Solutions 6.2.3

9 **a.** **i.** IV **ii.** I **iii.** II **iv.** I

b. **i.** The terminal side of $p + 2\pi$ is the same as that of p, so it is in Quadrant II.

ii. The terminal side of $p - \frac{\pi}{2}$ is a 90° clockwise rotation from that of p, so it is in Quadrant I.

iii. The terminal side of $p + 9\pi$ is two complete counterclockwise rotations of that of p plus π more, so it is in Quadrant IV.

iv. Since 2 radians is about 114.6°, the terminal side of $p - 2$ could be in either Quadrant I (if $p > 114.6°$) or in Quadrant IV (if $p < 114.6°$).

16 **a.** By the definition, the length of the arc is the length of the circle's radius, or 1 unit.

b. A size transformation centered at the origin with scale factor 2 takes the circle of radius 1 to that of radius 2. A size transformation centered at the origin with scale factor $\frac{2}{3}$ takes the circle of radius 3 to that of radius 2.

c. The lengths of the arcs are 2 units and 3 units, respectively. This follows from the definition of radian, which is a central angle that intercepts an arc whose length is the radius. The transformation in Part b with scale factor $\frac{2}{3}$ takes the circle of radius 3 to the circle of radius 2, and scales the arcs of length 3 to arcs of length 2 and the radii of length 3 to radii of length 2.

22 The value given by the calculator cannot be correct, because 25° is located in Quadrant I, and the values of sine in that quadrant are all positive. The calculator is probably in radian mode instead of degree mode.

23 The difference between degree measure and radian measure is just a matter of scale, that is, $1° = \frac{\pi}{180}$, or about 0.0175 radians, and 1 radian $= \left(\frac{180}{\pi}\right)^{\circ}$, or about 57.3°. For an exploration of the scale difference, see Applications Task 9. One aspect of the convenience of radians is explored in Extensions Task 30. In that task, students learn that the limit of $\frac{\sin x}{x}$ is 1 in radians, but the same limit is $\frac{\pi}{180}$ in degrees. This is a special case of an important convenience. In radians, the derivative of the sine is the cosine and the derivative of the cosine is the negative of the sine. In degree mode, these derivatives would include $\frac{\pi}{180}$, or a decimal approximation, as coefficient.

40 **a.** Cannot be simplified but could be factored: $\frac{4(4x+3)}{3(x+5)}$

b. $\frac{x}{x+9}$

c. $\frac{x+5}{x-1}$

d. $\frac{1}{4}$