# Verbal-to-Algebraic Conversions

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In algebra, the ability to convert verbal statements into algebraic expressions is an important skill to master. Without this knowledge, solving word problems could be quite difficult. The following table lists some of the more common words that you may encounter in word problems and how they are related to the four basic math operations.

| WORDS DENOTING | | | |
|---|---|---|---|
| ADDITION | SUBTRACTION | MULTIPLICATION | DIVISION |
| exceed | decrease | double | each |
| greater than | difference | multiplied by | divide by |
| higher | diminish | [fraction] of | per |
| increase | drop | product | quotient |
| larger than | fewer than | times | ratio |
| more than | less than | triple | |
| plus | lower | twice | |
| sum | minus | | |
| total | smaller than | | |

## NOTES

1.      The word *and* is usually used as a conjunction: "The product of 4 *and* c" = 4c
        It is less commonly used to represent addition (as in "two *and* two are four").

2.      "15 more than a number" may be written "15 + n" or "n + 15", but it is better to write the variable first and the constant last: "n + 15".

3.      "A number less 15" is written "n − 15", not "15 − n".
        "15 less a number" is "15 − n", not "n − 15"
        "The difference of 15 and a number" is "15 − n", not "n − 15"

4.      "The product of 15 and a number" is written as "15n". If you write "n15", you would be understood, but it is bad style.

5.      "The quotient of 15 and n" should be written $\frac{15}{n}$, not $\frac{n}{15}$.

6.      To treat an expression as a single number, use parentheses: "Twice the sum of b and c" is "2(b + c)".

7.      When you use a letter to represent an unknown, choose a letter that suggests what the unknown represents in the problem. For example, use "t" to represent time or temperature, "d" to represent distance or depth, and so on.

8.      Read from the beginning. Write the sentence in math symbols, but if you expect to read a number or a variable, and you get something else, start a new bracket. Close the brackets when the expressions you start are completed.
        Five times the sum of 15 and the quotient of the height and the base:
        5 × … the sum (add) → 5 × (15 + … the quotient (divide) →  5 × (15 + (h ÷ b))

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**EXERCISES**

A. If "h" represents height, express the phrases below algebraically. Assume height is already in the correct units.
    1) the sum of the height and 45

    2) the height plus 4 m

    3) height increased by 6 cm

    4) 2 more than the height

    5) the total of 8 and the height

    6) 7 in excess of the height

B. If "w" represents weight, then express the phrases below algebraically. Assume weight is already in the correct units.
    1) the weight less 6 kg

    2) 20 grams less the weight

    3) 20 grams less than the weight

    4) 15 pounds is subtracted from the weight

    5) the weight subtracted from 15 tonnes

    6) 5 ounces less than the weight

    7) 22 centigrams decreased by the weight

C. If "c" represents cost, then express the phrases below algebraically:
    1) the product of 5 and the cost

    2) 8 times the cost

    3) double the cost

    4) one-quarter of the cost

D. If "f" represents fruit, then express the phrases below algebraically:
    1) the fruit, divided by 2,…

    2) the quotient of the amount of fruit and 4

    3) the ratio of the amount of fruit and 6

    4) 20 divided by the number of fruit

E.  Express the phrases below algebraically. Use appropriate variables and parentheses where required:
   1)  twice the sum of hammer and saws

   2)  60 minutes, decreased by twice the total length of the commercials and theme song

   3)  eight times the difference of 8 and the number of votes

   4)  the product of 4 and the total number of Liberals and Conservatives

   5)  the quotient of width and the sum of width plus 2

F.  Express the phrases below algebraically. Use appropriate variables and parentheses where required:
   1)  Eight times the sum of the number of adults, the number of children and 4 pets

   2)  Six more than twice the product of 5 and a number

   3)  35 diminished by one-half the product of 5 and voltage

   4)  Twice the sum of the base and 22 diminished by 22

   5)  57 less than the ratio of apples to bananas

   6)  Five-sixths of the girls less twice the boys

   7)  41 less than the sum of length and width

   8)  the average of the number of men and women

   9)  the number of boots decreased by one-half the number of sandals

   10) the ratio of the number of tables to four times the number of chairs [*Hint: this expression can mean two different things, but most English speakers think that "four times the number of chairs" is one phrase.*]

G. Express the phrases below algebraically. Use appropriate variables and parentheses where required:
   1)  Michael's age in two years (compared to his age today)

   2)  Diana's age three years ago (compared to her age today)

   3)  The total cost of 15 Frisbees (in terms of the cost of 1 Frisbee)

4) The total value of a stack of quarters (in cents, and in terms of the number of quarters in the stack)

5) The next consecutive integer after n

6) The next even integer after the even integer n

7) The next odd integer after the odd integer n

8) The length of the remaining piece of a 20 cm dowel if two pieces, x cm each, have been cut from it

9) A time, in hours, that is 20 minutes less than t hours

10) The distance a car travels by going 30 $\text{km}/\text{h}$ for t hours, expressed in kilometres

**SOLUTIONS**

A. (1) h + 45   (2) h + 4   (3) h + 6   (4) h + 2   (5) h + 8   (6) h + 7

B. (1) w − 6   (2) 20 − w   (3) w − 20   (4) w − 15   (5) 15 − w   (6) w − 5   (7) 22 − w

C. (1) 5c   (2) 8c   (3) 2c   (4) $\frac{1}{4}$c  or  $\frac{c}{4}$  or .25c

D. (1) f ÷ 2   (2) f ÷ 4   (3) f ÷ 6   (4) 20 ÷ f

E. (1) 2(h + s)   (2) 60 − 2(c + t)   (3) 8(8 − v)   (4) 4(L + C)   (5) $\frac{w}{w+2}$

F. (1) t ÷ 4f   (2) 8(a + c + 4) [*not "…+ 4p"! Pets can multiply, but not like this!*]

　 (3) 2(5n)+ 6   (4) 35 − $\frac{5V}{2}$   (5) 2(b + 22) − 22   (6) $\frac{a}{b}$ − 57   (7) $\frac{5}{6}$ g − 2b

　 (8)(l + w) − 41   (9) $\frac{m+w}{2}$   (10) b − $\frac{1}{2}$ s

G. (1) M + 2   (2) D − 3   (3) 15f   (4) 25q   (5) n + 1   (6) n + 2   (7) n + 2   (8) 20 − 2x

　 (9) t − $\frac{20}{60}$ = t − $\frac{1}{3}$   (10) 30t