Test 1

Wednesday (June 3rd, 2020) 1:30pm-3:00pm EDT anywhere with Internet

Notes:

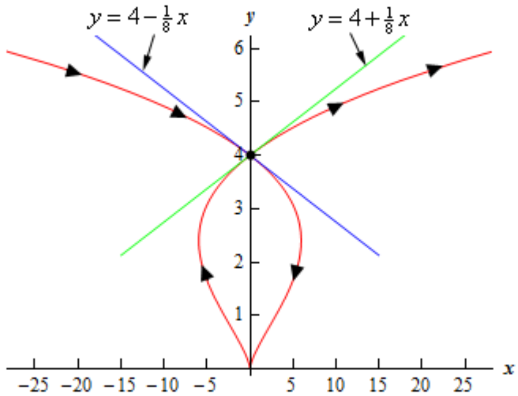
1. No communication with a live human, except the proctors, is allowed. Every student must turn on video to allow sufficient view area including the student during the test.
2. Test papers will be examined for abnormality and ~5% students may be interviewed.
3. No late papers are accepted for any reason(s). Same time (EDT) for all regardless of locations.
4. Earn 15 points for doing any one of the two problems correctly online;
5. Compose a self-contained report for each problem, the same format as you did for HW sets;
6. Use any language, e.g., C, C++, Fortran, Java, MATLAB, Python, etc;
7. Use any sources for programs as long as you quote the source;
8. Use any computer systems as long as you can e-submit your solutions.
9. Email: sbu.ams326d@gmail.com.

Please read this paragraph before starting the exam:

Academic integrity is expected of all students at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare that I shall not give, use, or receive unauthorized aid in this examination. I have been warned that any suspected instance of academic dishonesty will be reported to the appropriate office and that I will be subjected to the maximum possible penalty permitted under University guidelines.

Problem T1-1 (15 Points) The following parametric curve is given by

$$\begin{cases} x = t^5 - 4t^3 \\ y = t^2 \end{cases}$$



For example, at parameter $t = 0$, we have point $(x, y) = (0, 0)$. At parameter $t = 2$, we have point $(x, y) = (0, 4)$.

Please use any one of the numerical integration algorithms including rectangle rule, trapezoidal rule, and Monte Carlo methods, etc to write a program to compute the area enclosed by the red curve (the carrot).

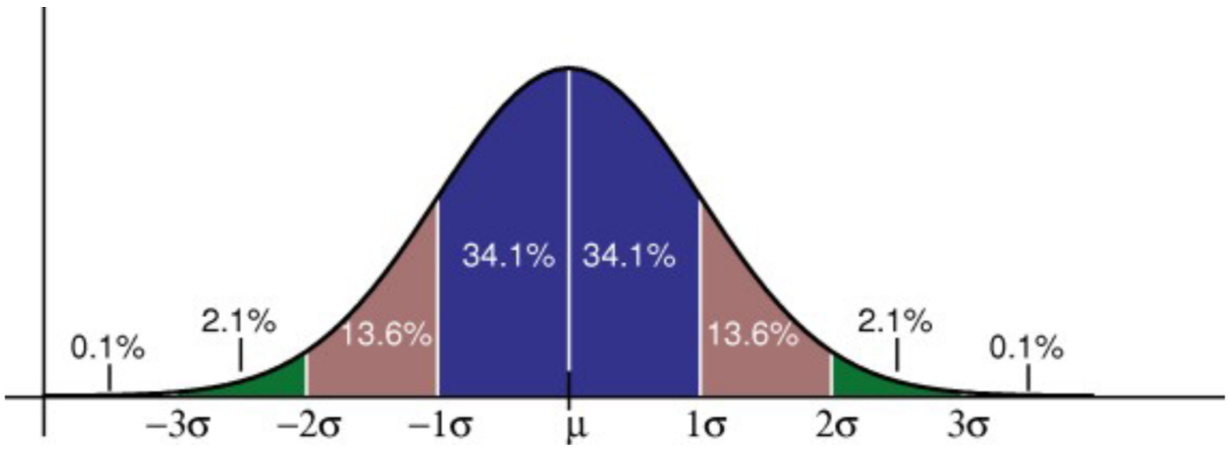
Your result should have four significant digits. If the exact area is 1.234567, your result must be 1.234xxx where xxx can be arbitrary.

Problem T1-2 (15 Points) Do the following two parts: (you can NOT use built-in one-line functions to achieve them)

(1) Generate N=250,000,000 uniformly distributed random number $x \in [0,1]$ and count the numbers of them that fall in each of the 10 bins: (0, 0.1), (0.1, 0.2), ..., (0.9, 1.0);

(2) Using the above 250M numbers (that you either regenerate or reuse), generate a normal distribution with mean $\mu = 8$ and standard deviation $\sigma = 4$ and plot the distribution.

For your reference, the following is the standard normal distribution $\mathcal{N}(0,1) \sim \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$:



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