

## Math 1680a Final Spring 2004

Put your name at the top of the page. Work each problem according to instructions. Problems marked with "pc" are partial credit problems where your work will be graded. all work must be shown on "pc" problems to earn credit. Problems marked with "ao" are answer only problems. On answer only problems, you will get full credit or zero depending only on the answer shown.

1. (ao 2pts each) Find the limits

(a)  $\lim_{x \rightarrow 1^+} \frac{x^2+1}{x^2-1}$

(b)  $\lim_{x \rightarrow 4} 6$

2. (ao 2pts each) Given that  $\lim_{x \rightarrow 1} f(x) = 5$  and  $\lim_{x \rightarrow 1} g(x) = 12$ , find

(a)  $\lim_{x \rightarrow 1} f(x)g(x)$

(b)  $\lim_{x \rightarrow 1} \frac{1}{\sqrt{f(x)^2+g(x)^2}}$

3. (ao 2pts each) Find the first second and third derivative of  $f(x) = \frac{1}{x+1}$

4. (pc 5pts) find the absolute maximum and minimum of  $f(x) = x^2 + 1$  on the interval  $[-1, 2]$

5. (ao 2pts each) Let  $f(x) = x^4 - 2x^2 + 1$

(a) find all  $x$  values where  $f'(x) = 0$

(b) find the interval(s) where the function is increasing, decreasing

(c) find all  $x$  values where  $f^{(2)}(x) = 0$

(d) find the interval(s) where the function is concave up, and concave down.

6. (ao 2pts each) Compute derivatives

(a)  $f(x) = x \ln(x)$

(b)  $f(x) = \ln(x^2 + 1)$

(c)  $f(x) = e^{\ln(x^2)}$

7. (pc 4pts) Compute  $y'$  implicitly where  $\ln(x + y) = xy$

8. (ao 2pts each) Formula:  $A = P(1 + i)^n, i = \frac{r}{m}, n = mt$

(a) Find the accumulated amount after 4 yrs if 5,000 is invested at 8 percent compound monthly

(b) Find the present value of 40,000 due in 4 years at 6 percent interest compounded semi-annually.

9. (pc 5pts) Find an equation for the line tangent to the graph of  $y = xe^{-x}$  at the point  $(0, 0)$ .

10. (pc 5pts) Use integration by substitution to compute

(a)  $\int \frac{e^x}{1+e^x} dx$

(b)  $\int x\sqrt{x^2 + 1} dx$

11. (pc 5pts) Compute the indefinite integral  $\int \sqrt{x} + \frac{1}{\sqrt{x}} dx$

12. (pc 5pts) If  $f'(x) = 1 + \sqrt{x}$  and  $f(0) = 0$ , find  $f(x)$

13. (pc 5pts) Evaluate the definite integral  $\int_1^e \frac{1}{x} dx$

14. (pc 5pts) Find the area bounded by the curves  $g(x) = x^2$  and  $f(x) = x^3$

15. (pc 5pts) Find the critical points of  $f(x, y) = xy - \ln(x) + 2y^2$

16. (ao 2pts each part) Use the 2nd derivative test to classify the critical points  $(0, -1)$ ,  $(0, 3)$  of  $f(x, y) = 4y^3 + x^2 - 12y^2 - 36y + 2$ .

17. (pc 5pts) Use the method of Lagrange multipliers to find the min of  $f(x, y) = 2x^2 + y^2$  subject to  $x + y = 1$

18. (pc 5pts each) Evaluate the double integrals:

(a)  $\int_0^1 \int_1^x x^2 y + 2y^2 dy dx$

(b) the integral of  $f(x, y) = x + y$  on the region bounded by the x-axis, the y-axis, and the line  $x + 2y = 4$