

FINAL REVIEW
Math 113 Section 3 Spring 2008

1. Write the equation of the circle $3x^2 + 3y^2 - 12x - 15 = 0$ in standard form.
2. Find the inverses of $f(x) = 12 \log(x - 7) + 3$ and $g(x) = 3e^{x^3+2} - 7$.
3. Find the domains of the following functions.

(a) $f(x) = \frac{x+2}{x-5x-14}$.

(b) $g(x) = \frac{1}{\ln(x-2)+3}$.

4. What does it mean for a function to be continuous at a point c ?
5. Where is the function

$$f(x) = \begin{cases} \frac{x-3}{x^2+2x-15}, & x < 5 \\ \frac{1}{2x}, & x \geq 5 \end{cases}$$

continuous?

6. Find $\lim_{x \rightarrow 4}(7f(x) + 3)$, where $f(x)$ is given above.
7. Choose m so that

$$f(x) = \begin{cases} mx + 4, & x < 2 \\ \sqrt{x-2}, & x \geq 2 \end{cases}$$

is continuous.

8. What is a derivative?
9. Using the definition of the derivative, find the derivatives of $f(x) = x^3 + 2$ and $g(x) = \sqrt{x+3}$.
10. Find the tangent line to $f(x) = xe^{x+4} + e^{3x^3+x}$ at the point $(0, e)$.
11. Find and simplify the derivatives of the following functions.

(a) $f(t) = 2te^{\sqrt{t^2-3}}$.

(b) $h(w) = \ln \left[\sqrt[8]{\frac{w^2-1}{w^3+9w}} \right]$.

12. If $f(3) = 4$, $g(3) = 7$, $f'(3) = 2$, and $g'(3) = -4$, evaluate the derivatives of $fg(x)$ and $\frac{f}{g}(x)$ at $x = 3$.
13. If $r(s) = e^{2s}$, find $r^{(11)}(s)$. Find $r^{(1000)}(s)$.
14. Find equations for the slopes of the tangent lines to the following graphs.

(a) The graph of $x^2 - y^2 = 7$.

(b) The graph of $2(x^2 + y^2)^2 = 25(x^2 - y^2)$.

15. The product of two numbers is 12. What is the largest that the sum of their squares can be?
16. Express the area inside a circle centered at the origin, with radius r , as an integral.
17. Compute $\int_2^5 \sqrt{5+4x-x^2} dx$. (Hint: use a geometric argument.)
18. What is an indefinite integral?
19. What is a definite integral?

20. Find the average value of $k(n) = \frac{e^{2/n}}{n^2}$ on the interval $[1, 2]$.
21. If $f(x)$ is odd, $g(x)$ is even, $\int_0^4 f(x)dx = 3$, and $\int_0^4 g(x) = 7$, compute $\int_{-4}^4 (f(x) - 2g(x))dx$.
22. Compute the following integrals.
- (a) $\int \frac{e^{41z}}{\sqrt{e^{41z} + 32}} dz$.
 - (b) $\int \frac{1}{r^5 \sqrt[3]{r^7}} dr$.
 - (c) $\int_e^{e^3} \frac{1}{x \ln(x)} dx$.
 - (d) $\int (x^2 + x)e^{3x} dx$.
 - (e) $\int_1^4 \ln(2x) dx$.
23. Find the areas of the regions bounded by the following curves.
- (a) $y = 2x^2 + 3x + 5$, $y = 0$, $x = 1$, and $x = 5$.
 - (b) $y = x^3 - 4x^2 + 3x$ and $y = x^2 - 2x$.