

**Tangent Planes and Normal Lines**

1. Find the equations of the tangent plane and normal line to the surface given by

$$x(z^2 - y) - e^{x+3y} = 107 \text{ at the point } (6, -2, 4).$$

2. Find the point(s) on the surface  $x^2 + 6y^2 - 3z^2 = -6$  where the tangent plane is parallel to the plane  $2x - y - 4z = 2$ .

**Relative Extrema**

For problems 3 & 4 find and classify all the critical points of the given function.

3.  $h(x, y) = x^4 - 2xy^2 - 8x^2 + 6y^2$

4.  $g(x, y) = \frac{x^3 - 4x^2 - 2x}{y^2 + 10}$

**Absolute Extrema**

5. Find the absolute extrema of  $f(x, y) = 2x(6 + xy + 2y^2)$  on the triangle with vertices (0,0), (6,12) and (6,-3).

**Lagrange Multipliers**

For problems 6 – 8 use Lagrange Multipliers to find the maximum and minimum values of the function subject to the given constraint.

6.  $f(x, y) = 4x^2 - 3y^2$  ;  $x^4 + y^4 = 16$

7.  $f(x, y, z) = xyz$  ;  $y^2 + 2z^2 - 2x = 32$

For this problem assume  $x \leq 0$ . Why is this assumption important? And yes I do expect you to answer this....

8.  $f(x, y, z) = 3x - 4y - z^2$  ;  $x^2 + y^2 + z^2 = 25$