1. Use Lagrange multipliers to find the closest point on the curve $y = x^2$ to the point $(0, 2)$.

2. Use Lagrange multipliers to find the maximum and minimum of the function $f(x, y) = 4xy$ subject to the constraint $4x^2 + y^2 = 8$.

3. Find the maximum and minimum of the function $f(x, y) = 4xy$ subject to the constraint $4x^2 + y^2 \leq 8$. 
4. Find the maximum and minimum of the function $f(x, y) = 2x^3y$ subject to the constraint $x^2 + y^2 \leq 4$

5. Maximize $f(x, y) = e^{x+y}$ subject to the constraint $x^2 + y^2 = 2$.

6. Minimize $f(x, y, z) = x^2 + y^2 + z^2$, subject to the constraints $x + 2y + 3z = 6$ and $y + z = 0$. 