

3. [14 points] Kiki and her pet mouse Mimi (who is now the size of a small dog via size-change technology) like to go to the park and play frisbee. Suppose after t minutes of playing frisbee at the park, Mimi's satisfaction level, in pleasits (a unit of satisfaction) is given by an exponential function $M(t)$ whose values are given in the table below.

t	1	2	3	4
$M(t)$	$9/2$	6	8	$32/3$

Express all answers for all parts of this problem in **exact form**.

- a. [4 points] Find the growth factor for $M(t)$ and fill in the missing values of $M(t)$ in the table.

The growth factor for $M(t)$ is $\underline{\frac{4}{3}}$.

Solution: If b is the growth factor, we know $b^3 M(1) = M(4)$. So $\frac{9}{2} b^3 = \frac{32}{3}$. This means $b = \frac{4}{3}$. We can get the values in the table by starting with $\frac{9}{2}$ and multiplying by the growth factor.

- b. [4 points] If Mimi never plays frisbee for more than 30 minutes, find the domain and range of $M(t)$.

The domain of $M(t)$ is $\underline{[0, 30]}$.

The range of $M(t)$ is $\underline{[\frac{27}{8}, \frac{27}{8}(\frac{4}{3})^{30}]}$.

Solution: We find the domain from the context of the problem. We find the range knowing that M is exponential growth so the highest point is at $t = 30$, and the lowest is at $t = 0$.

- c. [3 points] Kiki's satisfaction level in pleasits, $Q(t)$, t minutes after she starts playing frisbee is an exponential function, $Q(t) = 10e^{0.02t-2}$. Is $Q(t)$ an exponential growth function or an exponential decay function? **Circle** GROWTH or DECAY in the sentence below and state the *continuous* growth or decay rate either as a decimal or as a percentage.

The *continuous* GROWTH or DECAY rate is $\underline{0.02 \text{ or } 2\%}$.

- d. [3 points] Find Kiki's satisfaction level when she first begins playing frisbee, and find the per minute (non-continuous) growth rate of her satisfaction level, $Q(t)$, either as a decimal or as a percentage.

Kiki's satisfaction level is $\underline{Q(0) = 10e^{-2}}$ when she first begins playing.

The per minute growth rate of her satisfaction level is $\underline{e^{0.02} - 1 \text{ or } 100(e^{0.02} - 1)\%}$.