

Unit 7 Exponential and Logarithm Group Work
PCHA 2022-23 / Dr. Kessner

KEY

No calculator. Have fun!

1. Evaluate the following:

a. $\log_2(32)$ 5

b. $\log_{10}(10000)$ 4

c. $\ln(e^5)$ 5

d. $e^{\ln 10}$ 10

2. Suppose a bacterial colony has an initial population of 500 and has a population of 4000 at $t = 9$ hours.

a. Model the population $P(t)$ as an exponential in the following form. (i.e. find P_0 and k). Check your work.

$$P(t) = P_0 e^{kt}$$

$$P(t) = 500 e^{kt}$$

$$P(9) = 500 e^{k \cdot 9} = 4000$$

$$e^{9k} = \frac{4000}{500} = 8$$

$$9k = \ln 8 \Rightarrow k = \frac{\ln 8}{9}$$

$$P(t) = 500 e^{\frac{\ln 8}{9} t}$$

check: $P(0) = 500$
 $P(9) = 500 e^{\frac{\ln 8}{9} \cdot 9}$
 $= 500 \cdot 8$
 $= 4000 \checkmark$

b. What is the doubling time of the colony?

$$P(t) = 1000 = 500 e^{\frac{\ln 8}{9} t}$$

$$2 = e^{\frac{\ln 8}{9} t}$$

$$\ln 2 = \frac{\ln 8}{9} t$$

$$\Rightarrow t = \frac{9 \ln 2}{\ln(2^3)} = 3 \text{ hours}$$

c. Model the population as an exponential in the following form. What does T represent?

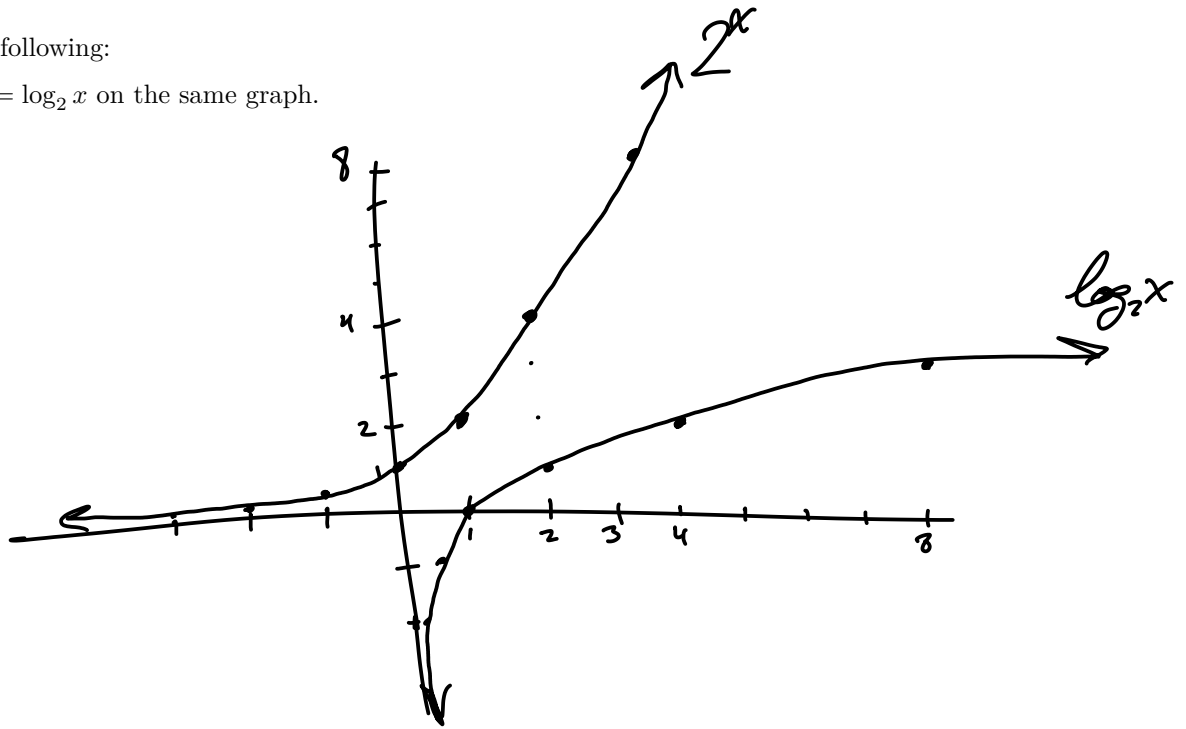
$$P(t) = P_0 2^{t/T}$$

$$P(t) = 500 \cdot 2^{t/3}$$

$T = 3$ doubling time

3. Graph the following:

$y = 2^x$ and $y = \log_2 x$ on the same graph.



$y = 10^x$ and $y = \log_{10} x$ on the same graph.

