Name: _____

Instructor: _____

Exam I - 126/S2000
February 15, 2000

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- No calculators.
- The exam lasts for one hour.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 11 pages of the test.

Good Luck!

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
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5.	(a)	(b)	(c)	(d)	(e)
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9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)

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Total multiple choice: _____

11. _____

12. _____

13. _____

14. _____

15. _____

Total: _____

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Multiple Choice

1.(5 pts.) Let $f(x) = e^{(x^3)}$. Find $\dfrac{df^{-1}}{dx}(e)$.

(a) e^3 (b) $3e$ (c) $\dfrac{3}{e}$ (d) $\dfrac{1}{2e}$ (e) $\dfrac{1}{3e}$

2.(5 pts.) Compute $\displaystyle\int_1^{e^\pi} \frac{\ln x}{x}\, dx$

(a) $\dfrac{1}{e} - \pi$ (b) $\dfrac{\pi}{e^\pi}$ (c) $3\pi^2 - 2$

(d) $e\pi - e$ (e) $\dfrac{\pi^2}{2}$

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3.(5 pts.) Find the critical point(s) of $f(x) = x \ln x$ and determine whether they are local minima, local maxima, absolute minima, absolute maxima or none of these. If a point is an absolute max/min, the answer local max/min will receive no credit.

(a) $x = e^{-1}$, a absolute maximum

(b) There are no local maxima or local minima

(c) $x = e^{-1}$, a local minimum

(d) $x = e^{-1}$, a absolute minimum

(e) $x = e^{-1}$, a local maximum

4.(5 pts.) Find all solutions of the equation $3^{(x^2)} = 2$

(a) $x = \frac{1}{2}\sqrt{\log_3 2}$ (b) $x = \pm\sqrt{\log_2 3}$ (c) $x = \pm\sqrt{\log_3 2}$

(d) $x = 0$ (e) $x = \frac{1}{2}\sqrt{\log_2 3}$

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5.(5 pts.) Let $f(x) = \dfrac{x^3 e^x}{(x^2+1)^5}$. Find $\dfrac{df}{dx}$.

(a) $\dfrac{-3x^2e^x(x^2+1)^5(5x^3e^x(x^2+1)^4)}{(x^2+1)^{10}}$

(b) $\dfrac{3x^2e^x + x^3e^x}{10x(x^2+1)^4}$

(c) $\dfrac{x^3e^x}{(x^2+1)^5}\left(\dfrac{3}{x} + 1 - 10x(x^2+1)^{-1}\right)$

(d) $\dfrac{x^3e^x(x^2+1)^5 - 10x^4e^x(x^2+1)^4}{(x^2+1)^{10}}$

(e) $\dfrac{x^3e^x}{(x^2+1)^5}\left(\dfrac{(x^2+1)^5 - 5x^3e^x(x^2+1)^4}{(x^2+1)^5}\right)$

6.(5 pts.) Calculate $\lim\limits_{x\to 2^-} \dfrac{x^2-4}{x^5-32}$.

(a) $\dfrac{1}{20}$ (b) $\dfrac{1}{40}$ (c) $\dfrac{1}{10}$ (d) $\dfrac{1}{5}$ (e) $\dfrac{2}{5}$

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7.(5 pts.) Calculate $\lim_{x \to 2} x^x$.

(a) 4 (b) 3 (c) 2

(d) Limit does not exist. (e) 1

8.(5 pts.) Calculate $\int_0^1 \frac{x}{\sqrt{1-x^4}}\, dx$.

(a) $\text{arcsec}(1)$ (b) $\frac{1}{2}\arcsin(1)$ (c) $\frac{1}{2}\text{arcsec}(1)$ (d) $\frac{1}{2}\arctan(1)$ (e) $2\arctan(1)$

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9.(5 pts.) Calculate $\dfrac{d}{dx}\arctan(\ln x)$.

(a) $\dfrac{1}{\ln x(1+x^2)}$

(b) $\dfrac{1}{x(1+(\ln x)^2)}$

(c) $\dfrac{\ln x}{(1+x^2)}$

(d) $\dfrac{x}{(1+(\ln x)^2)}$

(e) $\dfrac{1}{(1+(\ln x)^2)}$

10.(5 pts.) Calculate $\displaystyle\int_2^3 \frac{dx}{(x+1)\sqrt{x^2+2x}}$.

(a) $\operatorname{arcsec}(3) - \operatorname{arcsec}(2)$

(b) $\arctan(3) - \arctan(1)$

(c) $\arctan(2) - \arctan(1)$

(d) $\arcsin(\frac{1}{3}) - \arcsin(\frac{1}{2})$

(e) $\operatorname{arcsec}(4) - \operatorname{arcsec}(3)$

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Partial Credit

11.(10 pts.) Consider the function $f(x) = \sqrt{2x^4 + x^2}$.

a) Show that f is one to one on the domain $(0, \infty)$.

b) Find the slope of the tangent line to the graph of the inverse function f^{-1} at the point $f^{-1}(6) = 2$.

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12.(10 pts.) Find the derivative of the function

$$f(x) = \sqrt[x]{x} = x^{\frac{1}{x}} \quad .$$

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13.(10 pts.) The quantity of a radioactive substance decreases from 100% to 80% in three hours. Compute the half–life (the time until you have 50% of your sample left) as a quotient of logs.

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14.(10 pts.) Determine $\lim_{x\to\infty} \sqrt{e^x + x} - \sqrt{e^x + 1}$.

Hint: Rewrite the expression using algebra and then use what you know about rates of growth.

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15.(10 pts.) Express $\sec\big(\arctan(x)\big)$ as an algebraic function of x.

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