Chapter 01 Appendix

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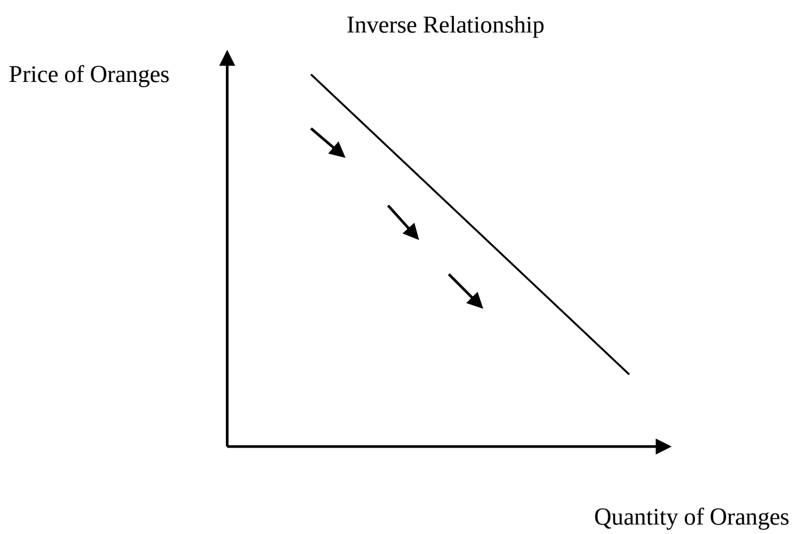
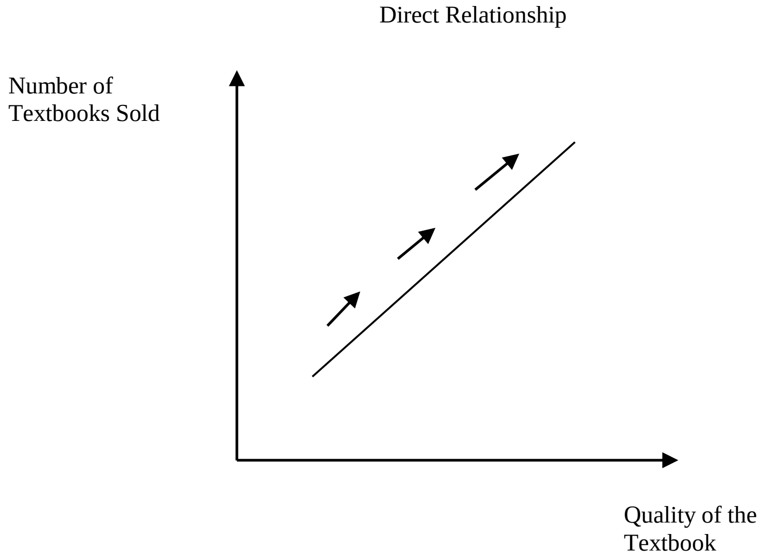
APPENDIX DISCUSSION QUESTIONS

1. Briefly explain the use of graphs as a way to represent economic relationships. What is an inverse relationship? How does it graph? What is a direct relationship? How does it graph? **LOA1.1**

> **Answer:** Graphs help us visualize relationships between key economic variables in the data. For example, the relationship between the price of oranges and the number of oranges purchased is likely to be an inverse relationship. An inverse relationship is one where we observe one variable increasing and the other variable decreasing as a result (moving in opposite directions). Thus, as the prices of oranges increase we would expect to see a decrease in the quantity of oranges purchased. Graphically, we represent this inverse relationship as follows.



> As another example, the relationship between the quality of a textbook and the number of textbooks sold is likely to be a direct relationship. A direct relationship is one where we observe one variable increasing and the other variable increasing as a result (moving in the same direction). Thus, as the quality of the textbook increases the number of books sold also increases. Graphically, we represent this direct relationship as follows.



2. Describe the graphical relationship between ticket prices and the number of people choosing to visit amusement parks. Is that relationship consistent with the fact that, historically, park attendance and ticket prices have both risen? Explain. **LOA1.1**

> **Answer:** There is likely an inverse relationship between ticket prices and the number of people visiting amusement parks. As ticket prices increase relative to other goods, people will spend their income on these other goods. For example, they may decide to go to the movies instead of visiting the now more expensive amusement park.
>
> The fact that, historically, park attendance and ticket prices have both risen over time does not change our story. This relationship is most likely the result of a change in demand, not a change in quantity demanded. The demand schedule for amusement parks has probably shifted to the right (an increase in demand) over time leading to an increase in attendance and prices.

3. Look back at Figure A1.2, which shows the inverse relationship between ticket prices and game attendance at Informed University (IU). (a) Interpret the meaning of both the slope and the intercept. (b) If the slope of the line were steeper, what would that say about the amount by which ticket sales respond to increases in ticket prices? (c) If the slope of the line stayed the same but the intercept increased, what can you say about the amount by which ticket sales respond to increases in ticket prices? **LOA1.1**

Answer:
Part a: The slope of this relationship tells us how much the price of a ticket must fall to induce someone to buy an additional ticket. In this case, the slope of -2.5 tells us that the price must fall by $2.50 to sell one more ticket (or to induce someone to buy one more ticket). The vertical intercept tells us the price at which no tickets will be sold. Here, this price is $50. Combining these two components tells us that if the initial price is $50 per ticket and the price falls to $40, then 4 tickets will be purchased (one for each reduction in price of $2.50, which is the slope).

Part b: If the slope of this line were steeper this would imply that the price must fall by more than $2.50 to sell one more ticket. Or, thinking about this in the other direction, a steeper line would result in a smaller decrease in tickets purchased for a given increase in price. In other words, ticket sales (purchases) are less responsive to price movements.

Part c: If the vertical intercept increased this would imply that individuals are willing to purchase more tickets at every price. This will be an increase in the demand for tickets. This will not affect the slope or the quantity response to a change in the price of tickets. We still have the relationship that the price must fall by $2.50 to sell one more ticket (or to induce someone to buy one more ticket).

APPENDIX REVIEW QUESTIONS

1. Indicate whether each of the following relationships is usually a direct relationship or an inverse relationship. **LOA1.1**
a. A sports team's winning percentage and attendance at its home games.
b. Higher temperature and sweater sales.
c. A person's income and how often they shop at discount stores.
d. Higher gasoline prices and kilometers driven in automobiles.

Answer:
Part a: direct relationship because winning reams are typically more popular.
Part b: inverse relationship because as higher temperatures people usually purchase fewer sweaters
Part c: inverse relationship because as people get richer, they typically shop less often at discount stores.
Part d: inverse relationship because higher gas prices cause most people to cut back on their driving.

2. Erin grows pecans. The number of bushels *(B)* that she can produce depends on the number of inches of rainfall *(R)* that her orchards get. The relationship is given algebraically as follows: $B = 3{,}000 + 800R$. Match each part of this equation with the correct term. **LOA1.1**

B	slope
3,000	dependent variable
800	vertical intercept
R	independent variable

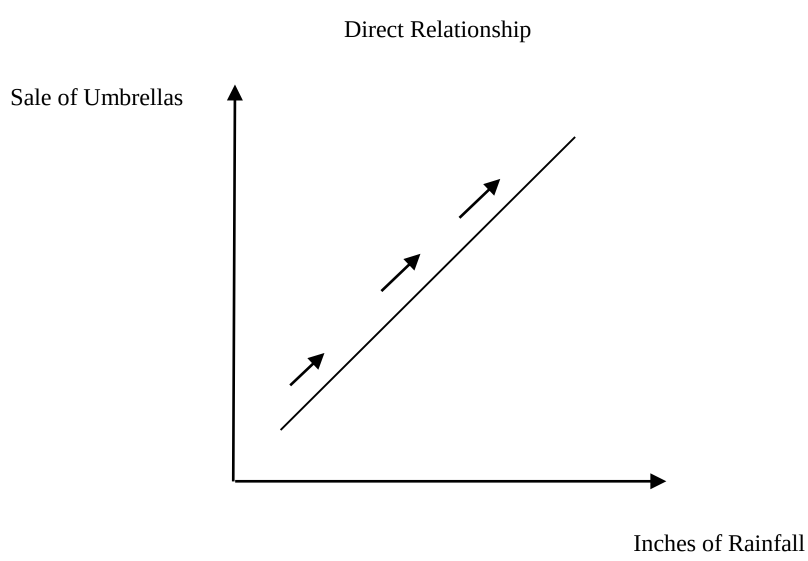
Answer:

B goes with dependent variable.
3,000 goes with vertical intercept.
800 goes with slope.
R goes with independent variable.

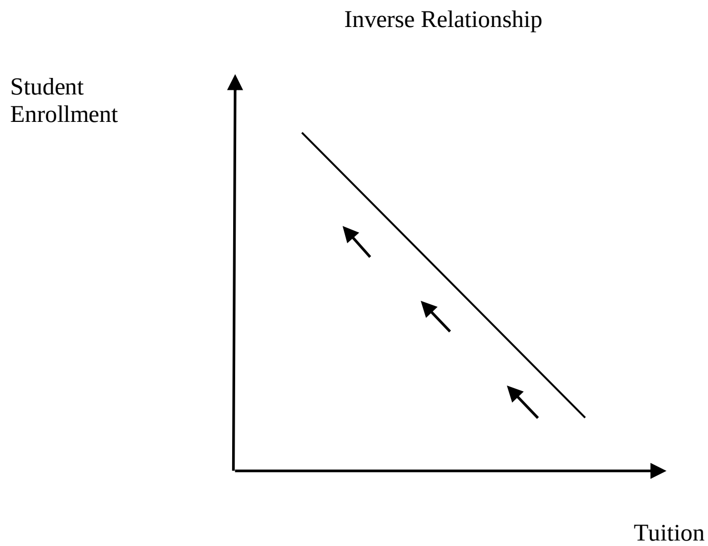
APPENDIX PROBLEMS

1. Graph and label as either direct or indirect the relationships you would expect to find between (a) the number of centimeters of rainfall per month and the sale of umbrellas, (b) the amount of tuition and the level of enrollment at a college or university, and (c) the popularity of an entertainer and the price of her concert tickets. **LOA1.1**

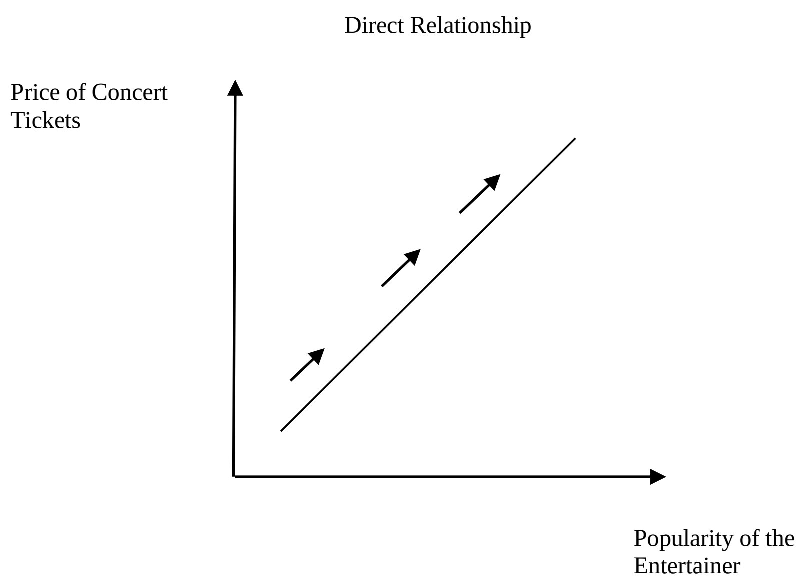
Answer:
Part a:



Part b:

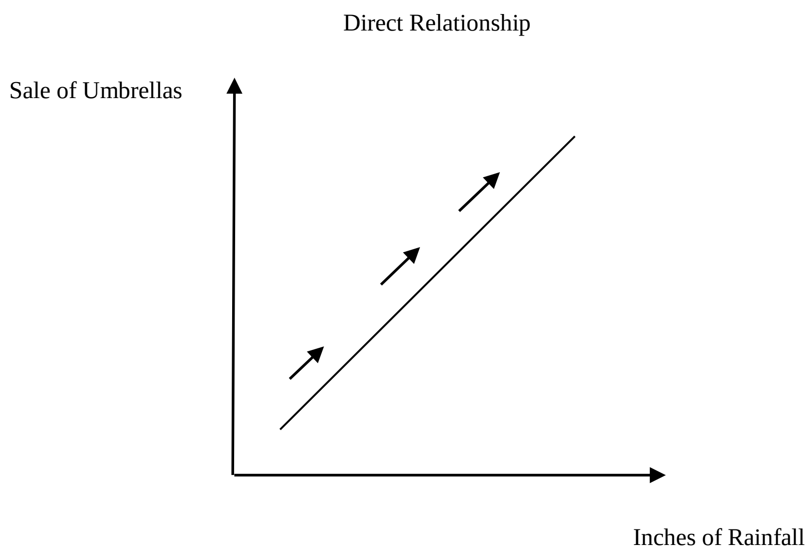


Part c:

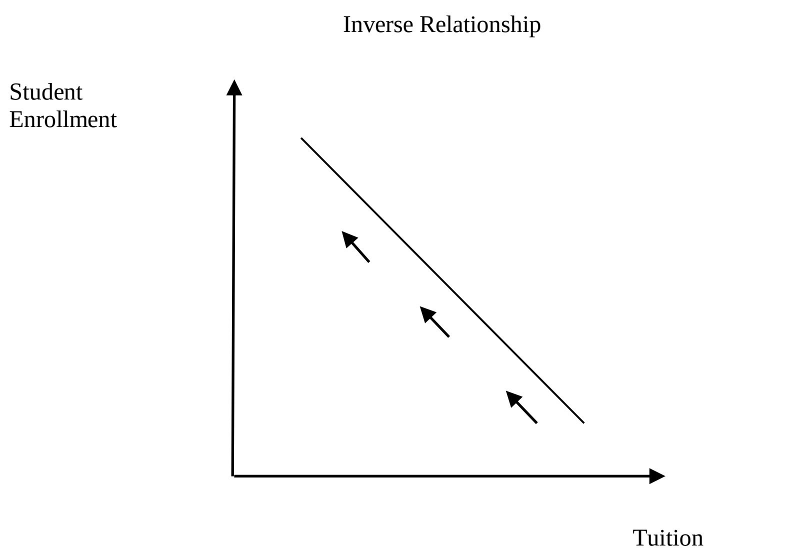


Feedback: Consider the following situations:

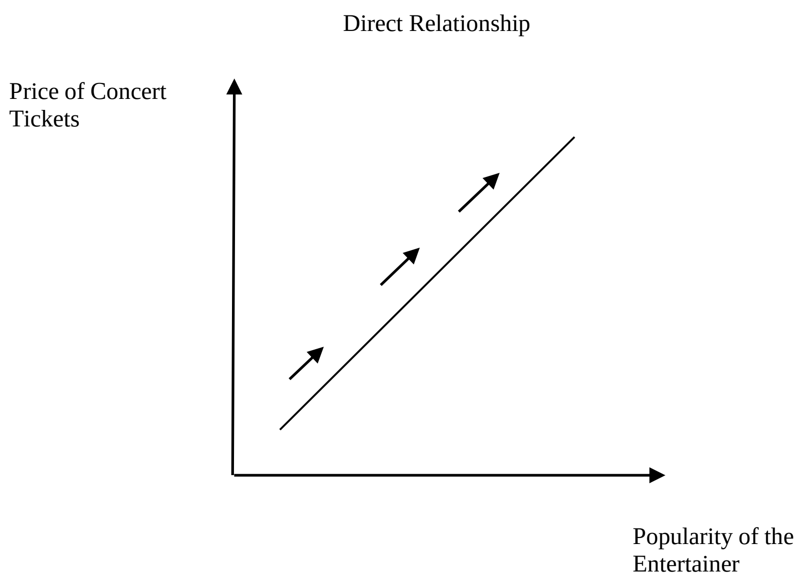
Part a: The number of centimeters of rainfall per month and the sale of umbrellas: There is likely a direct relationship between the number of centimeters of rainfall per month and the sale of umbrellas (more rain implies more umbrellas).



Part b: The amount of tuition and the level of enrollment at a college or university: There is likely an inverse relationship between the amount of tuition and the level of enrollment at a college or university. As tuition increases less students will attend the college or university.



Part c: The popularity of an entertainer and the price of her concert tickets: There is likely a direct relationship between the popularity of an entertainer and the price of her concert tickets. The more popular the entertainer, the more people are willing to pay to see her in concert.



2. Indicate how each of the following might affect the data shown in Figure A1.2 of this appendix: **LOA1.1**
a. IU’s athletic director schedules higher-quality opponents.
b. A National Basketball Association (NBA) team locates in the city where IU also plays.
c. IU signs a contract to have all of its home games televised.

Answer: (a) increase in demand; shift to the right; (b) decrease in demand; shift to the left; (c) decrease in demand; shift to the left.

Feedback: Consider the three scenarios:

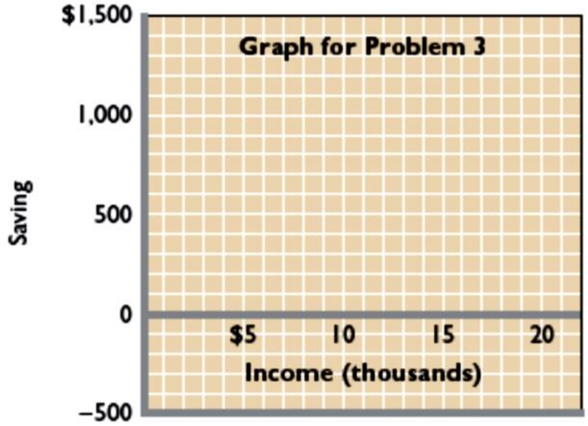
Part a: IU’s athletic director schedules higher-quality opponents. By scheduling higher quality opponents there will be an increase in demand. That is, more tickets will be purchased at every price. The demand schedule will shift to the right.

Part b: An NBA team locates in the city where IU plays. If an NBA team locates in the same city, this will reduce demand because the NBA team's games are likely a substitutes for IU's games. That is, less tickets will be purchased at every price. The demand schedule will shift to the left.

Part c: IU contracts to have all its home games televised. If IU contracts to have all of its home games televised, this will reduce demand because individuals can watch the game on television. That is, less tickets will be purchased at every price. The demand schedule will shift to the left.

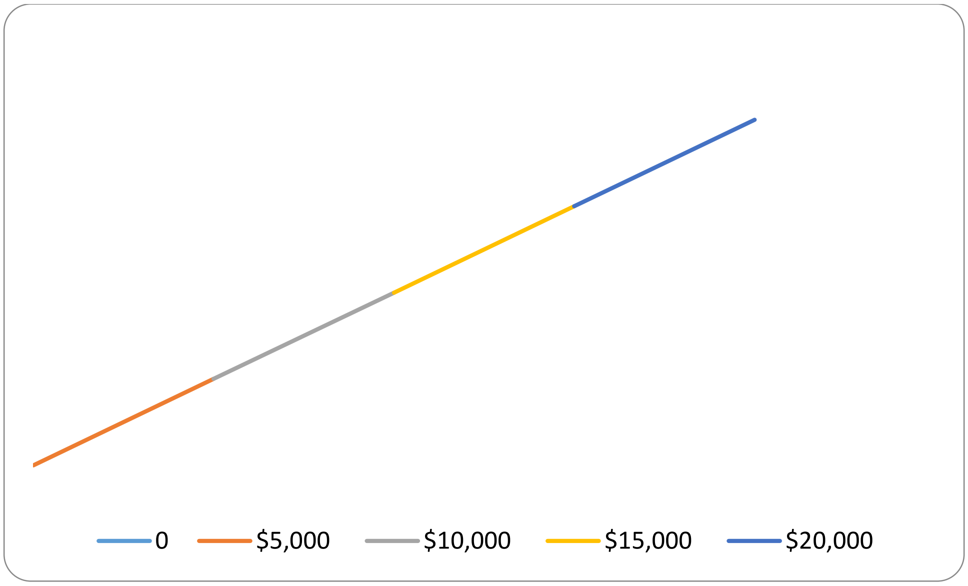
3. The following table contains data on the relationship between saving and income. Rearrange these data into a logical order and graph them on the accompanying grid. What is the slope of the line? The vertical intercept? Write the equation that represents this line. What would you predict saving to be at the $12,500 level of income? **LOA1.1**

Income per Year	Saving per Year
$15,000	$1,000
0	−500
10,000	500
5,000	0
20,000	1,500



Answer:

Income per Year	Saving per Year
0	-$500
$5,000	0
$10,000	$500
$15,000	$1,000
$20,000	$1,500



Slope equals (500/5000) or 0.10; the vertical intercept equals -$500. The equation representing this data is : Saving = -$500 + 0.1 × Income. The predicted level of saving is $750.

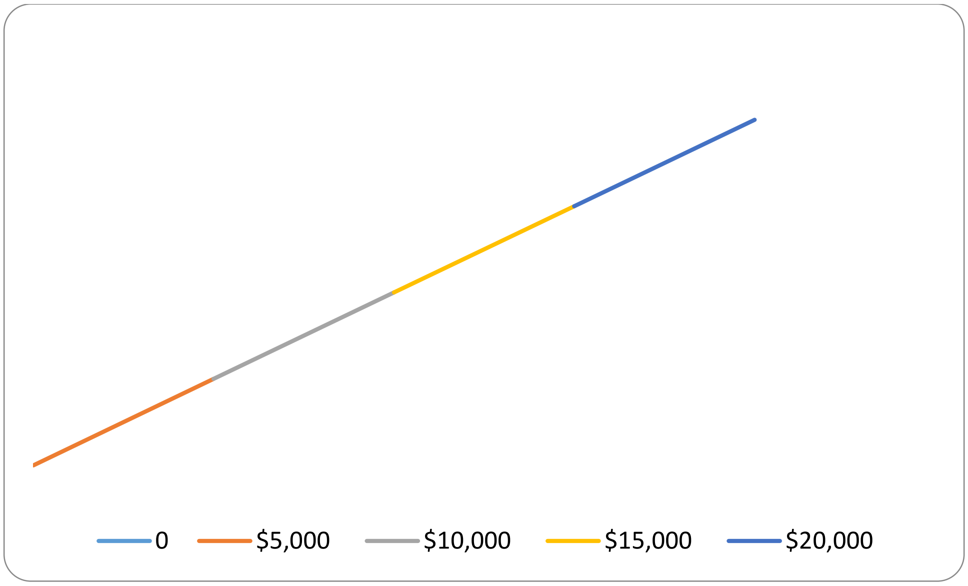
Feedback: Consider the following data:

Income per Year	Saving per Year
$15,000	$1,000
0	-$500
$10,000	$500
$5,000	0
$20,000	$1,500

To rearrange the above data into a meaningful order, we start with the lowest income and saving pair. We then continue with sequentially higher values of both income and saving. The reason for this ordering is that economic theory (and data) suggests that as income increases so does saving. The data are reordered as follows (you could also reorder from highest to lowest, but this is less intuitive).

Income per Year	Saving per Year
0	-$500
$5,000	0
$10,000	$500
$15,000	$1,000
$20,000	$1,500

Graphically, we have the following.

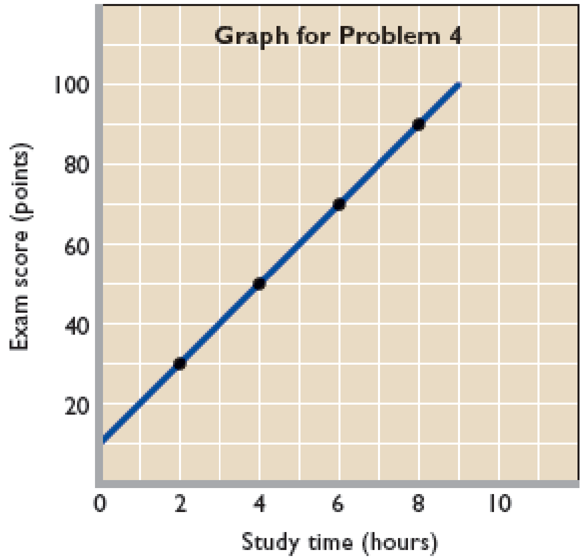


The slope of the saving line can be found by dividing the change in saving by the change in income between any two points. For example we have the entry (5000 (income), 0 (savings)) and the entry (10000 (income), 500 (savings)). This implies that the change in saving equals 500 minus zero (= 500) and the change in income equals 10000 minus 5000 (= 5000), therefore the slope equals (500/5000) or 0.10. That is, for every additional dollar an individual earns (net income) he or she will save 10 cents and consume 90 cents. The vertical intercept equals -$500. This implies that if the individual does not earn an income he or she either borrows $500 or reduces past savings (stock variable) by $500.

The equation representing this data is : Saving = -$500 + 0.1×Income.

To find the predicted amount of saving for a given level of income we substitute the income level into the equation above. For example if income equals $12,500, then the predicted level of saving equals -$500 + 0.1×$12,500. Thus the predicted level of saving is $750 (= -$500 + $1250).

4. Construct a table from the data shown on the graph below. Which is the dependent variable and which the independent variable? Summarize the data in equation form. **LOA1.1**

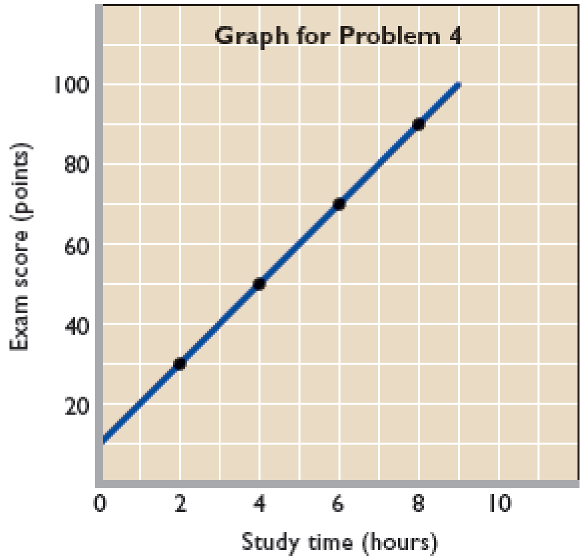


Answer:

Study Time (hours)	Exam Score (points)
0	10
2	30
4	50
6	70
8	90

The dependent variable is Exam Score (points); Study Time (hours) is the independent variable. Thus, the equation representing this relationship is: Exam Score = 10 + 10 x Study Time.

Feedback: Consider the following figure:



The table for this data is as follows:

Study Time (hours)	Exam Score (points)
0	10
2	30
4	50
6	70
8	90

The dependent variable is Exam Score (points) because we assume Study Time (hours) influences your score. The more hours you spend studying will increase your exam score. This means that Study Time (hours) is the independent variable.

The vertical intercept for this relationship is your exam score if you choose not to study (zero hours). From the table above this value is 10.

To find the slope we divide the change in your Exam Score by the change in Study Time for any two points. For example we have the entry (2 (study time), 30 (exam score)) and the entry (4, 50). This implies the slope equals (50-30) divided by (4-2), which equals 20/2 (= 10). For every additional hour you spend studying your exam score will increase by 10 point.

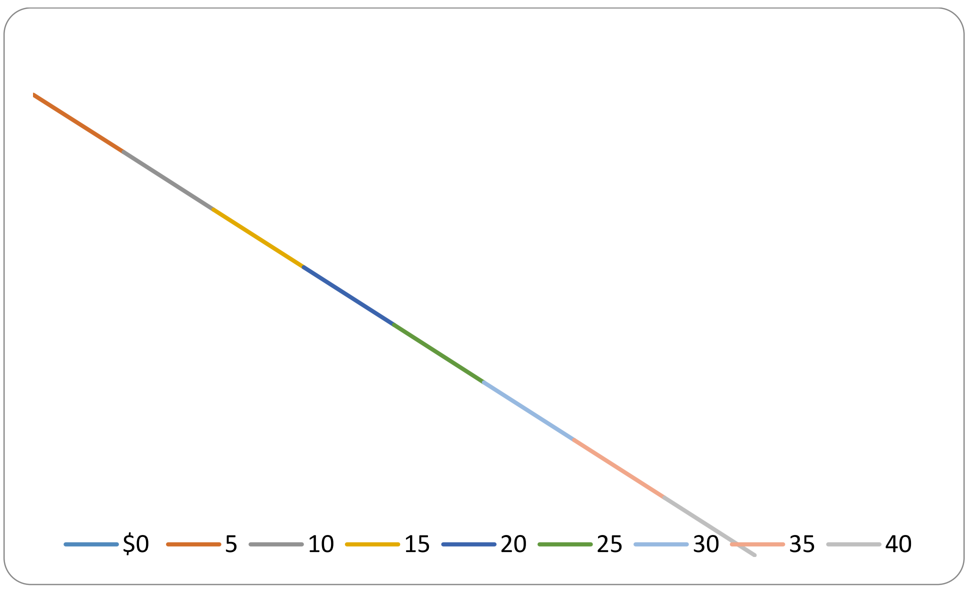
Thus, the equation representing this relationship is: Exam Score = 10 + 10 × Study Time

5. Suppose that when the interest rate on loans is 16 percent, businesses find it unprofitable to invest in machinery and equipment. However, when the interest rate is 14 percent, $5 billion worth of investment is profitable. At 12 percent interest, a total of $10 billion of investment is profitable. Similarly, total investment increases by $5 billion for each successive 2-percentage-point decline in the interest rate. Describe the relevant relationship between the interest rate and investment in a table, on a graph, and as an equation. Put the interest rate on the vertical axis and investment on the horizontal axis. In your equation use the form $i = a + bI$, where i is the interest rate, a is the vertical intercept, b is the slope of the line (which is negative), and I is the level of investment. **LOA1.1**

Answer:

Interest rate (in percent)	Amount of investment (billions of dollars)
16	$ 0
14	5
12	10
10	15
8	20
6	25
4	30
2	35
0	40

Equation: i = 16 - (2/5)I or I = 16 – (0.4)I



Feedback: Consider the following data as an example:
Suppose that when the interest rate on loans is 16 percent, businesses find it unprofitable to invest in machinery and equipment. However, when the interest rate is 14 percent, $5 billion worth of investment is profitable. At 12 percent interest, a total of $10 billion of investment is profitable. Similarly, total investment increases by $5 billion for each successive 2-percentage-point decline in the interest rate.

Interest rate (in percent)	**Amount of investment (billions of dollars)**
16	**$0**
14	**5**
12	**10**
10	**15**
8	**20**
6	**25**
4	**30**
2	**35**
0	**40**

When the interest rate is 16%, investment spending will be zero. When the interest rate is 14%, investment spending will be $5 billion. For each successive drop of 2 percentage points in the interest rate, investment spending will increase by $5 billion.

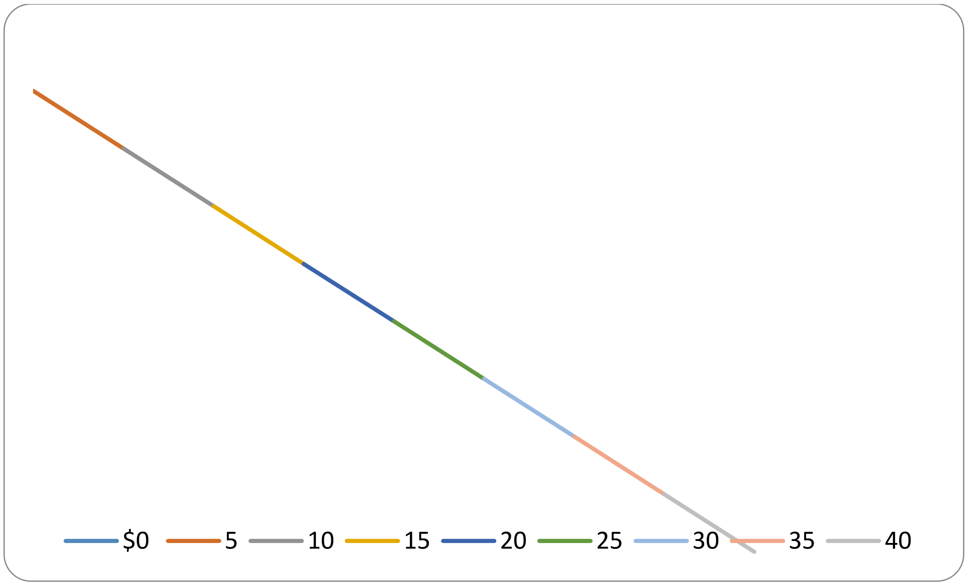
Using equation $i = a - bI$

$$i = 16 - [(16-14)/(5-0)] \times I$$

$$= 16 - \left(\frac{2}{5}\right) I$$

$$= 16 - 0.4I$$

Graphically we have the following relationship.



6. Suppose that $C = a + bY$, where C = consumption, a = consumption at zero income, b = slope, and Y = income. **LOA1.1**
a. Are C and Y positively related or are they negatively related?
b. If graphed, would the curve for this equation slope upward or slope downward?
c. Are the variables C and Y inversely related or directly related?
d. What is the value of C if a = 10, b = .50, and Y = 200?
e. What is the value of Y if C = 100, a = 10, and b = .25?

Answers: (a) positively related; (b) upward; (c) directly related; (d) C = 110; (e) Y = 360.

Feedback:

(a) C and Y are positively related because the slope, b, is positive by assumption. As individual income increases the individual will spend some of this additional income on consumption.

(b) The curve would slope upward because the slope is positive.

(c) C and Y are directly related because C and Y are positively related (move in the same direction).

(d) Consider the following values: If a = 10, b = .50, and Y = 200, then C = 110. If a = 10 and b = .50, then the consumption function takes the following form C = 10 + 0.50 x Y. If income equals 200, Y = 200, then consumption at this level of income equals C = 10 + 0.50 x 200 = 110.

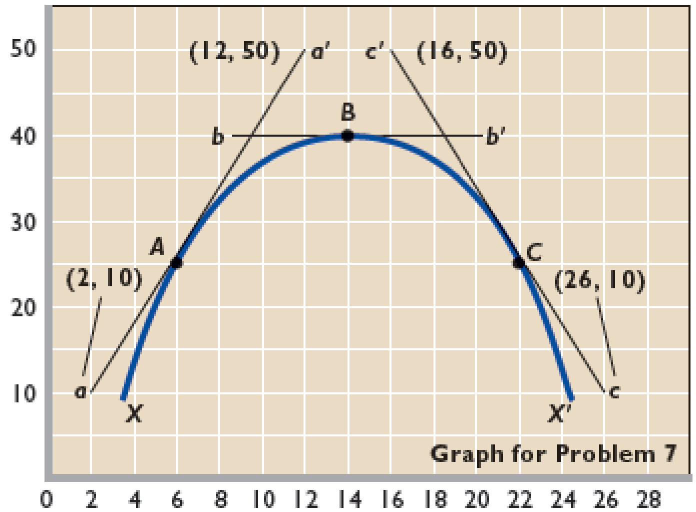
(e) Consider the following values: *Y* if *C* = 100, *a* = 10, and *b* = .25, then Y = 360. If *a* = 10 and *b* = .25, then the consumption function takes the following form C = 10 + 0.25 x Y. We can solve for Y as a function of C.

STEP 1: 0.25 x Y = C - 10

STEP 2: Y = (1/0.25) x C - (10/0.25) = 4 x C - 40

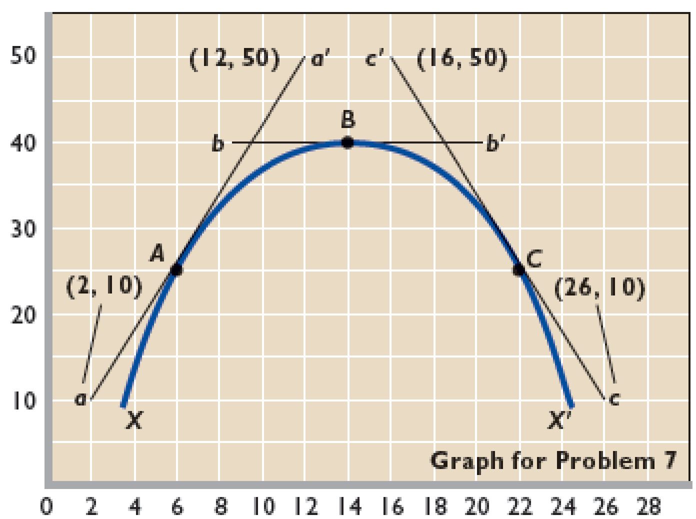
STEP 3: Substitute in the value of consumption given, *C* = 100. Y = 4 x 100 - 40 = 360.

7. The accompanying graph shows curve *XX*' and tangents at points *A*, *B*, and *C* . Calculate the slope of the curve at these three points. **LOA1.1**



Answer: Point A, slope = 4; Point B, slope = 0; Point C, slope = -4.

Feedback: Consider the following figure as an example:



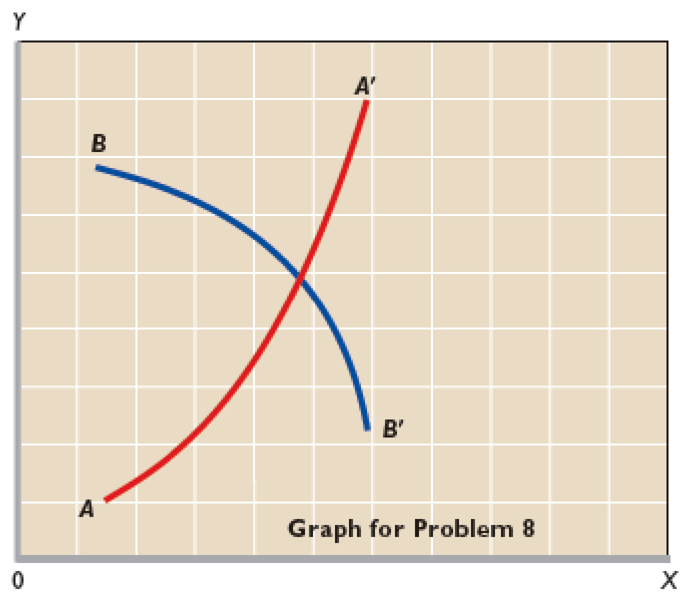
To calculate the slope of the function use the "rise-over-run" approach. The "rise" is the change in the variable on vertical axis as you move between entries (points) and the "run" is the change in the variable on the horizontal axis as you move between the SAME two entries (points).

Point A has a slope that equals 4. To see this we use the two entries (2,10) and (12,50). The "rise" equals 50 - 10 = 40. The "run" equals 12 - 2 = 10. To find the slope we use the rule "(rise/run)", which equals (40/10) = 4.

Point B has a slope equal to zero. There is no "rise" here, so we do not need coordinates to calculate this value.

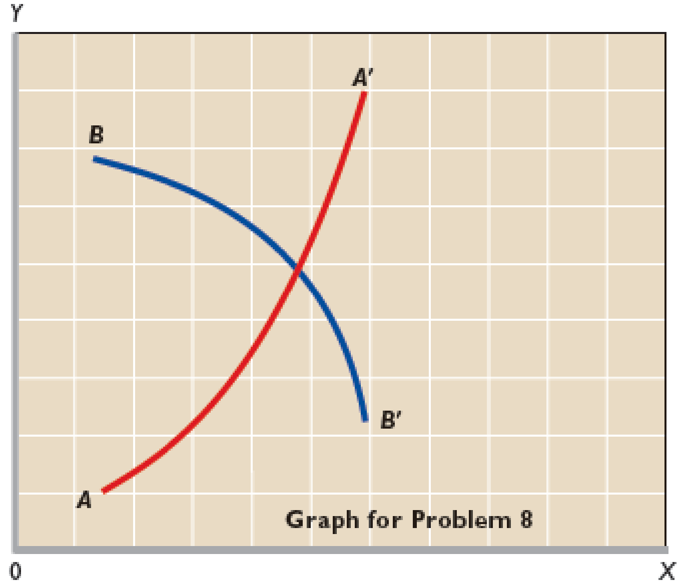
Point C has a slope that equals -4. To see this we use the two entries (16,50) and (26,10). The "rise" equals 10 - 50 = -40 (note that "rise" can be negative). The "run" equals 26 - 16 = 10. To find the slope we use the rule "(rise/run)", which equals (-40/10) = -4.

8. In the accompanying graph, is the slope of curve *AA*' positive or negative? Does the slope increase or decrease as we move along the curve from *A* to *A*'? Answer the same two questions for curve *BB*'. **LOA1.1**



Answer: Slope of *AA*' is positive; increases; Slope of *BB*' is negative; decreases.

Feedback: Consider the following figure:



Slope of *AA*' is positive (rising from left to right). The slope increases as we move from *A* to *A*'.

Slope of *BB*' is negative (dropping from left to right). The slope becomes more negative, thereby decreasing, as we move from B to B'.