4.

Solution

Quadratic function: is a function that can be written in the form:

$u(e) = ae^2 + be + c$ where a, b, and c are real numbers and $a \neq 0$

we have $u(e) = 2e^2 - 4e - 12$, note: $2e^2 - 4e - 12$ is in eu-plane

Here, we know that $a=2$, $b=-4$, $c=-12$

Since $a>0$,we know that the u-coordinate of the vertex is a minimum. However,to find the u-coordinate of our vertex we first need to find the e-coordinate of the vertex by using $e = -\frac{b}{2a} = -\frac{-4}{4} = 1$ Now that we have the e-coordinate, we can find the u-coordinate of the vertex by finding $u(1) = 2(1)^2 - 4(1) - 12 = 2 - 4 - 12 = -14$ Minimum$=-14$