Vertex of the Quadratic

Given a quadratic $v(q) = a\,q^2 + b\,q + c$ compute its value at $q_1 = -\frac{b}{2\,a}$ namely $v(q_1) = c - \frac{b^2}{4\,a}$

Now compute the same quadratic at $q_1 + h$, namely

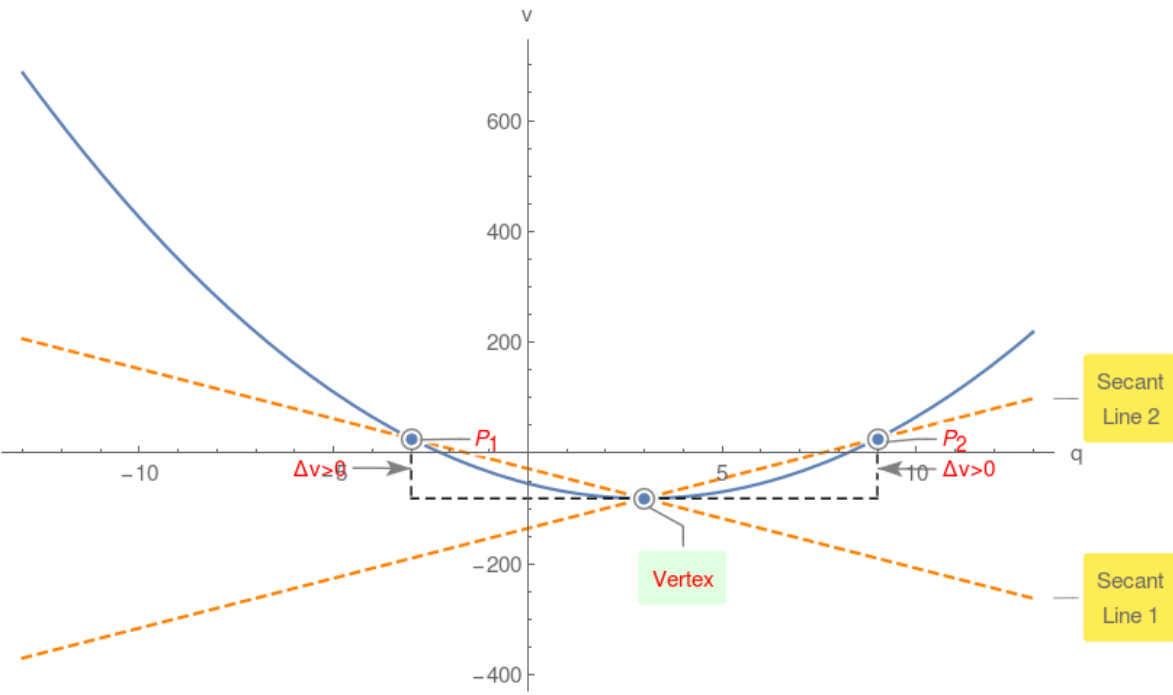
$v(q_1 + h) = -\frac{b^2}{4\,a} + a\,h^2 + c$

Compute $\triangle = v(q_1 + h) - v(q_1) = a\,h^2$

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

Example 1.

$v(q) = 3\,q^2 - 18\,q - 55$



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

Example 2.

$v(q) = -4\,q^2 - 8\,q + 40$