

Algebra: Applications of Linear Equations in One Variable (Overview)

Steps to Solving Applied Problems

Every day we encounter application or word problems. There is **NO** standard procedure for solving these problems, but there are some guidelines that can be used.

1. **READ** the problem until you understand the problem. Determine what information is given and what you are asked to find. Try to guess what the answer might be.
DRAW a picture, make a diagram, or construct a table to help illustrate the problem.
2. **IDENTIFY** what you are being asked to find.
SELECT a variable to represent one of the unknowns.
WRITE down what the variable represents.
DEFINE any other unknowns in terms of that variable.
LABEL the picture or diagram or parts of the table with the variable, any other unknowns, and any additional information provided by the problem.
3. **TRANSLATE** the word problem into an equation that models or represents the situation.
RESTATE the problem in your own words.
SEPARATE the larger word problem into small parts.
WRITE an algebraic expression to represent each part.
CREATE an algebraic equation that represents the situation by combining the expressions.
4. **SOLVE** the equation.
5. **INTERPRET** the meaning of your solution in terms of the original situation.
VERIFY that your solution answers the question posed in the original problem and makes sense.
CHECK your answer by using it to solve the original problem (not the equation).
FIND other unknowns if necessary.
6. **STATE** your solution in a sentence including appropriate labels as necessary.

Phrases often used in Number problems.

The sum of two *consecutive* integers is written: $x + (x + 1)$

The sum of three consecutive *even* integers is written: $x + (x + 2) + (x + 4)$

The sum of three consecutive *odd* integers is written: $x + (x + 2) + (x + 4)$

Situation statement:

Four plus the sum of two consecutive odd integers is one less than three times the first odd integer.

Solve:

$$4 + [x + (x + 2)] = 3x - 1$$

$$4 + [2x + 2] = 3x - 1$$

$$2x + 6 = 3x - 1$$

$$2x - 2x + 6 = 3x - 2x - 1$$

$$6 = x - 1$$

$$6 + 1 = x - 1 + 1$$

$$7 = x \quad \text{The two numbers are 7 and 9.}$$

State the Equation:

$$4 + [x + (x + 2)] = 3x - 1$$

Check:

$$4 + (7 + 9) = 3(7) - 1$$

$$4 + 16 = 21 - 1$$

$$20 = 20$$

TRY:

Seven more than one-third of a number is 10.

What is the equation?

What is the solution?

General Quantities

- A. Dr. Jay has a total of 48 students in his two labs. There are 4 more students in his 8:00 a.m. lab than in his 4:00 p.m. lab. Find the number of students in each lab.

Unknowns: S = number of students in the 4:00 p.m. lab.

$S+4$ = number of students in the 8:00 a.m. lab

Equation: $S + (S+4) = 48$

- B. There were three times more women participating in the Victory Run than men. A total of 60 people participated in the Run. Find the number of men and the number of women that participated.

HINT: express 'women' in terms of 'men'

Unknowns: M = number of men

$3M$ = number of women

Equation: $M + 3M = 60$

TRY:

Fido has a total of 62 treats. There are 14 more soft chewy treats than there are hard crunchy treats. Find the number of each type of treat. HINT: express 'chewy' in terms of 'hard'

There are 91 students registered in 3 sections of algebra. There are twice as many students in Section A as in Section B and 11 more in Section C than in Section B. How many students are in each section?

HINT: express 'A' and 'C' in terms of 'B'

Mrs. J. is 12 years more than 5 times the age of her daughter. If the difference between their ages is 24, how old is Mrs. J? HINT: express 'Mrs. J' in terms of 'daughter'

Different Lengths

- A. A plumber has a pipe that is 21 feet long. He needs to cut it into two sections so that one section is half as long as the other. Find the length of each section of pipe.

Unknowns: F = length in feet of the longer pipe

$$\text{Equation: } F + \frac{1}{2}F = 21$$

$\frac{1}{2}F$ = length in feet of the shorter pipe

- B. A 24-foot chain must be cut into three pieces. The longest piece needs to be three times the length of the shortest piece. The medium-length piece needs to be twice the length of the shortest piece. Find the lengths of each piece.

Unknowns: C = length in feet of the shortest piece
 $2C$ = length in feet of the medium-length piece
 $3C$ = length in feet of the longest piece

$$\text{Equation: } C + 2C + 3C = 24$$

TRY:

For Ky's art project, a cord must be cut into two pieces. The longer piece needs to be three times the length of the shorter piece. If the full length of the cord is 64 feet, find the lengths of the two pieces.

Consecutive Integers

- A. The sum of three consecutive integers is 123. Find the three integers.

Unknowns: $X =$ first integer
 $X+1 =$ second integer
 $X+2 =$ third integer

$$\text{Equation: } X + (X+1) + (X+2) = 123$$

- B. If the smaller of two consecutive odd integers is subtracted from twice the larger one, then the result is 13. Find the smaller odd integer.

Unknowns: $N =$ first odd integer
 $N+2 =$ second odd integer

$$\text{Equation: } 2(N+2) - N = 13$$

TRY:

If the smaller of two consecutive even integers is added to three times the larger one, then the result is five times the smaller one. Find the two integers.