

Unit Rates

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Unit Rates

Robert is writing a paper for language arts class. He can write $\frac{2}{3}$ of a page in $\frac{1}{2}$ of an hour. At what rate is Robert

1. writing?

- A. $1\frac{1}{6}$ pages per hour
 - B. 3 pages per hour
 - C. $\frac{1}{3}$ of a page per hour
 - D. $1\frac{1}{3}$ pages per hour
-

Tanya is training a turtle for a turtle race. For every $\frac{2}{3}$ of an hour that the turtle is crawling, he can travel

2. $\frac{1}{12}$ of a mile. At what unit rate is the turtle crawling?

- A. 18 miles per hour
 - B. $\frac{3}{4}$ of a mile per hour
 - C. $\frac{1}{18}$ of a mile per hour
 - D. $\frac{1}{8}$ of a mile per hour
-

A blueprint for a house shows the height of the house to be $3\frac{3}{8}$ inches. The actual house is $21\frac{1}{3}$ feet tall. What is the

3. unit rate in feet per inch?

- A. $6\frac{26}{81}$ feet per inch
 - B. $2\frac{10}{27}$ feet per inch
 - C. $\frac{81}{512}$ foot per inch
 - D. $\frac{27}{512}$ foot per inch
-

Martina walked $\frac{3}{4}$ of a mile in $\frac{2}{5}$ of an hour. At this rate,

4. how far can Martina walk in one hour?

- A. $\frac{8}{15}$ of a mile
- B. $\frac{3}{10}$ of a mile
-

- C. $2\frac{1}{2}$ miles
- D. $1\frac{7}{8}$ miles
-

Frodo ran $2\frac{1}{5}$ miles in $\frac{7}{12}$ of an hour. How many miles

5. can Frodo run in one hour?

- A. $18\frac{6}{7}$
- B. $\frac{35}{132}$
- C. $3\frac{16}{35}$
- D. $3\frac{27}{35}$
-

Stefanie is painting her bedroom. She can paint $12\frac{1}{3}$ square feet in $\frac{1}{5}$ of an hour. How many square feet can she paint

6. in one hour?

- A. 37
- B. $12\frac{1}{3}$
- C. $92\frac{1}{2}$
- D. $61\frac{2}{3}$
-

A punch recipe requires $\frac{4}{5}$ of a cup of pineapple juice for every $2\frac{1}{2}$ cups of soda. What is the unit rate of soda to

7. pineapple juice in the punch?

- A. $1\frac{3}{5}$ cups of soda per cup of pineapple juice
- B. $3\frac{1}{8}$ cups of soda per cup of pineapple juice
- C. $\frac{8}{25}$ cup of soda per cup of pineapple juice
- D. $6\frac{1}{4}$ cups of soda per cup of pineapple juice
-

Richard can read $\frac{1}{4}$ of a book in $\frac{3}{5}$ of an hour. At this rate,

8. how much can Richard read in 1 hour?

- A. $2\frac{2}{5}$ books
-
-

- B. $\frac{4}{9}$ of a book
- C. $\frac{5}{12}$ of a book
- D. $\frac{3}{20}$ of a book
-

A bakery uses $10\frac{1}{5}$ ounces of icing for every $\frac{1}{4}$ of a cake.

9. What is the unit rate in ounces of icing per cake?

- A. 51 ounces of icing per cake
- B. $40\frac{4}{5}$ ounces of icing per cake
- C. 41 ounces of icing per cake
- D. $50\frac{4}{5}$ ounces of icing per cake
-

A kitchen floor has $15\frac{1}{2}$ tiles in an area of $2\frac{4}{5}$ square feet.

10. How many tiles are in one square foot?

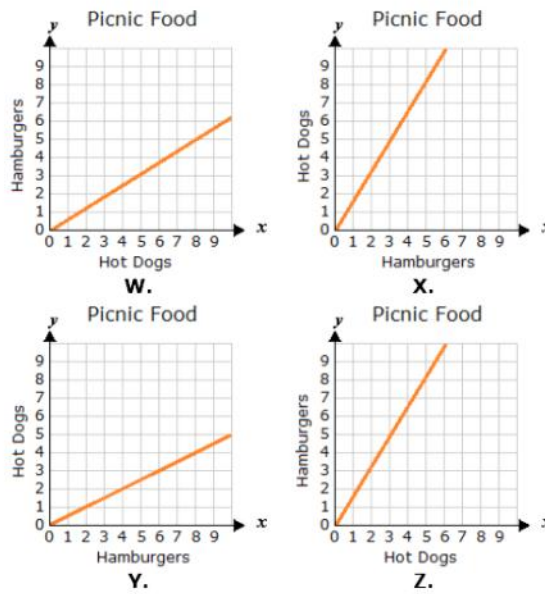
- A. $\frac{14}{31}$
- B. $\frac{28}{155}$
- C. $43\frac{2}{5}$
- D. $5\frac{15}{28}$
-

An airplane can ascend at a rate of $54\frac{1}{2}$ meters in $\frac{1}{3}$ of a second. How many meters can the airplane ascend in one

11. second?

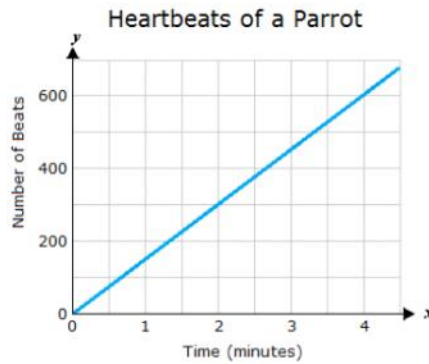
- A. $82\frac{1}{2}$
- B. $36\frac{1}{3}$
- C. 109
- D. $163\frac{1}{2}$
-

12. The ratio of hamburgers to hot dogs served at a picnic is $\frac{8}{5}$. Which graph could represent this ratio?



- A. W
- B. X
- C. Y
- D. Z

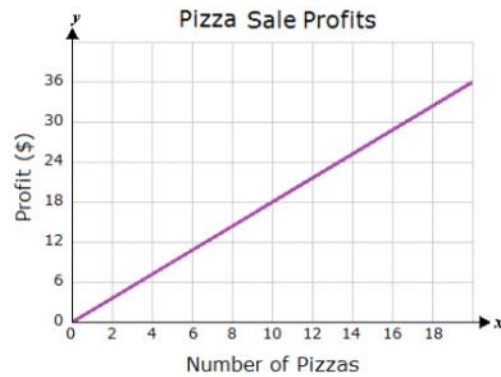
13. The graph below represents a parrot's heartbeat.



Based on the graph, what does the point (1, 150) represent?

- A. 150 beats in half a minute
- B. 150 parrots' heartbeats
- C. 150 beats per second
- D. 150 beats per minute

14. The seventh grade choir sold pizzas as a fundraiser. The choir teacher created the graph below for the students.



Based on the graph, what is the unit rate of profit for the pizzas?

- A. \$1.80 per pizza
- B. \$0.56 per pizza
- C. \$8.00 per pizza
- D. 18 pizzas per \$10

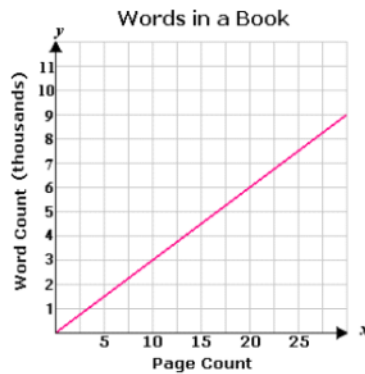
15. On a trip to Italy, Chandra traded her U.S. dollars for Euros, based on the graph below.



Based on the graph, what is the unit rate of Euros per dollar?

- A. 1.10 Euros per U.S. dollar
- B. 1.20 Euros per U.S. dollar
- C. 1.30 Euros per U.S. dollar
- D. 1.40 Euros per U.S. dollar

16. Mrs. Daniels, an English teacher, is having her students count the number of words in a book. She took their data and created the graph below.



What is the rate of words per page?

- A. 9,000 words per page
- B. 300 words per page
- C. 400 words per page
- D. 120 words per page

17. The science club is inflating a model of a hot air balloon. The graph below shows their progress.



At what rate is the diameter increasing?

- A. 30 centimeters per minute
- B. 90 centimeters per minute
- C. 4 centimeters per minute
- D. 7.5 centimeters per minute

18. Daniel mows lawns on the weekend. He graphed his earnings below.



What is the rate he charges to mow?

- A. \$20.00 per lawn
- B. \$2.00 per lawn
- C. \$15.00 per lawn
- D. \$10.00 per lawn

19. Adam bought a new video game. He graphed the points he earned below.



What is his rate of points per minute?

- A. 1,500 points per minute
- B. 1,000 points per minute
- C. 2,500 points per minute
- D. 3,000 points per minute

20. The table below shows the salvage value for raw steel.

Tons of Steel	Salvage Value
0	\$0.00
2	\$440.00
4	\$880.00
6	\$1,320.00
8	\$1,760.00
10	\$2,200.00

Based on the information in the table, what is the price per ton for raw steel?

- A. \$264
- B. \$210
- C. \$220
- D. \$230

21. The table below shows the cumulative distance and the number of hours Ryan drove on vacation.

Hours Driving	Distance Traveled (miles)
0	0
3	177
4	236
7	413
10	590

Based on the information in the table, at what speed did he drive (miles per hour)?

- A. 49 miles per hour
- B. 40.5 miles per hour
- C. 59 miles per hour
- D. 66 miles per hour

22. At the school fall festival, the student council sold sodas as a fundraiser. The table below shows the number of sodas they sold and the cumulative total money.

Sodas Sold	Money Collected
0	\$0.00
2	\$4.40
5	\$11.00
9	\$19.80
10	\$22.00

Based on the information, what is the price per soda?

- A. \$3.20 per soda
- B. \$1.20 per soda
- C. \$2.20 per soda
- D. \$3.30 per soda

23. The table below shows the cost of fresh lettuce at the farmer's market.

Pounds of Lettuce	Price
0	\$0.00
2	\$2.20
4	\$4.40
6	\$6.60
10	\$11.00

Based on the information in the table, what is the price per pound for fresh lettuce?

- A. \$1.32
 - B. \$1.10
 - C. \$0.60
 - D. \$2.10
-

24. A 1,000-foot tree has grown at a constant rate each year. In the equation below, t is the age of the tree in years.

$$20t = 1,000$$

What is the unit rate in the equation above?

- A. 1,000 feet per year
 - B. 980 feet per year
 - C. 50 feet per year
 - D. 20 feet per year
-

25. Steve drove at a constant rate to the beach for a vacation. In the equation below, t is the time in hours it took Steve to drive to the beach.

$$61t = 366$$

What is the unit rate in the equation above?

- A. 366 miles per hour
 - B. 305 miles per hour
 - C. 6 miles per hour
 - D. 61 miles per hour
-

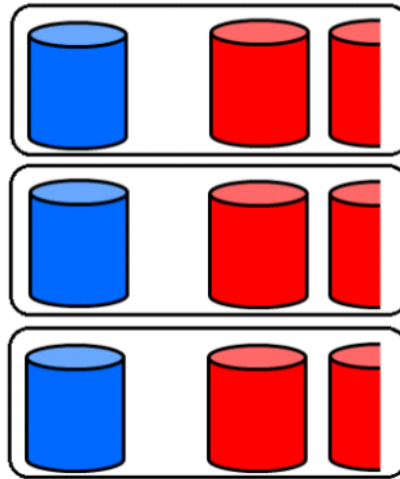
26. The students at Porterville Elementary sold raffle tickets, each for the same price, for a fundraiser. The equation below shows how much money was raised with t tickets sold.

$$\$810 = \$15t$$

What is the unit rate in the equation above?

- A. \$795 per raffle ticket
 - B. \$54 per raffle ticket
 - C. \$15 per raffle ticket
 - D. \$810 per raffle ticket
-

27. The diagram below shows the relationship between the number of blue paint cans and red paint cans needed for an art project.



Based on the diagram, what is the unit rate for this project?

- A. 1.5 red cans per blue can
- B. 2.5 blue cans per red can
- C. 1.5 blue cans per red can
- D. 2.5 red cans per blue can

28. Sandra bought 4 pounds of sweet potatoes for \$5.88. What is the cost per pound of the sweet potatoes?

- A. \$1.38
- B. \$0.68
- C. \$1.47
- D. \$9.88

29. Donna bought 4 bags of dog treats for \$8.80. What is the cost per bag of dog treats?

- A. \$0.45
- B. \$12.80
- C. \$2.20
- D. \$2.93

30. A store sells 5 T-shirts for \$45.90. What is the unit cost per T-shirt?

- A. \$0.11
- B. \$7.65
- C. \$9.18
- D. \$40.90

Answers

- 1. D
- 2. D
- 3. A
- 4. D
- 5. D

- 6. D
- 7. B
- 8. C
- 9. B
- 10. D
- 11. D
- 12. D
- 13. D
- 14. A
- 15. C
- 16. B
- 17. D
- 18. D
- 19. D
- 20. C
- 21. C
- 22. C
- 23. B
- 24. D
- 25. D
- 26. C
- 27. A
- 28. C
- 29. C
- 30. C

Explanations

To determine the rate Robert is writing, divide $\frac{2}{3}$ of a page by $\frac{1}{2}$ of an hour.

$$\begin{aligned}\frac{2}{3} \text{ of a page} \div \frac{1}{2} \text{ of an hour} &= \frac{2}{3} \text{ of a page} \times \frac{2}{1} \text{ per hour} \\ &= \frac{4}{3} \text{ pages per hour} \\ &= 1\frac{1}{3} \text{ pages per hour}\end{aligned}$$

1. Therefore, the unit rate is $1\frac{1}{3}$ pages per hour.

To determine at what unit rate the turtle is crawling, divide $\frac{1}{12}$ of a mile by $\frac{2}{3}$ of an hour.

$$\begin{aligned}\frac{1}{12} \text{ of a mile} \div \frac{2}{3} \text{ of an hour} &= \frac{1}{12} \text{ of a mile} \times \frac{3}{2} \text{ per hour} \\ &= \frac{1}{8} \text{ of a mile per hour}\end{aligned}$$

2. Therefore, the unit rate is $\frac{1}{8}$ of a mile per hour.

To find the unit rate in feet per inch, divide the number of feet on the house by the number of inches on the blueprint.

$$\begin{aligned}21\frac{1}{3} \div 3\frac{3}{8} &= \frac{64}{3} \div \frac{27}{8} \\ &= \frac{64}{3} \times \frac{8}{27} \\ &= \frac{512}{81} \\ &= 6\frac{26}{81}\end{aligned}$$

3. Therefore, the unit rate is $6\frac{26}{81}$ feet per inch.

To find how far Martina can walk in one hour, divide the distance she walked by the fraction of an hour.

$$\begin{aligned}\frac{3}{4} \div \frac{2}{5} &= \frac{3}{4} \times \frac{5}{2} \\ &= \frac{15}{8} \\ &= 1\frac{7}{8}\end{aligned}$$

4. Therefore, Martina can walk $1\frac{7}{8}$ miles in one hour.

To find how many miles Frodo can run in one hour, divide the number of miles he ran by the fraction of an hour.

$$\begin{aligned}2\frac{1}{5} \div \frac{7}{12} &= \frac{11}{5} \div \frac{7}{12} \\ &= \frac{11}{5} \times \frac{12}{7} \\ &= \frac{132}{35} \\ &= 3\frac{27}{35}\end{aligned}$$

5. Therefore, Frodo can run $3\frac{27}{35}$ miles in one hour.

To find how many square feet Stefanie can paint in one hour, divide the number of square feet by the fraction of an hour.

$$\begin{aligned}12\frac{1}{3} \div \frac{1}{5} &= \frac{37}{3} \div \frac{1}{5} \\ &= \frac{37}{3} \times \frac{5}{1} \\ &= \frac{185}{3} \\ &= 61\frac{2}{3}\end{aligned}$$

6. Therefore, Stefanie can paint $61\frac{2}{3}$ square feet in one hour.

To find the unit rate of soda to pineapple juice, divide the amount of soda by the amount of pineapple juice.

$$\begin{aligned}2\frac{1}{2} \div \frac{4}{5} &= \frac{5}{2} \div \frac{4}{5} \\ &= \frac{5}{2} \times \frac{5}{4} \\ &= \frac{25}{8} \\ &= 3\frac{1}{8}\end{aligned}$$

7. Therefore, the unit rate of soda to pineapple juice is $3\frac{1}{8}$ cups.

To find how much Richard can read in one hour, which is the unit rate, divide the amount he read by the fraction of an hour.

$$\begin{aligned}\frac{1}{4} \div \frac{3}{5} &= \frac{1}{4} \times \frac{5}{3} \\ &= \frac{5}{12}\end{aligned}$$

8. Therefore, Richard can read $\frac{5}{12}$ of a book in one hour.

To find the unit rate in ounces of icing per cake, divide the ounces of icing by the fraction of cake.

$$\begin{aligned}10\frac{1}{5} \div \frac{1}{4} &= \frac{51}{5} \div \frac{1}{4} \\ &= \frac{51}{5} \times \frac{4}{1} \\ &= \frac{204}{5} \\ &= 40\frac{4}{5}\end{aligned}$$

Therefore, the unit rate of ounces of icing per cake is

9. $40\frac{4}{5}$ ounces.

To find how many tiles are in one square foot, divide the number of tiles by the number of square feet.

$$\begin{aligned}15\frac{1}{2} \div 2\frac{4}{5} &= \frac{31}{2} \div \frac{14}{5} \\ &= \frac{31}{2} \times \frac{5}{14} \\ &= \frac{155}{28} \\ &= 5\frac{15}{28}\end{aligned}$$

10. Therefore, there are $5\frac{15}{28}$ tiles in one square foot.

To find how many meters the airplane can ascend in one second, divide the number of meters by the fraction of a second.

$$\begin{aligned}54\frac{1}{2} \div \frac{1}{3} &= \frac{109}{2} \div \frac{1}{3} \\ &= \frac{109}{2} \times \frac{3}{1} \\ &= \frac{327}{2} \\ &= 163\frac{1}{2}\end{aligned}$$

11. Therefore, the airplane can ascend $163\frac{1}{2}$ meters in one second.

12. The ratio is stated as hamburgers to hot dogs.

$$\frac{\text{hamburgers}}{\text{hot dogs}} = \frac{8}{5}$$

Therefore, the correct graph will increase 8 hamburgers for every 5 hot dogs.

The only graph that increases at this rate is **Z**.

13. Minutes are represented by the x -values on the graph. The corresponding number of heartbeats for a parrot are represented by the y -values on the graph.

Therefore, the point (1, 150) represents **150 beats per minute**.

14. A unit rate compares a quantity to one.

In a proportional relationship, graphically speaking, the unit rate is equivalent to the slope.

Furthermore, in a proportional relationship, the slope is equivalent to the ratio of y to x .

Find a point (x, y) on the graph to determine the unit rate.

Using the point (10, 18), the ratio of y to x is \$18.00 for 10 pizzas.

Since unit rate compares a quantity to 1, convert \$18 for 10 pizzas to **\$1.80 per pizza**.

15. A unit rate compares a quantity to one.

In a proportional relationship, graphically speaking, the unit rate is equivalent to the slope.

Furthermore, in a proportional relationship, the slope is equivalent to the ratio of y to x .

Find a point (x, y) on the graph to determine the unit rate.

Using the point (1, 1.30), the ratio of y to x is **1.30 Euros per U.S. dollar**.

16. To determine the rate of words per page, use two sets of coordinates from the graph.

Use the points (0, 0) and (10, 3,000).

Divide the difference in the y -coordinates by the difference in the x -coordinates to determine the rate.

$$\begin{aligned} \frac{3,000 \text{ words} - 0 \text{ words}}{10 \text{ pages} - 0 \text{ pages}} &= \frac{3,000 \text{ words}}{10 \text{ pages}} \\ &= \frac{300 \text{ words}}{1 \text{ page}} \end{aligned}$$

Therefore, the rate is **300 words per page**.

17. To determine the rate of centimeters per minute, use two sets of coordinates from the graph.

Use the points (0, 0) and (4, 30).

Divide the difference in the y -coordinates by the difference in the x -coordinates to determine the rate.

$$\begin{aligned} \frac{30 \text{ cm} - 0 \text{ cm}}{4 \text{ min} - 0 \text{ min}} &= \frac{30 \text{ cm}}{4 \text{ min}} \\ &= \frac{7.5 \text{ cm}}{1 \text{ min}} \end{aligned}$$

Therefore, the rate at which the diameter is increasing is **7.5 centimeters per minute**.

18. To determine the rate of dollars per lawn, use two sets of coordinates from the graph.

Use the points (0, 0) and (1, 10).

Divide the difference in the y -coordinates by the difference in the x -coordinates to determine the rate.

$$\frac{\$10 - \$0}{1 \text{ lawn} - 0 \text{ lawns}} = \frac{\$10}{1 \text{ lawn}}$$

Therefore, the rate per hour charged is **\$10.00 per lawn**.

19. To determine the rate of points per minute, use two sets of coordinates from the graph.

Use the points (0, 0) and (2, 6,000).

Divide the difference in the y -coordinates by the difference in the x -coordinates to determine the rate.

$$\begin{aligned}\frac{6,000 \text{ points} - 0 \text{ points}}{2 \text{ minutes} - 0 \text{ minutes}} &= \frac{6,000 \text{ points}}{2 \text{ minutes}} \\ &= \frac{3,000 \text{ points}}{1 \text{ minute}}\end{aligned}$$

Therefore, the rate is **3,000 points per minute**.

20. The salvage value can be modeled by the function $y = kx$, where x is the number of tons of steel, y is the salvage value, and k is the price per ton.

Pick a point from the table, (2, 440), and evaluate the function $y = kx$ at this point.

$$\begin{aligned}\$440 &= (k)(2 \text{ tons}) \\ \frac{\$440}{2 \text{ tons}} &= k \\ \$220 \text{ per ton} &= k\end{aligned}$$

Therefore, the price is **\$220 per ton**.

21. Miles per hour can be modeled by the function $y = kx$, where x is the number of miles traveled, y is the distance traveled, and k is the speed (miles per hour).

Pick a point from the table, (3, 177), and evaluate the function $y = kx$ at this point.

$$\begin{aligned}177 \text{ miles} &= (k)(3 \text{ hours}) \\ \frac{177 \text{ miles}}{3 \text{ hours}} &= k \\ 59 \text{ miles per hour} &= k\end{aligned}$$

Therefore, his speed was **59 miles per hour**.

22. The price of a soda can be modeled by the function $y = kx$, where x is the number of sodas sold, y is the total money collected, and k is the price per soda.

Pick a point from the table, (2, 4.4), and evaluate the function $y = kx$ at this point.

$$\begin{aligned}\$4.40 &= (k)(2 \text{ sodas}) \\ \frac{\$4.40}{2 \text{ sodas}} &= k \\ \$2.20 \text{ per soda} &= k\end{aligned}$$

Therefore, the price is **\$2.20 per soda**.

23. The price per head of lettuce can be modeled by the function $y = kx$, where x is the number of pounds of lettuce, y is the total price, and k is the price per pound.

Pick a point from the table, (2, 2.2), and evaluate the function $y = kx$ at this point.

$$\begin{aligned}\$2.2 &= (k)(2 \text{ pounds}) \\ \frac{\$2.2}{2 \text{ pounds}} &= k \\ \$1.1 \text{ per pound} &= k\end{aligned}$$

Therefore, the price is **\$1.1 per pound**.

24. The unit rate in the equation is the tree's growth per year. The height of the tree in feet, 1,000, is equal to the tree's growth per year multiplied by the age of the tree, t , in years.

$$20t = 1,000$$

Therefore, the unit rate is **20 feet per year**.

25. The unit rate in the equation is the number of miles driven per hour. The total miles driven, 366, is equal to the number of miles driven per hour multiplied by the number of hours, t , it took to drive.

$$61t = 366$$

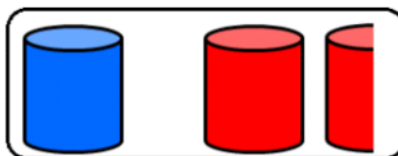
Therefore, the unit rate is **61 miles per hour**.

26. The unit rate in the equation is the price per ticket. The total amount of money raised, \$810, is equal to the price per ticket multiplied by the number of tickets, t .

$$\$810 = \$15t$$

Therefore, the unit rate is **\$15 per raffle ticket**.

27. The unit rate is the amount per one unit. Based on the diagram, for every 1 blue can, there are 1.5 red cans.



Therefore, the unit rate is **1.5 red cans per blue can**.

28. The question asks for the cost per pound.

The cost per pound is the unit price, or unit cost.

To determine the unit price, divide the cost by the quantity.

$$\$5.88 \div 4 = \mathbf{\$1.47}$$

29. The question asks for the cost per bag.

The cost per bag is the unit price, or unit cost.

To determine the unit price, divide the cost by the quantity.

$$\$8.80 \div 4 = \mathbf{\$2.20}$$

30. The question asks for the cost per T-shirt.

The cost per T-shirt is the unit price, or unit cost.

To determine the unit price, divide the cost by the quantity.

$$\$45.90 \div 5 = \mathbf{\$9.18}$$