Lecture 8 tasks

Equation 1 results

```
cos(pow(x,2))*exp(-x)
MidPoint result:  h1/h2 = 2
             i         A(h_i) A(h_(i-1)) - A(h_i)     alp^k     Rich-error      f-calculations order-estimate
             1       0.587675
             2       0.588433   -0.000758221
             3       0.589593    -0.00115949       0.653925      0.0033504             4      -0.612804
             4       0.589933   -0.000340603        3.40424   -0.000141667             8        1.76733
             5       0.590021   -8.80032e-05        3.87034   -3.06595e-05            16        1.95246
             6       0.590044   -2.21736e-05        3.96883   -7.46882e-06            32        1.98871
             7       0.590049   -5.55412e-06        3.99228   -1.85615e-06            64        1.99721
             8       0.590051    -1.3892e-06        3.99808   -4.63363e-07           128        1.99931
             9       0.590051   -3.47341e-07        3.99952   -1.15799e-07           256        1.99983
            10       0.590051   -8.68379e-08        3.99988   -2.89471e-08           512        1.99996
            11       0.590051   -2.17096e-08        3.99997   -7.23662e-09          1024        1.99999
            12       0.590051   -5.42742e-09        3.99999   -1.80914e-09          2048              2
            13       0.590051   -1.35686e-09              4   -4.52286e-10          4096              2
            14       0.590051   -3.39216e-10        3.99998   -1.13073e-10          8192        1.99999
            15       0.590051   -8.48052e-11        3.99995   -2.82689e-11         16384        1.99998
            16       0.590051   -2.12003e-11        4.00019    -7.0663e-12         32768        2.00007
0.590051

cos(pow(x,2))*exp(-x)
Trapezoidal result:  h1/h2 = 2
             i         A(h_i) A(h_(i-1)) - A(h_i)     alp^k     Rich-error      f-calculations order-estimate
             1       0.599383
             2       0.593529     0.00585398
             3       0.590981     0.00254788        2.29759     0.00196355             5        1.20012
             4       0.590287    0.000694194        3.67027    0.000259971             9        1.87589
             5        0.59011    0.000176796        3.92653    6.04113e-05            17        1.97326
             6       0.590066    4.43962e-05        3.98222    1.48869e-05            33        1.99357
             7       0.590055    1.11113e-05        3.99559    3.70921e-06            65        1.99841
             8       0.590052    2.77859e-06         3.9989    9.26535e-07           129         1.9996
             9       0.590051    6.94694e-07        3.99973    2.31586e-07           257         1.9999
            10       0.590051    1.73677e-07        3.99993    5.78935e-08           513        1.99998
            11       0.590051    4.34193e-08        3.99998    1.44732e-08          1025        1.99999
            12       0.590051    1.08548e-08              4    3.61829e-09          2049              2
            13       0.590051    2.71371e-09              4    9.04572e-10          4097              2
            14       0.590051    6.78427e-10        4.00001    2.26141e-10          8193              2
            15       0.590051    1.69601e-10        4.00013    5.65314e-11         16385        2.00005
            16       0.590051    4.24084e-11        3.99924    1.41397e-11         32769        1.99973
0.590051

cos(pow(x,2))*exp(-x)
Simpson result:  h1/h2 = 2
             i         A(h_i) A(h_(i-1)) - A(h_i)     alp^k     Rich-error      f-calculations order-estimate
             1       0.399589
             2       0.591578      -0.191989
             3       0.590132     0.00144585       -132.787   -1.08071e-05             5             nan
             4       0.590056    7.62983e-05        18.9499    4.25062e-06             9         4.24412
             5       0.590051    4.32959e-06        17.6225    2.60466e-07            17         4.13935
             6       0.590051    2.63056e-07        16.4588    1.70166e-08            33         4.04079
             7       0.590051    1.63208e-08        16.1178    1.07958e-09            65         4.01058
             8       0.590051    1.01817e-09        16.0296    6.77439e-11           129         4.00267
             9       0.590051     6.3606e-11        16.0074    4.23831e-12           257         4.00067
            10       0.590051     3.9746e-12        16.0031    2.64918e-13           513         4.00028
0.590051
```

Equation 2 results

```
sqrt(x)*cos(pow(x,2))*exp(-x)
Simpson result:  h1/h2 = 2
              i         A(h_i) A(h_(i-1)) - A(h_i)     alp^k     Rich-error      f-calculations order-estimate
              1      0.0662554
              2        0.31016      -0.243905
              3       0.330719      -0.020559        11.8637    -0.00189246               5        3.56848
              4       0.337653     -0.0069335        2.96517     -0.0035282               9        1.56811
              5       0.340039     -0.00238592        2.90601    -0.00125179              17        1.53904
              6        0.34087   -0.000831666        2.86884   -0.000445017              33        1.52047
              7       0.341162   -0.000291958        2.84858   -0.000157936              65        1.51024
              8       0.341265    -0.00010286         2.8384    -5.5951e-05             129        1.50508
              9       0.341302   -3.63031e-05        2.83337   -1.98013e-05             257        1.50252
             10       0.341314    -1.2824e-05        2.83088   -7.00424e-06             513        1.50125
             11       0.341319   -4.53199e-06        2.82965   -2.47697e-06            1025        1.50062
             12       0.341321   -1.60195e-06        2.82904   -8.75845e-07            2049        1.50031
             13       0.341321   -5.66315e-07        2.82873   -3.09676e-07            4097        1.50016
             14       0.341321   -2.00212e-07        2.82858    -1.0949e-07            8193        1.50008
             15       0.341321   -7.07837e-08         2.8285   -3.87113e-08           16385        1.50004
             16       0.341321   -2.50255e-08        2.82847   -1.36866e-08           32769        1.50002
             17       0.341321   -8.84779e-09        2.82844   -4.83897e-09           65537        1.50001
             18       0.341321   -3.12815e-09        2.82844   -1.71083e-09          131073        1.50001
             19       0.341321   -1.10597e-09        2.82843   -6.04873e-10          262145            1.5
             20       0.341321   -3.91019e-10        2.82843   -2.13855e-10          524289            1.5
             21       0.341321   -1.38254e-10        2.82825   -7.56211e-11         1048577        1.49991
             22       0.341321   -4.89018e-11        2.82718   -2.67635e-11         2097153        1.49937
             23       0.341321   -1.72691e-11        2.83175   -9.42768e-12         4194305        1.50169
0.341321
```

Equation 3 results

```
1/ sqrt(x)*cos(pow(x,2))*exp(-x)
MidPoint result:  h1/h2 = 2
              i         A(h_i) A(h_(i-1)) - A(h_i)     alp^k     Rich-error      f-calculations order-estimate
              1       0.831098
              2        1.00798      -0.176883
              3        1.13859      -0.130613        1.35426       -0.36869               4        0.437506
              4        1.23008     -0.0914892        1.42763       -0.213945              8        0.513621
              5        1.29398     -0.0638926        1.43192       -0.147926             16        0.517953
              6        1.33876      -0.044789        1.42652        -0.10501             32        0.512503
              7        1.37027     -0.0315079        1.42152       -0.074749             64        0.507431
              8        1.39249      -0.022216        1.41825      -0.0531162            128        0.504115
              9        1.40817     -0.0156852        1.41637      -0.0376717            256        0.502194
             10        1.41926     -0.0110823        1.41534      -0.0266829            512        0.501144
             11        1.42709     -0.0078332        1.41479      -0.0188847           1024        0.500588
             12        1.43263    -0.00553776        1.41451      -0.0133599           2048          0.5003
             13        1.43654    -0.00391537        1.41436     -0.00944915           4096        0.500152
             14        1.43931    -0.00276844        1.41429      -0.0066824           8192        0.500077
             15        1.44127    -0.00195753        1.41425     -0.00472547          16384        0.500039
             16        1.44265    -0.00138416        1.41423     -0.00334152          32768        0.500019
             17        1.44363   -0.000978746        1.41422     -0.00236285          65536         0.50001
             18        1.44432   -0.000692075        1.41422      -0.0016708         131072        0.500005
             19        1.44481    -0.00048937        1.41422      -0.00118144        262144        0.500002
             20        1.44516   -0.000346037        1.41421     -0.000835404        524288        0.500001
             21         1.4454   -0.000244685        1.41421     -0.000590721       1048576        0.500001
             22        1.44558   -0.000173018        1.41421     -0.000417703       2097152             0.5
             23         1.4457   -0.000122342        1.41421     -0.000295361       4194304             0.5
             24        1.44579   -8.65091e-05        1.41421     -0.000208852       8388608             0.5
1.44579
```

Equation 4 results

```
1000 * exp (-1.0/x)* exp(-1.0/(1.0 - x))
trapezoidal:  h1/h2 = 2
             i         A(h_i) A(h_(i-1)) - A(h_i)     alp^k     Rich-error      f-calculations
             1              0
             2        9.15782
             3        6.99288         2.16493
             4         7.0303     -0.0374197       -57.8555    0.000635788              9
             5        7.02981    0.000495216       -75.5623   -6.46814e-06             17
             6        7.02986   -4.91767e-05       -10.0701    4.44229e-06             33
```