Vertex of the Quadratic

Given a quadratic $w(p) = a\,p^2 + b\,p + c$ compute its value at
$p_1 = -\frac{b}{2\,a}$ namely $w(p_1) = c - \frac{b^2}{4\,a}$
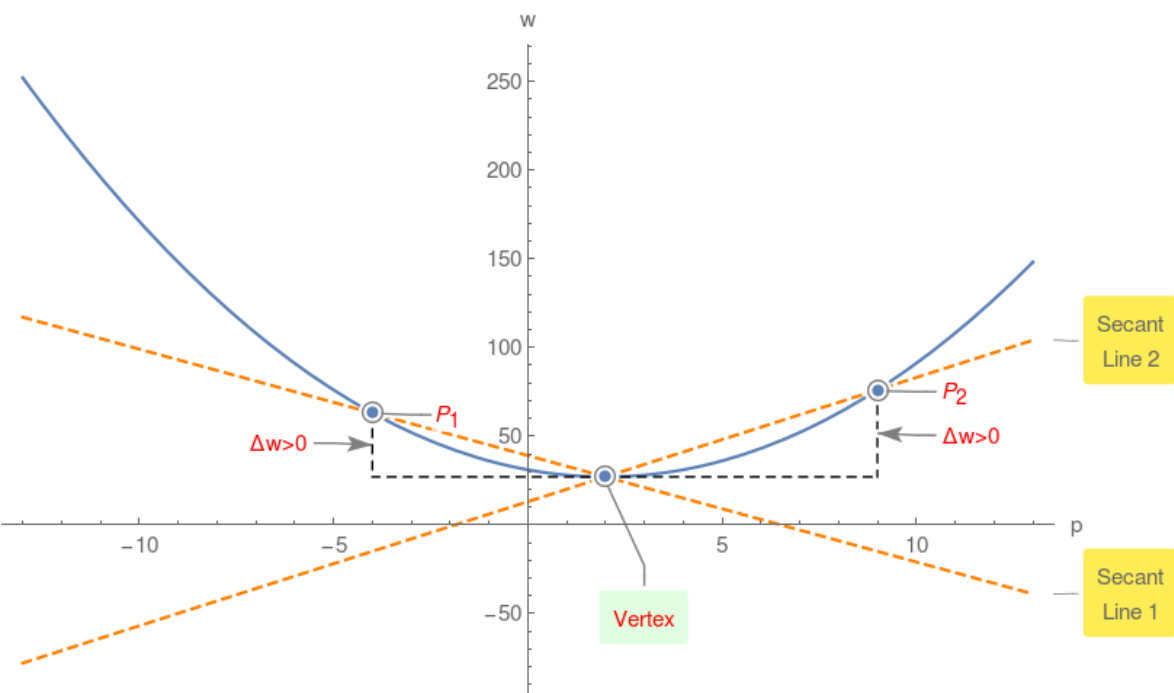Now compute the same quadratic at $p_1 + h$, namely
$w(p_1 + h) = -\frac{b^2}{4\,a} + a\,h^2 + c$

Compute $\triangle = w(p_1 + h) - w(p_1) = a\,h^2$

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

Example 1.
$w(p) = p^2 - 4\,p + 31$

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

Example 2.
$w(p) = -4\,p^2 - 32\,p - 60$