Now, consider the following equation:

$$\frac{x}{5} = 9$$

If we multiply each side by 5, we are left with x isolated on the left and a value of 45 on the right.

$$(5)\left(\frac{x}{5}\right) = (9)(5)$$
$$x = 45$$

In all cases, *whatever operation is performed on the left side of the equation must also be performed on the right side.*

Factoring

Some useful formulas for factoring an equation are given in **Table 3.** As an example of a common factor, consider the equation $5x + 5y + 5z = 0$. This equation can be expressed as $5(x + y + z) = 0$. The expression $a^2 + 2ab + b^2$, which is an example of a perfect square, is equivalent to the expression $(a + b)^2$. For example, if $a = 2$ and $b = 3$, then $2^2 + (2)(2)(3) + 3^2 = (2 + 3)^2$, or $(4 + 12 + 9) = 5^2 = 25$. Finally, for an example of the difference of two squares, let $a = 6$ and $b = 3$. In this case, $(6^2 - 3^2) = (6 + 3)(6 - 3)$, or $(36 - 9) = (9)(3) = 27$.

Table 3 Factoring Equations

$ax + ay + az = a(x + y + z)$	common factor
$a^2 + 2ab + b^2 = (a + b)^2$	perfect square
$a^2 - b^2 = (a + b)(a - b)$	difference of two squares

Quadratic Equations

The general form of a quadratic equation is as follows:

$$ax^2 + bx + c = 0$$

In this equation, x is the unknown quantity and a, b, and c are numerical factors known as *coefficients.* This equation has two roots, given by the following:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $b^2 \geq 4ac$, the value inside the square-root symbol will be positive or zero and the roots will be real. If $b^2 < 4ac$, the value inside the square-root symbol will be negative and the roots will be imaginary numbers. In problems in this physics book, imaginary roots should not occur.