Vertex of the Quadratic

Given a quadratic $z(r) = a\,r^2 + b\,r + c$ compute its value at $r_1 = -\frac{b}{2a}$ namely $z(r_1) = c - \frac{b^2}{4a}$

Now compute the same quadratic at $r_1 + h$, namely

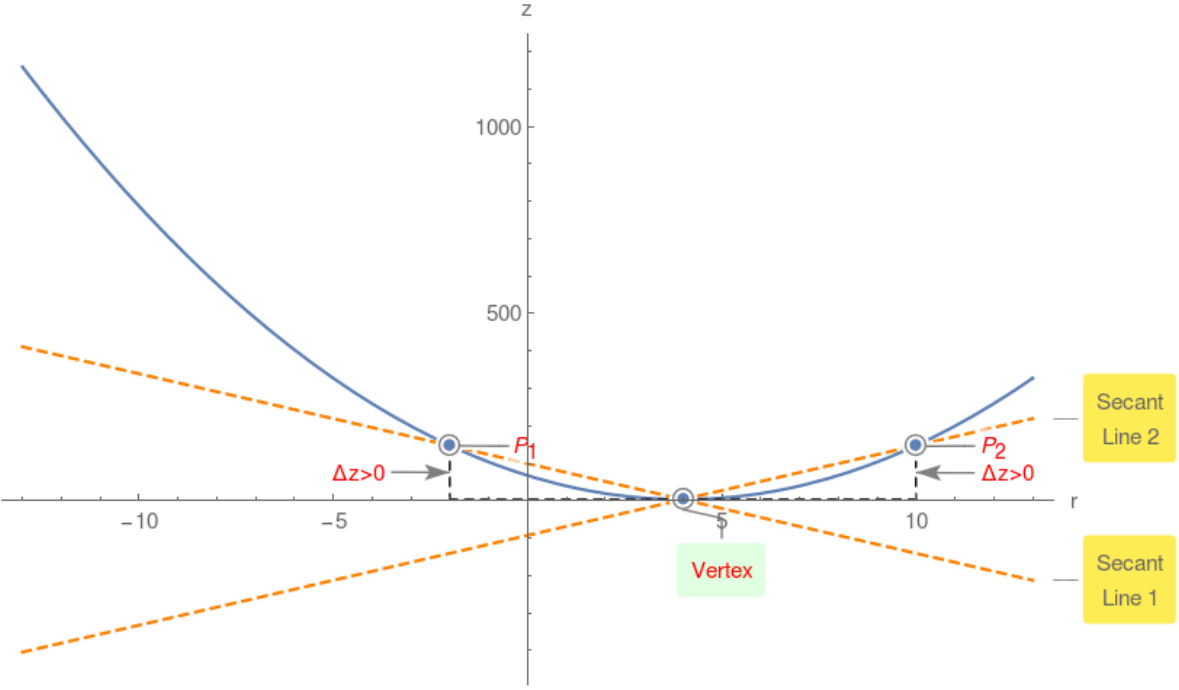
$z(r_1 + h) = -\frac{b^2}{4a} + a\,h^2 + c$

Compute $\triangle = z(r_1 + h) - z(r_1) = a\,h^2$

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

Example 1.

$z(r) = 4\,r^2 - 32\,r + 67$



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

Example 2.

$z(r) = 70 - r^2$