Cornell Notes	Topic/Objective: 4.8 APPLICATIONS OF LOGS AND EXPONENTIAL FUNCTIONS	Name:
AVID Decades of College Dreams		Class/Period: 4
		Date: 3/3/17

Essential Question: HOW CAN WE USE LOGS + EXPONENTS TO SOLVE REAL-WORLD PROBLEMS?

Questions:

p. 383 #27

Notes:

REAL-WORLD APPLICATIONS
(EXPONENTIAL GROWTH / DECAY)
- CARBON DATING
- INTEREST (INVEST/LOANS)
- RADIO ACTIVITY
- 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?

$t = 5$

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

b) THE CAN IS COMPLETELY FULL AT 1:00. AT WHAT TIME WAS THE CAN ½ FULL?

FULL took 60 minutes to fill

$P(60) = 2^{60} = 1.153 \times 10^{18}$

½ of ↗ is 5.77×10^{17}

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

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

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

Questions:	Notes:

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Ex) Compound Interest

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$$

A = amount after t years
r = rate, in decimals
t = number of years
n = number of times per year of compounding.
P = PRINCIPAL

Continuous Compounding

$$A = Pe^{rt} \qquad (\text{Pert})$$

· COMPARE THE INVESTMENT OF P DOLLARS AT: INVESTED FOR 1 YEAR

a) $8\frac{1}{2}$% PER YEAR COMPOUNDED QUARTERLY

b) 8% PER ANUM COMPOUNDED CONTINUOUSLY

WHICH IS THE BETTER INVESTMENT?

better investment

a) $A(t) = P\left(1+\frac{r}{n}\right)^{nt}$

$r = .085$, $t = 1$, $n = 4$

$$A(1) = P\left(1 + \frac{.085}{4}\right)^{4 \cdot 1} = P\,1.0877$$

b) $A(t) = Pe^{rt} = P\,1.08329$

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

Process example

HOW MANY YEARS WOULD AN INVESTMENT AT 8% COMPOUNDED DAILY WOUILD IT TAKE TO RETURN \$1.90 FOR EVERY DOLLAR INVESTED?

$A(t) = P\left(1+\frac{r}{n}\right)^{nt}$ $\quad n = 365$

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

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

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

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

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

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

HW 4T
p. 133
#1, 2

Questions:	Notes:

T2   ~~Days~~ 100

Day 1 100×1.1 [illegible]

i. $\longrightarrow$ Day 2 100×1.1^2 $100 + 100 \times .1$

ii after 1 week $= 100 \times 1.1^7$

$f(x) = a^x$

$P(1 + \frac{r}{n})^{nt}$

$\frac{.10}{1}$

$P(1 + .10)^d$

POPULATION GROWTH

$P = P_0(1+r)^t$ t in units given

$P = 100(1+.10)^t$

$\ln \square = \ln \bigcirc$

$P = P_0 e^{rt} \longrightarrow \ln \frac{P}{P_0} = \ln e^{rt}$

b. How long for 250 Infected?

$\frac{250}{100} = \frac{100 \times 1.1^d}{100}$

$2.5 = 1.1^d$

$\ln 2.5 = \ln 1.1^d$

$\ln 2.5 = d \ln 1.1$

$\frac{\ln 2.5}{\ln 1.1} = d$

$d \approx 9.6$ days

10 days

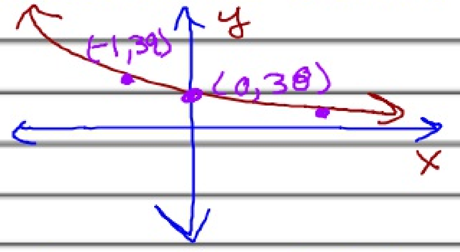
Questions:	Notes:

p.134 #4

$$v = 9 + 29e^{-.063t}$$

a. Sketch graph of s against t
(DISTANCE VERSUS TIME GRAPH)

-1	39
0	38
1	36.229



b. What was his speed the instant the parachute opened?

Time $t=0$

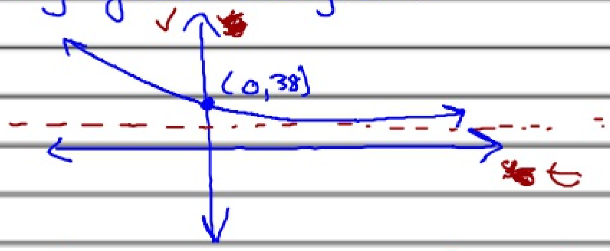
$v = 9 + 29e^{-.063(0)}$

$v = 9 + 29e^{0}$

$v = 9 + 29$

$v = 38 \text{ ms}^{-1}$

c. What is his lowest possible speed if he fell from a very great height?



as $t \to \infty$, $v \to 9 \text{ ms}^{-1}$

approaches

d. If he landed after 45s, what is his speed on landing?

$v = 9 + 29e^{-.063(45)}$

$v = 10.7 \text{ ms}^{-1}$

Questions:	Notes:
	e. How $\boxed{\text{long}}$ did it take him to reach $\frac{1}{2}$ the speed he had when the parachute opened?
	initial speed was $38\ ms^{-1}$
	so $\frac{1}{2}$ that is $19\ ms^{-1}$
HW 4T 3,5 p.134	$9+29e^{-.063t}=19$
Review Exercises all p.134-136	$29e^{-.063t}=10$
	$e^{-.063t}=\frac{10}{29}$
	$-.063t=\ln\left(\frac{10}{29}\right)$
	$t=\frac{\ln\left(\frac{10}{29}\right)}{-.063}$
	$t\approx 16.9\ s$
	$t\approx 17\ s$