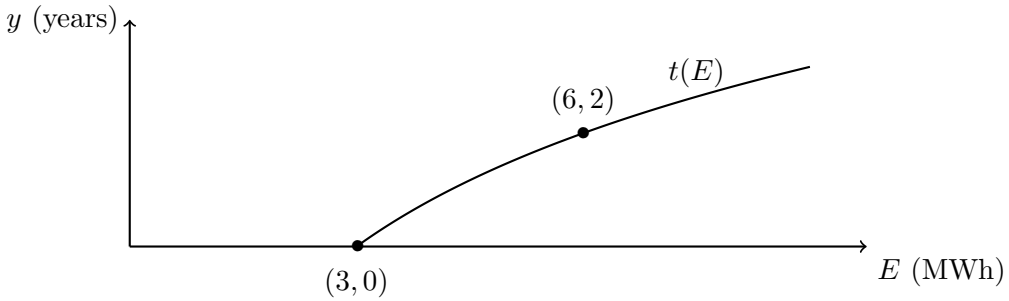
4. [7 points] Mad scientist Kiki LeBlanc is analyzing the amount of energy she needs to run another one of her time machines named Machine1. Below is a graph of $y = t(E)$, the number of years into the past or future she can send a 1 kg notebook when the energy consumption of Machine1 is E megawatt-hours (MWh).



a. [4 points] The function $t(E)$ (assuming the domain is $E \geq 3$) can be written in the form $t(E) = a\log(E) + b$ for some constants a and b. Given the information in the graph, find a and b in **exact** form.

$a =$ $\frac{2}{\log 2}$.

$b =$ $-\frac{2\log 3}{\log 2}$.

Solution: If we use the two points on the graph, we get the system of equations:

$$0 = a\log(3) + b$$

$$2 = a\log(6) + b.$$

Solving for b in both equations and setting those expressions equal gives us

$$-a\log(3) = 2 - a\log(6).$$

If we solve for a we get

$$a = \frac{2}{\log 6 - \log 3} = \frac{2}{\log 2}.$$

This means $b = -\frac{2\log 3}{\log 2}$.

b. [3 points] Give a practical interpretation of the point $(6, 2)$ on the graph.

Solution: The point $(6, 2)$ on the graph means that, using Machine1, Kiki can send a 1kg notebook 2 years into the past or future when it's supplied with 6 MWh of energy.

