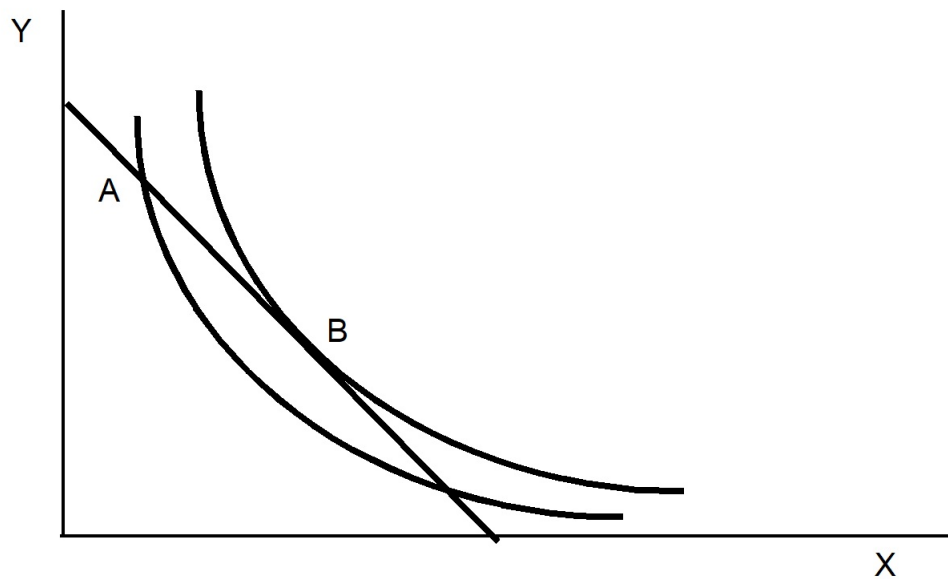
- A. The equation of the budget line is $X \times P_x + Y \times P_y = \text{Income}$.
- B. The budget line reflects consumers' preferences; indifference curves reflect what they can afford to buy.
- C. The slope of the budget line is $-P_x / P_y$.
- D. At the consumer's optimum, the slope of the indifference curve is $-P_x / P_y$.
- E. All of A, B, C, and D are true.

Answer 3.19: B (The statement is reversed.)

Exercise 3.20: Marginal Value

(T/F) If the marginal value of X in terms of Y is greater than $P_x \div P_y$, the consumer would be better off buying less X and more Y.

Solution 3.20: False. The consumer would be better off buying *more* X and *less* Y.



This situation is like point A, where the indifference curve is *steeper* than the budget line. The consumer would be better off at point B, with more X and less Y.

At point A, the consumer would trade more Y for 1 unit of X than the market requires.

Illustration: Suppose the price of X is \$3 and the price of Y is \$1.50, so the slope of the budget line is -2 . At point A, the consumer may be willing to give up 3 units of Y to get 1 extra unit of X, so the marginal value of X in terms of Y is 3. The consumer is better off buying more X and less Y, until the marginal rate of substitution equals the exchange rate.

Question 3.21: Utility Functions

If a consumer's utility function is $U(x, y)$, all but which of the following are true?

- A. An indifference curve is represented by $U(x, y) = C$, where C is a constant.
- B. The marginal utility of X is represented by $\partial U / \partial X$.
- C. The marginal value of X in terms of Y is MU_x / MU_y .
- D. The consumer optimum is where $MU_x / P_x = MU_y / P_y$.
- E. All of A, B, C, and D are true.

Answer 3.21: E

Statement A is true. An indifference curve shows a set of baskets of goods among which the consumer is indifferent, so each basket gives the consumer the same utility. Setting the utility equal to a constant provides the equation for an indifference curve.

Statement B is true. Marginal utility is the additional utility derived from another unit of X, when Y is held constant. This is a partial derivative.

Statement C is true.

Statement D is true. To maximize utility, the consumer must get as much utility from the last dollar spent on X as from the last dollar spent on Y. Were this not the case, utility could be increased by switching the last dollar from the the good that provides less utility to the good that provides more utility. At the consumer's

optimum, the ratio of the marginal utility of the good to its price must be the same for both goods.

Statement D says that the slope of the budget line equals the slope of the indifference curve. Rearrange the ratios to put the two prices on one side of the equal sign and the two utilities on the other side of the equal sign.