Recitation Time ______ PRINT your name ________________________________

Math 141, Final Exam, Spring 2009

The exam is worth a total of 100 points. There are 20 questions on 9 pages. Each problem is worth 5 points. **SHOW your work. Make your work be coherent and clear.** Write in complete sentences whenever this is possible. $\boxed{CIRCLE}$ your answer. **CHECK** your answer whenever possible. **No Calculators.**

I will post the solutions on my website sometime after the exam.

1. Let $y = e^{x \tan x}$. Find $\frac{dy}{dx}$.

2. Let $y = x \ln(x^2 + 3x)$. Find $\frac{dy}{dx}$.

3. Let $y = [1 + \sin^3(x^5)]^{12}$. Find $\frac{dy}{dx}$.

4. If $\sin(x^2y^2) = x$, then find $\frac{dy}{dx}$.

5. Let $y = \cos^2(3\sqrt{x})$. Find $\frac{dy}{dx}$.

6. Let $f(x) = x^4 - 2x^2$. Where is $f(x)$ increasing and decreasing? Where is $f(x)$ concave up and concave down? Find the local extreme points and points of inflection of $y = f(x)$. Graph $y = f(x)$.

7. Let $f(x) = xe^{-x}$. Find all vertical and horizontal asymptotes of $y = f(x)$. Where is $f(x)$ increasing and decreasing? Where is $f(x)$ concave up and concave down? Find the local extreme points and points of inflection of $y = f(x)$. Graph $y = f(x)$.

8. Find $\int \frac{e^x}{1+e^x} dx$. **Check your answer.**

9. Find $\int \frac{e^x}{1+e^{2x}} dx$. **Check your answer.**

10. Find $\int \frac{e^x}{\sqrt{1+e^x}} dx$. **Check your answer.**

11. Find $\int \frac{1+e^x}{e^x} dx$. **Check your answer.**

12. Find $\int e^x(1+e^x)dx$. **Check your answer.**

13. Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 feet per second. How fast is the area of the spill increasing when the radius of the spill is 60 feet? **Be sure to have units in your answer.**

14. Find the radius and height of the right circular cylinder of largest volume that can be inscribed in a right circular cone with radius 6 inches and height 10 inches. **Be sure to have units in your answer.**

15. An object moves in a straight line with acceleration given by $a(t) = 3\sin 3t$. If the initial velocity is $v(0) = 3$ and the initial position is $s(t) = 3$, then find the position, $s(t)$, of the object at time t .

16. Find the area between $y = -x^2$ and $y = x - 2$.

17. State either part of the Fundamental Theorem of Calculus.

18. **Use the DEFINITION OF THE DERIVATIVE** to find $f'(x)$ for $f(x) = \sqrt{2x-1}$.

19. Compute $\lim_{x \to 0^+} (1 - 2x)^{1/3x}$.

20. Find the equation of the line tangent to $f(x) = 3x^2 + 5x$ at $x = 1$.