Exercises on (quasi) Newton methods

Exercise (i) (2P) Show that Newton's method applied to a nondegenerate quadratic function yields a Quasi-Newton method.
Bonus points: Show that this is an *if and only if*.

Exercise (ii) (2P) Consider a step of the secant method:

$$x_{k+1} = x_k - f(x_k)\frac{x_k - x_{k-1}}{f(x_k) - f(x_{k-1})}.$$

Assuming that $x_k \neq x_{k-1}$ and $f(x_k) \neq f(x_{k-1})$, prove that the line through the two points $(x_{k-1}, f(x_{k-1}))$ and $(x_k, f(x_k))$ intersects the x-axis at the point $x = x_{k+1}$.

Exercise (iii) (6P) Complete the notebook.