Math Library Design

Pre-Lab Questions

PART 1

1. For next term until less than EPSILON, ++k

   next term = (input / k) * next term

   summation += next term

   return summation

2. For 0 to 9 with increments of .1

   print x value, exp approx, library approx, difference between 2

PART 2

1. getopt() returns the next option character from argv if it matches a character in optstring.

2. enum is a better choice as you can only choose one argument out of mulitple

3. define options for all 5 tests

```
int main(argument) {
  while (arguments are supplied)
    if argument is sin
      print header
      for x -2pi -2pi with x+= pi/16
    print x, sin approx., math library sin, and delta
    break (allows arguments to be mutually
    exclusive and only executes 1st on
    else if argument is cos
      print header
      for x -2pi -2pi with x+= pi/16
    print x, cos approx., math library cos, and delta
    break
    else if argument is tan
      print header
      for x -pi/3 - pi/3 with x+= pi/16
    print x, tan approx., math library tan, and delta
    break
    else if argument is exp
      print header
      for x 0 - 9 with x+= .1
        print x, exp approx., math library exp, and delta
    break
    else if argument is all
      run all tests above
      break
  }
```

Pseudo-code

int main { main pseudo-code to left}

Helper functions:

```
power(x) {
  while input exponent is > 0
    set product to input base multiplied by product
    decrement exponent
  return product after while loop
}

Sin(x) {
    normalize x to be in
    range [-pi, pi]
    set x^2 to a variable for efficiency
    return horner approximant of sin with 14 terms
}

Cos(x) {
    normalize x to be in
    range [-pi, pi]
    set x^2 to a variable for efficiency
    return horner approximant of cos with 14 terms
}

Tan(x) {
    normalize x to be in
    range [-pi/3, pi/3]
    set x^2 to a variable for efficiency
    return horner approximant of tan with 14 terms
}
```

Exp(x) { Exp psuedo-code to left}

Notes:
Trig functions use horner form found on lab manual
Tan function horner form was derived from pade equation given in lab manual
Exp function was derived from Lecture 9 @ 24 minutes (code from Prof. Dunne)