$f_a = (x_2 - x_1^2)(x_2 - 3x_1^2)$

Figure 1: The behavior of $f_a(x_1, x_2) = (x_2 - x_1^2)(x_2 - 3x_1^2)$ near the origin, a nonminimizing point where there are no directions of decrease.

Figure 2: Contours of two quadratic functions with positive definite Hessian matrices, where darker shading corresponds to smaller function values.
Figure 3: Contours are shown, with darker shading corresponding to smaller function values, for a quadratic function whose Hessian is positive semidefinite and singular, where the linear system $Hx = -c$ is compatible. The point $x^*$ is a weak minimizer, as is every point on the finely dashed line, and the function is bounded below.

Figure 4: Contours are shown, with darker shading corresponding to smaller function values, for a quadratic function whose Hessian is nonsingular, with one positive and one negative eigenvalue. The unique stationary point $x^*$ is a saddle point, neither a minimizer nor a maximizer, with the function increasing as one moves away from $x^*$ in some directions and decreasing in others. On the right, the variation of $q$ is plotted when moving away from $x^*$ along two directions, $p_1$ and $p_2$, with $q$ increasing along $p_1$ and decreasing along $p_2$. 
Figure 5: Contours are shown, with darker colors for smaller function values, for a quadratic function with no stationary point, meaning that $c$ does not lie in the range of $H$. Even though $H$ is positive semidefinite and singular, $q(x)$ is unbounded below when moving along the direction $-c_N$ (the part of $c$ in the null space of $H$), indicated by the arrow.