Estimating Trig Functions
Math 130

A circle has radius of 24.

Consider an angle of 7 radians.

Do all work by hand without a calculator.

- Find the angle in degrees, estimating to the nearest degree.
- Estimate, to the nearest 0.01, the length of the opposite arc.
- Estimate, with an accuracy of 0.01, the sine and the cosine of 7 radians.

Answers.

Here are the steps that will lead to reasonable estimates without any use of a calculator.

1. Find the reference angle in radians with an accuracy of two decimal places.

   Answer: 0.72.

2. Convert to degrees by hand.

   Answer: 41°.

3. Find the degree equivalent of 7 radians to the nearest degree.

   Answer: 401°.

4. Find an exact expression for the raidus.

   Answer: $\frac{12}{\pi}$.

5. Estimate the arc length, using hand division.

   Answer: 26.7.

6. Estimate the sine and cosine of 7, by working with 41°.

   Solution:

   Start with 30°, which has sine and cosine of 0.5 and 0.866; and 45°, which has sine and cosine of 0.71 and 0.707.

   Interpolate to get the values for 41°, noting that it is 4/15 of the way from 45° to 30°. Since the circle is not linear, allow about a 10% adjustment to the interpolated differences in the direction that will make the answers for sine and cosine larger.

   Answers: Roughly, $\sin 7 \approx 0.66$ and $\cos 7 \approx 0.75$.