Equations of Proportional Relationships

Question 1 .

A class is going on a field trip to see a movie. Each ticket is $6.00. The number of students, *n,* who will receive a $6.00 ticket is proportional to the total cost, *C*, of all the tickets. Which equation could be used to find the total cost of all the tickets?

- A. $\$6.00 + n = C$

- B. $\$6.00n = C$

- C. $\frac{\$6.00}{n} = C$

- D. $\frac{n}{\$6.00} = C$

Question 2 .

Directions: Select the correct phrases in the table.

Select the scenario that could be modeled by each of the given equations. For each equation, the variable *c* represents the cost and the variable *n* represents the number of items.

Equation	Scenario
$c = 1.85n$	4 gallons of milk cost $7.40 3 loaves of bread cost $5.88
$c = 1.41n$	5 loaves of bread cost $7.05 6 dozen eggs cost $10.32
$c = 1.89n$	6 gallons of milk cost $9.36 4 dozen eggs cost $7.56
$c = 2.69n$	5 gallons of milk cost $13.75 3 gallons of orange juice cost $8.07

Question 3 .

The following graph shows Ryan's hourly earnings.
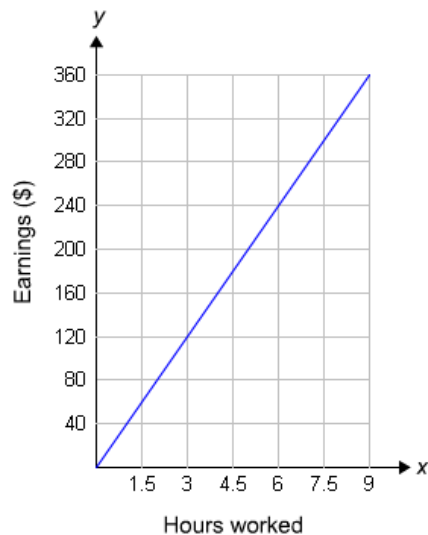
In the graph, *y* represents Ryan's earnings and *x* represents the number of hours he worked. Which equation describes the proportional relationship between the number of hours worked and total earnings?

- A. $y = 3x$
- B. $x = 3y$
- C. $x = 40y$
- D. $y = 40x$

Question 4 .

Directions: Drag each situation to the correct location on the table.

Each situation represents a proportional relationship. Drag each situation to the related equation on the table.

14 bags of ice for $53.90	15 cups of coffee for $57.75	18 bags of popcorn for $71.28	17 gallons of milk for $39.44
12 gallons of gas for $26.76	13 boxes of paper for $51.48		

Question 5 .

Directions: Drag each expression or equation to the correct location on the table. Not all expressions or equations will be used.

The table below shows proportional relationships and a matching proportional equation. Complete the table.

38 candy canes for $12.54 $t = \$1.11n$ $t = \$0.98n$ $t = \$0.77n$

233 pencils for $53.59 $t = \$0.95n$ 17 pillows for $17.51

$t = \$0.23n$

Question 6 .

Sandra sets the cruise control in her car to 66 miles per hour when she goes on road trips. Which equation can be used to find how many hours, h, it will take her to drive m miles at her constant speed?

   ○ **A.** $\frac{66}{m} = h$

   ○ **B.** $66 + m = h$

   ○ **C.** $66m = h$

   ○ **D.** $\frac{m}{66} = h$

Question 7 .

Adrian's lawn mower runs on a fuel combination of oil and gasoline. The table shows the amount of of oil, l, Adrian mixed with the amount of gasoline, g, when he filled the fuel tank.

Amount of Oil, l (in liters)	Amount of Gasoline, g (in liters)
0.05	1.6
0.10	3.2
0.15	4.8
0.2	6.4
0.25	8

Which equation represents the proportional relationship between the amounts of oil and gasoline used to make the fuel for the lawnmower?

   ○ **A.** $g = l + 3.2$
   ○ **B.** $g = 32l$
   ○ **C.** $l = g + 3.2$
   ○ **D.** $l = 32g$

Question 8 .

A supply company sells packs of paper by the box. Each box contains the same number of packs of paper, P. Which equation could be used to find the total number of packs of paper, T, that would be in B boxes ordered?

   ○ **A.** $\frac{B}{P} = T$

   ○ **B.** $BP = T$

   ○ **C.** $\frac{P}{B} = T$

   ○ **D.** $B + P = T$

Question 9 .

Which equation could be used to find the number of days, *d*, in *h* hours?

A. $\frac{h}{24} = d$

B. $24h = d$

C. $\frac{24}{h} = d$

D. $24 + h = d$

Question 10 .

The height of a widescreen monitor is proportional to its length. The table lists the length, *l*, and the height, *h*, of a few widescreen monitors.

Length, *l* (in inches)	Height, *h* (in inches)
14.4	8.1
17.6	9.9
19.2	10.8
20.8	11.7
22.4	12.6
24.0	13.5

Which equation represents the proportional relationship between the lengths and heights of widescreen monitors?

A. $h = l - 7.0$

B. $h = \frac{9}{16}l$

C. $l = \frac{9}{16}h$

D. $l = h - 7.0$

Question 11 .

Ronald can read at a constant rate of *p* pages per minute. Which equation represents the relationship between the total number of pages, *N*, that Ronald can read in *m* minutes?

A. $N = pm$

B. $N = p + m$

C. $N = \frac{p}{m}$

D. $N = \frac{m}{p}$

Question 12 .

At her juice parlor, Mrs. Jones makes a different amount of fruit punch each day by mixing grape juice and peach juice. The table shows the amount of grape juice, g, and the amount of peach juice, p, Mrs. Jones uses to make different quantities of the punch.

Amount of Grape Juice, g (in liters)	Amount of Peach Juice, p (in liters)
11.5	6.9
17.5	10.5
20.5	12.3
26.5	15.9
34.5	20.7

Which equation represents the proportional relationship between the amounts of grape juice and peach juice?

   A. $g = p + 0.6$

   B. $g = \frac{3}{5}p$

   C. $p = \frac{3}{5}g$

   D. $p = g + 0.6$

Question 13 .

A baker makes icing for his cakes using cocoa powder and honey. The diagram below shows the relationship between the number of cups of honey and the number of cups of cocoa powder used.
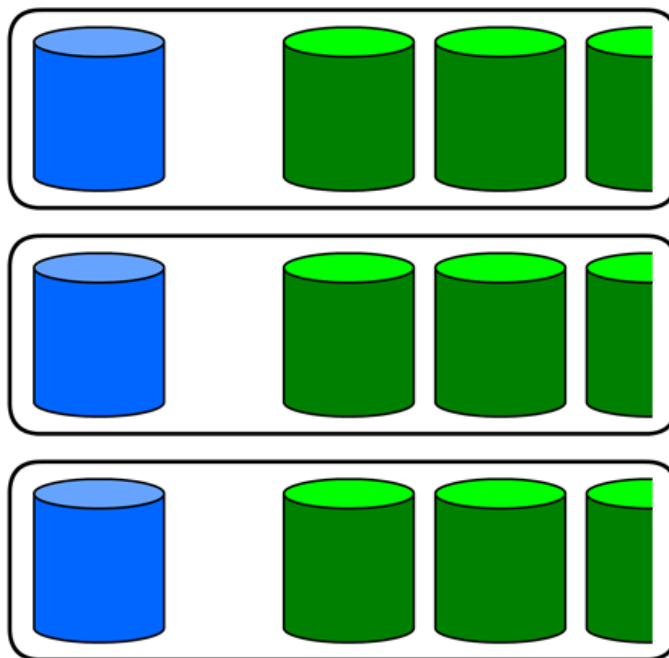

In the equations below, y represents cups of cocoa powder, and x represents cups of honey. Which equation represents the proportional relationship in this diagram?

   A. $y = 1.5x$

   B. $x = 1.75y$

   C. $y = 1.75x$

   D. $x = 1.5 + y$

Question 14 .

The diagram below shows the relationship between the number of blue buckets of chemical 1 and the number of green buckets of chemical 2 needed to form a chemical mixture.
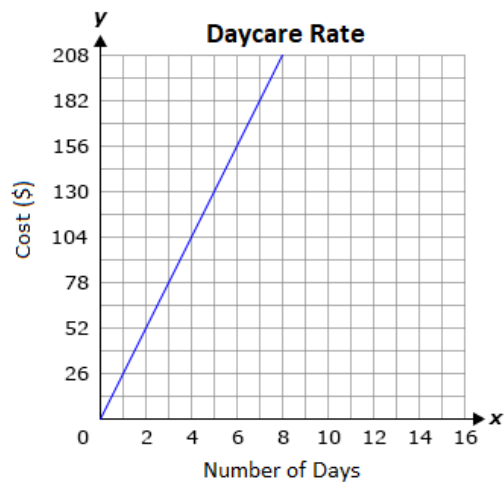

In the equations below, *y* represents the number of green buckets of chemical 2, and *x* represents the number of blue buckets of chemical 1. Which equation represents the proportional relationship in this diagram?

- A. $y = 2.5x$
- B. $y = 1.5 + x$
- C. $x = 1.5y$
- D. $x = 2.5y$

Question 15 .

The given graph shows the cost of keeping a toddler at KinderBlush daycare center.

In the graph, y represents the cost for keeping a toddler at the daycare center and x represents the number of days. Which equation describes the proportional relationship between the cost and the number of days?

- **A.** $x = 26y$
- **B.** $y = 52x$
- **C.** $x = 52y$
- **D.** $y = 26x$

Answers

1. B

2. --

3. D

4. --

5. --

6. D

7. B

8. B

9. A

10. B

11. A

12. C

13. C

14. A

15. D

Explanations

1. To find the total cost of all the tickets, C, multiply the price of each ticket, $6.00, by the number of students, n, going on the trip.

   Therefore, the equation is **$6.00n = C**.

2. To find the correct scenario for each equation, first find the unit rate for each scenario.

4 gallons of milk cost $7.40	$\frac{\$7.40}{4 \text{ gallons}} = \$1.85$ per gallon of milk
5 loaves of bread cost $7.05	$\frac{\$7.05}{5 \text{ loaves}} = \$1.41$ per loaf of bread
4 dozen eggs cost $7.56	$\frac{\$7.56}{4 \text{ dozen}} = \$1.89$ per dozen eggs
4 gallons of orange juice cost $8.07	$\frac{\$7.40}{3 \text{ gallons}} = \$2.69$ per gallon of orange juice

   Next, use the unit rates found above to write a proportional relationship for each scenario in the form $c = rn$, where c is the cost in dollars, r is the unit rate, and n is the number of items.
   The correct scenarios are shown below.

Equation	Scenario
$c = 1.85n$	4 gallons of milk cost $7.40 3 loaves of bread cost $5.88
$c = 1.41n$	5 loaves of bread cost $7.05 6 dozen eggs cost $10.32
$c = 1.89n$	6 gallons of milk cost $9.36 4 dozen eggs cost $7.56
$c = 2.69n$	5 gallons of milk cost $13.75 3 gallons of orange juice cost $8.07

3. Ryan's earnings can be modeled by the equation $y = kx$, where x is the number of hours worked, y is the total earnings in dollars, and k is the earnings per hour.

   Use a point from the graph, like $(3, 120)$, and substitute the values of x and y in the equation $y = kx$ to find the value of k.

   $$y = kx$$
   $$120 = k \cdot 3$$
   $$\frac{120}{3} = k$$
   $$40 = k$$

   Therefore, the equation that describes the proportional relationship given in this graph is **$y = 40x**.

4. To match each proportional relationship to its equation, find the unit rate of each situation.

$$\frac{\$26.76}{12 \text{ gallons of gas}} = \$2.23 \text{ per gallon}$$

$$\frac{\$53.90}{14 \text{ bags of ice}} = \$3.85 \text{ per bag}$$

$$\frac{\$39.44}{17 \text{ gallons of milk}} = \$2.32 \text{ per gallon}$$

$$\frac{\$71.28}{18 \text{ bags of popcorn}} = \$3.96 \text{ per bag}$$

$$\frac{\$51.48}{13 \text{ boxes of paper}} = \$3.96 \text{ per box}$$

$$\frac{\$57.75}{15 \text{ cups of coffee}} = \$3.85 \text{ per cup}$$

Each equation uses the variables y, representing the total price, and x, representing the number of items. The correct matches are shown below.

$y = 2.23x$	$y = 3.85x$
12 gallons of gas for $26.76	14 bags of ice for $53.90 15 cups of coffee for $57.75
$y = 3.96x$	**$y = 2.32x$**
18 bags of popcorn for $71.28 13 boxes of paper for $51.48	17 gallons of milk for $39.44

5. To match each proportional relationship to its equation, find the unit rate in dollars per item for each situation. Since the equations are proportional, they can be written in the form total cost = unit rate × number of items.

$$\frac{\$12.32}{16 \text{ oranges}} = \$0.77; \quad t = 0.77n$$

$$\frac{\$53.59}{233 \text{ pencils}} = \$0.23; \quad t = 0.23n$$

$$\frac{\$17.51}{17 \text{ pillows}} = \$1.03; \quad t = 1.03n$$

$$\frac{\$56.05}{59 \text{ songs}} = \$0.95; \quad t = 0.95n$$

$$\frac{\$40.70}{74 \text{ beach balls}} = \$0.55; \quad t = 0.55n$$

$$\frac{\$12.54}{38 \text{ candy canes}} = \$0.33; \quad t = 0.33n$$

$$\frac{\$39.20}{40 \text{ jump ropes}} = \$0.98; \quad t = 0.98n$$

Each equation uses the variables t, representing the total price, and n, representing the number of items. The completed table is shown below.

74 beach balls for $40.70	$t = \$0.55n$
40 jump ropes for $39.20	$t = \$0.98n$
17 pillows for $17.51	$t = \$1.03n$
38 candy canes for $12.54	$t = \$0.33n$
59 songs for $56.05	$t = \$0.95n$

6. The distance that Sandra travels is proportional to the number of hours she drives at a constant speed of 66 miles per hour. This can be written as $m = 66h$. To find the number of hours, divide the distance in miles by the constant speed.

Therefore, the equation is $\frac{m}{66} = h$.

7. A proportional relationship between the variables l and g is described by an equation of the form $g = kl$.

In the equation $g = kl$, g represents the amount of gasoline, l represents the amount of oil, and k represents the constant of proportionality or, unit rate, of the relationship.

To find the value of k, choose one pair of values of l and g from the table. Substitute the values into the equation $g = kl$ and solve the equation to find the value of k.

$$4.8 = 0.15k$$
$$0.15k = 4.8$$
$$k = \frac{4.8}{0.15}$$
$$k = 32$$

Therefore, the equation that describes the relationship in the table is shown.

$$g = 32l$$

8. To find the total number of packs of paper, T, multiply the number of boxes, B, by the number of packs of paper, P, in each box.

Therefore, the equation is **$BP = T$**.

9. The number of days, d, in h hours is a proportional relationship because there are 24 hours in each day. This can be written as $h = 24d$. To find the number of days in a certain number of hours, divide the total number of hours by 24.

Therefore, the equation is $\dfrac{h}{24} = d$.

10. A proportional relationship between the variables l and h is described by an equation of the form $h = kl$.

In the equation $h = kl$, h represents the height of the wide screen monitor, l represents the length of the widescreen monitor, and k represents the constant of proportionality or unit rate of the relationship.

To find the value of k, choose one pair of values of l and h from the table. Substitute the values into the equation $h = kl$, and solve the equation to find the value of k.

$$10.8 = 19.2k$$
$$19.2k = 10.8$$
$$k = \frac{10.8}{19.2}$$
$$k = \frac{9}{16}$$

Hence, the equation that describes the relationship in the table is given below.

$$h = \frac{9}{16}l$$

11. The total number of pages that Ronald can read, N, can be found by multiplying the number of minutes, m, he reads by the number of pages, p, he can read per minute.

Therefore, the equation is $N = pm$.

12. A proportional relationship between the variables g and p is described by an equation of the form $p = kg$.

In the equation $p = kg$, p represents the amount of peach juice, g represents the amount of grape juice, and k represents the constant of proportionality or, unit rate, of the relationship.

To find the value of k, choose one pair of values of p and g from the table. Substitute the values into the equation $p = kg$ and solve the equation for k.

$$10.5 = 17.5k$$
$$17.5k = 10.5$$
$$k = \frac{10.5}{17.5}$$
$$k = \frac{3}{5}$$

Therefore, the equation that describes the proportional relationship in the table is shown.

$$p = \frac{3}{5}g$$

13. The equation that represents the proportional relationship is $y = kx$, where x represents the number of cups of honey, y represents the number of cups of cocoa powder, and k represents the unit rate. The unit rate is the ratio of the y-values to the x-values.

Based on this diagram, for every 2 cups of honey, there are 3.5 cups of cocoa powder.

$$\frac{3.5}{2} = 1.75$$
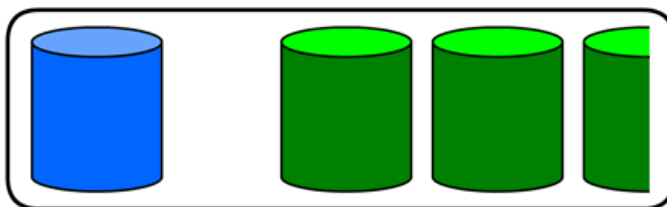
So the unit rate, k, is 1.75.

Substitute 1.75 for k in the equation.

Therefore, the following equation represents the proportional relationship in the diagram.

$$y = 1.75x$$

14. The equation that represents the proportional relationship is $y = kx$, where y represents the number of green buckets of chemical 2, x represents the number of blue buckets of chemical 1, and k represents the unit rate.

Based on this diagram, for every 1 blue bucket, there are 2.5 green buckets. So, the unit rate, k, is 2.5.

Substitute 2.5 for k in the equation.

Therefore, the equation that represents the proportional relationship in the diagram is given below.

$$y = 2.5x$$

15. The cost to keep a toddler at the daycare center can be modeled by the equation $y = kx$, where x is the number of days, y is the cost in dollars, and k is the rate per day.

Use a point from the graph, such as (6 , 156), and substitute the values of x and y in the equation $y = kx$ to find the value of k.

$$y = kx$$
$$156 = k \cdot 6$$
$$\frac{156}{6} = k$$
$$26 = k$$

Therefore, the equation that describes the proportional relationship in this graph is **$y = 26x$**.