Chapter 8

Jerry has $12 a week to spend on yogurt and berries. The price of yogurt is $2, and berries are $4 a box.

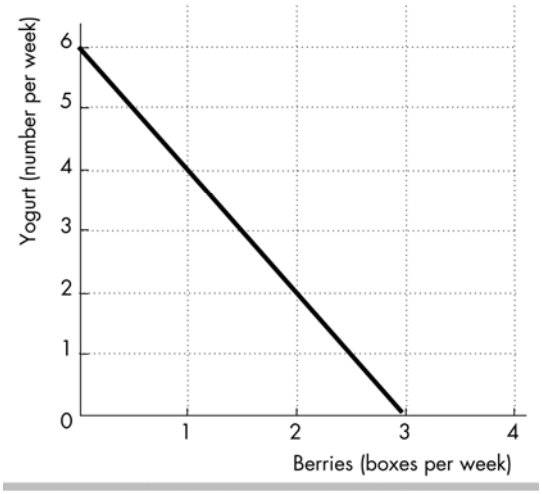
1. List the combinations of yogurt and berries that Jerry can afford. Draw a graph of Jerry's budget line with the quantity of berries plotted on the *x*-axis.

   Jerry can buy 6 yogurts and 0 boxes of berries; 4 yogurts and 1 box of berries; 2 yogurts and 2 boxes of berries; and, 0 yogurts and 3 boxes of berries. Figure 8.1 shows Jerry's budget line.

2. How do Jerry's consumption possibilities change if, other things remaining the same, (i) the price of berries falls and (ii) Jerry's income increases.

   (i) If the price of a box of berries falls, Jerry's consumption possibilities increase. His budget line rotates outward around the unchanged vertical intercept, which shows the (unchanged) maximum quantity of yogurt Jerry can buy.
   (ii) If Jerry's income increases, Jerry's consumption possibilities increase. His budget line shifts outward and its slope does not change.

FIGURE **8.1**
Problem 1



Use the following data to work Problems 3 to 9. Max has $35 a day to spend on windsurfing and snorkeling and he can spend as much time as he likes doing them. The price of renting equipment for windsurfing is $10 an hour and for snorkeling is $5 an hour. The table shows the total utility Max gets from each activity.

Hours per day	Total utility from windsurfing	Total utility from snorkeling
1	120	40
2	220	76
3	300	106
4	360	128
5	396	140
6	412	150
7	422	158

3. Calculate Max's marginal utility from windsurfing at each number of hours per day. Does Max's marginal utility from windsurfing obey the principle of diminishing marginal utility?

   Max's marginal utility from windsurfing 1 hour per day is 120; from windsurfing 2 hours per day is 100; from windsurfing 3 hours per day is 80; from windsurfing 4 hours per day is 60; from windsurfing 5 hours per day is 36; from windsurfing 6 hours per day is 16; and, from windsurfing 7 hours per day is 10. Max's marginal utility from windsurfing obeys the principle of diminishing marginal utility because it decreases as consumption increases.

4. Calculate Max's marginal utility from snorkeling at each number of hours per day. Does Max's marginal utility from snorkeling obey the principle of diminishing marginal utility?

   Max's marginal utility from snorkeling 1 hour per day is 40; from 2 hours per day is 36; from snorkeling 3 hours per day is 30; from snorkeling 4 hours per day is 22; from snorkeling 5 hours per day is 12; from snorkeling 6 hours per day is 10; and, from snorkeling 7 hours per day is 8. Max's marginal utility from snorkeling obeys the principle of diminishing marginal utility because it decreases as consumption increases.

5. Which does Max enjoy more: his 6th hour of windsurfing or his 6th hour of snorkeling?

   Max's marginal utility from his 6th hour of windsurfing is 16 and his marginal utility from his 6th hour of snorkeling is 10. Max enjoys his 6th hour of windsurfing more than his 6th hour of snorkeling.

6. Make a table of the combinations of hours spent windsurfing and snorkeling that Max can afford.

   The table is to the right. The first and third columns show the combinations of windsurfing and snorkeling Max can afford.

7. Add two columns to your table in Problem 6 and list Max's marginal utility per dollar from windsurfing and from snorkeling.

   The columns are in the table, in the second and fourth columns.

Hours windsurfing	Marginal utility per dollar from windsurfing	Hours snorkeling	Marginal utility per dollar from snorkeling
3	8.0	1	8.0
2	10.0	3	6.0
1	12.0	5	2.4
0		7	1.6

8. a. To maximize his utility, how many hours a day does Max spend on each activity?

   To maximize his utility, Max windsurfs for 3 hours and snorkels for 1 hour.
   Max uses his $35 so that all of the $35 is spent and so that the marginal utility per dollar from each activity is the same. When Max windsurfs for 3 hours and snorkels for 1 hour, he spends $30 renting the windsurfing equipment and $5 renting the snorkeling equipment—a total of $35.
   The marginal utility from the third hour of windsurfing is 80 and the rent of the windsurfing equipment is $10 an hour, so the marginal utility per dollar from windsurfing is 8. The marginal utility from the first hour of snorkeling is 40 and the rent of the snorkeling equipment is $5 an hour, so the marginal utility per dollar from snorkeling is 8. The marginal utility per dollar from windsurfing equals the marginal utility per dollar from snorkeling.

   b. If Max spent a dollar more on windsurfing and a dollar less on snorkeling than in part (a), how would his total utility change?

   If Max windsurfs another hour, he pays $10 and gains 60 units of utility (the marginal utility from the 4th hour), which is 6.0 units of utility per dollar. So if he spends a dollar more on windsurfing, his utility from windsurfing increases by 6.0. If he spends an hour less on snorkeling, he saves $5 and loses 40 units of utility (the marginal utility from the 1st hour of snorkeling), which is 8.0 units of utility per dollar. So if he spends a dollar less on snorkeling, he loses 8.0 units of utility. Overall, spending a dollar more on windsurfing and a dollar less on snorkeling lowers Max's total utility by 2.0 units of utility.

   c. If Max spent a dollar less on windsurfing and a dollar more on snorkeling than in part (a), how would his total utility change?

   If Max snorkels another hour, he pays $5 and gains 36 units of utility (the marginal utility from the 2nd hour), which is 7.2 units of utility per dollar. So if he spends a dollar more on snorkeling, his utility from snorkeling increases by 7.2. If he spends an hour less on windsurfing, he saves $10 and loses 80 units of utility (the marginal utility from the 3rd hour of windsurfing), which is 8.0 units of utility per dollar. So if he spends a dollar less on windsurfing, he loses 8.0 units of utility. Overall, spending a dollar more on snorkeling and a dollar less on windsurfing lowers Max's total utility by 0.8 units of utility.

Use the data in Problem 3 to work Problems 9 to 13.

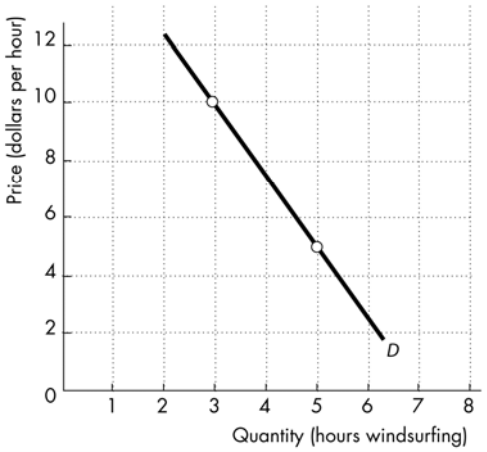
9. If the price of renting windsurfing equipment is cut to $5 an hour, how many hours a day does Max spend on each activity?

   Max will now maximize his total utility by spending 5 hours windsurfing and 2 hours snorkeling. This combination of windsurfing and snorkeling uses all of Max's income and sets the marginal utility per dollar from windsurfing equal to the marginal utility per dollar from snorkeling.

10. Draw Max's demand curve for rented windsurfing equipment. Over the price range from $5 to $10 an hour, is Max's demand for windsurfing equipment elastic or inelastic?

    From Problem 8 (a), when the price of renting windsurfing equipment is $10 per hour, Max rents windsurfing equipment for 3 hours. From Problem 9, when the price of renting windsurfing equipment is $5 per hour, Max rents windsurfing equipment for 5 hours. These points lead to the demand curve in Figure 8.2. Max's elasticity of demand for renting windsurfing equipment is inelastic because a fall in the price decreases Max's total expenditure on renting windsurfing equipment.

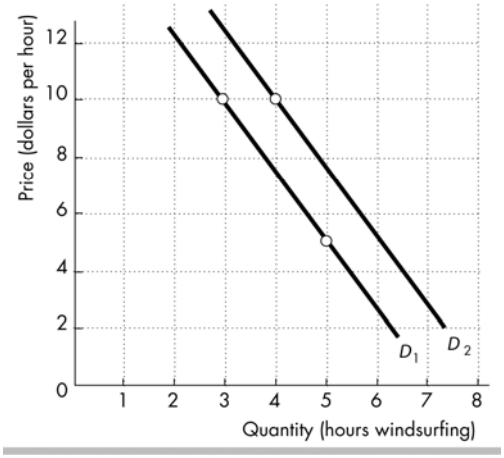
FIGURE **8.2**
Problem 10



11. How does Max's demand for snorkeling equipment change when the price of windsurfing equipment falls? What is Max's cross elasticity of demand for snorkeling with respect to the price of windsurfing? Are windsurfing and snorkeling substitutes or complements for Max?

    When the price of windsurfing falls, Max increases the hours he snorkels from 1 hour to 2 hours. Max's demand for snorkeling increases when the price of windsurfing falls. Max's cross elasticity of demand equals (1 hour/1.5 hours)/($5/$7.50) = −1.00. Windsurfing and snorkeling are complements for Max.

FIGURE **8.3**
Problem 12



12. If Max's income increases from $35 to $55 a day, how does his demand for rented windsurfing equipment change? Is windsurfing a normal good? Explain.

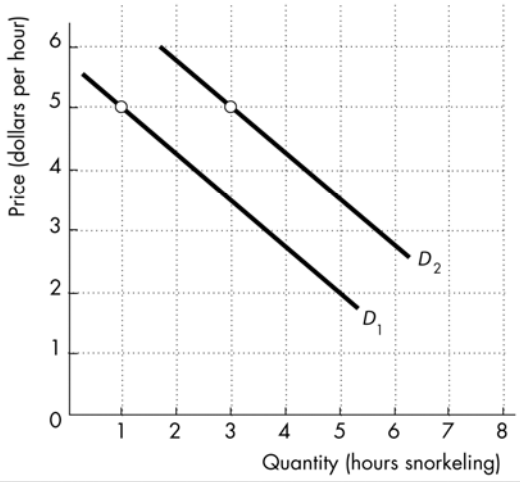
    To maximize his utility, Max windsurfs for 4 hours and snorkels for 3 hours. Max uses his $55 such that all of the $55 is spent and marginal utility per dollar for each activity is the same. When Max windsurfs for 4 hours and snorkels for 3 hours, he spends $40 renting the windsurfing equipment and $15 renting the snorkeling equipment—a total of $55. The marginal utility from the fourth hour of windsurfing is 60 and the rent of the windsurfing equipment is $10 an hour, so the marginal utility per dollar from windsurfing is 6. The marginal utility from the third hour of snorkeling is 30 and the rent of the snorkeling equipment is $5 an hour, so the marginal utility per dollar from snorkeling is 6. The marginal utility per dollar from windsurfing equals the marginal utility per dollar from snorkeling.

    Max's demand for rented windsurfing equipment increases. The quantity of windsurfing equipment rented at $10 per hour increases from 3 hours (problem 8 (a)) to 4 hours (this problem). Max's demand curve for rented windsurfing equipment shifts rightward as shown in Figure 8.3 by the shift from D_1 to D_2. Windsurfing equipment is a normal good.

13. If Max's income increases from $35 to $55 a day, how does his demand for snorkeling equipment change? Is snorkeling a normal good? Explain.

Max's demand for rented snorkeling equipment increases. The quantity of snorkeling equipment demanded at a price of $5 per hour increases from 1 hour (problem 8 (a)) to 3 hours (this problem). As a result Max's demand curve for rented snorkeling equipment shifts rightward as illustrated in Figure 8.4 by the shift from D_1 to D_2. Snorkeling equipment is a normal good.

FIGURE **8.4**
Problem 13



25. Katy has made her best affordable choice of noodles and iced tea. She spends all of her income on 15 packets of instant noodles at $3 each and 30 cups of iced tea at $2 each. Now the price of a packet of noodles rises to $3.50 per packet and the price of iced tea falls to $1.75 a cup.

a. Will Katy now be able to consume 15 packets of instant noodles and 30 cups of iced tea?

Before the changes in price, Katy spent all her income on noodles and iced tea. Therefore, Katy's income is (15 packets of noodles) x ($3 each) + (30 cups of iced tea) x ($2 each) = $105. After the change in prices, the cost of 15 packets of instant noodles and 30 cups of iced tea is (3.50 x 15) + (1.75 x 30) = $105. Therefore, Katy can buy 15 packets of instant noodles and 30 cups of iced tea.

b. If Katy changes the quantities she buys, will she buy more or fewer packets of instant noodles? Explain your answer.

If Katy changes the quantities she buys, she will buy fewer packets of instant noodles and more iced tea. She will make these changes because iced tea has fallen in relative price while instant noodles have risen in relative price.

Chapter 9

Use the following information to work Problems 1 to 2.

Sara's income is $12 a week. The price of popcorn is $3 a bag, and the price of a smoothie is $3.

1. Calculate Sara's real income in terms of smoothies. Calculate her real income in terms of popcorn. What is the relative price of smoothies in terms of popcorn? What is the opportunity cost of a smoothie?

   Sara's real income is 4 smoothies. Sara's real income in terms of smoothies is equal to her money income divided by the price of a smoothie. Sara's money income is $12, and the price of a smoothie is $3. Sara's real income is $12 divided by $3 a smoothie, which is 4 smoothies.

   Sara's real income is 4 bags of popcorn. Sara's real income in terms of popcorn is equal to her money income divided by the price of a bag of popcorn, which is $12 divided by $3 a bag or 4 bags of popcorn.

   The relative price of a smoothie is 1 bag of popcorn per smoothie. The relative price of a smoothie is the price of a smoothie divided by the price of a bag of popcorn. The price of a smoothie is $3 and the price of popcorn is $3 a bag, so the relative price of a smoothie is $3 divided by $3 a bag, which equals 1 bag of popcorn per smoothie.

   The opportunity cost of a smoothie is 1 bag of popcorn. The opportunity cost of a smoothie is the quantity of popcorn that must be forgone to get a smoothie. The price of a smoothie is $3 and the price of popcorn is $3 a bag, so to buy one smoothie Sara must forgo 1 bag of popcorn.

2. Calculate the equation for Sara's budget line (with bags of popcorn on the left side). Draw a graph of Sara's budget line with the quantity of smoothies on the *x*-axis. What is the slope of Sara's budget line? What determines its value?

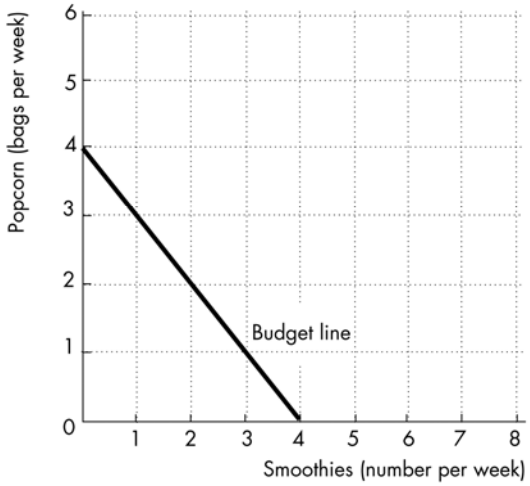
   The equation that describes Sara's budget line is $Q_P = 4 - Q_S$. Call the price of popcorn P_P and the quantity of popcorn Q_P, the price of a smoothie P_S and the quantity of smoothies Q_S, and income y.

   Sara's budget equation is $P_P Q_P + P_S Q_S = y$. If we substitute $3 for the price of popcorn, $3 for the price of a smoothie, and $12 for the income, the budget equation becomes $\$3Q_P + \$3Q_S = \$12$. Dividing both sides by $3 and subtracting Q_S from both sides gives $Q_P = 4 - Q_S$.

   To draw a graph of the budget line, plot the quantity of smoothies on the *x*-axis and the quantity of popcorn on the *y*-axis. The budget line is a straight line from 4 bags of popcorn on the *y*-axis to 4 smoothies on the *x*-axis.

   The slope of the budget line, when smoothies are plotted on the *x*-axis, is minus 1. The magnitude of the slope is equal to the relative price of a smoothie. The slope of the budget line is "rise over run." If the quantity of smoothies decreases from 4 to 0, the quantity of popcorn increases from 0 to 4. The rise is 4 and the run is □4. Therefore the slope equals 4/□4, which is □1.

FIGURE **9.1**
Problem 2



Use the following data to work Problems 3 and 4.
Sara's income falls from $12 to $9 a week, while the price of popcorn is unchanged at $3 a bag and the price of a smoothie is unchanged at $3.

3. What is the effect of the fall in Sara's income on her real income in terms of (a) smoothies and (b) popcorn?
   a. Sara's real income falls from 4 smoothies to 3 smoothies. Sara's real income in terms of smoothies is equal to her money income divided by the price of a smoothie. Sara's money income is now $9 and the price of a smoothie is $3. Sara's real income is now $9 divided by $3 a smoothie, which is 3 smoothies.
   b. Sara's real income falls from 4 bags of popcorn to 3 bags of popcorn. Sara's real income in terms of popcorn is equal to her money income divided by the price of a bag of popcorn. Sara's money income is now $9 and the price of a bag of popcorn is $3. Sara's real income is now $9 divided by $3 a bag, which is 3 bags of popcorn.
4. What is the effect of the fall in Sara's income on the relative price of a smoothie in terms of popcorn? What is the slope of Sara's new budget line if it is drawn with smoothies on the *x*-axis?

   The relative price of a smoothie is 1 bag of popcorn per smoothie, the same relative price as before her income fell. The relative price does not depend on Sara's income. Instead the relative price of a smoothie is the price of a smoothie divided by the price of a bag of popcorn. The price of a smoothie is $3 and the price of popcorn is $3 a bag, so the relative price of a smoothie is $3 divided by $3 a bag. The relative price equals 1 bag per smoothie.

   The slope of the budget line, when smoothies are plotted on the *x*-axis is minus 1, the same slope as before her fall in income. The magnitude of the slope of the budget line is equal to the relative price of a smoothie. The relative price does not change when Sara's income decreases so the slope of the budget line does not change.
5. Sara's income is $12 a week. The price of popcorn rises from $3 to $6 a bag, and the price of a smoothie is unchanged at $3. Explain how Sara's budget line changes with smoothies on the *x*-axis.

   The budget line rotates inward around the unchanged *x* intercept. The magnitude of the slope of the budget line is equal to the relative price of a smoothie. The relative price of a smoothie is the price of a smoothie divided by the price of a bag of popcorn. The rise in the price of a bag of popcorn lowers the relative price of a smoothie in terms of popcorn. The relative price has fallen so the magnitude of the slope of the budget line has fallen.

7. Discuss the shape of the indifference curve for each of the following pairs of goods. Explain the relationship between the shape of the indifference curve and the marginal rate of substitution as the quantities of the two goods change.
   - Orange juice and smoothies
     Orange juice and smoothies are substitutes. They are not perfect substitutes, so the indifference curves are bowed in toward the origin. The marginal rate of substitution falls moving down along an indifference curve.
   - Baseballs and baseball bats
     These are complements but probably not perfect complements. The indifference curves should be significantly bowed inward. (If a student says these goods are perfect complements, the indifference curves should be right angles, such as those in Figure 9.2A.) If the indifference curves are not right angles, then the marginal rate of substitution falls rapidly moving down along an indifference curve. (If the goods are perfect complements, the marginal rate of substitution does not change moving down along the indifference curve except when moving around the 90 degree point where it goes from infinity to zero.)
   - Left running shoe and right running shoe
     These are perfect complements so the indifference curves are right angles, as shown in Figure 9.2A. The marginal rate of substitution does not change moving down along the indifference curve except when moving around the 90 degree point where it goes from infinity to zero.
   - Eyeglasses and contact lenses
     The indifference curves should either be linear (for perfect substitutes, as shown in Figure 9.2B) or nearly linear as in Figure 9.2C. If the indifference curves are linear, then the marginal rate of substitution does not change moving down along the indifference curve; if the indifference curves are nearly linear, then the marginal rate of substitution falls slightly moving down along an indifference curve.

Use the following data to work Problems 8 and 9.
Pam has made her best affordable choice of cookies and granola bars. She spends all of her weekly income on 30 cookies at $1 each and 5 granola bars at $2 each. Next week, she expects the price of a cookie to fall to 50¢ and the price of a granola bar to rise to $5.

8. a. Will Pam be able to buy and want to buy 30 cookies and 5 granola bars next week?
   Pam can still buy 30 cookies and 5 granola bars. When Pam buys 30 cookies at $1 each and 5 granola bars at $2 each, she spends $40 a week. Now that the price of a cookie is 50 cents and the price of a granola bar is $5, 30 cookies and 5 granola bars will cost $40. So Pam can still buy 30 cookies and 5 granola bars. But Pam will not *want* to buy 30 cookies and 5 granola bars because the marginal rate of substitution does not equal the relative price of the goods. Pam will move to a point on the highest indifference curve possible where the marginal rate of substitution equals the relative price.

   b. Which situation does Pam prefer: cookies at $1 and granola bars at $2 or cookies at 50¢ and granola bars at $5?
   Pam prefers cookies at 50 cents each and granola bars at $5 each because she can get onto a higher indifference curve than when cookies are $1 each and granola bars are $2 each. To see why Pam can move to a higher indifference curve, note that the new budget line and the old budget line both pass through the point 30 cookies and 5 granola bars. If granola bars are plotted on the *x*-axis, the marginal rate of substitution at this point on Pam's indifference curve is equal to the relative price of a granola bar at the original prices, which is 2. The new relative price of a granola bar is $5/50 cents, which is 10. That is, the budget line is steeper than the indifference curve at 30 cookies and 5 granola bars. So Pam's new equilibrium combination of cookies and granola bars must be on an indifference curve at a point steeper than the initial indifference curve. Because the new budget line is steeper and passes through the initial equilibrium combination, the new best affordable point must lie above the initial equilibrium point so it must be on a higher indifference curve.

9. a. If Pam changes how she spends her weekly income, will she buy more or fewer cookies and more or fewer granola bars?

   Pam will buy more cookies and fewer granola bars. The new budget line and the old budget line pass through the point at 30 cookies and 5 granola bars. If granola bars are plotted on the *x*-axis, the marginal rate of substitution at this point on Pam's indifference curve is equal to the relative price of a granola bar at the original prices, which is 2. The new relative price of a granola bar is \$5/50 cents, which is 10. That is, the budget line is steeper than the indifference curve at 30 cookies and 5 granola bars. Pam will buy more cookies and fewer granola bars.

   b. When the prices change next week, will there be an income effect, a substitution effect, or both at work?

   There will be a substitution effect and an income effect. A substitution effect arises when the relative price changes and the consumer moves along the *same* indifference curve to a new point where the marginal rate of substitution equals the new relative price. An income effect arises when the consumer moves from one indifference curve to another, keeping the relative price constant.

Use the following information to work Problems 10 and 11.

Boom Time For "Gently Used" Clothes

Most retailers are blaming the economy for their poor sales, but one store chain that sells used name-brand children's clothes, toys, and furniture is boldly declaring that an economic downturn can actually be a boon for its business. Last year, the company took in \$20 million in sales, up 5% from the previous year.

Source: CNN, April 17, 2008

10. a. According to news clip, is used clothing a normal good or an inferior good? If the price of used clothing falls and income remains the same, explain how the quantity of used clothing bought changes.

   According to the article, the demand for used clothing increases when the economy is in a downturn and incomes are falling. Because the demand increases when income decreases, used clothing is an inferior good.

   If the price of used clothing falls and income remains the same, the quantity of used clothing purchased increases.

   b. Describe the substitution effect and the income effect that occur.

   The price fall creates both a substitution effect and an income effect. The substitution effect leads to an increase in the quantity of used clothing demanded. The price decrease increases consumers' real incomes. Because used clothing is an inferior good, the income effect leads to a decrease in the quantity of used clothing purchased. The substitution effect is larger so that the quantity of used clothing purchased increases.

11. Use a graph of a family's indifference curves for used clothing and other goods. Then draw two budget lines to show the effect of a fall in income on the quantity of used clothing purchased.

    In Figure 9.3, the fall in income shifts the budget line from BL_1 to BL_2. The quantity of used clothing purchased increases, in the figure from 4 items per month to 5 items per month.

FIGURE **9.3**
Problem 11