

1.2 Arithmetic Operations on Vectors

In this section, various arithmetic operations on vectors used in problem solving are described. Because a vector has both a geometric representation (as a point or as an arrow) and an algebraic representation (as an ordered list of real numbers), each operation has a geometric representation with an algebraic counterpart. The advantage of the geometric version is that you can visualize the operation, at least for vectors in 2-space and 3-space. The algebraic version has two distinct advantages: (1) the algebraic operation is applicable to vectors in n -space, for any positive integer n and (2) computers are capable of performing algebraic operations but not geometric ones.

When an operation on a vector is described in an algebraic (or symbolic) form, you should use visualization to create an appropriate image of the operation.

Mathematical Thinking Process

Similarly, for each operation described in a geometric form, you should create a corresponding symbolic form by using a skill hereafter referred to as translating visual images to symbolic form.

To illustrate both the technique of visualization and its counterpart, translating visual images to symbolic form, some operations are described in this section first in geometric form and then translated to symbolic form. Other operations are described first in symbolic form and then visualization is used to create an appropriate geometric image.