Vertex of the Quadratic

Given a quadratic $d(f) = a f^2 + b f + c$ compute its value at $f_1 = -\frac{b}{2a}$ namely $d(f_1) = c - \frac{b^2}{4a}$

Now compute the same quadratic at $f_1 + h$, namely

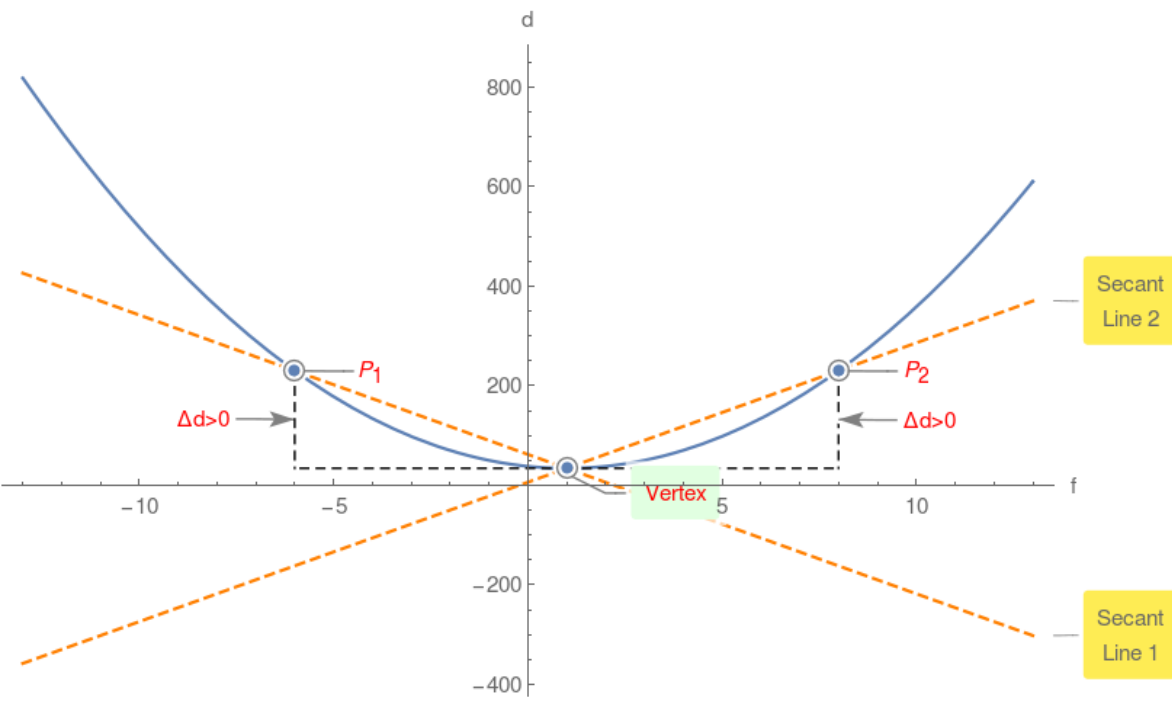
$d(f_1 + h) = -\frac{b^2}{4a} + a h^2 + c$

Compute $\triangle = d(f_1 + h) - d(f_1) = a h^2$

Since $h^2 > 0$, therefore if $a > 0$ then $\triangle > 0$ or vertex is the global minimum!

Example 1.

$d(f) = 4 f^2 - 8 f + 38$



However if $a < 0$ then $\triangle < 0$ or vertex is the global maximum!

Example 2.

$d(f) = -f^2 - 6 f + 30$