Macroeconomics Canada in the Global Environment (Canadian) 11th edition Parkin Solutions Manual

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Chapter 1

WHAT IS ECONOMICS?

Answers to the Review Quizzes

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1. List some examples of the scarcity that you face.

Examples of scarcity common to students include not enough income to afford both tuition and a car, not enough learning capacity to study for both an economics exam and a chemistry exam in one night, and not enough time to allow for extensive studying and extensive socializing.

2. Find examples of scarcity in today's headlines.

Scarcity is our inability to satisfy all our wants. An example of scarcity is the headline on *www.cbc.ca* on March 30, 2020, which states "Farmers concerned about disruptions to spring seeding, livestock operations amid COVID-19." Farmers are preparing to plant their crops, and supply disruptions mean that farmers are unable to plant all the crops that they want. Farmers also want to hire foreign workers to help on livestock farms but a scarcity of foreign workers means that they can't hire the number of workers that they want. Farmers face scarcity.

3. Find an example of the distinction between microeconomics and macroeconomics in today's headlines.

Microeconomics: On March 30, 2020, a headline in *The Globe and Mail* was "For graduating students, high anxiety as COVID-19 decimates job market." This story covers a microeconomic topic because it discusses choices made by students and businesses, and how they interact in the labour market.

Macroeconomics: On March 30, 2020, a headline in *The Globe and Mail* was "Canadian dollar weakens over 1 per cent as oil prices slide." This story covers a macroeconomic topic because it concerns the effect of performances of the Canadian and world economy on the Canadian dollar.

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1. Describe the broad facts about *what*, *how*, and *for whom* goods and services are produced.

What we produce varies over time. In Canada today, services account for 70 percent of production, manufactured goods for 28 percent, and agriculture for 2 percent. *What* we produce also varies over countries. Agriculture and manufacturing are small percentages of production in rich countries and large percentages of production in poorer countries.

How goods and services are produced is by businesses determining how the factors of production, land, labour, capital, and entrepreneurship, are combined to make the goods and services we consume. Land includes all natural resources, both renewable natural resources such as wood, and nonrenewable natural resources such as natural gas. The quality of labour depends on human capital. In Canada in 2020, 28 percent of the adult population had a

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university degree, a further 37.6 percent had some post-secondary education, and 95.7 percent had completed high school.

For whom goods and services are produced depends on the incomes that people earn. People with large incomes can buy a wide range of goods and services. People with small incomes can afford a smaller range of goods and services.

2. Use headlines from the recent news to illustrate the potential for conflict between self-interest and the social interest.

One example of an issue that illustrates the potential for conflict between self-interest and the social interest is the proposed Trans Mountain Pipeline. In the *Financial Post* on January 20, 2020, the headline "Supreme Court dismisses B.C. case against Trans Mountain Pipeline" appears. The potential for conflict exists between the self-interest of the potential workers whose employment is being delayed or possibly eliminated and the social interest of those concerned about the environment.

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1. Explain the idea of a tradeoff and think of three tradeoffs that you have made today.

A tradeoff is an exchange—giving up one thing to get something else. What is given up is the opportunity cost of whatever is obtained. Three examples of tradeoffs are: a) When a student sleeps in rather than attending his early morning economics class, the student trades additional sleep for study time. The opportunity cost of the decision is the difference between the A and the C he receives on the exam. b) When a student running late for class parks her car illegally, the student trades saving time for the risk of a ticket. The potential opportunity cost of the decision is the goods and services that cannot be purchased if the student receives an expensive parking ticket. c) A student trades higher income by spending time during the day working at a part-time job for less time spent at leisure. The opportunity cost of the higher income is the leisure time given up.

2. Explain what economists mean by rational choice and think of three choices that you've made today that are rational.

A rational choice is one that compares the costs and benefits and achieves the greatest benefit over cost for the person making the choice. Three rational choices are: a) The choice to skip breakfast to go to class. In this case the benefit is the higher grade in the class and the cost is the breakfast forgone. b) The choice to stop talking with a friend on the phone and start studying for an impending exam. In this case the benefit is the resulting higher grade in the class and the cost is the conversation forgone. c) The choice to do laundry today rather than watch television. In this case the benefit is clean clothes to wear and the cost is the loss of the entertainment the television show would have provided.

3. Explain why opportunity cost is the best forgone alternative and provide examples of some opportunity costs that you have faced today.

When a decision to undertake one activity is made, often many alternative activities are no longer possible. Often these activities are mutually exclusive so only the highest-valued alternative is actually forgone. For instance, the decision to go to a student's 8:30 AM class eliminates the possibility of sleeping in during the hour and of jogging during the hour. But in this case, it is impossible to *both* sleep in and to jog during the hour, so the opportunity cost of attending class cannot be both activities. The opportunity cost of attending class is *only* the activity that otherwise would have been chosen—*either* sleeping in *or* jogging—whatever activity is the most highly valued of the forgone alternatives.

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4. **Explain what it means to choose at the margin and illustrate with three choices at the margin that you have made today.**

   Choosing at the margin means choosing to do a little more or a little less of some activity. Three examples are: a) When a student faces a chemistry and an economics final exam in one day, the student must determine whether spending the last hour studying a little more chemistry or a little more economics will yield a better contribution (marginal benefit) to his overall GPA. b) A student buying a computer must decide whether the marginal benefit of adding 1 GB of additional memory is worth the marginal cost of the additional memory. c) A student football fan with a choice of a cheap seat in the student bleachers located at the far end of the playing field or a more expensive seat located on the 30 yard line must determine whether the marginal benefit of watching the game in a better seat is worth the marginal cost of the higher ticket price.

5. **Explain why choices respond to incentives and think of three incentives to which you have responded today.**

   People making rational decisions compare the marginal benefit of an action to its marginal cost. A person's choice changes when the incentive—the marginal benefit or the marginal cost changes. Examples of incentives are: a) A student studies because of the incentives offered by grades. b) A student is more likely to attend a class if attendance is factored into the grade. c) A student might attend a meeting of a club if the student's significant other is eager to attend the meeting.

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1. **Distinguish between a positive statement and a normative statement and provide examples.**

   A *positive* statement is about what *is*. It is testable. A *normative* statement is about what *ought to be*. It is not testable because there is no universally approved criterion by which the statement can be judged. "I will receive an A for this course," is a positive statement made by an economics student—it might not be true, but it is testable. "I will receive a good grade for this course," is a normative statement. Whether someone agrees with it depends on his interpretation of what makes for a "good" grade.

2. **What is a model? Can you think of a model that you might use in your everyday life?**

   A *model* is a description of some aspect of the world. An economic model is a description of some aspect of the economic world that includes only those features that are needed for the purpose at hand. An example of a model is a GPS map. It reflects only those aspects of the real world that are relevant to the user in reaching her destination and avoids information irrelevant to travel.

3. **How do economists try to disentangle cause and effect?**

   Economists disentangle cause and effect by using natural experiments (situations in the ordinary course of economic life in which the one factor of interest is different and other things are equal or similar); conducting statistical investigations to find correlations; and performing economic experiments by putting people in decision-making situations and varying the influence of one factor at a time to discover how they respond.

4. **How is economics used as a policy tool?**

   Individuals, businesses, and governments use economics as a policy tool. Individuals use the economic ideas of marginal benefit and marginal cost when making decisions for such topics as attending university, paying cash or credit for a purchase, and working. Businesses also

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use the concepts of marginal benefit and marginal cost when making decisions about what to produce, how to produce, and how many hours to stay open. Governments use marginal benefit and marginal cost when deciding issues such as the level of property taxes, the amount to fund higher education, or the level of a tariff on EU imports.

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1. What types of jobs do economists do?

Economists do jobs that require the collection and analysis of data on the production and use of resources. They work at jobs that require the ability to predict future trends. Economists are also in jobs that study to determine ways of using resources more efficiently.

Three common jobs that hire economists are market research analyst, financial analyst, and budget analyst.

A market research analyst works with data on buying patterns to forecast the likely success of a product and the price consumers are willing to pay for it.

A financial analyst studies trends and fluctuations in interest rates and stock and bond prices and tries to predict the cost of borrowing and the returns on investments.

A budget analyst keeps track of an organization's cash flow and prepares budget plans that incorporate predictions of future cash flows.

2. What is the range and median level of economists' pay?

The Web resource payscale.com reports a pay range for economists of all types from $60,675 to $127,500, with a median of $91,210.

3. What are the skills needed for an economics job?

The five most important skill requirements for an economics job are critical-thinking skills, analytical skills, math skills, writing skills, and oral communication skills.

Critical-thinking skills are the ability to clarify and solve problems using logic and relevant evidence.

Analytical skills are the use of economic ideas and tools to examine data, notice patterns, and reach a logical conclusion.

Math skills are the ability to use mathematical and statistical tools to analyze data and reach valid conclusions.

Writing skills are the ability to present ideas, conclusions, and reasons in succinct written reports appropriate for the target audience.

Oral communication skills are the ability to explain ideas, conclusions, and reasons to people with a limited background in economics.

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Answers to the Study Plan Problems and Applications

1. Apple Inc. decides to make iTunes freely available in unlimited quantities.

a. Does Apple's decision change the incentives that people face?

Apple's decision changes people's incentives. For example, it increases the incentive to buy an iPhone to take advantage of the newly "free" music available on iTunes.

b. Is Apple's decision an example of a microeconomic or a macroeconomic issue?

Apple's decision is a microeconomic issue because it affects a single company and a single market.

2. Which of the following pairs does not match?

a. Labour and wages

Labour earns wages, so this pair matches.

b. Land and rent

Land earns rent, so this pair matches.

c. Entrepreneurship and profit

Entrepreneurship earns profit, so this pair matches.

d. Capital and profit

Capital earns interest, so this pair does *not* match.

3. Explain how the following news headlines concern self-interest and the social interest.

a. Walmart Builds 500 New Stores in China

Walmart's expansion is a decision made by Walmart to further Walmart's interest. The decision is directly in Walmart's self-interest because Walmart's total revenue will increase. The social interest is affected because it gives the Chinese consumers more shopping options.

b. Amazon Will Deliver Groceries For Free

Amazon's decision to deliver groceries for free is a decision made by Amazon to further Amazon's interest. The decision is directly in Amazon's self-interest because more people will order from Amazon than from other online firms who do not offer free delivery. The social interest is affected because people will spend less time waiting in lines at grocery stores.

c. Food Must Be Labelled with Nutrition Data

The decision to require that food be labelled with nutrition information is made in the social interest. This decision is not made by any one single firm and so does not (necessarily) reflect anyone's self-interest.

4. The night before an economics test, you decide to go to the movies instead of staying home and working your MyLab Study Plan. Your grade on the test was 50 percent, lower than your usual 70 percent.

a. Did you face a tradeoff?

Yes, you faced a tradeoff. The tradeoff was between a higher test score and an evening with your friends at the movies.

b. What was the opportunity cost of your evening at the movies?

The opportunity cost of going to the movies is the fall in your grade. That is the 20 points forgone from choosing to see the movie rather than study.

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5. Olympics Could Cost More Than $26 Billion

Japanese media estimate that overall spending on Japan's new venues, including an expensive national stadium and athletes' village, is between $26 billion and $28 billion.

Source: *Los Angeles Times*, December 20, 2019

What is the opportunity cost of hosting the 2020 Olympics? Explain your answer.

The opportunity cost of something is the highest-valued alternative that we give up to get it. Japan spent $28 billion to host the Olympics in Tokyo. The opportunity cost of hosting the 2020 Olympics is not $28 billion, but the goods and services that would have been purchased with $28 billion if the money had not been spent on hosting the 2020 Olympics.

6. Which of the following statements is positive, which is normative, and which can be tested?

a. Canada should cut its imports.

The statement is normative and cannot be tested.

b. China is Canada's largest trading partner.

The statement is positive and can be tested.

c. If the price of gasoline rises, people will drive less and use less gasoline.

The statement is positive and can be tested.

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Answers to Additional Problems and Applications

7. **Swifties, Rejoice! Taylor Swift Will Perform a Free JamFest Concert in Atlanta**

Calm down, Swifties! Taylor Swift will headline a free concert at the Capital One JamFest, April 5!

Source: *USA Today*, November 8, 2019

When Taylor Swift performs at JamFest, what is free and what is scarce? Explain your answer.

The seats in the concert venue are scarce—there are only a limited number available. Also scarce is the time the enthusiastic fans spend at the concert. If the fans who obtain passes attend the concert rather than sell their "free" passes, they incur the opportunity cost of the forgone pass price. So the concert is *not* "free" for the concert-goers. The publicity that Taylor Swift receives is free to her but the publicity used reporters' scarce time to report on the event rather than reporting on other news worthy events.

8. **How does the creation of a successful movie influence *what*, *how*, and *for whom* goods and services are produced?**

The "what" question is influenced in two ways. First, one good or service that is produced is the successful movie. Second, spinoffs or similar films likely will be created in the future. The "how" question is influenced because movies use different production methods. Some movies, for example, have a lot of special effects while other movies have few or none. The "for whom" question is influenced because those people who, as the result of the blockbuster movie, have higher incomes have more goods and services produced for them.

9. **How does a successful movie illustrate self-interested choices that are also in the social interest?**

A successful movie increases the income of the people involved with the movie production. The choices of these people are driven largely by self-interest. The creation of a successful movie also increases the quantity of widely enjoyed entertainment. The amount of entertainment available in the economy increases, which benefits society. So the choices the people made in their self-interest are also in the social interest.

10. **Before starring in *Guardians of the Galaxy*, Chris Pratt had appeared in 11 movies that grossed an average of $7 million on the opening weekend. *Guardians of the Galaxy* grossed $94 million.**

a. **How will the success of *Guardians of the Galaxy* influence the opportunity cost of hiring Chris Pratt?**

The opportunity cost of something is the highest-valued alternative that must be given up to get it.

Based on the success of *Guardians of the Galaxy*, Chris Pratt will now require a higher salary to star in a movie. The extra money that is paid to Chris Pratt could have been used to hire other actors or to film more on location. The best alternative that is forgone because Chris Pratt is paid more money is the opportunity cost of hiring him.

b. **How have the incentives for a movie producer to hire Chris Pratt changed?**

Because Chris Pratt is now a proven actor who can draw in large first-weekend box office revenues, movie producers have a greater incentive to hire him. Since *Guardians of the Galaxy* was a hit, it is probable that Chris Pratt's future films will also be hits.

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11. What might be an incentive for you to take a class in summer school? List some of the benefits and costs involved in your decision. Would your choice be rational?

Early graduation, smaller class sizes, and retaining eligibility for a scholarship are examples of incentives that encourage taking summer classes. The benefits of taking summer classes might include more personal attention from the instructor and increased knowledge about some aspect of the world. Costs include forgone summer jobs or internships, less time to spend with friends, and additional tuition and other class-related expenses. The choice is rational if the student achieves the greatest benefit over cost.

12. Look at today's *National Post.* What is the leading economic news story? With which of the big economic questions does it deal and what tradeoffs does it discuss or imply?

On March 19, 2020, a top economic news story discussed was "Bacardi Helps Produce Hand Sanitizer With Change in Production". This news stories answers the following questions:
What goods and services are produced? The news story deals with the production of hand sanitizer by Bacardi.
How are goods and services produced? The news story describes how 1.7 million bottles of 10-ounce hand sanitizer will be produced using raw materials provided by Bacardi.
A tradeoff is giving up one thing to get something else. When Bacardi uses alcohol to produce hand sanitizer, it produces less rum.

13. Provide two microeconomic statements and two macroeconomic statements. Classify your statements as positive or normative. Explain why.

Microeconomic statements are: Fewer deep water oil wells should be drilled off the B.C. coast. If less oil is produced, the price of oil will rise. The first statement is normative because it relies on what the person thinks "should" be done. The second statement is positive because it is possible to test the effect of less oil being produced.
Macroeconomic statements are: The current unemployment rate is too high. The current unemployment rate is higher for men than for women. The first statement is normative because it depends on what is deemed "too high." The second statement is positive because it can be checked to determine its validity.

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Answers to the Appendix Review Quiz

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1. Explain how we "read" the graphs in Figs. A1.1 and A1.2.

The points in the graphs relate the quantity of the variable measured on the one axis to the quantity of the variable measured on the other axis. The quantity of the variable measured on the horizontal axis (the *x*-axis) is measured by the horizontal distance from the *y*-axis to the point. The quantity of the variable measured on the vertical axis (the *y*-axis) is measured by the vertical distance from the *x*-axis to the point. The point relates these two quantities. For example, in Figure A1.2a, point *A* shows that at a price of $9.11 a ticket, 1.2 billion movie tickets are sold.

2. Explain what scatter diagrams show and why we use them.

A scatter diagram is a graph that plots the value of one variable against the value of another variable for a number of different values of each variable. We use scatter diagrams because they quickly reveal if a relationship exists between the two variables.

3. Explain how we "read" the three scatter diagrams in Figs. A1.3 and A1.4.

The scatter diagram in Figure A1.3 shows the relationship between production budgets and worldwide box office revenues for ten popular movies. The figure shows no tendency for a larger production budget to bring a greater box office revenue.

The scatter diagram in Figure A1.4a shows the relationship between income measured in thousands of dollars per year, and expenditure measured in thousands of dollars per year, for the years 2008 to 2018. The scatter diagram shows that higher income leads to higher expenditure. The figure also shows this is a close relationship.

The scatter diagram in Figure A1.4b shows the relationship between the unemployment rate and the inflation rate for the years 2009 to 2019. The figure shows that for most of the years, the relationship between inflation and unemployment is weak.

4. Draw a graph to show the relationship between two variables that move in the same direction.

A graph that shows the relationship between two variables that move in the same direction is shown by a line that slopes upward.

5. Draw a graph to show the relationship between two variables that move in opposite directions.

A graph that shows the relationship between two variables that move in opposite directions is shown by a line that slopes downward.

6. Draw a graph of two variables whose relationship shows (a) a maximum and (b) a minimum.

A graph that shows the relationship between two variables that have a maximum is shown by a curve that starts out sloping upward, reaches a maximum, and then slopes downward.
A graph that shows the relationship between two variables that have a minimum is shown by a curve that starts out sloping downward, reaches a minimum, and then slopes upward.

7. Which of the relationships in Questions 4 and 5 is a positive relationship and which is a negative relationship?

The relationship in Question 4 between the two variables that move in the same direction is a positive relationship. The relationship in Question 5 between the two variables that move in opposite directions is a negative relationship.

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8. What are the two ways of calculating the slope of a curved line?

To calculate the slope of a curved line we can calculate the slope at a point or across an arc. The slope of a curved line at a point on the line is defined as the slope of the straight line tangent to the curved line at that point. The slope of a curved line across an arc—between two points on the curved line—equals the slope of the straight line between the two points.

9. How do we graph a relationship among more than two variables?

To graph a relationship among more than two variables, hold constant the values of all the variables except two. Then plot the value of one of the variables against the other variable.

10. Explain what change will bring a *movement along* a curve.

A movement along a curve occurs when the value of a variable measured on one of the axes changes while all of the other relevant variables not graphed on the axes do not change.

11. Explain what change will bring a *shift* of a curve.

A curve shifts when there is a change in the value of a relevant variable that is not graphed on the axes.

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Answers to the Appendix Study Plan Problems and Applications

Use the spreadsheet to work Problems 1 to 3. The spreadsheet provides the economic data: Column A is the year, column B is the inflation rate, column C is the interest rate, column D is the growth rate, and column E is the unemployment rate.

	A	B	C	D	E
1	2009	0.3	0.7	-2.9	8.3
2	2010	1.8	0.9	3.1	8.0
3	2011	2.9	1.3	3.1	7.4
4	2012	1.5	1.3	1.8	7.3
5	2013	0.9	1.3	2.3	7.1
6	2014	1.4	1.3	2.9	6.9
7	2015	1.6	0.9	0.7	6.9
8	2016	1.5	0.8	1.0	7.0
9	2017	1.8	1.0	3.2	5.8
10	2018	2.0	1.7	2.0	5.7
11	2019	2.1	2.0	1.6	5.6

1. Draw a scatter diagram of the inflation rate and the interest rate. Describe the relationship.

To make a scatter diagram of the inflation rate and the interest rate, plot the interest rate on the *x*-axis and the inflation rate on the *y*-axis. The graph will be a set of dots. The pattern made by the dots shows a weak positive relationship.

2. Draw a scatter diagram of the growth rate and the unemployment rate. Describe the relationship.

To make a scatter diagram of the growth rate and the unemployment rate, plot the growth rate on the *x*-axis and the unemployment rate on the *y*-axis. The graph will be a set of dots. The pattern made by the dots shows that when the growth rate increases, the unemployment rate usually decreases so there is a negative relationship.

3. Draw a scatter diagram of the interest rate and the unemployment rate. Describe the relationship.

To make a scatter diagram of the interest rate and the unemployment rate, plot the interest rate on the *x*-axis and the unemployment rate on the *y*-axis. The graph will be a set of dots. The pattern made by the dots tells us that when the interest rate increases, the unemployment rate usually decreases so there is a negative relationship.

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Use the following news clip to work Problems 4 to 6.

***Star Wars* Tops the Box Office**

Movie	Theatres (number)	Revenue (dollars per theatre)
Star Wars: Episode IX- The Rise of Skywalker	4,406	$7,835
Jumanji: The Next Level	4,134	$6,344
Little Women	3,308	$4,114
Frozen II	3,175	$3,733

Source:
boxofficemojo.com

Data for weekend of January 3-5, 2020

4. Draw a graph of the relationship between the revenue per theatre on the *y*-axis and the number of theatres on the *x*-axis. Describe the relationship.

The graph shows a positive relationship.

5. Calculate the slope of the relationship in Problem 4 between 3,308 and 4,134 theatres.

The slope equals the change in revenue per theatre divided by the change in the number of theatres. The slope equals ($6,344 – $4,114)/(4,134 – 3,308), which equals $2.70 per theatre.

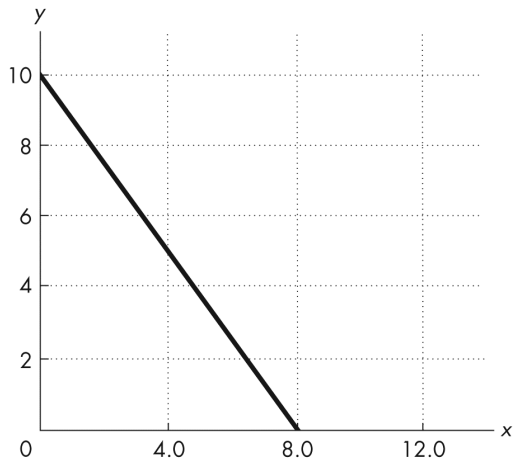
6. Calculate the slope of the relationship in Problem 4 between 3,175 and 4,406 theatres.

The slope equals the change in revenue per theatre divided by the change in the number of theatres. The slope equals ($7,835 – $3,733)/(4,406 – 3,175), which equals $3.33 per theatre.

7. Calculate the slope of the relationship shown in Figure A1.1.

The slope is –5/4. The curve is a straight line, so its slope is the same at all points on the curve. Slope equals the change in the variable measured on the *y*-axis divided by the change in the variable measured on the *x*-axis. To calculate the slope, select two points on the line. One point is at 10 on the *y*-axis and 0 on the *x*-axis, and another is at 8 on the *x*-axis and 0 on the *y*-axis. The change in *y* from 10 to 0 is associated with the change in *x* from 0 to 8. The slope of the curve equals –10/8, which equals –5/4.

FIGURE **A1.1**
Problem 7

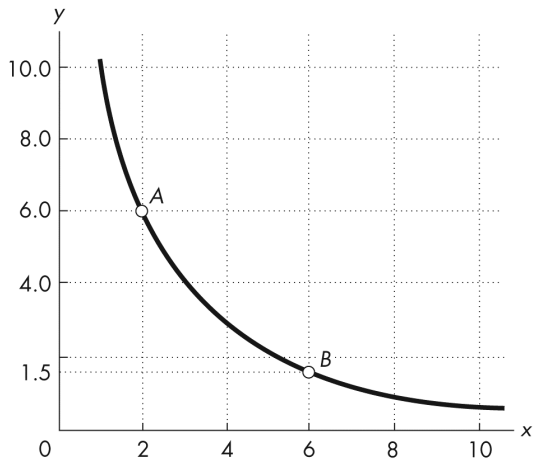


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Use the relationship shown in Figure A1.2 to work Problems 8 and 9.

FIGURE **A1.2**
Problems 8 and 9



8. Calculate the slope of the relationship at point *A* and at point *B*.

The slope at point *A* is –2, and the slope at point *B* is –0.25. To calculate the slope at a point on a curved line, draw the tangent to the curved line at the point. Then find a second point on the tangent and calculate the slope of the tangent.

The tangent at point *A* cuts the *y*-axis at 10. The slope of the tangent equals the change in *y* divided by the change in *x*. The change in *y* equals –4 (6 minus 10) and the change in *x* equals 2 (2 minus 0). The slope at point *A* is –4/2, which equals –2.

The tangent at point *B* goes through the point (4,2). The change in *y* equals –0.5, and the change in *x* equals 2. The slope at point *B* is –0.25.

9. Calculate the slope across the arc *AB*.

The slope across the arc *AB* is –1.125. The slope across the arc *AB* equals the change in *y*, which is 4.5 (6.0 minus 1.5) divided by the change in *x*, which equals –4 (2 minus 6). The slope across the arc *AB* equals 4.5/–4, which is –1.125.

Use the table to work Problems 10 and 11. The table gives the price of a balloon ride, the temperature, and the number of rides a day.

Price (dollars per ride)	Balloon rides (number per day)		
	10°C	20° C	30° C
5	32	40	50
10	27	32	40
15	18	27	32

10. Draw a graph to show the relationship between the price and the number of rides, when temperature is 20°C. Describe this relationship.

The graph plots the price on the y-axis and the number of rides on the *x*-axis using the number of balloon rides in the column of the table labelled 20°C. The relationship between the price and the number of rides is negative. As the price rises, the number of rides decreases.

11. What happens in the graph in Problem 10 if the temperature rises to 30°C?

If the temperature rises to 30°C, the curve shifts rightward. At every price, more balloon rides are taken when the temperature is 30°C rather than 20°C.

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Answers to Appendix Additional Problems and Applications

Use the spreadsheet to work Problems 12 to 14. The spreadsheet provides data on oil and gasoline: Column A is the year, column B is the price of oil (dollars per barrel), column C is the price of gasoline (cents per litre), column D is oil production, and column E is the quantity of gasoline refined (both in millions of barrels per day).

	A	B	C	D	E
1	2009	66	92	5.4	14.8
2	2010	79	102	5.5	15.2
3	2011	95	124	5.6	15.1
4	2012	94	127	6.5	15.5
5	2013	98	128	7.5	15.2
6	2014	93	128	8.8	15.5
7	2015	51	106	9.4	16.6
8	2016	43	101	8.9	16.4
9	2017	53	113	9.8	16.9
10	2018	68	127	9.9	17.7
11	2019	62	117	9.9	17.4

12. Draw a scatter diagram of the price of oil and the quantity of oil produced. Describe the relationship.

The scatter diagram between the price of oil and the quantity of oil produced shows no relationship.

13. Draw a scatter diagram of the price of gasoline and the quantity of gasoline refined. Describe the relationship.

The scatter diagram between the price of gasoline and the quantity of gasoline refined shows a weak positive relationship.

14. Draw a scatter diagram of the quantity of oil produced and the quantity of gasoline refined. Describe the relationship.

The scatter diagram between the quantity of oil produced and the quantity of gasoline refined shows a positive relationship.

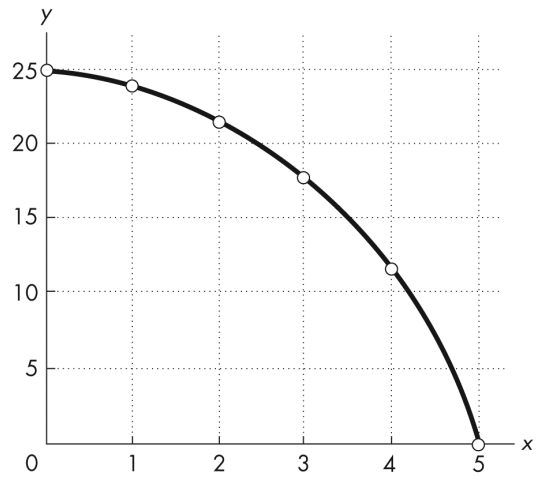
Use the following data to work Problems 15 to 17.

x	0	1	2	3	4	5
y	25	24	22	18	12	0

Draw a graph that shows the relationship between the two variables *x* and *y*.

To make a graph that shows the relationship between *x* and *y*, plot the *x*-variable on the *x*-axis and the *y*-variable on the *y*-axis. The graph is shown in Figure A1.3.

FIGURE **A1.3**
Problems 15, 16, and 17



15. a. Is the relationship positive or negative?

The relationship is negative because *x* and *y* move in opposite directions: As *x* increases, *y* decreases.

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b. Does the slope of the relationship become steeper or flatter as the value of *x* increases?

The slope becomes steeper as *x* increases.

c. Think of some economic relationships that might be similar to this one.

The less expensive a good, the greater is the number of people who buy it. The higher the interest rate, the smaller is the number of people who take out home mortgages. The less expensive gasoline, the greater the miles car owners drive.

16. Calculate the slope of the relationship between *x* and *y* when *x* equals 3.

The slope equals –4. The slope of the curve at the point where *x* is 3 is equal to the slope of the tangent to the curve at that point. Draw the tangent line at the point in Figure A1.3 where *x* is 3 and *y* is 18. Now calculate the slope of this tangent line by finding another point on the tangent. When *x* equals 5, *y* equals 10 on the tangent, so another point is *x* equals 5 and *y* equals 10. The slope equals the change in *y*, –8, divided by the change in *x*, 2, so the slope is –4.

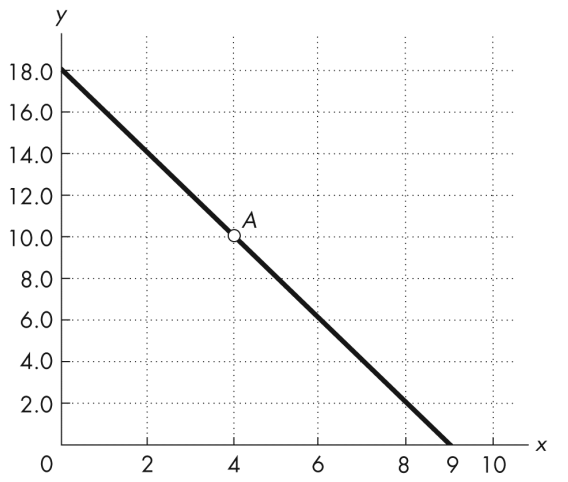
17. Calculate the slope of the relationship across the arc as *x* increases from 4 to 5.

The slope is –12. The slope of the relationship across the arc when *x* increases from 4 to 5 is equal to the slope of the straight line joining the points on the curve at *x* equals 4 and *x* equals 5. When *x* increases from 4 to 5, *y* falls from 12 to 0. The slope equals the change in *y*, –12 (0 minus 12), divided by the change in *x*, 1 (5 minus 4), so the slope across the arc is –12.

18. Calculate the slope of the curve in Figure A1.4 at point *A*.

The slope is –2. The curve is a straight line, so its slope is the same at all points on the curve. Slope equals the change in the variable measured on the *y*-axis divided by the change in the variable measured on the *x*-axis. To calculate the slope, select two points on the line. One point is at 18 on the *y*-axis and 0 on the *x*-axis, and another is at 9 on the *x*-axis and 0 on the *y*-axis. The change in *y* from 18 to 0 is associated with the change in *x* from 0 to 9. Therefore the slope of the curve is –18/9, which equals –2.

FIGURE **A1.4**
Problem 18



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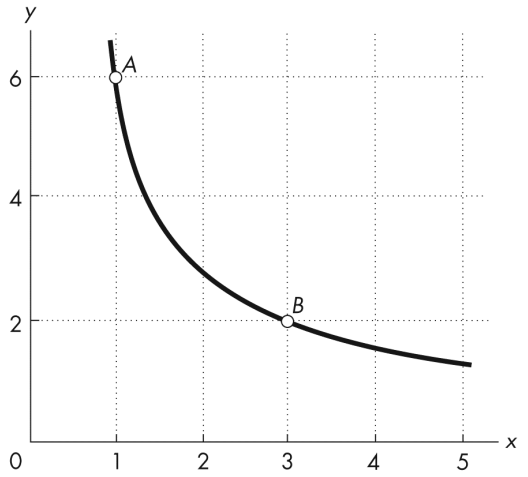
Use Figure A1.5 to work Problems 19 and 20.

19. Calculate the slope at point *A* and at point *B*.

The slope at point *A* is –4, and the slope at point *B* is –1. To calculate the slope at a point on a curved line, draw the tangent to the line at the point. Then find a second point on the tangent and calculate the slope of the tangent.

The tangent at point *A* cuts the *x*-axis at 2.5. The slope of the tangent equals the change in *y* divided by the change in *x*. The change in *y* equals 6 (6 minus 0) and the change in *x* equals –1.5 (1 minus 2.5). The slope at point *A* is 6/–1.5, which equals –4. Similarly, the slope at point *B* is –1. The tangent at point *B* cuts the *y*-axis at 5. The change in *y* equals 3, and the change in *x* equals –3.

FIGURE **A1.5**
Problems 19 and 20



20. Calculate the slope across the arc *AB*.

The slope across the arc *AB* is –2. The slope across the arc *AB* equals the change in *y*, which is 4 (6 minus 2) divided by the change in *x*, which equals –2 (1 minus 3). The slope across the arc *AB* is 4/–2, which equals –2.

Use the following table to work Problems 21 to 23.

The table gives information about umbrellas: price, the number purchased, and rainfall in millimeters (mms).

Price (dollars per umbrella)	Umbrellas (number purchased per day)		
	0 mm	200 mm	400 mm
20	4	7	8
30	2	4	7
40	1	2	4

21. Draw a graph to show the relationship between the price and the number of umbrellas purchased, holding the amount of rainfall constant at 200 mm. Describe this relationship.

To draw a graph of the relationship between the price and the number of umbrellas when the rainfall equals 200 mm, keep the rainfall at 200 mm and plot the data in that column against the price. The relationship between the price and the number of umbrellas is a negative relationship.

22. What happens in the graph in Problem 21 if the price rises and rainfall is constant?

If the price rises, the number of umbrellas decreases. There is a movement upward along the (unchanged) curve.

23. What happens in the graph in Problem 21 if the rainfall increases from 200 mm to 400 mm?

The curve when the rainfall is 400 mm lies to the right of the curve when the rainfall is 200 mm showing that at every price, more umbrellas are purchased when the rainfall is 400 mm than when the rainfall is 200 mm.

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