## Assignment \#4 Due Oct 9

1. Evaluate the integral by a substitution
(a) $\int \frac{x+3}{x^{2}+6 x+7} d x$
(b) $\int \frac{3 t^{4}}{4-9 t^{5}} d t$
(c) $\int_{e}^{e^{2}} \frac{4}{x \ln x} d x$
(d) $\int \frac{1}{\sqrt{x}(1+4 \sqrt{x})} d x$
(e) $\int_{0}^{\frac{\pi}{6}} \frac{\sin 3 x}{1+\cos 3 x} d x$
(f) $\int \frac{1+\sin 3 x}{\cos 3 x} d x$
(g) $\int \frac{\ln x}{3 x\left(1+\ln ^{2} x\right)} d x$
(h) $\int_{2 \ln 2}^{3 \ln 2} \frac{e^{2 x}}{e^{2 x}+8} d x$
(i) $\int \frac{\sec ^{2} \theta}{1+5 \tan \theta} d \theta$
(j) $\int \frac{\cot \left(\frac{4}{x}\right)}{x^{2}} d x$
(k) $\int \frac{x^{2}}{(2 x+1)^{3}} d x$
(l) $\int \frac{x^{3}-x^{2}+1}{x^{3}+1} d x$
(m) $\int \frac{2 x+3}{2 x-3} d x$
2. Evaluate the integral by a substitution
(a) $\int x^{3} \sqrt{4 x^{2}-1} d x$
(b) $\int \frac{x^{5}}{\left(x^{2}+4\right)^{2}} d x$
3. A population of bacteria growth exponentially. Initially it was 1500 bacteria. After five hours there was 4500 bacteria. Find a function of time, $N(t)$, which represents the bacteria population growth.
(i) Find the population size after ten hours;
(ii) Find the time when the population size was 3,000 .
4. Let the revenue in the year 2000 was $\$ 800,000$, and in the year 2002 it was $\$ 600,000$. Assuming the exponential law of change, find the expected revenue for the year 2003.
5. A quantity of a radioactive element decays exponentially. Given that on the 20 th day of an observation the amount of the radioactive element became twice smaller compare to the initial amount and on the 10th day of the observation the amount of the element was 50 mg , find:
(i) the initial amount of the radioactive element;
(ii) how many days is required in order to have the amount that is ten times smaller than the initial one.
6. When an object was removed from a furnace it had temperature 1500 deg. In was placed in a media of temperature 90 deg , and after an hour it cooled down to 1120 deg . What is the temperature of the object after five hours?
7. (Extra Point Problem) Compose your own problem about exponential growth/decay and solve it.
