DO NOT TURN OVER UNTIL INSTRUCTED TO DO SO.

Formulae

$$\int \tan(x)\ dx = \ln|\sec(x)| + C \qquad \int \sec(x)\ dx = \ln|\sec(x) + \tan(x)| + C$$

$$\int \frac{1}{1+x^2} dx = \arctan(x) + C \qquad \int \frac{1}{\sqrt{1-x^2}} dx = \arcsin(x) + C$$

$$\frac{d\tan(x)}{dx} = \sec^2(x) \qquad \frac{d\sec(x)}{dx} = \tan(x)\sec(x)$$

$$1 = \sin^2(x) + \cos^2(x) \qquad 1 + \tan^2(x) = \sec^2(x)$$

$$\cos^2(x) = \frac{1+\cos(2x)}{2} \qquad \sin^2(x) = \frac{1-\cos(2x)}{2}$$

$$|E_T| \leq \frac{K(b-a)^3}{12n^2} \qquad |E_S| \leq \frac{K(b-a)^5}{180n^4}$$

CALCULATORS ARE NOT PERMITTED

YOU MAY USE YOUR OWN BLANK PAPER FOR ROUGH WORK

SO AS NOT TO DISTURB OTHER STUDENTS, EVERYONE MUST STAY UNTIL THE EXAM IS COMPLETE

REMEMBER THIS EXAM IS GRADED BY A HUMAN BEING. WRITE YOUR SOLUTIONS NEATLY AND COHERENTLY, OR THEY RISK NOT RECEIVING FULL CREDIT

This exam consists of 5 questions. Answer the questions in the spaces provided.

Name and discussion section: ______________________________

GSI's name: ______________________________

1. Compute the following integrals:

   (a) (10 points)

$$\int x^{-2}\ln(x)\ dx$$

   Solution:

   (b) (10 points)

$$\int \frac{1}{\sqrt{x^2+4x+5}}dx$$

   Solution:

2. (20 points) Compute the following integral:

$$\int \frac{x^2 + 3x + 3}{(x+1)^3}\, dx$$

Solution:

3. (20 points) Find the area of the surface of revolution (about the x-axis) of the curve $y = (x-1)^3$ between $x = 1$ and $x = 2$.

   Solution:

4. Evaluate following improper integrals (if divergent, write divergent and explain your reasoning):

   (a) (10 points)

$$\int_{-\infty}^{\infty} e^{|x|} dx$$

   Solution:

   (b) (10 points)

$$\int_{0}^{2} \frac{4+\cos(x)}{x^5} dx$$

   (Hint: use the comparison test)

   Solution:

5. (a) (10 points) Assume that $f(0) = 3$. Use Simpsons Rule with $n = 6$ to approximate the value of $f(6)$, where $f'(x)$ takes the following values:

x	0	1	2	3	4	5	6
$f'(x)$	0	2	4	3	1	4	5

Solution:

(b) (10 points) Assuming that $|f^{(5)}(x)| \leq 1$, for all $0 < x < 6$, how large an n would you need to choose to guarantee that the above estimate is within 0.001 of the true value of $f(6)$? You do not need to give an exact answer, just a rough bound.

Solution:

END OF EXAM