## MATH 16B, SPRING 2004 SECOND MIDTERM SAMPLE

1. Compute the following indefinite integrals.

- $\int x \ln (7 x) d x$
- $\int x \sin \left(x^{2}\right) d x$
- $\int \frac{d x}{x(\ln (x))^{5}}$

2. Using Simpson's method with $n=2$ subdivisions, compute an estimate for $\int_{1}^{5} \frac{d x}{x}$.
3. Compute the following improper integrals. If the integrals fail to converge, say so.

- $\int_{-\infty}^{0} e^{x} \cos \left(e^{x}\right) d x$
- $\int_{-1}^{1} \frac{d x}{x^{4}}$
- $\int_{-\infty}^{\infty} x d x$
- $\int_{0}^{2} \frac{\ln (x)}{x} d x$

4. Find the general solution to the differential equation $y^{\prime}-y=e^{t}$.
5. Find the solution to the initial value problem $y^{\prime}=t y^{3} e^{t}$ and $y(0)=-1$.
6. It had been proposed that the velocity of an object in a free fall is proportional to the distance it has fallen. Let $f(t)$ denote the distance fallen at time $t$.

- Write the differential equation satisfied by $f$.
- Find the general solution to this differential equation.
- In this case, this differential equation is implicitly an initial value problem. What is $f(0)$ ? What is the solution to this initial value problem? What is wrong with this mathematical model?

7. Compute the following definite integrals.

- $\int_{0_{\pi}}^{1} x \sin (\pi x) d x$
- $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \cot (x) d x$

