

## Possible Outline of Project: Building a Sine Calculator.

1. Reduce  $x$  to a value as close as possible to 0. One possible approach is outlined below.
  - a. Recall that the sine function is periodic with period  $2\pi$ . Given an initial input  $x$ , find a formula for a value  $x_2 \in [0, 2\pi]$  such that  $\sin(x_2) = \sin(x)$ .
  - b. Explain why  $\sin(x) = -\sin(x - \pi)$ . Now find a formula for a value  $x_3 \in [0, \pi]$  such that  $\sin(x_3) = \pm \sin(x)$ .
  - c. Explain why  $\sin(x) = \sin(\pi - x)$ . Now find a formula for a value  $x_4 \in [0, \pi/2]$  such that  $\sin(x_4) = \pm \sin(x)$ .
2. Find the error bound.
  - a. Use the Lagrange error formula to find an upper bound for the error when using a Taylor polynomial to estimate  $\sin(x)$  for  $x \in [0, \pi/2]$ .
  - b. Give an inequality that can be used to determine the number of terms needed to estimate  $\sin(x)$  to within a desired accuracy. Devise a way to find the number of terms needed.
3. Put it all together.
  - a. Write a program that computes the sine function to a desired accuracy.
  - b. Polish, test, and document your program.