Vertex of the Quadratic

Given a quadratic $d(t) = a\,t^2 + b\,t + c$ compute its value at $t_1 = -\frac{b}{2a}$ namely $d(t_1) = c - \frac{b^2}{4a}$

Now compute the same quadratic at $t_1 + h$, namely

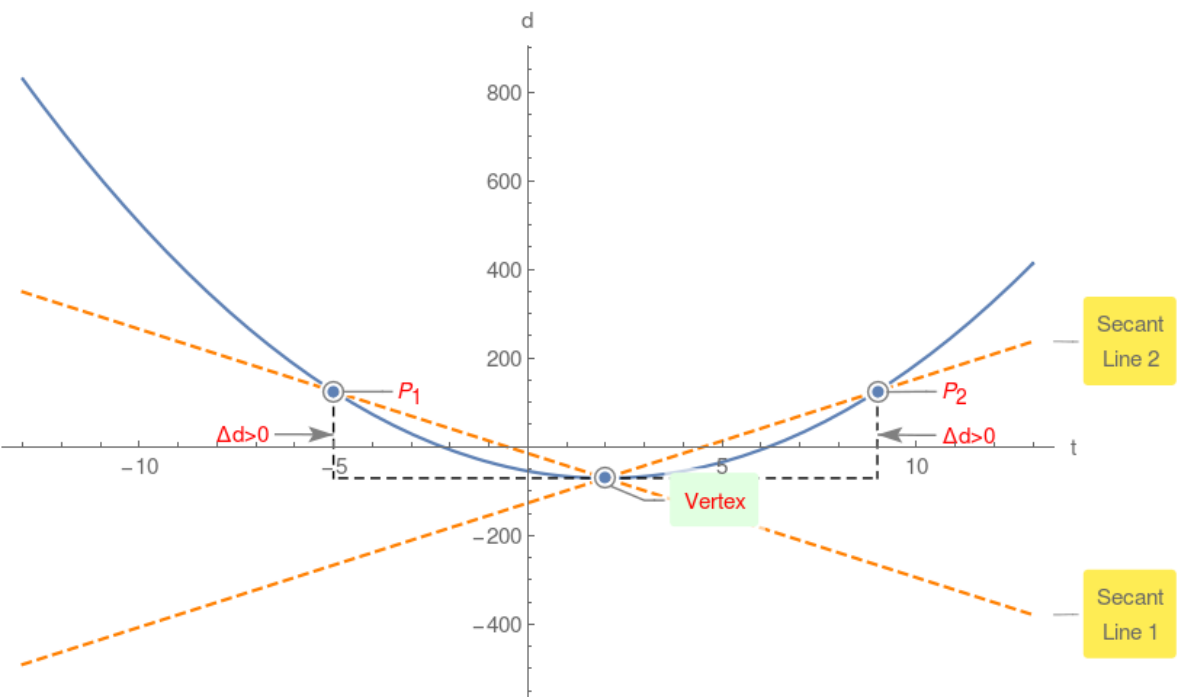$d(t_1 + h) = -\frac{b^2}{4a} + a\,h^2 + c$

Compute $\triangle = d(t_1 + h) - d(t_1) = a\,h^2$

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

Example 1.

$d(t) = 4\,t^2 - 16\,t - 55$

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

Example 2.

$d(t) = -2\,t^2 - 8\,t - 53$