Name: _____

4-digit code: _____

- Write your name and the last 4 digits of your SSN in the space provided above.
- The test has five (5) pages, including this one.
- Enter your answer in the box(es) provided.
- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given in parentheses at the right of the problem number.
- No books, notes or calculators may be used on this test.

Page	**Max. points**	**Your points**
2	30	
3	25	
4	25	
5	20	
Total	100	

Problem 1 (15 pts)**.** Sketch the domain of $f(x,y) = \dfrac{\sqrt{4-x^2}}{y^2+3}$.

Problem 2 (15 pts)**.** Evaluate the limit, if it exists

$$\lim_{(x,y)\to(0,0)} (x^2+y^2)\ln\left(x^2+y^2\right)$$

Problem 3 (15 pts)**.** The volume of a right circular cone of radius r and height h is $V = \frac{1}{3}\pi r^2 h$. Show that if the height remains constant while the radius changes, then the volume satisfies

$$\frac{\partial V}{\partial r} = \frac{2V}{r}.$$

Problem 4 (10 pts)**.** Use the method of Lagrange multipliers to find the dimensions of a rectangle with perimeter p and maximum area.

width:

height:

Problem 5 (15 pts)**.** Recall the formula for the volume of a right circular cone of radius r and height h. Suppose that the height decreases from 20 to 19.95 inches, and the radius increases from 4 to 4.05 inches. Compare the change in volume of the cone with an approximation of this change using a total differential.

$dV =$ $\boxed{}$

$\Delta V =$ $\boxed{}$

Problem 6 (10 pts)**.** Find an equation for the tangent plane to the surface $z = xe^{-y}$ at the point $P = (1, 0, 1)$.

tangent plane: $\boxed{}$

Problem 7 (20 pts)**.** Find the absolute extrema of the function $f(x, y) = xy - x - 3y$ on the triangular region R with vertices $(0, 0)$, $(0, 4)$ and $(5, 0)$.

absolute max:

absolute min: