1. Let \( f(x, y) = 2x^2 y^3 - x^3 y^5 \). Find \( \frac{\partial f}{\partial x} \) and \( \frac{\partial f}{\partial y} \).

2. Sketch and label the level sets for levels 1, 0, \(-1\), for the function \( f(x, y) = x^2 - y^2 \).

3. Graph and name \( z = x^2 + y^2 \) in 3-space.

4. Graph and name \( z^2 = x^2 + y^2 \) in 3-space.

5. Find the equation of the plane tangent to \( z^2 = x^2 + y^2 \) at the point \((3, 4, 5)\).

6. Consider the curve whose position vector is
\[
\mathbf{r}(t) = 2t^2 \mathbf{i} - t^3 \mathbf{j} + \frac{2}{t} \mathbf{k}.
\]
Find the equations of the line tangent to this curve at \( t = 1 \).

7. Find the directional derivative \( D_uf \) at \((1, 2)\) for the function \( f(x, y) = 3x^2y \) in the direction of the unit vector \( \frac{3}{5} \mathbf{i} + \frac{4}{5} \mathbf{j} \).

8. Find the length of the curve whose position vector is
\[
\mathbf{r}(t) = t^2 \mathbf{i} - 2t^3 \mathbf{j} + 6t^3 \mathbf{k},
\]
for \( 0 \leq t \leq 1 \).

9. The temperature of a plate at the point \((x, y)\) is \( T(x, y) = xy \).
   (a) Draw and label the level sets \( T = 0 \), \( T = 1 \), \( T = -1 \), \( T = 2 \), and \( T = -2 \).
   (b) A heat seeking particle always moves in the direction of the greatest increase in temperature. Place such a particle on your answer to (a) at the point \((1, -2)\). Draw the path of the particle.
   (c) Find the equation which gives the path of the particle of part (b).

10. The position of a moving particle at time \( t \) is given by the position vector
\[
\mathbf{r}(t) = 2 \cos t \mathbf{i} - 3 \sin^2 t \mathbf{j}.
\]
   (a) Graph the path of the object.
   (b) Eliminate the parameter and express the path of the object in cartesian coordinates.
   (c) Which point on the curve corresponds to \( t = \frac{\pi}{3} \) ?
   (d) Draw \( \mathbf{r}(\frac{\pi}{3}) \). Point the tail on your answer to (c).
   (e) Draw \( \mathbf{a}(\frac{\pi}{3}) \). Point the tail on your answer to (c).