Exam 4, Math 141, 1996

PRINT Your Name:_____ Section:_____

There are 10 problems on 5 pages. Each problems is worth 10 point. SHOW your work. $\boxed{CIRCLE}$ your answer. **NO CALCULATORS!** You might find the following formulas to be useful:

$$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6} \quad \text{and} \quad \sum_{k=1}^{n} k^3 = \frac{n^2(n+1)^2}{4}.$$

1. State the Mean Value Theorem.

2. Define the definite integral $\int_a^b f(x)dx$.

3. Find $\int x\left(2x^2 + \frac{1}{x}\right)dx$. (Check your answer.)

4. Find $\int (\cos^4 x^3)(x^2 \sin x^3)dx$. (Check your answer.)

5. Find $\int x\sqrt{x+1}dx$. (Check your answer.)

6. Solve the Initial Value Problem $\frac{dy}{dt} = t^3y^2$, $y(2) = 1$. (Check your answer.)

7. Consider the region A , which is bounded by the $x-$ axis, $y = (x-1)^2$, $x = 1$, and $x = 2$. Consider 50 rectangles, all with base $1/50$, which UNDER estimate the area of A . How much area is inside the 50 rectangles? (You must answer the question I asked. I expect an exact answer in closed form.)

8. Let $f(x) = x^{5/3} - x^{2/3}$. Where is $f(x)$ increasing, decreasing, concave up, and concave down? What are the local extreme points and points of inflection of $y = f(x)$. Find all vertical and horizontal asymptotes. Graph $y = f(x)$.

9. Find the points on the curve $y = 10 - x^2$ which are closest to the point $(0, 0)$.

10. A $30-$ foot ladder is leaning against a wall. If the bottom of the ladder is pulled along the level pavement directly away from the wall at 3 feet per second, how fast is the top of the ladder moving down the wall when the foot of the ladder is 5 feet from the wall?