HOMEWORK 4 - MATH 151
DUE DATE: Monday, February 19
INSTRUCTOR: George Voutsadakis

Read each problem **very carefully** before starting to solve it. Four out of the ten problems will be chosen at random and graded. Each problem graded is worth 3 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Find the derivative dy/dx:
   (a) $x^2 - 2xy + y^3 = c$
   (b) $y^5 + x^2y^3 = 1 + x^4y$
   (c) $y \sin(x^2) = x \sin(y^2)$
2. Find an equation of the tangent line to the curve of $x^2 + 2xy - y^2 + x = 2$ at the point $(1, 2)$.
3. Find all points on the curve $x^2y^2 + xy = 2$ where the slope of the tangent line is -1.
4. Each side of a square is increasing at a rate of 6 cm/sec. At what rate is the area of the square increasing when the area of the square is 16 square centimeters?
5. A plane flying horizontally at an altitude of 1 mile and a speed of 500 mi/hr passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when it is 2 miles away from the station.
6. At noon ship A is 100 km west of ship B. Ship A is sailing south at 35 kn/hr and ship B is sailing north at 25 km/hr. How fast is the distance between the two ships changing at 4:00 pm?
7. A paper cup has the shape of a cone with height 10 cm and radius 3 cm at the top. If water is poured into the cup at the rate of 2 cubic centimeters per second, how fast is the water level rising when the water is 5 cm deep?
8. Use a linear approximation to estimate the numbers $\sqrt{99.8}$ and $\frac{1}{1002}$.
9. Find the differentials of the functions
   (a) $y = x^2 \sin 2x$
   (b) $y = \frac{1}{x+1}$.
10. The radius of a circular disk is given as 24 cm with a maximum error of measurement of 0.2 cm.
    (a) Use differentials to estimate the maximum error in the calculated area of the disk.
    (b) What is the relative error? What is the percentage error?