

You may keep this page of questions. Turn in your answers with all of your work on the blue paper and the tan paper. You are NOT allowed to use your calculator on the first three questions. Answer these three questions on the blue paper. When you have completed these three questions, turn in all of the blue paper and receive tan paper to use on the last three questions. You ARE allowed to use your calculator on the last three questions and you will need your calculator for some parts of the last three questions.

(1) 20 Points. The base of a solid is the region in the xy -plane that is bounded by $x = 0$, $y = 2$ and $y = \sqrt{x}$. Every cross-section perpendicular to the x -axis is a square. Find the volume of this solid.

(2) 20 Points. Find the volume of the solid of revolution that is generated by revolving the region bounded by $x = 1$, $x = 2$, $y = 0$ and $y = \frac{1}{x^2}$ about the y -axis.

(3) 15 Points. Analyze and evaluate $\int_0^{\infty} \frac{1}{x^2 + 4} dx$.

(4) 12 Points. Suppose that $I = \int_2^7 f(x) dx$ and that on the interval $[2, 7]$ we have $|f'(x)| \leq 24.0$, $|f''(x)| \leq 75.0$, $|f'''(x)| \leq 316.0$ and $|f^{(4)}(x)| \leq 1827$. Find a value of n which is large enough to guarantee that $|I - T_n| \leq 0.00005$ where T_n is the n^{th} trapezoidal rule approximation for I . Show your work!

(5) 15 Points. A certain spring has a natural length of 0.200 meters and exerts a force of 10.0 newtons when it is stretched to the length of 0.400 meters. How much work (in joules) is done in stretching this spring from 0.265 meters to 0.400 meters.

(6) 18 Points. Suppose that x measures that time (in minutes) it takes for a student to complete a quiz. Assume that all students are done in 10 minutes and the density function for x is given by

$$p(x) = \begin{cases} k(10x^3 - x^4) & \text{if } 0 < x < 10 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Find the value of k required for $p(x)$ to be a density function.
- (b) What percentage of students finish the quiz in 8 minutes or less?
- (c) What is the mean time for students to complete the quiz?