

Math Skills

The Law of Gravitation and Algebraic Rearrangement

In order to study gravity and its effects, scientists must use mathematical equations. To solve these equations, they use algebra and algebraic rearrangement.

Algebraic equations contain *constants* (numbers) and *variables* (unknowns represented by letters such as x or y .) To solve algebraic problems, you will need to determine the value of a variable. An algebraic equation involves one or more of the four basic mathematical operations: addition, subtraction, multiplication, and division.

The goal in solving an algebraic equation is to find the value of the the variable. To do so, remember that the value on one side of the equal sign must always be the same as the value on the opposite side. If you perform the same mathematical operation on both sides of the equal sign, the values will still be equal. To determine the value of the variable, reduce both sides of the equation to a simple statement that tells exactly what the variable equals.

SAMPLE PROBLEM:

A cargo plane is carrying special medical equipment to a hospital in northern Alaska. Its cargo's weight in flight is 1,500 kg. The plane is flying at a height where a given mass weighs two-thirds of its weight on Earth. How much does that equipment weigh when it reaches its destination?

Step 1: Write this word problem as an algebraic equation.

x = weight of the equipment on on the ground in Alaska

$$\frac{2}{3}x = 1,500$$

Step 2: Calculate.

In this case, to solve for x , multiply both sides by $\frac{3}{2}$. The result is the following:

$$\frac{3}{2} \times \frac{2}{3}x = \frac{3}{2} \times 1,500$$

$$1 x = \frac{3}{2} \times 1,500$$

$$x = 2,250 \text{ kg on the ground in Alaska}$$

PRACTICE

Using the sample problem as a guide, solve the following problems. Remember to show your work.

1. A weather satellite is carrying meteorological equipment to chart hurricane activity over the course of a year. That equipment weighs 4,800 newtons (N) on the ground. If the weight of a mass at 19,778 km from Earth's center is only 10% of the weight of the mass on Earth, how much will the weather equipment weigh when the satellite is in space, 19,788 km from Earth's core?

Write this word problem as an algebraic equation:

Calculate your answer:

2. $12x + 43 = 247$

3. $(4x + 10)/2 - 4 = 22$

4. $6x/3 - 16 = 6$

