Test 1 for Calculus II, Math 1502 K1 - K6, September 11, 2013
Name:
Section:
Name of TA:
This test is to be taken without calculators and notes of any sorts. The allowed time is 50 minutes. Provide exact answers; not decimal approximations! For example, if you mean $\sqrt{2}$ do not write $1.414 \ldots$. Show your work, otherwise credit cannot be given.
Write your name, your section number as well as the name of your TA on EVERY PAGE of this test. This is very important.


## Name:

## Section:

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I: Calculate the limits:
a) (8 points)

$$
\lim _{x \rightarrow 0} \frac{\cos x^{2}-1}{x^{4}}
$$

b) (8 points)

$$
\lim _{x \rightarrow 0} \frac{x-\int_{0}^{x} e^{-t^{2} / 3} d t}{x^{3}}
$$

c) (9 points)

$$
\lim _{n \rightarrow \infty} n\left(\sqrt{n^{2}+1}-n\right)
$$

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II:(25 points) a) Decide which of the following improper integrals exists and compute its values if it exists:
a) (8 points)

$$
\int_{0}^{\infty} e^{-x} x d x
$$

b) (8 points)

$$
\int_{2}^{\infty} \frac{1}{x \ln (x)^{2}} d x
$$

c) ( 9 points) Does the following integral exist:

$$
\int_{0}^{\infty} \frac{1}{\sqrt{x}+x^{2}} d x
$$

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III: a) (11 points) Solve the initial value problem

$$
y^{\prime}+\frac{1}{x} y=1
$$

with initial condition $y(1)=1$.
b) (14 points) On an arctic expedition food is stored outside at $-20^{\circ} \mathrm{C}$. At some time the food is brought in a room with temperature $20^{\circ} \mathrm{C}$ and after two hours the food has a temperature of $0^{\circ} \mathrm{C}$. How How much does one have to wait until the food has a temperature of $10^{\circ} \mathrm{C}$ ?

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IV: a) (7 points) Does the following series converge?

$$
\sum_{n=1}^{\infty} \frac{n-2}{n^{3}-n^{2}+3}
$$

b) (7 points) Sum the series

$$
\sum_{k=2}^{\infty} \frac{2^{k+3}}{3^{k}}
$$

c) (11 points) Compute the limit

$$
\lim _{n \rightarrow \infty} \frac{\sum_{k=1}^{n} \frac{1}{k}}{\ln n}
$$

