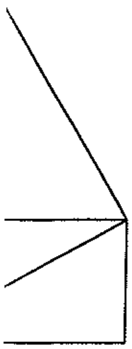

ometry. (Euclid's proof was
a simpler diagram suggesting

correct?

tes that for every line *l* and for
a unique line *m* through P that is

veen two rays that emanate from

nts were discovered by Euclid

a line *l* if for any two points P, Q
P to *l* is the same as the perpen-

e the parallel postulate because
proved it.
line that intersects both of them

angle.
nts that are assumed, without
s" or "propositions" are proved

(9) We call $\sqrt{2}$ an "irrational number" because it cannot be expressed as a quotient of two whole numbers.

(10) The ancient Greeks were the first to insist on proofs for mathematical statements to make sure they were correct.

EXERCISES

In Exercises 1–4 you are asked to define some familiar geometric terms. The exercises provide a review of these terms as well as practice in formulating definitions with precision. In making a definition, you may use the five undefined geometric terms and all other geometric terms that have been defined in the text so far or in any preceding exercises.

Making a definition sometimes requires a bit of thought. For example, how would you define *perpendicularity* for two lines *l* and *m*? A first attempt might be to say that "*l* and *m* intersect and at their point of intersection these lines form right angles." It would be legitimate to use the terms "intersect" and "right angle" because they have been previously defined. But what is meant by the statement that *lines* form right angles? Surely, we can all draw a picture to show what we mean, but the problem is to express the idea verbally, using only terms introduced previously. According to the definition on p. 17, an angle is formed by two nonopposite *rays* emanating from the same vertex. We may therefore define *l* and *m* as *perpendicular* if they intersect at a point A and if there is a ray $\overrightarrow{AB}$ that is part of *l* and a ray $\overrightarrow{AC}$ that is part of *m* such that $\sphericalangle$BAC is a right angle (Figure 1.16). We denote this by $l \perp m$.

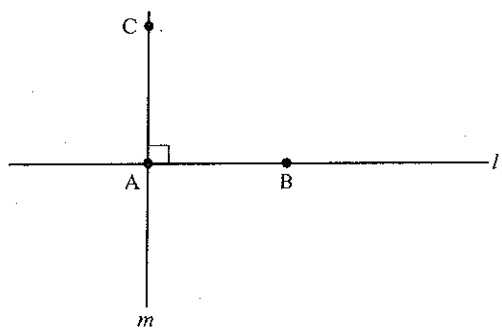

FIGURE 1.16 Perpendicular lines.

1. Define the following terms:
   (a) *Midpoint* M of a segment AB.
   (b) *Perpendicular bisector* of a segment AB (you may use the term "midpoint" since you have just defined it).
   (c) Ray $\overrightarrow{BD}$ *bisects* angle ∢ABC (given that point D is between A and C).
   (d) Points A, B, and C are *collinear.*
   (e) Lines *l*, *m*, and *n* are *concurrent* (see Figure 1.17).

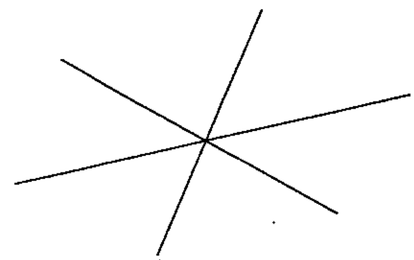

FIGURE 1.17 Concurrent lines.

2. Define the following terms:
   (a) The *triangle* △ABC formed by three noncollinear points A, B, and C.
   (b) The *vertices, sides,* and *angles* of △ABC. (The "sides" are segments, not lines.)
   (c) The sides *opposite to* and *adjacent to* a given vertex A of △ABC.
   (d) *Medians* of a triangle (see Figure 1.18).
   (e) *Altitudes* of a triangle (see Figure 1.19).
   (f) *Isosceles* triangle, its *base,* and its *base angles.*
   (g) *Equilateral* triangle.
   (h) *Right* triangle.

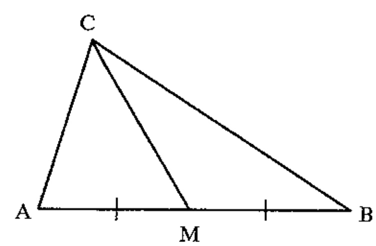

FIGURE 1.18 Median.