EM215 Tutorial-1 E/20/280

```
import numpy as np
import matplotlib.pyplot as plt
from tabulate import tabulate
import math
```

Approach 1

```
x = 5
terms = 20
ap1 = []
ap1Ans = 0

termNum = [i for i in range(terms)]
for i in termNum:
    ap1Ans += ((-1)**i) * (x**i)/math.factorial(i)
    ap1.append(ap1Ans)
```

Approch 2

```
ap2 = []
ap2Ans = 0
ap2AnsD = 0

termNum = [i for i in range(terms)]
for i in termNum:
    ap2AnsD += (x**i)/math.factorial(i)
    ap2Ans = 1/ap2AnsD
    ap2.append(ap2Ans)
```

Now lets do the error analysis

```
Et1 = [] # True error
Et2 = [] # True error
RE1 = [] # Relative error
RE2 = [] # Relative error

Xtrue = 6.737946999085 * 10**-3

print("Approach1\tApproach2\tEi(Approach1)\tEi(Approach2)\tRE(Approach1)\tRE(Approach2)")

for i in termNum:
    Et1.append(abs(ap1[i] - Xtrue))
    RE1.append(abs((ap1[i] - ap1[i - 1]) / ap1[i]))

    Et2.append(abs(ap2[i] - Xtrue))
    RE2.append(abs((ap2[i] - ap2[i - 1]) / ap2[i]))

    print(f"{ap1[i]:.10f}\t{ap2[i]:.10f}\t{Et1[i]:.10f}\t{Et2[i]:.10f}\t{RE1[i]:.10f}\t{RE2[i]:.10f}")
```

```
Approach1       Approach2       Ei(Approach1)   Ei(Approach2)   RE(Approach1)   RE(Approach2)
1.0000000000    1.0000000000    0.9932620530    0.9932620530    0.9932936589    0.9932620507
-4.0000000000   0.1666666667    4.0067379470    0.1599287197    1.2500000000    5.0000000000
8.5000000000    0.0540540541    8.4932620530    0.0473161071    1.4705882353    2.0833333333
-12.3333333333  0.0254237288    12.3400712803   0.0186857818    1.6891891892    1.1261261261
13.7083333333   0.0152963671    13.7015953863   0.0085584201    1.8996960486    0.6620762712
-12.3333333333  0.0109389243    12.3400712803   0.0042009773    2.1114864865    0.3983428936
9.3680555556    0.0088403217    9.3613176086    0.0021023747    2.3165307635    0.2373898511
-6.1329365079   0.0077748982    6.1396744549    0.0010369512    2.5274991912    0.1370337563
3.5551835317    0.0072302833    3.5484455847    0.0004923363    2.7250688897    0.0753241469
-1.8271053792   0.0069594529    1.8338433262    0.0002215059    2.9458010316    0.0389154734
0.8640390763    0.0068315063    0.8573011293    0.0000935593    3.1146096622    0.0187288930
-0.3592084035   0.0067748911    0.3659463505    0.0000369441    3.4053977243    0.0083566229
0.1504780464    0.0067515774    0.1437400994    0.0000136304    3.3871150113    0.0034530702
-0.0455552035   0.0067426533    0.0522931505    0.0000047063    4.3032021530    0.0013235337
0.0244566714    0.0067394718    0.0177187244    0.0000015248    2.8626902538    0.0004720658
0.0011193798    0.0067384120    0.0056185672    0.0000004650    20.8484126844   0.0001572810
```

```
0.0084122834    0.0067380809    0.0016743364    0.0000001339    0.8669350846    0.0000491426
0.0062673118    0.0067379835    0.0004706352    0.0000000365    0.3422474802    0.0000144530
0.0068631372    0.0067379564    0.0001251902    0.0000000094    0.0868153209    0.0000040147
0.0067063411    0.0067379493    0.0000316059    0.0000000023    0.0233802863    0.0000010565
```