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Lesson 3.6 Writing Algebraic Expressions

Translate each verbal description into an algebraic expression. Simplify the expression when you can.

1. The sum of one-half t and one-third s

2. Twenty subtracted from $\frac{15}{23}b$

3. The product of $5r$ and 7 divided by 15

4. 120% of the sum of w and one-twelfth u

5. Nine-fourteenths of $6x$ reduced by 10

6. 20% of one-half w

7. Seven-tenths of the product of $5p$ and 3

8. The sum of x, three-fourths x, and 90% of z

9. Four times the difference of one-half x subtracted from three-eighths y

10. 60% of the difference of five-eighteenths v subtracted from four-sixths w

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Solve. You may use a diagram, model, or table.

11. The length of a picture frame is $(8u - 12)$ inches. Its width is $\frac{3}{4}$ of the length. Express the width of the picture frame in terms of u.

12. If 6 tablespoons = 1 fluid ounce, how many fluid ounces are in $(10t - 4)$ tablespoons?

13. Eleven notebooks were added to w notebooks. 7 friends then shared the notebooks equally. Express the number of notebooks for each person in terms of w.

14. A pear costs \$0.40 and an apple costs \$0.25. What is the total cost of p pears and q apples?

15. The ratio of pencils to pens is 5 : 7. There are q pens. Express the numbers of pencils in terms of q.

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Solve. You may use a diagram, model, or table.

16. When 5 adults joined a group of y diners, the ratio of adults to children in the restaurant became 3 : 5. Express the number of children in terms of y.

17. Freddy paid w dollars for a camera and \$120 for an additional camera lens. If the sales tax is 8%, how much did Freddy pay for the camera and lens, including the sales tax?

18. Emily has $5u$ game cards. John has $\frac{8}{13}$ fewer game cards than Emily. Find the average number of game cards that Emily and John have in terms of u.

19. A train traveled at 140 miles per hour for $2\frac{1}{14}x$ hours, and $(2x - 3)$ miles per hour for the next 3 hours.

a) Express the total distance traveled by the train in terms of x.

b) If $x = 3$, what is the total distance traveled by the train?

22. $-3x - 24 = -3x + (-24)$
$= (-3)(x) + (-3)(8)$
$= -3(x + 8)$

23. $-7k - 35 = -7k + (-35)$
$= (-7)(k) + (-7)(5)$
$= -7(k + 5)$

24. $-9u - 81 = -9u + (-81)$
$= (-9)(u) + (-9)(9)$
$= -9(u + 9)$

25. $-2 - 6n = -2 + (-6n)$
$= (-2)(1) + (-2)(3n)$
$= -2(1 + 3n)$

26. $-4 - 12p = -4 + (-12p)$
$= (-4)(1) + (-4)(3p)$
$= -4(1 + 3p)$

27. $-24x - 18y = -24x + (-18y)$
$= (-6)(4x) + (-6)(3y)$
$= -6(4x + 3y)$

28. $-35m - 20n = -35m + (-20n)$
$= (-5)(7m) + (-5)(4n)$
$= -5(7m + 4n)$

29. $-28w - 7q = -28w + (-7q)$
$= (-7)(4w) + (-7)(q)$
$= -7(4w + q)$

30. $-48y - 16x = -48y + (-16x)$
$= (-16)(3y) + (-16)(x)$
$= -16(3y + x)$

31. $3x + 3y + 9 = 3(x) + 3(y) + 3(3)$
$= 3(x + y + 3)$

32. $4a + 2b + 6 = 2(2a) + 2(b) + 2(3)$
$= 2(2a + b + 3)$

33. $15p + 5q + 10 = 5(3p) + 5(q) + 5(2)$
$= 5(3p + q + 2)$

34. $18d + 9e + 12 = 3(6d) + 3(3e) + 3(4)$
$= 3(6d + 3e + 4)$

35. $4s - 8t - 20 = 4s + (-8t) + (-20)$
$= 4(s) + 4(-2t) + 4(-5)$
$= 4[s + (-2t) + (-5)]$
$= 4(s - 2t - 5)$

36. $7a - 14b - 28 = 7a + (-14b) + (-28)$
$= 7(a) + 7(-2b) + 7(-4)$
$= 7[a + (-2b) + (-4)]$
$= 7(a - 2b - 4)$

37. $16a - 12b - 6 = 16a + (-12b) + (-6)$
$= 2(8a) + 2(-6b) + 2(-3)$
$= 2[8a + (-6b) + (-3)]$
$= 2(8a - 6b - 3)$

38. $33g - 11h - 66 = 33g + (-11h) + (-66)$
$= 11(3g) + 11(-h) + 11(-6)$
$= 11[3g + (-h) + (-6)]$
$= 11(3g - h - 6)$

39. $9 + 18m - 12n = 9 + 18m + (-12n)$
$= 3(3) + 3(6m) + 3(-4n)$
$= 3[3 + 6m + (-4n)]$
$= 3(3 + 6m - 4n)$

40. $35 - 5w + 25k = 35 + (-5w) + 25k$
$= 5(7) + 5(-w) + 5(5k)$
$= 5[7 + (-w) + 5k]$
$= 5(7 - w + 5k)$

Lesson 3.6

1. $\frac{t}{2} + \frac{s}{3}$

2. $\frac{15}{23}b - 20$

3. $\frac{5r \cdot 7}{15} = \frac{35r}{15} = \frac{7r}{3}$

4. $1.2\left(w + \frac{u}{12}\right) = 1.2 \cdot w + 1.2 \cdot \frac{u}{12}$
$= 1.2w + \frac{u}{10}$

5. $\frac{9}{14}(6x) - 10 = \frac{27}{7}x - 10$

6. $\frac{20}{100} \cdot \frac{1}{2}w = \frac{1}{10}w$

7. $\frac{7}{10} \cdot 5p \cdot 3 = \frac{21p}{2}$

8. $x + \frac{3}{4}x + 0.9z = \frac{4}{4}x + \frac{3}{4}x + 0.9z = \frac{7}{4}x + 0.9z$

9. $4\left(\frac{3}{8}y - \frac{1}{2}x\right) = 4\left(\frac{3}{8}y\right) + 4\left(-\frac{1}{2}x\right)$
$= \frac{3}{2}y + (-2x)$
$= \frac{3}{2}y - 2x$

10. $0.6\left(\frac{4}{6}w - \frac{5}{18}v\right) = 0.6\left(\frac{4}{6}w\right) + 0.6\left(-\frac{5}{18}v\right)$
$= \frac{2}{5}w + \left(-\frac{1}{6}v\right)$
$= \frac{2}{5}w - \frac{1}{6}v$

11. Width: $\frac{3}{4}(8u - 12) = \frac{3}{4}(8u) + \frac{3}{4}(-12)$
$= 6u + (-9)$
$= (6u - 9)$ inches

The width of the picture frame is $(6u - 9)$ inches.

12. 1 tablespoon $= \frac{1}{6}$ fluid ounces

$(10t - 4)$ tablespoons $= \frac{1}{6}(10t - 4)$ fluid ounces

$= \frac{1}{6} \cdot 10t - \frac{1}{6} \cdot 4$

$= \left(\frac{5}{3}t - \frac{2}{3}\right)$ fluid ounces

$(10t - 4)$ tablespoons is $\left(\frac{5}{3}t - \frac{2}{3}\right)$ fluid ounces.

13. Each person gets $\left(\frac{11 + w}{7}\right)$ notebooks.

14. Total cost of pears and apples:
$0.4p + 0.25q$

15. Number of pencils: $\frac{5}{7}q$

There are $\frac{5}{7}q$ pencils.

16. Number of diners after 5 adults joined: $y + 5$

Number of children: $\frac{5}{8}(y + 5)$

The number of children is $\frac{5}{8}(y + 5)$.

17. Cost of camera and lens before tax: $w + 120$
Cost of camera and lens including tax:
$1.08(w + 120) = 1.08 \cdot w + 1.08 \cdot 120$
$= (1.08w + 129.6)$
Freddy paid $(1.08w + 129.6)$ dollars for the camera and lens.

18. Number of cards Johnson has: $\left(5u - \frac{8}{13}\right)$

Total number of cards that Emily and Johnson have: $5u - \frac{8}{13} + 5u = (5u + 5u) - \frac{8}{13}$
$= 10u - \frac{8}{13}$

Average number of cards:

$\frac{1}{2}\left(10u - \frac{8}{13}\right) = \frac{1}{2}(10u) + \frac{1}{2}\left(-\frac{8}{13}\right)$

$= 5u + \left(-\frac{4}{13}\right)$

$= 5u - \frac{4}{13}$

Emily and Johnson have an average of $\left(5u - \frac{4}{13}\right)$ cards.

19. a) Total distance traveled:

$140 \cdot 2\frac{1}{14}x + 3(2x - 3)$

$= 140 \cdot \frac{29}{14}x + 3(2x) + 3(-3)$
$= 290x + 6x + (-9)$
$= 290x + 6x - 9$
$= (296x - 9)$ mi
The bullet train traveled a total of $(296x - 9)$ miles.

b) When $x = 3$, total distance traveled:
$296x - 9 = 296 \cdot 3 - 9 = 879$ mi
The total distance traveled by the bullet train is 879 miles.

Lesson 3.7

1. Difference in length:
$(12.5x + 17) - (5x + 0.4w)$
$= 12.5x + 17 + (-1)(5x) + (-1)(0.4w)$
$= 12.5x + (-1)(5x) + 17 + (-1)(0.4w)$
$= 12.5x - 5x + 17 - 0.4w$
$= 12.5x - 5x + 17 - 0.4w$
$= (7.5x + 17 - 0.4w)$ cm
The difference in length of the two ropes is $(7.5x + 17 - 0.4w)$ centimeters.

2. Circumference $= 2\pi r$

$= 2\left(\frac{22}{7}\right)(7n - 21)$

$= \left(\frac{44}{7}\right)(7n - 21)$

$= \left(\frac{44}{7}\right)(7n) + \left(\frac{44}{7}\right)(-21)$

$= 44n + (-132)$

$= (44n - 132)$in.

The circumference of the circle is $(44n - 132)$ inches.

3. Total sales: $4(7.6k + 2.2)$
$= 4(7.6k) + 4(2.2)$
$= (30.4k + 8.8)$ dollars
The total sales during the promotion was $(30.4k + 8.8)$ dollars.

4. Number of yellow ribbons: $\frac{6}{17}(2m + 5)$

$= \frac{6}{17}(2m) + \frac{6}{17}(5)$

$= \frac{12}{17}m + 1\frac{13}{17}$

There are $\frac{12}{17}m + 1\frac{13}{17}$ yellow ribbons.

5. Number of children who went to New Zealand: $c - 0.36c - 24 = 0.64c - 24$
$(0.64c - 24)$ children went to New Zealand.