Midterm Question 6

May 4, 2018

In [1]:
```
from sympy import*
%matplotlib inline
import matplotlib.pyplot as plt
from __future__ import division
x, y, z, t = symbols('x y z t')
k, m, n = symbols('k m n', integer = True)
f, g, h = symbols('f g h', cls = Function)
import math
```

In [2]:
```
def compositeSimpson(startPoint, endPoint, numIntervals):
    a = startPoint
    b = endPoint
    n = numIntervals
    h = (b - a) / n
    leftRight = f(a) + f(b)
    oddSum = 0
    evenSum = 0
    for i in range (1, n):
        x = a + i*h
        if i % 2 == 1:
            oddSum = oddSum + f(x)
        else:
            evenSum = evenSum + f(x)
    areaEstimate = h * (leftRight + 2*evenSum + 4*oddSum) / 3
    return areaEstimate
```

In [3]:
```
def SimpsonDouble(a, b, m, n, f, g, answer):
    h = (b - a)/n
    J1 = 0
    J2 = 0
    J3 = 0
    for i in range (0, n+1):
        x = a + i*h
        HX = (d(x) - c(x))/m
        K1 = answer*f(x) + g(c(x)) + answer*f(x) + g(d(x))
        K2 = 0
        K3 = 0
```

```
            for j in range (1, m):
                y = c(x) + j*HX
                Q = answer*f(x) + g(y)
                if j%2 == 0:
                    K2 = K2 + Q
                else:
                    K3 = K3 + Q
            L = ((K1 + 2*K2 + 4*K3)*HX)/3
            if i ==0 or i == n:
                J1 = J1 + L
            elif i % 2 == 0:
                J2 = J2 + L
            else:
                J3 = J3 + L
        J = h*(J1 + 2*J2 + 4*J3)/3
        return J

In [4]: def c(x):
        return 0
        #return x - 2

In [5]: def d(x):
        return -x + 2

In [6]: def f(x):
        return math.e**(-x)*x**5.1

In [7]: def g(y):
        return y

In [16]: def findC(initialValue):
             areaEstimate = 0
             while abs(areaEstimate - 2.067) > 0.00001:
                 areaEstimate = SimpsonDouble(0, 2, 10, 10, f, g, initialValue)
                 initialValue = initialValue + 0.00001
             return initialValue

In [17]: findC(0.9)

Out[17]: 1.0000799999995453

In [18]: abs(SimpsonDouble(0, 2, 10, 10, f, g, 1.000080) - 2.067)

Out[18]: 2.908774168197681e-07
```