Applications

For Exercises 1–5, find the sales tax.

1. a sweater for $36.00 at 7% sales tax

2. a skateboard for $62.80 at 6% sales tax

3. a baseball hat for $22.90 at 5% sales tax

4. a digital camera for $249.99 at 4% sales tax

5. a board game for $29.95 at 8% sales tax

6. Bennett bought a $21 meal. The sales tax was 5%. Bennett tried to find the sales tax in a few different ways. Which of his methods are correct? Of the correct methods, which makes the most sense to you? Explain.

   A. 5% sales tax means that for every dollar you spend, you need to pay a nickel in tax. If you buy something for $21, you need to pay 21 nickels in tax.

   B. You can set up a proportion and solve for the missing value.

   $$\frac{\$.05}{\$1.00} = \frac{x}{\$21.00}$$

   C. I know that 10% of $21.00 is $2.10, so 5% would be half of $2.10.

   D. 5% is equal to $\frac{1}{20}$. To find the amount of tax on $21, find $21 ÷ 20.

   E. 1% of $21.00 is $.21, so 5% of $21.00 is 5 × $.21.

7. A group of friends orders pizza at a restaurant. Each person gives some money to Chris before they order.

   a. Chris has $63 to spend on the order, including tax. The tax at the restaurant is 5%. What is the maximum cost of food the group can order and not go over $63? Explain your reasoning.

   b. Chris wants to leave a 15% tip on the price of the food, calculated before sales tax. What is the maximum cost of food the group can order and not go over $63? Explain.

For Exercises 8–10, identify which estimate seems the most reasonable. Explain.

8. 5% tax on a $42.00 purchase

   under $2.00   exactly $2.00   over $2.00

9. 9% tax on a $59.99 purchase

   under $6.00   exactly $6.00   over $6.00

10. 5.5% tax on a $309.95 purchase

   under $15.00   exactly $15.00   over $15.00

For Exercises 11–14, use the following information.

Bill's Bikes sells new and used bikes. Bill buys used bikes, fixes them, and marks up the prices by 80%. The salesperson selling the bike gets a 25% commission on the markup.

11. Find the missing values in the table.

Costs and Revenue for Roberto's Sales

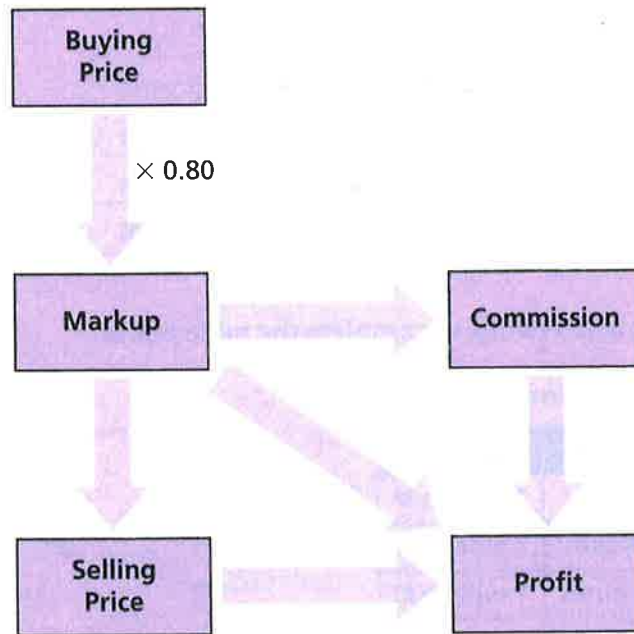| Buying Price	Markup (80% of buying price)	Selling Price	Commission (25% of markup)	Profit (money the shop makes on the sale)
$100	$80	$180	$20	$60
$10	■	■	■	■
$55	■	■	■	■
$125	■	■	■	■

12. Find the missing values in the table.

Costs and Revenue for Linda's Sales

Buying Price	Markup (80% of buying price)	Selling Price	Commission (25% of markup)	Profit (money the shop makes on the sale)
▩	$48	▩	▩	▩
■	▩	$252	▩	▩
▩	▩	▩	$14.40	▩
▩	▩	▩	▩	$54
$N	▩	▩	▩	▩

13. For each arrow in the figure below, write a mathematical rule describing how to get from one value to the next value. The first one is done for you.

14. For each part, write two equations for the listed relationship.

   a. the markup amount and the buying price

   b. the buying price and the selling price

   c. the commission and the markup amount

   d. the profit and the commission

For Exercises 15–18, solve the conversion problem.

15. Allen runs 8 miles in 3 hours at a steady pace. How long does it take him to run 3 miles?

16. Maren walks $\frac{3}{5}$ mile in 24 minutes at a steady pace. How long does it take her to walk 2 miles?

17. Half an avocado has about 160 Calories. How many Calories do a dozen avocados have?

18. There are about 1.5 grams of fat in 1 tablespoon of hummus. How many grams of fat are in $2\frac{1}{2}$ cups of hummus? (**Note:** 16 tablespoons = 1 cup)

19. The United States uses the English system of measurement. The English system has many old conversions that are rarely used.

English System Measurement Conversions

1 foot = 12 inches	1 furlong = 220 yards	1 rod = 5.5 yards
1 yard = 3 feet	1 furlong = 10 chains	1 yard = 16 nails
1 mile = 5,280 feet	1 furlong = 1,000 links	1 foot = 4 palms
1 mile = 1,760 yards	1 furlong = 40 rods	1 foot = 3 hands

Use the measurement conversions to complete the table below.

Time Predictions

	Distance and Time	Prediction
a.	1,584 feet in 3 minutes	1 mile in ▦
b.	2 furlongs in 10 minutes	1 mile in ▦
c.	1,500 links in 12 minutes	1 mile in ▦
d.	4 rods in 11 seconds	1 mile in ▦
e.	5 chains in 1 minute	1 mile in ▦

For Exercises 20–22, describe what value x represents. Then solve for x.

20. $\dfrac{16 \text{ ounces}}{1 \text{ pound}} = \dfrac{x}{3\frac{1}{2} \text{ pounds}}$

21. $\dfrac{1 \text{ gallon}}{16 \text{ cups}} = \dfrac{x}{36 \text{ cups}}$

22. $\dfrac{x}{12.5 \text{ cups}} = \dfrac{8 \text{ fluid ounces}}{1 \text{ cup}}$

For Exercises 23–25, use the conversions chart in Problem 3.2. Write a proportion and solve the conversion problem.

23. How many ounces are in $10\frac{1}{2}$ pounds?

24. How many cups are in 55 gallons?

25. About how many pounds are in 60 kilograms?

26. a. Alicia, Brandon, and Charlene wanted to solve the proportion $\frac{x}{4.24} = \frac{6.82}{2.2}$. Which of the students used a correct method?

Alicia

First, I simplified the fraction on the right.

$$\frac{x}{4.24} = 3.1$$

Then, I multiplied 3.1 by 4.24 to find x.

Charlene

I figured out that 6.82 – 2.2 = 4.62. So, the numerator in the right fraction was 4.62 greater than the denominator. This means that x = 4.24 + 4.62, or 8.86.

Brandon

I multiplied all the values by 100 to eliminate the decimals.

$$\frac{100x}{424} = \frac{682}{220}$$

Then I multiplied both sides by 424.

$$100x = \frac{682 \cdot 424}{220}$$

I simplified the fraction on the right.

$$100x = 1{,}314.4$$

Then I divided both sides by 100.

$$x = \frac{1{,}314.4}{100}$$

b. Of the correct methods, which makes the most sense to you? Explain.

For Exercises 27–30, find the unit rate for the chimp food mix.
Consider the unit rate to be the number of scoops of high-fiber
food per 1 scoop of high-protein food.

27. 75% high-fiber chimp food to 25% high-protein chimp food

28. 80% high-fiber chimp food to 20% high-protein chimp food

29. 85% high-fiber chimp food to 15% high-protein chimp food

30. 95% high-fiber chimp food to 5% high-protein chimp food

For Exercises 31–33, find the percentage of the chimp food mix that
is high fiber and the percentage of the mix that is high protein.
Note: The unit rate is the number of scoops of high-fiber food per one
scoop of high-protein food.

31. unit rate: 1   **32.** unit rate: $\frac{1}{3}$ **33.** unit rate: 9

34. Lealani has 24 scoops of high-fiber chimp food.

   a. How many scoops of high-protein
food should Lealani add to the
mix if she wants to give it to baby
chimps? Recall that baby chimps
need 40% high-fiber food and
60% high-protein food.

   b. How many scoops of high-protein
food should Lealani add to the
mix if she wants to give it to adult
chimps? Recall that adult chimps
need 60% high-fiber food and
40% high-protein food.

Grown chimpanzees are about 4 feet tall.
You can use that information to estimate
the height of this baby chimp.

Connections

35. Claire and Pam consider the two situations below.

- marking up the price 25% and getting a 10% commission on the markup

- marking up the price 10% and getting a 25% commission on the markup

Will these situations result in the same commission, or will one commission be greater? If one commission is greater, which one?

36. Erin finds 5% sales tax for a shirt that costs $21. She calculates the tax as $0.05 \times 21 = 1.05$, or $1.05.

Erin notices that she can add $21 + 1.05 = 22.05$ to find the total cost, $22.05. She uses the Distributive Property to write $(1 \times 21) + (0.05 \times 21) = 1.05 \times 21$.

For each item below, write the total cost of the item as the product of two numbers.

	Item Name	Price	Tax Rate	Tax
	shirt	$21.00	5%	1.05 × 21
a.	bicycle	$45.90	7%	
b.	shoes	$67.50	6%	
c.	laptop	$299.99	8%	
d.	video game	$39.95	4%	

Credit	Debit	Subtotal	$474.34
Check	Cash	Tax	
Print Receipt		Order total	
		Cash	

37. In Exercise 36, you used the Distributive Property to find the total cost of a product and sales tax. You can also use the Distributive Property to find the total cost after a discount.

Suppose there is a 5% discount on a shirt that was originally priced at $21. Write an expression that shows the discounted price of the shirt as the product of two numbers. Explain your reasoning.

38. Bill's bike shop has a sale where the bike shop pays the customer's tax. By law, Bill has to charge a 6% sales tax, so he finds a different way to take the tax off the bill. Bill decides to give each customer a 6% discount.

   a. The customer pays the discounted price plus tax. Will this amount be the same as the original price? Explain your reasoning.

   b. Does it matter which is applied first, the discount or the tax? Explain.

Multiple Choice For Exercises 39–44, choose the best estimate for the division problem. Explain your reasoning.

39. $1\frac{2}{5} \div \frac{3}{4}$

   A. less than 1   **B.** between 1 and 2   **C.** between 2 and 3   **D.** greater than 3

40. $10 \div 1\frac{7}{8}$

   F. less than 1   **G.** between 1 and 5   **H.** between 5 and 10   **J.** greater than 10

41. $5\frac{9}{10} \div 1\frac{1}{2}$

   A. less than 1   **B.** between 1 and 4   **C.** between 4 and 12   **D.** greater than 12

42. $14\frac{2}{7} \div \frac{8}{10}$

   F. less than 1   **G.** between 1 and 7   **H.** between 7 and 14   **J.** greater than 14

43. $\frac{3}{4} \div \frac{7}{8}$

   A. less than 1   **B.** between 1 and 2   **C.** between 2 and 8   **D.** greater than 8

44. $\frac{19}{20} \div \frac{6}{10}$

   F. less than 1   **G.** between 1 and 2   **H.** between 2 and 10   **J.** greater than 10

45. Felipe walks $2\frac{1}{4}$ miles in 45 minutes at a constant rate. Use the model below to answer the questions about how far Felipe walks.

Hours 0 $\frac{3}{4}$

Miles 0 $2\frac{1}{4}$
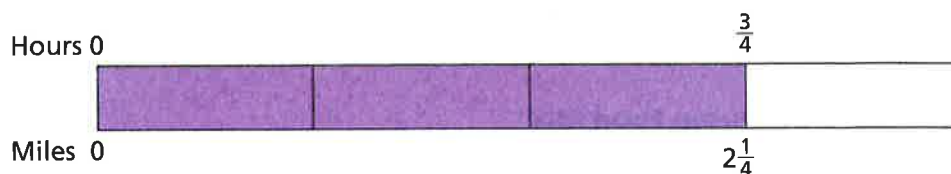
    a. How far does Felipe walk in 15 minutes?

    b. How far does Felipe walk in 1 hour?

    c. How long does it take Felipe to walk $4\frac{1}{2}$ miles?

    d. How long does it take for Felipe to walk $3\frac{1}{4}$ miles?

For Exercises 46–49, solve each proportion.

46. $\dfrac{\frac{4}{5}}{\frac{1}{5}} = \dfrac{x}{1\frac{1}{2}}$ **47.** $\dfrac{\frac{5}{6}}{\frac{2}{3}} = \dfrac{x}{\frac{4}{9}}$

48. $\dfrac{\frac{6}{5}}{\frac{6}{10}} = \dfrac{x}{1\frac{2}{10}}$ **49.** $\dfrac{2}{\frac{1}{3}} = \dfrac{x}{\frac{5}{6}}$

50. The table below shows the conversion between liters and quarts.

Conversion Table

Liters	Quarts
1	1.06
4	4.24
5	5.30
9	9.54

    a. About how many liters are in 5.5 quarts?

    b. About how many quarts are in 5.5 liters?

    c. Write an equation that relates liters L to quarts Q.

Exercises 51–53 are about ways to mix food for different primates at the zoo.

51. Pilar mixes the primate food. For the orangutans, she uses the information in the table below.

Orangutan Food Mix

Scoops of High-Protein Food	21	24	27	18	33
Scoops of High-Fiber Food	7	8	9	6	11

   a. What is the ratio of high-protein food to high-fiber food?

   b. Write an equation that relates the number of scoops of high-protein food to the number of scoops of high-fiber food.

   c. If Pilar mixes 12 scoops of high-protein food, how many scoops of high-fiber food should she add?

   d. For every 1 scoop of high-protein food, how many scoops of high-fiber food does Pilar need?

   e. Draw a graph with the amounts of high-protein food on the y-axis and the amounts of high-fiber food on the x-axis.

52. The ratio of high-fiber food to high-protein food for baby gorillas is 30% to 70%.

   a. What is the unit rate for this mixture?

   b. Copy and complete the table below.

Baby Gorilla Food Mix

Scoops of High-Protein Food	▦	14	1	▦	x
Scoops of High-Fiber Food	3	▦	▦	1	▦

   c. Graph the relationship of high-protein food to high-fiber food for baby gorillas.

   d. Write an equation relating the number of scoops of high-protein food to the number of scoops of high-fiber food.

53. Pilar was given the following graph of the mix ratio for adult baboon food at the zoo.

Scoops of High-Fiber Food
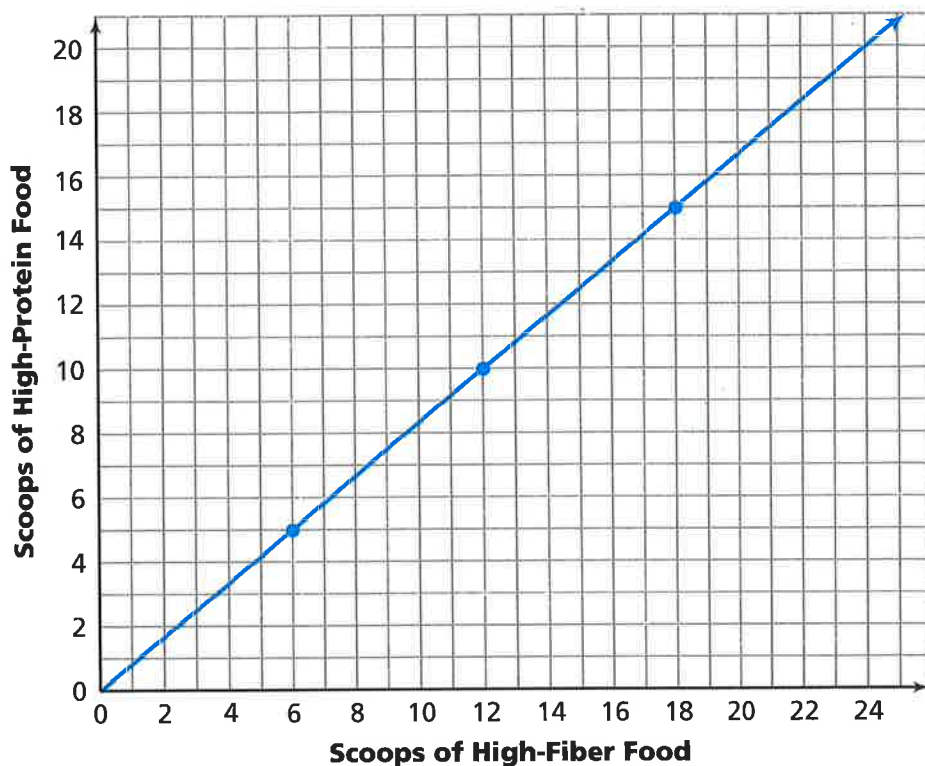
a. What is a good estimate for the number of scoops of high-protein food Pilar should use with 5 scoops of high-fiber food?

b. Pilar wants to remember a ratio of high-protein food to high-fiber food that uses small whole numbers. What ratio should she remember?

c. Write an equation that represents the graph above.

d. Pilar uses 45 scoops of high-protein food in a mix. How many scoops of high-fiber food should she use?

Extensions

54. The city of Spartanville runs two summer camps, the Green Center and the Blue Center. The table at the right shows recent attendance at the two camps.

	Green	Blue
Boys	125	70
Girls	75	30

   a. Use differences to compare the two centers' camp programs for boys and girls. Which center seems to offer a program that appeals more to girls?

   b. Use fractions to compare the two centers' camp programs for boys and girls. Which center seems to offer a program that appeals more to girls?

   c. Use percents to compare the two centers' camp programs for boys and girls. Which center seems to offer a program that appeals more to girls?

   d. Use ratios to compare the appeal of the two centers' camp programs for boys and girls. Which center seems to offer a program that appeals more to girls?

55. Use the table at the right.

   a. In which sport do boys most outnumber girls?

   b. In which sport do girls most outnumber boys?

   c. The participation in these team sports is about the same for students at Key Middle School.

Participation in Team Sports at Springbrook Middle School

Sport	Girls	Boys
Basketball	30	80
Football	10	60
Soccer	120	85
Total surveyed	160	225

   i. Suppose 250 boys at Key play sports. How many boys would you expect to play each of the three sports?

   ii. Suppose 240 girls at Key play sports. How many girls would you expect to play each of the three sports?