

Final Math 129 - R5

You have 2 hours to complete the test. Show all relevant work (or else no credit). Make your work legible, if I can't read it, I can't grade it. Each problem is worth 10 points, unless otherwise noted. Use back of pages if necessary. For the 'essay' questions, I am looking for clear sentences that convey a sense of understanding.

REMEMBER: Use all the differentiation rules when needed, and don't interchange integral and derivative!

Name _____

Code Name (optional) _____

1. There were three new concepts introduced in this class. How would you explain to someone who doesn't know calculus the following ideas?

(a) Limit

(b) Derivative

(c) Integral

2. Can you fill in the question mark (?) to make the following function continuous? If you can, fill in the (?) and tell me why that makes the function continuous. If not, explain why not.

$$g(x) = \begin{cases} \frac{6x^2-x-15}{2x-5} & x \neq \frac{5}{2} \\ ? & x = \frac{5}{2} \end{cases}$$

3. What is the (limit) definition of derivative?

4. The percentage of U.S. workers in farm occupations can be modeled by the function

$$F(t) = \frac{-4000t + 1200000}{t^2 - 60t + 15000}$$

Where t is the number of years past 1800.

- (a) Find $F(200)$ and explain what this number means to someone who doesn't understand calculus.
- (b) Find $F'(200)$ and explain what this number means to someone who doesn't understand calculus. (Hint: what rule should you use?)

5. The percentage of high school seniors who have tried pot can be modeled by the formula:

$$P(t) = -.228t^2 + 37.1t - 1440$$

where t is the number of years past 1900. In what year did the highest percentage of seniors try pot, and what was this maximum percentage?

6. Draw a graph of a function that matches the data below: (label all local maximums and minimums and all inflection points)

$$f'(x) > 0 \quad \text{if } x < 0 \text{ or } 0 < x < 2$$

$$f'(x) < 0 \quad \text{if } 2 < x$$

$$f''(x) < 0 \quad \text{if } 0 < x < 1$$

$$f''(x) > 0 \quad \text{if } x < 0 \text{ or } 1 < x$$

7. Find $\frac{dy}{dx}$ for the curve: (Hint: don't forget your rules!)

$$x^4 + 2x^3y^2 + \frac{x}{y+1} = x - y^3$$

8. Find the integral

$$\int \frac{x}{(3x^2 - 8)^{\frac{4}{3}}} dx$$

9. You are helping Detective Colombo on a homicide case. Colombo found the dead body of Mrs. Greene at 9 pm, quickly found that the temperature of her body at this time was 70° F. Now, he needs to determine when she was murdered. The temperature, B in $^{\circ}$ F, of a body, after being killed satisfies the following differential equation:

$$\frac{dB}{dt} = -\frac{1}{2}(B - 60)$$

where t is in hours. What time was Mrs. Greene murdered? (Hint: it will be necessary to use that fact that the temperature of a living body is 98.6° F.)

10. (a) Approximate the following integral using 3 rectangles(3 subintervals): (Use either a left or right hand rule.)

$$\int_1^9 x^2 + 2x \, dx$$

- (b) Evaluate the integral and tell me why this number is not the same as in the previous problem

$$\int_1^9 x^2 + 2x \, dx$$

11. What is the Fundamental Theorem of Calculus, and what makes it fundamental?

12. Evaluate the integral.

$$\int_1^2 \frac{-x^2 + 5x - 3}{x} dx$$

13. Find the area enclosed between the two graphs

$$y = x - x^2$$

$$y = x^3 - x^2$$

14. Evaluate the integral.

$$\int \frac{\ln x}{x^3} dx$$

15. Evaluate the integral

$$\int_4^{\infty} \frac{1}{x^{\frac{7}{2}}} dx$$