Vertex of the Quadratic

Given a quadratic $k(v) = a v^2 + b v + c$ compute its value at

$v_1 = -\frac{b}{2a}$ namely $k(v_1) = c - \frac{b^2}{4a}$

Now compute the same quadratic at $v_1 + h$, namely

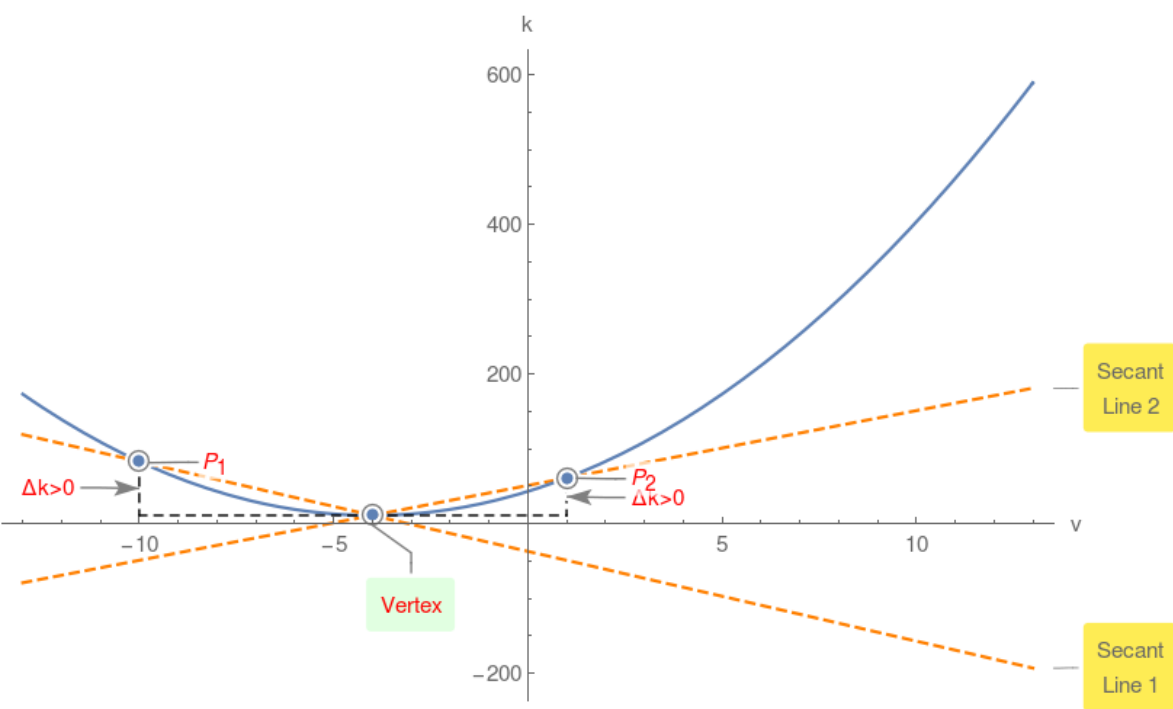$k(v_1 + h) = -\frac{b^2}{4a} + a h^2 + c$

Compute $\triangle = k(v_1 + h) - k(v_1) = a h^2$

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

global minimum!

Example 1.
$k(v) = 2 v^2 + 16 v + 43$

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

Example 2.
$k(v) = -3 v^2 + 18 v + 69$