Math 126: Calculus II Name:_____
Exam I *September 30, 1999* Section:_____

There are 5 problems worth a total of 80 points on 6 pages plus a page to be used as a scratch sheet. You start with 20 points. Unless otherwise noted, each part of a problem is worth the same number of points.

Please read the questions carefully, especially the **bold** words.

You may use a calculator if you wish.

If you want partial credit on any problem, be sure to indicate **clearly** what you are doing. **Show your work** and **all** important steps. **No partial credit** will be given for any numerical answer that is not explained clearly.

1. (10 points) Compute the following limits.

a) $\lim_{x \to 0} \dfrac{\sin^{-1}(3x)}{x}$

b) $\lim_{x \to 0} \dfrac{5 - 5\cos x}{e^x - x - 1}$

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2. (20 points) In each part of this problem you are presented with two functions $f(x)$ and $g(x)$ and you are to decide which of the following three possibilities holds as $x \to \infty$. i) $f(x)$ grows faster than $g(x)$, ii) $g(x)$ grows faster than $f(x)$, iii) $f(x)$ and $g(x)$ grow at the same rate. Write the answer as i), ii), or iii); if the answer is iii) **you must also give** $\lim_{x\to\infty} \dfrac{f(x)}{g(x)}$.

THINK!

a) $f(x) = (\ln x)^2$ and $g(x) = 2^{\ln x}$. Ans. a) _____

b) $f(x) = \dfrac{1}{x}$ and $g(x) = \cos(\tan^{-1} x)$. Ans. b) _____

c) $f(x) = \tan^{-1}(x^2)$ and $g(x) = (\tan^{-1} x)^2$. Ans. c) _____

d) $f(x) = x$ and $g(x) = \cosh(\ln x)$ Ans. d) _____

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3. (15 points) Radioactive radon gas has a half-life of 3.85 days. A leaky basement of a house has a dangerous 30 picocuries of radioactive radon per liter of air. After the leaks are repaired how long will it take for the air in the basement to get down to a safe 4 picocuries of radioactive radon per liter? (*Remember:* The half-life of a radioactive element is the time required for half of the radioactive nuclei present in the sample to decay.)

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4. (10 points) Solve the differential equation $\dfrac{dy}{dx} = e^{x-y}$.

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5. (25 points, 5 points each for the first three parts, 10 points for the last part) Compute the following integrals.

a) $\int_1^4 \frac{1}{\sqrt{x}+x}\,dx$

b) $\int \frac{e^x}{1+4e^{2x}}\,dx$

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c) $\int_0^{\pi/2} x^2 \sin(x)\, dx$

d) $\int \frac{2x}{\sqrt{6x - x^2}}\, dx$