1. Find the domain and range of \( f(x, y, z) = -\frac{z^2}{\sqrt{x^2 - y^2}} \). Where is \( f \) continuous?

2. Let \( f(x, y) = xe^y + ye^x \). Find all first and second partial derivatives.

3. Draw a contour map for the function \( f(x, y) = 3y - 2x^2 \).

4. \[ \lim_{(x,y,z)\rightarrow(0,0,0)} \frac{xy+yz^2+zx^2}{x^2+y^2+z^2} = ? \] (Or show doesn’t exist.)

5. Find \( f_{xyz} \) where \( f(x, y, z) = x^5 + x^4y^4z^3 + yz^2 \).

6. Find the rate of change of the function \( f(x, y) = \sqrt{xy} \) at \( P(2, 8) \) in the direction \( Q(5, 4) \).

7. The temperature in degrees Celsius on the surface of a metal plate is \( T(x, y) = 20 - 4x^2 - y^2 \), where \( x \) and \( y \) are measured in inches. In what direction from \( (2, -3) \) does the temperature increase most rapidly? What is this rate of increase?

8. Sketch and identify: \( 4x^2 + 4y^2 - z^2 = 4 \)

9. Sketch the ellipse: \( 9x^2 + 10x^2 = 90 \). Make sure you label the focii and the intercepts with the axes.

10. Find the equation of the parabola with focus \( (1, 2) \) and directrix \( y = 4 \).