

# PREPARATORY MATH SKILLS LAB

Lab **P<sup>M</sup>S<sup>2</sup>**

## MATH ACTIVITY

### *Learning How to Draw and Measure Angles*

## MATH SKILLS LAB OBJECTIVES

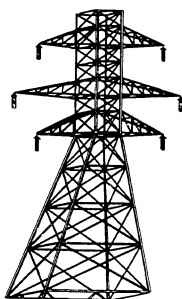
*When you complete this activity, you should be able to do the following:*

- 1. Use a protractor to measure a given angle.*
- 2. Given the size of an angle and a protractor, draw the angle.*

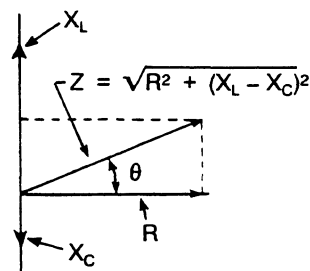
## MATERIALS

For this activity, you'll need a protractor, a ruler or straightedge, and a sharp pencil.

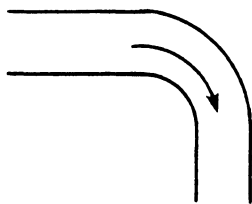
Drawing and measuring angles is a common part of many technical jobs. Technicians working with a mechanical system frequently measure angles to determine accurately how the parts of a device fit together. When working with electrical systems, technicians sometimes calculate a "phase angle." In a fluid system, technicians measure angles through which fluid moves in a torque convertor. The angle formed between the sun's rays and a solar heating panel is an important part of the operation of a solar-powered thermal system. (See Figure 1.)



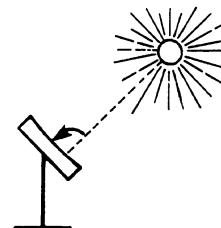
a. Angles in a mechanical system



b. Phase angle in an electrical system



c. Deflection angle in a fluid system



d. Angle of incidence in a thermal system

**Fig. 1** Examples of angles measured by technicians.

When two straight lines extend from the same point, an angle is formed. Figure 2 shows two straight lines, line AB and line AC, extending from point A. Lines AB and AC are also known as the “sides” of the angle. Point A is called the “vertex of the angle.” Some people call point A the “origin of the angle,” but “vertex of the angle” is more correct.

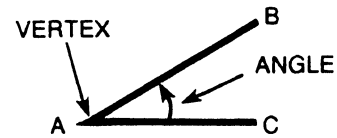
Angles are identified with letters that indicate the angle's sides and vertex, such as A, B, and C. The symbol  $\angle$  often is used instead of the word “angle.” Accordingly, the angle in Figure 2 can be written as  $\angle BAC$ , or  $\angle CAB$ . Both notations identify the same angle. Note that the letter “A” representing the vertex is the second letter in either notation.

The size of an angle is a measure of the rotation required to have one side of the angle rotate about the vertex until it's directly “in line” with the other side. Angles are measured in a unit called a “degree.” Figure 3 shows a 1-degree angle.

Figure 4 shows a 30-degree angle. The symbol  $^\circ$ , placed to the right of—and above—a number, usually is used instead of the word “degree.”

Measuring the size—or number of degrees—in an angle is done with a measuring instrument, called a “protractor.” The protractor, shown in Figure 5, has a semicircle (half-circle) shape. A complete circle consists of 360 degrees. The scale of the protractor is divided into degrees, and the divisions of the scale are numbered from  $0^\circ$  to  $180^\circ$ . ( $180^\circ$  is half of the  $360^\circ$  that are in a circle.)

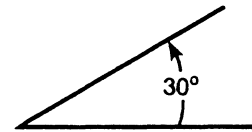
To measure an angle with a protractor, align the straight edge (reference line) of the protractor with one of the lines forming the angle to be measured. In Figure 6, the straight edge of the protractor is in alignment with line AC. At the same time, the “index” of the protractor is placed directly over the vertex of the angle.



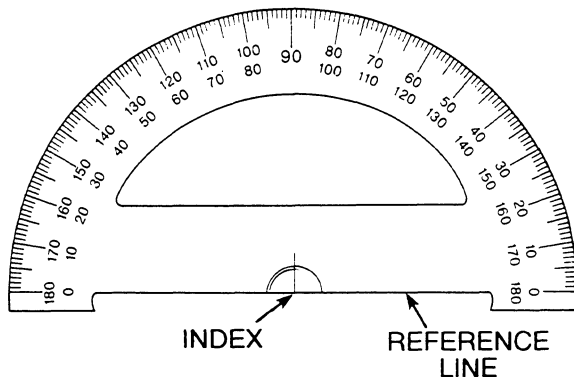
**Fig. 2** Components of an angle.



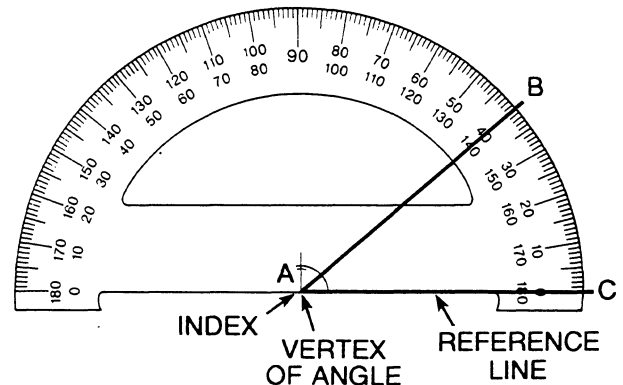
**Fig. 3** A 1-degree angle.



**Fig. 4** A 30-degree angle.

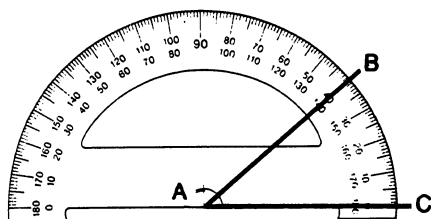


**Fig. 5** Components of a protractor.

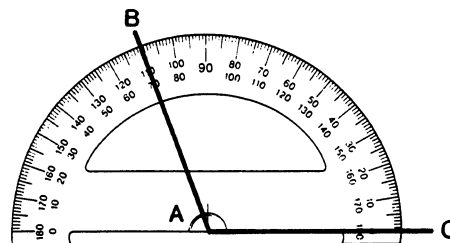


**Fig. 6** Placing protractor over angle to be measured.

The size of the angle in degrees is equal to the reading on the scale where the second line (AB) crosses the "degree scale" part of the protractor. For example, the measure of the angle shown in Figure 7a is  $40^\circ$ . The measure of the angle shown in Figure 7b is  $110^\circ$ .



a. A 40-degree angle

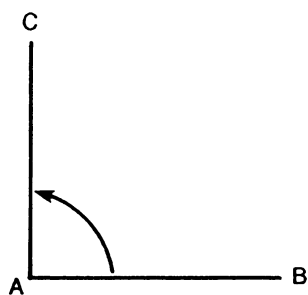


b. A 110-degree angle

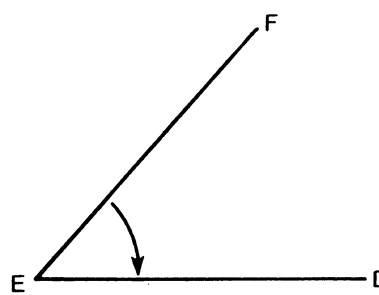
**Fig. 7** Measuring angles with a protractor.

### PRACTICE EXERCISES

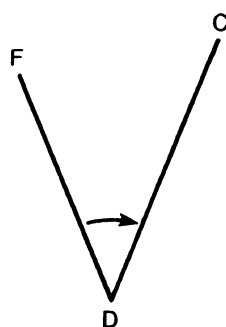
1. Measure each of the angles shown here. On a separate sheet of paper, identify each angle. Record its measurement. For example,  $\angle BAC = \underline{\hspace{1cm}}^\circ$ .



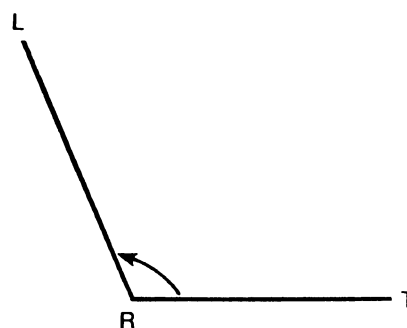
a.



b.



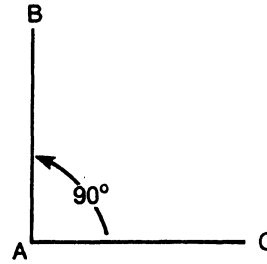
c.



d.

2. Draw and label (identify) each of the following angles.  
Example:  $\angle BAC = 90^\circ$

- a.  $\angle CDF = 50^\circ$
- b.  $\angle XYZ = 115^\circ$
- c.  $\angle RST = 13^\circ$
- d.  $\angle JIH = 67^\circ$



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**Student Challenge**

3. Draw  $\angle BAC = 45^\circ$ . On line AB, mark a length representing 15 newtons. Use the scale: 1 cm = 5 N. Using the same scale, mark a length on the line AC that represents 8 newtons.