



Essential Question:

 How CAN WE USE LOGS + EXPONENTS TO  
 SOLVE REAL-WORLD PROBLEMS?

Questions:

Notes:

REAL-WORLD APPLICATIONS

(EXPONENTIAL GROWTH/DECAY)

- CARBON DATING
- INTEREST (INVEST/LOANS)
- RADIOACTIVITY
- CANCER CELL GROWTH
- BACTERIA
- ANIMAL POPULATIONS
- VIRAL VIDEOS

EX) AT 12:00, A SINGLE BACTERIA COLONIZES A CAN. THE GROWTH OF THE POPULATION CAN BE MODELED WITH THE FUNCTION  $P(t) = 2^t$ , WHERE  $t$  IS TIME IN MINUTES SINCE 12:00.

a) HOW MANY BACTERIA ARE IN THE CAN AT 12:05?

$$t = 5$$

$$P(5) = 2^5 = 32$$

p. 1. 32

b) THE CAN IS COMPLETELY FULL AT 1:00. AT WHAT TIME WAS THE CAN  $\frac{1}{2}$  FULL?

FULL took 60 minutes to fill  
 $P(60) = 2^{60} = 1.153 \times 10^{18}$   
 $\frac{1}{2}$  of  $\uparrow$  is  $5.77 \times 10^{17}$

$$2^t = 5.77 \times 10^{17}$$

$$\ln 2^t = \ln 5.77 \times 10^{17}$$

$$t \frac{\ln 2}{\ln 2} = \frac{\ln 5.77 \times 10^{17}}{\ln 2} \approx 59$$



Questions:	Notes: <u>Ex) COMPOUND INTEREST</u>
	$A(t) = P \left(1 + \frac{r}{n}\right)^{nt}$ <p>A = amount after t years  r = rate, in decimals  t = number of years  n = number of times per year of compounding  P = PRINCIPAL</p>
	<p>CONTINUOUS COMPOUNDING</p> $A = P e^{rt} \quad (\text{Pert})$ <p>COMPARE THE INVESTMENT OF P DOLLARS  AT: INVESTED FOR 1 YEAR</p> <p>a) 8 1/2% PER YEAR COMPOUNDED QUARTERLY</p> <p>b) 8% PER ANNUM COMPOUNDED CONTINUOUSLY</p> <p>WHICH IS THE BETTER INVESTMENT?</p> <p>a) <math>A(t) = P \left(1 + \frac{r}{n}\right)^{nt}</math>  <math>r = .085, t = 1, n = 4</math></p> <p>b) <math>A(t) = P e^{rt} = P 1.08329</math></p>
	<p>How MANY YEARS WOULD AN INVESTMENT AT 8% COMPOUNDED DAILY WOULD IT TAKE TO RETURN \$1.90 FOR EVERY DOLLAR INVESTED?</p> <p><math>A(t) = P \left(1 + \frac{r}{n}\right)^{nt}</math>     <math>n = 365</math></p> <p><math>1.90 = 1 \left(1 + \frac{.08}{365}\right)^{365t}</math></p> <p><math>\ln 1.90 = \ln \left(1 + \frac{.08}{365}\right)^{365t}</math></p>

better investment →

$$15 = 2^x$$

$$\ln 15 = \ln 2^x$$

$$\ln 15 = x \ln 2$$

$$\frac{\ln 15}{\ln 2} = x$$

Process example →

HW 4T  
P. 133  
#1, 2

$$\ln 1.90 = 365t \ln \left(1 + \frac{.08}{365}\right)$$

$$\ln 1.90 = 365 \ln \left(1 + \frac{.08}{365}\right) t$$

$$\frac{\ln 1.90}{365 \cdot \ln \left(1 + \frac{.08}{365}\right)} = t$$

$$t \approx 8.02 \text{ years}$$