1. Evaluate \( \int_{0}^{\infty} e^{-\sqrt{x}} \frac{dx}{\sqrt{x}} \), or show that it doesn’t exist.

2. Solve the initial value problem \( y' = \frac{1}{\sqrt{xy}} \), \( y(1) = 4 \).

3. Find an equation for the plane that is parallel to \( x - 2y + 6z = 1 \) and contains the point \((4, 0, 2)\).

4. Sketch the level curves of \( z = y^2 - \frac{1}{4}x^2 \) at the heights \( z = -1, 0, 1 \).

5. Evaluate the limit \( \lim_{(x,y) \to (0,0)} \frac{5x - 2y^2}{x + 2y^2} \), or show that it doesn’t exist.

6. Consider the hill given by the function \( z = f(x, y) = \sqrt{1 - x^2 - 4y^2} \).
   
   (a) Compute \( f_x \) and \( f_y \).
   
   (b) Find the unit vector that gives the direction of steepest ascent at the point \((\frac{1}{2}, \frac{1}{4}), f\left(\frac{1}{2}, \frac{1}{4}\right)\) on the hill. Also find a unit vector that gives the direction of no change at that point.

   (c) Suppose you’re walking over the hill along the path that is right above the path \((x(t), y(t)) = (t, t^2)\) in the \(xy\)-plane. As you pass the point \((\frac{1}{2}, \frac{1}{4}), f\left(\frac{1}{2}, \frac{1}{4}\right)\), at what rate is your height changing?

7. Find the critical points of \( f(x, y) = \frac{1}{2}x^2 + 4xy + y^3 + 8y^2 + 3x + 2 \), and classify each one as a maximum, minimum or saddle point.