
\[ f(x, y) = x^2 - y^2 - 2x + 4y + 6 \]

**Solution**

1. \[ f_x(x, y) = 2x - 2 \quad f_y(x, y) = -2y + 4 \]

2. \[ \begin{align*}
    0 &= f_x(x, y) = 2x - 2 \quad \Rightarrow \quad x = 1 \\
    0 &= f_y(x, y) = -2y + 4 \quad \Rightarrow \quad y = 2
\end{align*} \]

3. All "partials" are defined everywhere, so \( P_0(1, 2) \) is the only c.p.

4. \[ f_{xx}(x, y) = 2, \quad f_{xy}(x, y) = 0 = f_{yx}(x, y), \quad \text{and} \]
   \[ f_{yy}(x, y) = -2. \]

5. \[ \Delta(x, y) = f_{xx}(x, y) f_{yy}(x, y) - \left[f_{xy}(x, y)\right]^2 = -4 < 0 \]
   \[ \text{and} \quad \Delta(P_0) = -4 < 0 \]

6. By 2nd Der Test, the graph of \( f \) has a saddle point.

7. \[ f(1, 2) = 1 - 4 - 2 + 8 + 6 = 15 - 6 = 9 \]

8. The graph of \( f(x, y) = x^2 - y^2 - 2x + 4y + 6 \) has a saddle point \( P(1, 2, 9) \).