

True / False

1. If all consumers are price-takers facing the same prices, then their budget lines will all have the same slope.

- a. True
- b. False

**ANSWER:** True

**RATIONALE:** The slope of the budget constraint is  $-p_1/p_2$  --- i.e. it is made up solely of prices. If those are the same for all consumers, then the slope is the same for all consumers.

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2. If all consumers are price-takers facing the same prices, then all choice sets are the same.

- a. True
- b. False

**ANSWER:** False

**RATIONALE:** While the slopes of the budget constraints will be the same for all consumers, the choice sets will differ depending on each consumer's income.

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3. Regardless of which consumption bundle in her choice set a consumer chooses, she will spend all of her available income.

- a. True
- b. False

**ANSWER:** False

**RATIONALE:** All available income is spent only on the portion of the choice set that is equal to the budget line (or budget constraint).

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4. In a graph of choice sets, a price change causes the slope of budget lines to change.

- a. True
- b. False

**ANSWER:** True

**RATIONALE:** As the price of a good is reduced, the budget line swings outward.

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5. If a consumer's fixed income increases, his opportunity cost also increases.

- a. True
- b. False

**ANSWER:** False  
**RATIONALE:** Although a consumer's choices may change, his opportunity cost does not, since the opportunity cost is determined by the price of the good, not by his increased income.

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6. When the good on the vertical axis is a composite good, the slope of the budget line is equal to minus the price of the good on the horizontal axis.

- a. True
- b. False

**ANSWER:** True  
**RATIONALE:** The price of composite goods is 1 --- which means that the usual slope  $-p_1/p_2$  becomes  $-p_1$ .

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7. When the good on the horizontal axis is a composite good, the slope of the budget constraint is minus the price of the good on the vertical axis.

- a. True
- b. False

**ANSWER:** False  
**RATIONALE:** The slope is usually  $-p_1/p_2$  --- and when  $p_1=1$  (as it is when good 1 is a composite good), then the slope of the budget line is  $-1/p_2$ ; i.e. minus the *inverse* of  $p_2$ .

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8. While the endowment bundle must lie on the original budget line, it need not lie on the budget line when prices change.

- a. True
- b. False

**ANSWER:** False

**RATIONALE:** Consumers always have the option of consuming their endowment bundle --- which means the endowment bundle always lies on the budget line regardless of what happens to prices.

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9. For choice sets emerging from “exogenous” income, the budget line will shift parallel whenever both prices change by the same percentage.

- a. True
- b. False

**ANSWER:** False

**RATIONALE:** Since the slope of the budget constraint is the negative price ratio, the slope will remain the same if both prices increase by the same factor --- which means the new budget line will be parallel to the original.

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10. For choice sets generated from endowment bundles, the budget line will shift parallel if both prices change by the same proportion.

- a. True
- b. False

**ANSWER:** False

**RATIONALE:** The slope of the budget remains unchanged --- as does the endowment bundle. Since the budget line always has to pass through the endowment bundle, an simultaneous and proportionate increase in both prices will cause no change in the budget constraint.

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11. The budget line on a graph represents choices which exhaust all resources.

- a. True
- b. False

**ANSWER:** True

**RATIONALE:** The budget line represents all combinations of goods that, if chosen by a particular consumer would

leave no money in his or her budget.

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12. In a graph of choice sets, a price change affects the ratio but does not affect the budget line.
- a. True
  - b. False

**ANSWER:** False  
**RATIONALE:** A price change will cause the slope of a budget line to change.  
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#### Multiple Choice

13. The following changes in a consumer's economic circumstances result in a steeper budget line with the vertical intercept unchanged. (Denote the good on the horizontal as good 1 and the good on the vertical as good 2.)
- a. A  $k$  percent decrease in the price of good 2 combined with a  $k$  percent decrease in income
  - b. A  $k$  percent increase in the price of good 2 combined with a  $k$  percent decrease in income
  - c. A  $k$  percent decrease in the price of good 2 combined with a  $k$  percent increase in income
  - d. A  $k$  percent increase in the price of good 2 combined with a  $k$  percent increase in income.
  - e. None of the above

**ANSWER:** a  
**RATIONALE:** A decrease in the price of good 2 causes the slope to become steeper, and a decrease in income shifts the budget line inward. Together, these imply that the budget line rotates inward with the vertical intercept fixed --- just as it would if the price of good 1 increases by itself.  
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**DIFFICULTY:** A section material  
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14. Suppose inflation comes in the form of an across-the board increase in all prices by some percentage  $k$ . For a consumer with exogenous income operating in a 2-good world, this will cause the budget constraint to
- a. rotate inward
  - b. rotate outward
  - c. shift out in a parallel way
  - d. shift inward in a parallel way
  - e. none of the above

**ANSWER:** d  
**RATIONALE:** Since the slope of the budget is the price ratio, and since both prices increased by the same

proportion, the slope is unchanged --- but the same level of exogenous income now buys less.

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15. Suppose you are given a coupon for pizza. This coupon lowers the price for each additional pizza you buy by 5% for each addition pizza you buy. What happens to your budget constraint, with pizza on the horizontal axis and a composite good on the vertical?

- a. The vertical intercept remains the same but the slope becomes steeper as more pizzas are bought.
- b. The vertical intercept increases and the slope becomes steeper as more pizzas are bought.
- c. The vertical intercept remains the same but the slope becomes shallower as more pizzas are bought.
- d. The vertical intercept increases but the slope becomes shallower as more pizzas are bought.
- e. None of the above.

*ANSWER:* c  
*RATIONALE:* If no pizzas are bought, then nothing changes --- implying that the vertical intercept remains the same. But as more pizzas are bought, the price falls, implying an increasingly shallower budget line.  
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*DIFFICULTY:* A-Section material  
*QUESTION TYPE:* Multiple Choice  
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16. Suppose the government wants to discourage excessive consumption of alcohol. It therefore imposes a per-unit tax on alcohol that increases as more alcohol is bought by a consumer at a store. What happens to a consumer's budget at a liquor store (with liters of alcohol on the horizontal axis and a composite good on the vertical) --- assuming the consumer takes only one trip to the store.

- a. The vertical intercept decreases and the slope becomes shallower as more alcohol is bought.
- b. The vertical intercept remains constant but the slope becomes shallower as more alcohol is bought.
- c. The vertical intercept decreases and the slope becomes steeper as more alcohol is bought.
- d. The vertical intercept remains constant but the slope becomes steeper as more alcohol is bought.
- e. None of the above.

*ANSWER:* d  
*RATIONALE:* If no alcohol is bought, nothing changes as a result of the tax --- implying the vertical intercept remains unchanged. But the price of alcohol increases as more is bought --- implying a steepening of the slope.  
*POINTS:* 1  
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Subjective Short Answer

17. Consider a consumer with a choice set that emerges from an exogenous income  $I$ . Suppose that, as a result of changes in a consumer's economic circumstances, the budget line rotates outward, with the vertical intercept remaining unchanged but the horizontal intercept shifting to the right. How could this have happened if the price of the good on the horizontal axis did not change?

**ANSWER:** If the price of the good on the vertical axis increases by the same proportion as income does. (The increase in income along causes a parallel shift outward, and the increase in the price of good 2 causes the slope to become shallower. If the two increase by the same percentage, the amount of good 2 that is affordable remains unchanged while the amount of good 1 that is affordable increases.)

**POINTS:** 1

**DIFFICULTY:** A section material

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18. Consider a consumer with a choice set that emerges from an exogenous income  $I$ . Suppose that, as a result of changes in a consumer's economic circumstances, the budget line rotates outward, with the vertical intercept remaining unchanged but the horizontal intercept shifting to the right. Demonstrate, using the budget line equation, how this could have happened if the price of the good on the horizontal axis did not change?

**ANSWER:** The budget equation is  $x_2 = I/p_2 - (p_1/p_2)x_1$ , with the first term representing the intercept and the term in parenthesis representing the slope. The rotation of the budget that is described implies the intercept remains constant and the slope falls in absolute value. If  $p_1$  does not change, this can happen only if  $I$  and  $p_2$  change by the same factor  $k$  --- which then cancels in the first term (leaving the intercept unchanged) and causes the second term to fall in absolute value.

**POINTS:** 1

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19. Suppose that the price of a TV is \$200 and the price of an MP3 player is \$50. What is the opportunity cost of a TV (in terms of MP3 players), and what is the opportunity cost of an MP3 player (in terms of TVs)?

**ANSWER:** The opportunity cost of a TV is 4 MP3 players, and the opportunity cost of an MP3 player is one fourth of a TV.

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20. Derive the budget line equation for the case where good 2 is a composite good. What is the vertical intercept and what is the slope?

**ANSWER:** Since  $p_2 = 1$ , the usual budget line equation  $x_2 = I/p_2 - (p_1/p_2)x_1$  becomes  $x_2 = I - p_1x_1$ , an equation with a vertical intercept of  $I$  and a slope of  $-p_1$ .

**POINTS:** 1

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21. Derive the budget line equation for the case where good 1 is a composite good. What is the vertical intercept and what is the slope?

**ANSWER:** Since  $p_1 = 1$ , the usual budget line equation  $x_2 = I/p_2 - (p_1/p_2)x_1$  becomes  $x_2 = I/p_2 - (1/p_2)x_1$ , an equation with a vertical intercept of  $I/p_2$  and a slope of  $-(1/p_2)$ .

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22. A consumer has \$1,000 a week to spend on renting square feet of housing (at a price of \$5 per square foot) and eating out (at a price of \$20 per meal). With square feet of housing on the horizontal and meals on the vertical axis, what is the vertical intercept and what is the slope of this consumer's budget constraint?

**ANSWER:** The most meals that can be consumed with \$1,000 is 50 per week --- implying a vertical intercept of 50. The most square feet that can be rented with \$1,000 per week is 200, implying a horizontal intercept of 200. The slope is then  $-50/200 = -1/4$ .

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23. A consumer has \$1,000 a week to spend on renting square feet of housing  $x_1$  (at a price of \$5 per square foot) and eating out meals  $x_2$  (at a price of \$20 per meal). Derive the budget line equation and find the opportunity cost of housing in terms of meals in your equation.

**ANSWER:** The budget equation  $x_2 = I/p_2 - (p_1/p_2)x_1$  becomes  $x_2 = 1000/20 - (5/20)x_1$  or  $x_2 = 50 - (1/4)x_1$ . The slope of the budget line is equal to the opportunity cost of housing in terms of meals --- and this slope is  $-1/4$  in the equation.

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24. Suppose the government levies a per-unit tax on TVs, and this tax increases the price of TVs by \$10.

a. On a graph with TVs on the horizontal axis and "\$'s of other consumption" on the vertical, illustrate how the budget constraint for a consumer with exogenous income changes as a result of the tax.

b. Suppose you know the bundle on the after-tax budget that is chosen by the consumer. Illustrate on your graph how much in tax revenue the government is raising from this consumer.

c. If the government replaced the tax on TVs with a lump sum tax that does not alter any prices but raises the same amount of revenue from the consumer, how would this consumer's budget constraint change?

**ANSWER:** a. The graph should have two budget constraints with the same vertical intercept but different slopes --- with the steeper budget line representing the after tax case.

b. The tax revenue the government collects is the vertical distance between the after-tax bundle that is bought and the before-tax budget line.

c. The consumer's after-tax budget constraint would rotate through the previous after-tax bundle --- becoming shallower as the price distortion from the TV tax is lifted and ending up parallel to the before-tax budget.

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**DIFFICULTY:** A-Section material

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25. Suppose the government levies a per-unit tax on TVs, and this tax increases the price of TVs by \$100. Model TVs as  $x_1$  and all other goods as a composite good  $x_2$ .

a. For a consumer with income  $I$ , write down an equation for the before-tax budget line.

b. Write down the after-tax budget line equation.

c. Suppose you know the bundle on the after-tax budget that is chosen by the consumer contains 3 TVs. How much in tax revenue is the government raising from this consumer?

d. If the government replaced the tax on TVs with a lump sum tax that does not alter any prices but raises the same amount of revenue from the consumer, how would this change the consumer's budget line equation?

**ANSWER:** a.  $x_2 = I - p_1 x_1$  or  $I = p_1 x_1 + x_2$

b.  $x_2 = I - (p_1 + 100)x_1$  or  $I = (p_1 + 100)x_1 + x_2$

c. \$300

d.  $x_2 = (I - 300)/p_2 - (p_1/p_2)x_1$  or  $I = p_1 x_1 + x_2 + 300$

**POINTS:** 1

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26. Suppose a business offers a 10% discount on the good  $x_1$  that it sells.

- a. Illustrate a consumer's before and after-discount budget constraint by modeling  $x_2$  as a composite good.
- b. Suppose you observe only the after-discount consumption decision of the consumer. Can you tell from this information how much revenue the firm is giving up (from this consumer) by offering the discount? If so, illustrate this in your graph.
- c. Suppose that, instead of the firm offering the 10% discount, the government subsidized consumption of  $x_1$  sufficiently to reduce  $p_1$  by 10%. Suppose again that you only observe the after-subsidy decision of the consumer. Can you tell how much of a subsidy payment is made to this consumer by the government? If so, illustrate it in your graph.
- d. Why are your answers to (b) and (c) different?

**ANSWER:**

- a. The graph should contain two budget lines with the same vertical intercept but different slopes --- with the shallower constraint representing the after-discount budget constraint.
- b. No, you cannot. The reason for this is that we do not know what decision the consumer would have made in the absence of the discount --- and so we can't tell whether (or how much) revenue was lost.
- c. Yes, you can. The subsidy payment by the government is the vertical difference between the before and after-subsidy constraints measured at the after-subsidy consumption bundle.
- d. If you are a firm and you want to assess the impact on revenues of a discount policy, you need to know what consumers do *both* before and after the discount --- because you need to calculate the difference in revenues. If you are a government subsidizing a good, you don't have to know what consumers do before the subsidy in order to calculate how much the subsidy will cost --- because all that matters is how much consumers will buy under the subsidy.

**POINTS:**

1

**DIFFICULTY:**

A-Section material

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