

1. Give a brief description of the law of diminishing marginal utility and use it to explain the downward slope of the demand curve.

Ans: Utility is a subjective notion in economics, referring to the amount of satisfaction a person gets from consumption of a certain product. Marginal utility refers to the extra utility a consumer gets from one additional unit of a specific product. In a short period of time, the marginal utility derived from successive units of a given product will decline. This situation is known as diminishing marginal utility. The law of diminishing marginal utility can be used to explain the downward sloping demand curve. The more units of a product that a consumer has, the less he will want additional units because additional units provide less and less additional satisfaction. The only way to get a consumer to purchase more units of a product is to drop the price. What applies to the individual consumer also applies to consumers as a group. Hence, there is an inverse relationship between price and quantity demanded.

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Learning Objective: 5.1

2. Describe the law of diminishing marginal utility. On what assumptions is this law based?

Ans: As the consumer obtains more units of a given good or service, the consumer receives increasing amounts of total utility or satisfaction. However, the more units of the item that the consumer obtains, the less additional satisfaction or utility each successive unit of the good or service will provide. Total utility increases but by diminishing amounts. This is the *law of diminishing marginal utility*.

The law assumes that more is preferred to less (i.e., more units of a consumer good or service will bring more total utility), but also that consumer satisfaction from the first unit obtained is greater than that for successive units. In other words, the intensity of the want or need declines as it is gradually more and more satisfied.

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Learning Objective: 5.1

3. What is the difference between marginal and total utility?

Ans: Marginal utility is the additional satisfaction received from consuming one more unit of a product. Total utility is the overall or total satisfaction received from consuming some particular amount of the product. Total utility can be determined by summing the marginal utility for each unit of a product that is consumed.

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Learning Objective: 5.1

4. Can marginal utility be negative? Briefly explain with an example.

Ans: Yes. The consumption of an additional unit of a product may be unpleasant. Consider a person who likes pizza. The first four slices of a large pizza taste great. Each slice gives the consumer additional satisfaction, although the amount of satisfaction diminishes with the consumption of each slice. Finally, the consumer eats the fifth slice of pizza and develops a stomach-ache from overeating. That fifth slice had negative marginal utility for this pizza consumer.

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Learning Objective: 5.1

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5. What is the total utility of four units of the good shown in the following table?

<u>Quantity</u>	<u>Total Utility</u>
1	18
2	30
3	40
4	?
5	52

Ans: According to the law of diminishing marginal utility, the marginal utility of the 4<sup>th</sup> unit must be less than the marginal utility of the 3<sup>rd</sup> unit. Since the marginal utility of the 3<sup>rd</sup> unit is 10, the marginal utility of the 4<sup>th</sup> unit must be less than 10 or the total utility of 4 units must be less than 50. However, at the same time, the marginal utility of the 5<sup>th</sup> unit must also be lower than the marginal utility of the 4<sup>th</sup> unit. Therefore, the total utility of 4 units must be greater than 46. Keeping to integer values, the total utility of 4 units can be 47, 48, or 49 (any  $x$  such that  $46 < x < 50$ ).

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Learning Objective: 5.1

6. What is the total utility of four units of the good shown in the following table?

<u>Quantity</u>	<u>Total Utility</u>
1	60
2	100
3	130
4	?
5	170

Ans: According to the law of diminishing marginal utility, the marginal utility of the 4<sup>th</sup> unit must be less than the marginal utility of the 3<sup>rd</sup> unit. Since the marginal utility of the 3<sup>rd</sup> unit is 30, the marginal utility of the 4<sup>th</sup> unit must be less than 30 or the total utility of 4 units must be less than 160. However, at the same time, the marginal utility of the 5<sup>th</sup> unit must also be lower than the marginal utility of the 4<sup>th</sup> unit. Therefore, the total utility of 4 units must be greater than 150. The total utility of 4 units must be less than 160 but more than 150.

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Learning Objective: 5.1

7. What are the four dimensions of the typical consumer's situation?

Ans: First, the consumer is a rational person who tries to maximize total utility. Second, the consumer has preferences for certain types of products and also has an idea of how much marginal utility will be obtained from consuming an additional unit. Third, the consumer has a budget constraint that limits the amount of products purchased, although this constraint is tighter for lower income consumers than higher income ones. Fourth, each product that the consumer wishes to purchase has a positive price that reflects the relative scarcity or value of the product. These conditions serve as the basis for understanding how the consumer allocates money income to purchases of different products to maximize utility.

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Learning Objective: 5.2

8. Explain the utility maximizing rule for two products in words and using algebra.

Ans: The utility maximizing rule explains how a consumer decides to allocate his or her money income so that the last dollar spent on each product purchased yields the same amount of marginal or extra utility. The consumer is in equilibrium when marginal utility per dollar spent on each product is equal. When a consumer is in equilibrium, there is no incentive to change spending on products, unless preferences, income, or prices change. The marginal utility per dollar spent is equalized, which means that a consumer compares the extra utility from each product with its cost. In a two-product case, as long as one product provides more utility per dollar than another, the consumer will buy more of the first product. As more of the first product is purchased, its marginal utility diminishes until the amount of utility per dollar just equals that of the other product. The algebraic statement of this utility-maximizing state is that the consumer will allocate income in such a way for these two products (A and B) such that:  $MU \text{ of A} / \text{price of A} = MU \text{ of B} / \text{price of B}$ .

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Learning Objective: 5.2

9. Evaluate. Given a choice between two products, the consumer would choose to buy the product with the lower price.

Ans: This is not necessarily true. Given a choice between two or more products, a consumer would choose to buy the product that provides the highest marginal utility per dollar spent. The consumer would buy a higher priced product if the marginal utility per dollar spent on that product was greater than that of any other product.

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Learning Objective: 5.2

10. Evaluate. Given a choice between two products, the consumer would choose to buy the product with the higher marginal utility.

Ans: This is not necessarily true. Given a choice between two or more products, a consumer would choose to buy the product that provides the highest marginal utility per dollar spent. The consumer would buy a product that provided a lower marginal utility if the marginal utility per dollar spent on that product was greater than that of any other product.

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Learning Objective: 5.2

11. A consumer is purchasing a combination of products such that  $MU/\text{price}$  is the same for all products. However, the consumer is not maximizing utility. How is this possible?

Ans: Although the consumer has equalized the marginal utility per dollar spent, the consumer is not maximizing utility if all of the income is not spent. The consumer can increase purchases using the unspent income and increase total utility.

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Learning Objective: 5.2

12. Assume that a consumer purchases a combination of products A and B. The  $MU_A$  is 5 and the  $P_A$  is \$5. The  $MU_B$  is 6 and the  $P_B$  is \$6. What should this consumer do to maximize utility?

Ans: The  $MU_A/P_A = 1$ . The  $MU_B/P_B = 1$ . The consumer is maximizing utility and should make no changes in consumption patterns. The marginal utility per dollar is the same for both products.

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13. Assume that a consumer purchases a combination of products Y and Z. The  $MU_Y$  is 50 and the  $P_Y$  is \$25. The  $MU_Z$  is 20 and the  $P_Z$  is \$5. What should this consumer do to maximize utility?

Ans: The  $MU_Y/P_Y = 2$ . The  $MU_Z/P_Z = 4$ . The consumer should consume more of product Z and less of product Y until the marginal utility per dollar is the same for both products.

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Learning Objective: 5.2

14. Columns 1 through 3 in the table below show the *marginal utility* which a particular consumer would get by purchasing various quantities of products A, B, and C.

(1)	(2)	(3)	(4)
<u>Unit</u>	<u>Marginal utility, A</u>	<u>Marginal utility, B</u>	<u>Marginal utility, C</u>
1	18	39	12
2	16	36	10
3	14	33	9
4	12	30	8
5	10	27	7
6	8	24	5
7	6	21	3

If the prices of A, B, and C are \$2, \$3, and \$1, respectively, and the consumer has \$26 to spend on these three products, what combination of the three products should be purchased in order to maximize utility?

Ans: The consumer should purchase 2 units of A, 6 units of B, and 4 units of C. At this consumption level, the marginal utility per dollar from each product is identical (shown by the fact that  $16/\$2 = 24/\$3 = 8/\$1$ . The \$26 in income is fully spent.

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Learning Objective: 5.2

15. A consumer finds only three products, X, Y, and Z, are for sale. The amount of utility yielded by their consumption is shown in the table below. Assume that the prices of X, Y, and Z are \$10, \$2, and \$8, respectively, and that the consumer has an income of \$74 to spend.

- (a) Complete the following table by computing the marginal utility per dollar for successive units of X, Y, and Z to one or two decimal places.
- (b) How many units of X, Y, and Z will the consumer buy when maximizing utility and spending all income? Show this result using the utility maximization formula.
- (c) Why would the consumer *not* be maximizing utility by purchasing 2 units of X, 4 units of Y, and 1 unit of Z?

Product X			Product Y			Product Z		
Quantity	Utility	Marginal Utility per \$	Quantity	Utility	Marginal Utility per \$	Quantity	Utility	Marginal Utility Per \$
1	42		1	14		1	32	
2	82		2	26		2	60	
3	118		3	36		3	84	
4	148		4	44		4	100	
5	170		5	50		5	110	
6	182		6	54		6	116	
7	182		7	56.4		7	120	

Ans: Product X			Product Y			Product Z		
Quantity	Utility	Marginal Utility Per \$	Quantity	Utility	Marginal Utility per \$	Quantity	Utility	Marginal Utility Per \$
1	42	4.2	1	14	7.0	1	32	4.0
2	82	4.0	2	26	6.0	2	60	3.5
3	118	3.6	3	36	5.0	3	84	3.0
4	148	3.0	4	44	4.0	4	100	2.0
5	170	2.2	5	50	3.0	5	110	1.25
6	182	1.2	6	54	2.0	6	116	.75
7	182	0.0	7	56.4	1.2	7	120	.50

- (a) See completed table above.
- (b) The consumer will purchase 4 units of X, 5 units of Y, and 3 units of Z to maximize utility. The marginal utilities per dollar for each of the products is equal to 3.0. Also, all income (\$74) is spent on the products (\$40 for X, \$10 for Y, and \$24 for Z).

(c) Although the marginal utility per dollar spent is equal to 4.0 for X, Y, and Z, the consumer does not spend all available income. There is \$74 available but the consumer only spends \$36. More goods could be obtained by spending the income to maximize utility as shown in the answer to (b).

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Learning Objective: 5.2

16. A consumer has an income of \$24 to spend each day. The only two goods the consumer is interested in purchasing are goods A and B. The marginal-utility schedules for these two goods are shown in the table below. The price of B does not change and is \$2. The marginal utility per dollar from B is also shown in the table. But the price of A varies as shown in the table. The marginal utility per dollar from A when the price of A is \$8 and \$4 is shown in the following table.

<u>Quantity</u>	<u>Good A</u>			<u>Good B</u>	
	<u>MU</u>	<u>MU/\$8</u>	<u>MU/\$4</u>	<u>MU</u>	<u>MU/\$2</u>
1	48	6	12	24	12
2	32	4	8	15	8
3	24	3	6	12	6
4	16	2	4	8	4
5	8	1	2	6	3
6	4	0.5	1	4	2

Complete the table below to show how much of A the consumer will buy each week at each of the two possible prices of A. Also, show how much B will be demanded when the price of A changes.

<u>Price of A</u>	<u>Quantity of A</u> <u>demanded</u>	<u>Price of B</u>	<u>Quantity of B</u> <u>demanded</u>
\$8.00	_____	\$2.00	_____
4.00	_____	2.00	_____

Ans:

<u>Price of A</u>	<u>Quantity of A</u> <u>demanded</u>	<u>Price of B</u>	<u>Quantity of B</u> <u>demanded</u>
\$8.00	2	\$2.00	4
4.00	4	2.00	4

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Learning Objective: 5.2



17. How does the marginal utility for goods A and B change if a consumer moves from the situation where  $MU \text{ of A/price of A} > MU \text{ of B/price of B}$  to utility maximization?

Ans: To maximize utility, the consumer should purchase more units of good A and fewer units of good B. When the consumer does this, the marginal utility of good A decreases because of the law of diminishing marginal utility and the marginal utility of good B increases.

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Learning Objective: 5.2

18. What two reasons explain the negative slope of a demand curve?

Ans: The first explanation for a negatively sloped demand curve involves the law of diminishing marginal utility. When an individual consumes more units of a product, the utility from each additional unit is lower than for previous units. In other words, the consumer does not value additional units as much. At each price, the consumer will want to buy a specific quantity of the good. The consumer will not want to buy any more units because they are not worth what the consumer must pay. However, if the price falls below what the consumer believes additional units are worth, the consumer will want to buy more units.

The second reason for a downward sloping demand curve involves income and substitution effects. When the price of a product falls, a consumer has more real income that can be spent on the good or other goods. This is the income effect. Also, when the price of a product falls, it becomes less expensive relative to other goods. The consumer can purchase more of the good and less of its substitutes. This is known as the substitution effect.

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Learning Objective: 5.1, 5.3

19. How can the utility-maximizing rule be used to explain the substitution and income effect?

Ans: According to the utility-maximizing rule, when the price of a product decreases, the consumer will no longer be in equilibrium. Equilibrium will only be restored when more of the product is purchased and the marginal utility of the product decreases to match the decline in price. The consumer will purchase or substitute this now cheaper product for the relatively more expensive substitute. The income effect is shown by the fact that a decrease in price increases the real income of the consumer. Thus, the consumer can purchase more of this product and other products until equilibrium is achieved for the new level of real income.

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Learning Objective: 5.3

20. Why would an ounce of gold be priced higher than an ounce of coffee beans, even though coffee is generally considered more essential than gold? Explain the paradox in terms of marginal and total utility.

Ans: The basic reason is that the gold is relatively scarce, and it has a high price. Coffee is relatively abundant, and has a low price. The utility-maximizing rule indicates that consumers should continue purchasing any product until the ratio of its marginal utility to its price is equal to that for all other products. Gold must have a high marginal utility and price, while coffee must have a low marginal utility and price for consumers to maximize utility. Consumers, however, generally purchase only small quantities of gold because of the high price, and large quantities of coffee because of the low price. Coffee is considered to be more essential than gold, even though its price is lower, because the total utility from consuming coffee (sum of the marginal utilities) is much greater than the total utility from consuming gold.

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Learning Objective: 5.4

21. A person has a basic choice between eating meals at home or eating meals in a restaurant. The cost of the food that is eaten at home is \$10 per meal. The cost of a restaurant meal is \$20. It takes two hours to eat a meal at home (including preparation time and cleanup time). It takes one hour of time to eat a meal in a restaurant. The marginal utilities of the home meal and the restaurant meal are the same. The person values time at \$12 per hour. What does the theory of consumer behaviour suggest the rational consumer will decide to do: eat at home or in a restaurant? Answer by first excluding the value of time from the decision. Then include the value of time in the decision.

Ans: If time is not a consideration in the cost of a meal, then the marginal utility per dollar of a meal at home is greater than the marginal utility per dollar of the restaurant meal ( $MU_H/\$10 > MU_R/\$20$ ). The consumer will eat meals at home. If, however, the value of time is included in the cost of a meal, then the marginal utility per dollar spent will be the greater for restaurant meals than home meals. The full cost of a home meal is \$34 (\$10 food plus \$24 in time). The full cost of the restaurant meal is \$32 (\$20 in food and \$12 in time). Since the marginal utility of restaurant and home meals are the same, the marginal utility per dollar of restaurant meals will be greater than the marginal utility per dollar of home meals when the value of time enters the calculation ( $MU_R/\$32 > MU_H/\$34$ ).

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Learning Objective: 5.4

22. How does the pricing of health care in Canada affect the quantity consumed?

Ans: The publicly funded health insurance system pays the cost of medical care for individuals. Thus, the price of health care to the individual consumer is zero. The marginal utility/price of health care, therefore, is infinite. As a result, consumers have an incentive to use more health care than they otherwise would if they paid the full cost for services.

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Learning Objective: 5.4

23. Why do consumers generally prefer receiving \$100 rather than 5 units of a product that would cost \$100 to purchase?

Ans: Although the 5 units of the product cost \$100 in the market, a consumer does not necessarily value the 5 units at \$100. The consumer would not be willing to spend \$100 on the 5 units because higher utility may be derived by spending the \$100, in part or in its entirety, on other goods.

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Learning Objective: 5.4

24. Describe how time inconsistency has contributed to the development of government policy on retirement savings.

Ans: Time inconsistency refers to empirical regularity that people tend to correctly predict how they will feel in the future, but fail to act in the present when it means sacrificing current consumption to meet their goals. For instance, young workers often recognize the need to save for retirement but fail to act in a timely manner to begin that saving (e.g., they put too little away now to meet their future goals). Realizing this, government and companies use payroll taxes that create retirement savings plans that do not permit an “opt-out.” Income tax-shifting (i.e., saving tax payments now when income earning is high to the future when income earning is lower) through tax breaks for RRSP contributions is another government policy based, at least in part, on time-inconsistency.

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Learning Objective: Last Word

25. What is shown by the budget line in a two-product (A and B) case? Describe what happens when there is a change in income or the price of a product.

Ans: A budget line shows various combinations of two products which can be purchased with a given money income of a consumer and given the prices of the two products. A decrease in the money income of a consumer shifts the budget line inward to the origin. An increase in the money income of a consumer shifts the budget line outward from the origin. Price changes in either of the two products will rotate the budget line along one axis. Assume that the quantity of product A is shown on the vertical axis. If the price of A rises, less of A will be purchased at each of the possible combinations of A and B, so the budget line will rotate downward along the vertical A axis towards the origin. A decrease in the price of A would have the budget line rotate upward along the A axis away from the origin.

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Learning Objective: Appendix

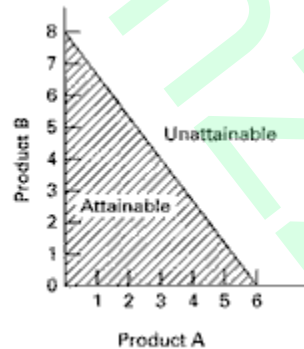
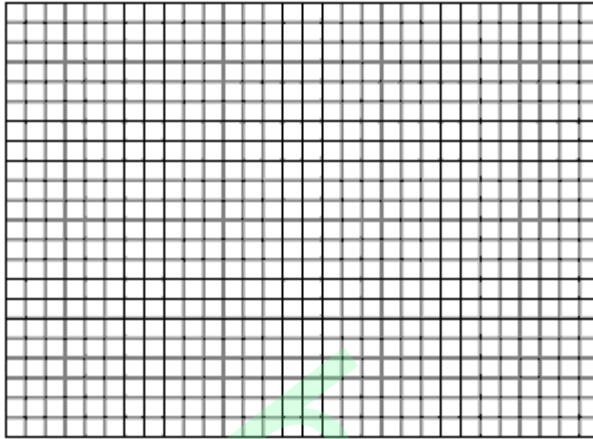
26. How will an increase in income affect the budget line for two goods, all other things equal? How does an increase in the price of one good affect the budget line for two goods, all other things equal?

Ans: A budget line is defined by the intercepts for the two goods in a two-quadrant graph. These intercept values are calculated by dividing money income by the price of the product. If money income increases and prices stay the same, then the intercept values will increase and the budget line will shift outward from the origin. In the case of an increase in the price of one good, the rise in price will reduce the intercept value for that good. The budget line will rotate toward the origin along that axis because the new intercept value will be less than the old intercept value for that good.

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Learning Objective: Appendix

27. Suppose a consumer has a daily income of \$48 and purchases just two goods, A and B. The price of A is \$8 and the price of B is \$6. In the graph below, draw the budget line for the consumer. Indicate the area of the below graph that is attainable given the income and the area that is unattainable.



Ans:

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Learning Objective: Appendix

28. Why are indifference curves downward sloping?

Ans: Indifference curves are downward sloping because both products (A and B) yield utility to the consumer. More of both would increase utility, so for utility to remain constant, more of A means less of B and vice versa.

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Learning Objective: Appendix

29. What is the rationale for the slope of an indifference curve in a two-product (A and B) case?

Ans: The slope of the curve measures the marginal rate of substitution of one good for the other (B for A) for the consumer to have a constant level of satisfaction. The rationale for this shape is related to diminishing marginal utility. If the consumer has many units of A and few units of B, B is more valuable at the margin while A has a lower marginal utility. The consumer will then be willing to give up more of A to get more units of B. This relationship changes, however, as the consumer gets more and more of B and gives up more and more A. In this case, the consumer will not be willing to give up many units of A to obtain more units of B. This situation means that the slope of the curve diminishes. It is thus convex to the origin.

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Learning Objective: Appendix

30. Explain two important characteristics of indifference curves for two goods.

Ans: First, indifference curves are downward sloping because both goods will yield utility for the consumer. Because total utility is constant for each indifference curve, the consumption of more of one good would increase total utility and this must be offset by the decrease in the amount consumed of the other good. More utility is derived from the consumption of one good; less utility is obtained from the other good. This inverse relationship produces the downward (negative) slope of the indifference curves.

Second, indifference curves are convex to the origin. The willingness to substitute one good for the other diminishes as the consumer moves down the curve. Thus indifference curves have a diminishing slope that makes them convex to the origin in a two-quadrant graph.

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Learning Objective: Appendix

31. Explain the meaning of the “marginal rate of substitution.”

Ans: An indifference curve shows all the combinations of two products, X and Y that will give the consumer the same level of satisfaction or utility. Indifference curves are downward sloping because of the inverse relationship between products X and Y. To obtain more of product X means giving up some total utility from product Y. The marginal rate of substitution is the slope of the indifference curve at any point and measures that rate at which the consumer is willing to give up Y for X while remaining at the same level of satisfaction.

Indifference curves are also convex to the origin. Thus, the slope of an indifference curve diminishes as you move down the curve. The reason for the diminishing slope is that the marginal rate of substitution of product X and Y falls as you move down the curve. As the consumer moves down the indifference curve, the consumer is willing to give up less of Y to get more of X.

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Learning Objective: Appendix

32. Why can't indifference curves intersect?

Ans: By definition, an indifference curve shows all the combinations of two products that give the consumer the same level of satisfaction. Also, the higher the indifference curve on an indifference map, the greater the level of satisfaction. If indifference curves intersected, then it would be possible to be higher on one curve than another at one point and lower on the same curve than the other curve at another point. This contradictory result is not possible, and thus indifference curves can't intersect.

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Learning Objective: Appendix

33. What is shown by the indifference map for two goods? Which indifference curve would a consumer want to be on?

Ans: An indifference map shows the set of indifference curves for the consumer. Each curve is convex to the origin and does not cross the other. Each indifference curve shows a level of utility. The farther an indifference curve is away from the origin, the higher the level of utility. The consumer will want to be on the indifference curve that is the farthest from the origin.

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Learning Objective: Appendix

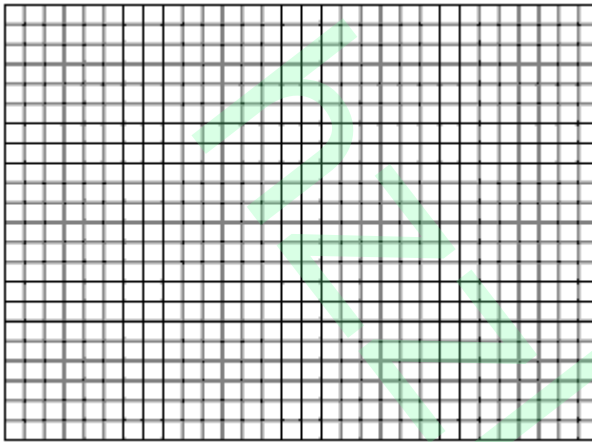
34. What are the conditions for equilibrium in indifference curve analysis?

Ans: The utility maximizing combination of two products, A and B, for a consumer will be determined by the tangency of a budget line with the highest attainable indifference curve.

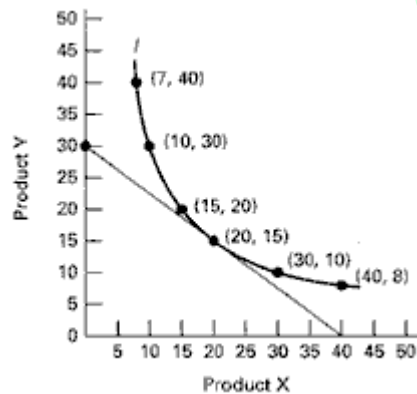
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Learning Objective: Appendix

35. A consumer has a daily income of \$120 and purchases two products, X and Y. The price of X is \$3 and the price of Y is \$4. The following six pairs of points for X and Y define an indifference schedule: (7,40), (10,30), (15,20), (20,15), (30,10), and (40,8). In the graph below, draw the budget line and the indifference curve. What amounts of X and Y will allow the consumer to achieve equilibrium?



Ans: The answer is shown by the graph. The point of tangency between the budget line and indifference curve is at 20X and 15Y.



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Learning Objective: Appendix



36. When does the marginal rate of substitution (MRS) in an indifference curve equal the ratio of marginal utilities in marginal-utility analysis? Explain.

Ans: In equilibrium for the two good case, the MRS for good A and good B equals the ratio of the price of B to the price of A ( $P_B/P_A$ ). Similarly, in equilibrium in marginal utility analysis, the ratio of the marginal utility of B to the marginal utility of A ( $MU_B/MU_A$ ) equals the price of B divided by the price of A ( $P_B/P_A$ ). MRS and the  $MU_B/MU_A$  equal the same value and are equal when there is equilibrium. If this equilibrium were not the case, then the consumer could be made better off by buying more of one good and less of the other since the marginal utility of one exceeds the other. This situation will cause the marginal utilities to change until they reach the equilibrium ratios, and the consumer can be made no better off.

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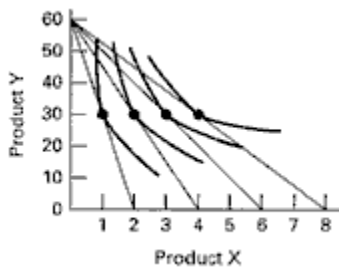
37. What happens to the budget line when the price of a product falls? Use indifference curve analysis to explain how this change affects consumption of the product.

Ans: Changing the price of one product shifts the budget line. When the price falls, the budget line rotates outward along the axis for that good. This means that the consumer can achieve a new equilibrium on a higher indifference curve. For most goods, the new equilibrium will most likely increase the consumption of the now lower-priced good.

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Learning Objective: Appendix

38. Using the indifference curve graph below, determine the demand curve for product X across four different prices when the income is \$60 and price of Y is \$1.



Ans: Each indifference curve is tangent to a budget line at 30 units of Y. Using this point as a reference point, you can calculate the values of X that can be purchased as the price of X falls. The budget line shifts outward along the X axis. The demand schedule for product X has the following values: (\$30, 1X) (\$15, 2X), (\$10, 3X), and (\$7.5, 4X).

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Learning Objective: Appendix

39. Suppose the price of bananas falls. Explain how the income and substitution effects work in the adjustment to a new level of banana consumption.

Ans: When bananas fall in price, they become cheaper relative to other goods and services a person could buy. Even if we prevented this consumer from becoming better-off (i.e., if she only moved around her original indifference curve), she would consume more bananas. This is the *substitution effect*.

Now, when the price of bananas falls, this consumer has more real income (i.e., she could convert all of her income into more bananas now than she could before the price drop). Whether she chooses to buy more or less bananas as compared to where the substitution effect leads her depends upon whether bananas are a normal or inferior good for her. This is the *income effect*.

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Answer