A1 A Brief Review of Algebra

There are many techniques from elementary algebra that are needed in calculus. This appendix contains a review of such topics, and we begin by examining numbering systems.

The Real Numbers

An **integer** is a "whole number," either positive or negative. For example, 1, 2, 875, -15, -83, and 0 are integers, while $\frac{2}{3}$, 8.71, and $\sqrt{2}$ are not.

A **rational number** is a number that can be expressed as the quotient $\frac{a}{b}$ of two integers, where $b \neq 0$. For example,

$$\frac{2}{3} \quad \frac{8}{3} \quad -6\frac{1}{2} = \frac{-13}{2} \qquad \text{and} \qquad 0.25 = \frac{25}{100} = \frac{1}{4}$$

are rational numbers. Every integer is a rational number since it can be expressed as itself divided by 1. When expressed in decimal form, rational numbers are either terminating or infinitely repeating decimals. For example,

$$\frac{5}{8} = 0.625 \qquad \frac{1}{3} = 0.33\ldots \qquad \text{and} \qquad \frac{13}{11} = 1.181818\ldots$$

A number that cannot be expressed as the quotient of two integers is called an **irrational number.** For example,

$$\sqrt{2} \simeq 1.41421356 \qquad \text{and} \qquad \pi \simeq 3.14159265$$

are irrational numbers.

The rational numbers and irrational numbers form the **real numbers** and can be visualized geometrically as points on a **number line** as illustrated in Figure A.1.

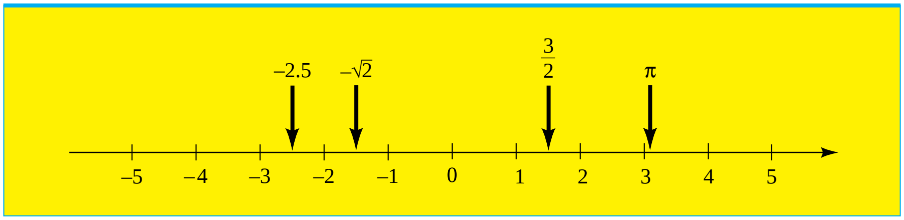

FIGURE A.1 The number line.

Inequalities

If a and b are real numbers and a is to the right of b on the number line, we say that ***a* is greater than *b*** and write $\boldsymbol{a > b}$. If a is to the left of b, we say that ***a* is less than *b*** and write $\boldsymbol{a < b}$ (Figure A.2). For example,

$$5 > 2 \qquad -12 < 0 \qquad \text{and} \qquad -8.2 < -2.4$$