Vertex of the Quadratic

Given a quadratic $c(m) = a\,m^2 + b\,m + c$ compute its value at

$m_1 = -\frac{b}{2a}$ namely $c(m_1) = c - \frac{b^2}{4a}$

Now compute the same quadratic at $m_1 + h$, namely

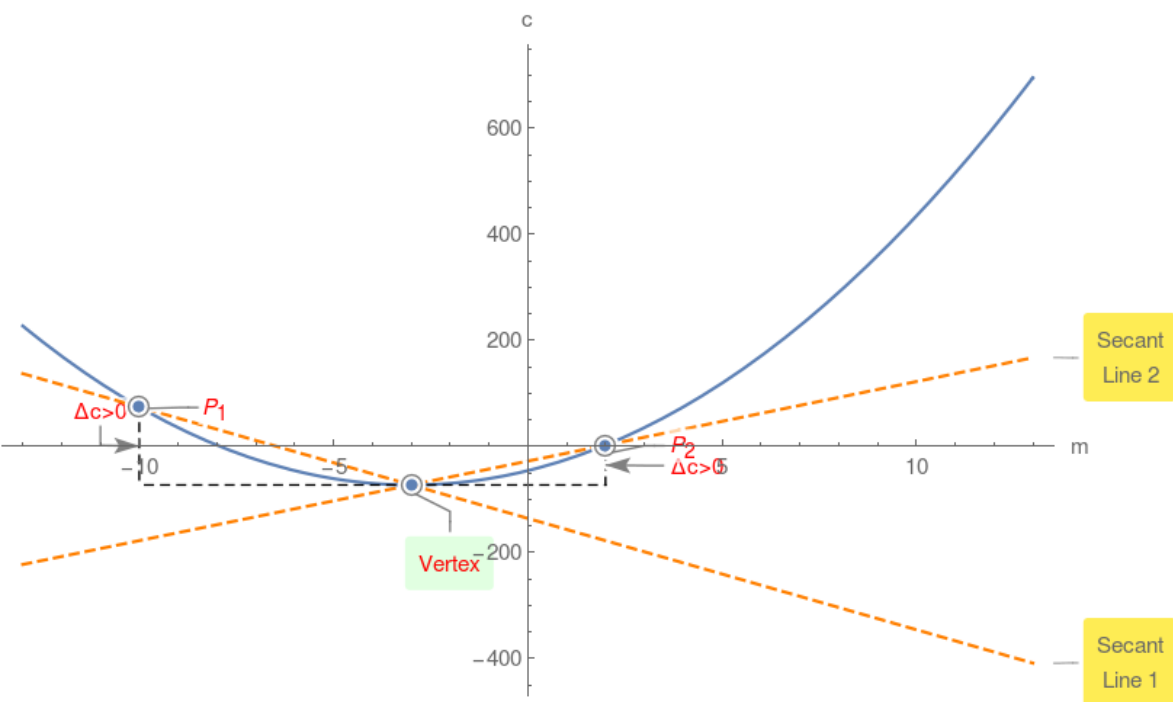$c(m_1 + h) = -\frac{b^2}{4a} + a\,h^2 + c$

Compute $\triangle = c(m_1 + h) - c(m_1) = a\,h^2$

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

Example 1.

$c(m) = 3\,m^2 + 18\,m - 46$

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

Example 2.

$c(m) = -2\,m^2 + 16\,m + 55$