

Math 31B: Mock Midterm 2

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Time: 40 minutes. Note, this practice midterm is shorter than the other practice midterm to reflect the shorter time. In particular, question 3 is significantly shorter.

Question 1.

(a) Compute S_6 for the integral $\int_0^1 x dx$.

(b) The error bound for the trapezoidal rule approximation to $\int_a^b f(x) dx$ is given by

$$\left| \int_a^b f(x) dx - T_N \right| \leq \max_{x \in [a,b]} \frac{|f''(x)| |b-a|^3}{12N^2}.$$

If $f(x) = e^{-x}$ and $[a, b] = [0, 3]$, what should N be if the right hand side of the error bound is to be less than or equal 10^{-6} ?

Question 2.

(a) Calculate the arclength of $y = 9 - 3x$ over the interval $[1, 3]$.

(b) Calculate the surface of revolution around the x -axis of $y = \sin(x)$ over the interval $[0, \pi]$. You may use

$$\int \sqrt{1+u^2} du = \frac{u}{2} \sqrt{1+u^2} + \frac{1}{2} \ln(u + \sqrt{1+u^2}) + C.$$

Question 3.

(a) Calculate the third Maclaurin polynomial of $\arcsin(x)$.

Question 4.

(a) Evaluate $\int_{-\infty}^{\infty} \frac{1}{x^2+1} dx$.

(b) Use the comparison test to prove that $\int_1^{\infty} \frac{dx}{x^2 + \sinh(x)}$ converges.