FINAL EXAM

QSci 291
Fall 1999

sample final

name:_____

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This exam consists of four parts: **A,B,C & D.** Do any 3 of the 6 problems in **A**, 2 of the 4 in **B**, 2 of the 4 in **C** and 3 of the 6 in **D**. 10 points for each correct answer; 100 pts total. Star (*) the problems you want corrected. Put your name on every piece of paper you turn in.

Part A: Do any 3 problems
(for 1-3 find an iterative formula for determining the roots of the given function and use the value of 1 for the initial guess to compute the first approximation to one of the roots.)

1. $x \ln x + x - 2 = 0$

2. $x^4 + x - 3 = 0$

3. $e^x - x - 3 = 0$

(for 4-6 differentials are involved)

4. find a value for dy if $y = \sin(2x)$, $x = \pi/2$ and $dx = 0.01$

5. find a formula for the percentage error in the kinetic energy, E, of a particle with a constant mass, m, traveling with a velocity, v, as a function of the percentage error in the velocity, if $E = \frac{1}{2} m v^2$

6. find a value of du if $u = \arctan(t^2)$, $t = 1$ and $dt = 0.4$.

Part B: Do any 2

7. find $\frac{\partial z}{\partial x}$ if $z = \ln(\cos(2x+y))$

8. find $\frac{dy}{dx}$ if $x = \sqrt{t-4}$
and $y = t+5$

9. find $\frac{\partial z}{\partial y}$ if $z = \ln(x^2 y^3)$

10. find $\frac{du}{ds}$ if $u = \ln x - x$
and $s = \ln x + x$

Part C: Do 2 of 4

11. for $x > 0$, find a maximum, minimum or inflection point for $y = x^3 \cdot e^{-6x}$

12. find the second derivative of $y = \arcsin(x/4)$

13. for $x > 0$, find a maximum, minimum or inflection point for $y = 3x + \frac{16}{x^3}$

14. find the second derivative of $y = \sin(\arcsin(x^2))$

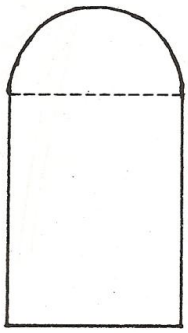
In addition to problems in Neu., Chapt. 5 (Optimization) 5.4, p. 243, here are a few more

Part D: Do 3 of 6

15. The sum of two nonnegative numbers is 36. Find these numbers if the first plus the square of the second is minimum.

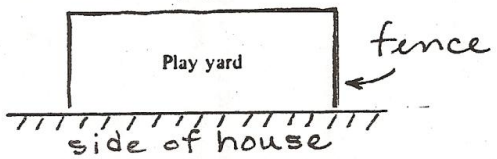
16. A model for the spread of disease assumes that the rate at which a disease spreads is proportional to the product of the number of people infected and the number not infected. Assume the size of the population to be a constant N. When is the disease spreading most rapidly?

17. A window has the shape of a rectangle surmounted by a semicircle. Find the dimensions that provide maximum area if the perimeter of the window is 10 meters.

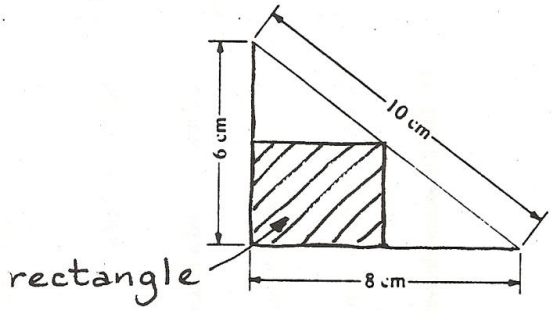


circle: area $= \pi r^2$
perimeter $= 2\pi r$

18. A rectangular play yard is to be constructed along the side of a house by erecting a fence on three sides, using the house wall as the fourth wall of the play yard. Find the dimensions that produce the play yard of maximum area if 20 meters of fence is available for the project.



19. A rectangle is inscribed in a right triangle with sides of length 6 cm, 8 cm, and 10 cm, respectively. Find the dimensions of the rectangle of maximum area if two sides of the rectangle lie along two sides of the triangle.



20. A farmer has 120 meters of fencing with which he plans to make a rectangular pig pen. The pen is to have one internal fence running parallel to the end fences that divides the pen into two sections. Find the dimensions that produce the pen of maximum area if the length of the larger section is to be twice the length of the smaller section.

pen {