Lesson 3.6  Writing Algebraic Expressions

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

1. Sum of one-half t and one-third s
   \[ \frac{t}{2} + \frac{s}{3} \text{ or } \frac{1}{2}t + \frac{1}{3}s \]

2. Twenty subtracted from \( \frac{15b}{23} \)
   \[ \frac{15}{23}b - 20 \]

3. Product of 5r and 7 divided by 15
   \[ \frac{5r \cdot 7}{15} = \frac{35r}{15} \]

4. 120% of the sum of \( w \) and one-twelfth \( u \)
   \[ 1.2 \left( \frac{w + u}{12} \right) = 1.2 \cdot \frac{w + u}{12} \]
   \[ = 1.2w + \frac{u}{10} \]

5. Nine-fourteenths of 6x reduced by 10
   \[ \frac{9}{14}(6x) - 10 = \frac{27}{7}x - 10 \]

6. 20% of one-half \( w \)
   \[ \frac{20}{100} \cdot \frac{1}{2} = \frac{1}{10}w \]
7. Seven-tenths of the product of 5p and 3
   \[ \frac{7}{10} (5p \cdot 3) = \frac{21p}{2} \text{ or } 10.5p \]

8. Sum of \( x \), three-fourths \( x \), and 90% of \( z \)
   \[ x + \frac{3}{4} x + 0.9z = \left( \frac{4}{4} x + \frac{3}{4} x \right) + 0.9z \]
   \[ = \frac{7}{4} x + 0.9z \]

9. Four times the difference of one-half \( x \) subtracted from three-eighths \( y \)
   \[ 4 \left( \frac{3}{8} y - \frac{1}{2} x \right) = 4 \left( \frac{3}{8} y \right) + 4 \left( -\frac{1}{2} x \right) \]
   \[ = \frac{3}{2} y + (-2x) \]
   \[ = \frac{3}{2} y - 2x \]

10. 60% of the difference of five-eighteenths \( v \) subtracted from four-sixths \( w \)
    \[ \frac{60}{100} \left( \frac{4}{6} w - \frac{5}{18} v \right) = \frac{60}{100} \left( \frac{4}{6} w \right) + \frac{60}{100} \left( -\frac{5}{18} v \right) \]
    \[ = \frac{2}{3} w + \left( -\frac{1}{6} v \right) \]
    \[ = \frac{2}{3} w - \frac{1}{6} v \]
11. The length of a picture frame is \((8u - 12)\) inches. Its width is \(\frac{3}{4}\) of its length. Express the width of the picture frame in terms of \(u\).

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

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

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

12. \(1\) tablespoon = \(\frac{1}{6}\) fl oz

\((10t - 4)\) tablespoons = \(\frac{1}{6} \cdot (10t - 4)\) fl oz

= \(\frac{1}{6} \cdot 10t - \frac{1}{6} \cdot 4 = \left(\frac{5}{3} - \frac{2}{3}\right)\) fl oz

\(\left(\frac{5}{3} - \frac{2}{3}\right)\) fluid ounces are in \((10t - 4)\) tablespoons.
13. 11 notebooks were added to \( w \) notebooks. 7 friends then shared the notebooks equally. Express the number of notebooks each person received in terms of \( w \).

\[
\text{Each person received } \frac{11 + w}{7} \text{ notebooks.}
\]

\[
\frac{1}{7} (11 + w) \text{ OR } \frac{11}{7} + \frac{1}{7} \cdot w
\]

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

\[
\text{The total cost of } p \text{ pears and } q \text{ apples is } (0.4p + 0.25q) \text{ dollars.}
\]

15. The ratio of the number of pencils to pens is 5 : 7. There are \( q \) pens. Express the number of pencils in terms of \( q \).

\[
\text{Number of pencils: } \frac{5}{7} \cdot q
\]

\[
\text{There are } \frac{5}{7} \cdot q \text{ pencils.}
\]
16. When 5 adults joined a group of \( y \) diners, the ratio of the number of adults to children in the restaurant became 3 : 5. Express the number of children in terms of \( y \).

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. 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?

Cost of camera and lens before tax:
\[ w + 120 \text{ dollars} \]

Cost of camera and lens including tax:
\[ 1.08(w + 120) = 1.08 \cdot w + 1.08 \cdot 120 = (1.08w + 129.6) \text{ dollars} \]

Freddy paid \( 1.08w + 129.6 \) dollars for the camera and lens.

\[ \frac{(y+5)}{8} \cdot 5 = \frac{(5y+25)}{8} = \frac{5(y+5)}{8} \]
18. Emily has $5u$ game cards. John has $\frac{3}{13}$ fewer game cards than Emily. Find the average number of game cards that Emily and John have in all in terms of $u$.

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

Total number of cards that Emily and John have:

$$5u - \frac{8}{13} + 5u = (5u + 5u) - \frac{8}{13}$$

$$= 10u - \frac{8}{13}$$

**Average number of cards:**

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

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

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

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