3.

Solution

To find the vertex, we look at the coefficients in the function $e(q) = aq^2 + bq + c$

in this equation, a= 3 and b= 3

The first coordinate of the vertex has the formula: $\frac{-b}{2a}$ now, plugging into formula to get:

$\frac{-b}{2a} = -\frac{3}{2(3)} = -\frac{1}{2}$

The second coordinate of the vertex is $e(-\frac{1}{2}) = 3(-\frac{1}{2})^2 + 3(-\frac{1}{2}) - 4$

$= -\frac{19}{4}$

Therefore, the vertex of the graph of f is $(-\frac{1}{2}, -\frac{19}{4})$