

**Let**  $f(x, y) = x^2 - y^2$

1. Find the first order partial derivatives  $f_x, f_y$
2. Find the second order partial derivatives  $f_{xx}, f_{xy}, f_{yx},$  and  $f_{yy}$
3. Evaluate  $f_x, f_y, f_{xx}$  and  $f_{yy}$  the point  $(2, 1)$ .
4. What does your answer to 3 tell you about the graph  $z = f(x, y)$  at  $(2, 1)$ ?
5. Use a contour plot and/or 3D plot in Mathematica to verify your answers

Let  $g(x, y) = x^2 - 8x + 2xy - 14y + 4y^2 + 19$

1. Find the first order partial derivatives  $g_x$ ,  $g_y$
2. Find the second order partial derivatives  $g_{xx}$ ,  $g_{xy}$ ,  $g_{yx}$ , and  $g_{yy}$
3. Evaluate  $g_x$ ,  $g_y$ ,  $g_{xx}$  and  $g_{yy}$  the point  $(3, 1)$ .
4. What does your answer to 3 tell you about the graph  $z = g(x, y)$  at  $(3, 1)$ ?
5. Use a contour plot and/or 3D plot in Mathematica to verify your answers