Instructions:

• Do not open the exam until you are instructed to do so.

• Write your name and student ID number on the front page of the exam.

• Write your name and student ID number at the top of every page of the exam.

• Answer the questions in the spaces provided. If you run out of room for an answer, continue on the back of the page.

• If you need more paper, ask one of the proctors and we will provide it.

• There are extra pages at the end of the exam for scratch work.

Math 20B - Midterm 1 - 10/24/2018

Name & Student ID: _______________________________________________________

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1. Sam the snake slithers sneakily south at a speed of

\[ s(t) = 1 + \frac{1}{1 + t} \sin (\ln(1 + t)) \]

meters per second, where \( t \) is the number of seconds which have passed since sunset.

(a) (3 points) Set up an integral (but do not evaluate it) which calculates Sam's displacement over the first \( T \) seconds after the sun sets.

(b) (7 points) Calculate Sam's displacement over the first 10 seconds after the sun sets.
2. (a) (5 points) Find the antiderivative:

\[ \int \tan(x) \, dx. \]

Show your work!

(b) (5 points) Compute the definite integral:

\[ \int_{0}^{3} xe^{x} \, dx. \]
3. (10 points) Find the volume of the solid of revolution given by rotating the region bounded by \( y = 1 + x, y = 3 - x, \) and \( y = 1 \) around the \( x \)-axis.
4. (10 points) Find the area between the polar curve $r = f(\theta)$ and the origin, for $0 \leq \theta \leq \pi$.

Here

$$f(\theta) = \sqrt{\frac{\theta}{1 + \theta}}.$$
Scratch Paper.