More Applications of Exponential Functions

Half - Life

Approximately every 5730 years, the amount of C-14 in the remains of an organism is reduced by a factor of one-half. Scientists can estimate when the organism was alive by comparing the amount of C-14 in the remains to the amount of C-14 in a living organism.

a. Make a table of values

years	% of C-14
0	100
5730	50
11460	25
17190	12.5
22920	6.25
28650	3.125
34380	1.56

← 20%

b. Use the table to determine the approximate age of a bone that has 20% of C-14 left.

~ 12500

c. C-14 dating is only used for objects less than 50000 years old. Use your table or graph to explain why.

at 50000 years essentially nothing left

- spreadsheet
- data + stats

$$y = 100\left(\frac{1}{2}\right)^{\frac{t}{5730}}$$

initial value

half life of C-14

The population of Ontario was 9.3 million in 1985 and has been growing at an annual rate of 1.5%. This situation can be modelled by the equation $P = 9.4(1.0125)^t$, where P million represents the population t years after 1985. In which year did Ontario's population first exceed 10 million?

a. Solve using algebra

$$\frac{10}{9.4} = \frac{9.4(1.0125)^t}{9.4}$$

$$1.06 = 1.0125^t$$

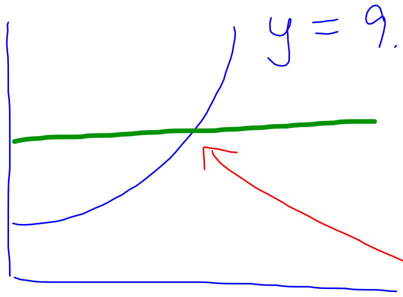
Trial and Error

$$t = 4.7$$

$$\therefore 1985 + 4.7 = 1989.7$$

b. Draw the graph on the TI-Nspire
Use the graph to verify your previous answer.

$y = 9.4(1.0125)^x$



$y = 10$

intersection
4.9

c. Check the table of values.
Use the table to verify your previous answer.

table

(5, 10.0024)

On the Boards...

1. A new car decreases in value exponentially after it is purchased. The value, V dollars, of a certain car t years after it was purchased is given by $V = 20\,000(0.84)^t$. Write an exponential equation that can be used to determine when the value of the car is equal to each amount.

a) \$10 000 b) \$15 000

$10\,000 = 20\,000(0.84)^t$

$0.5 = 0.84^t$

$t = 4$

$15000 = 20\,000(0.84)^t$

$0.75 = 0.84^t$

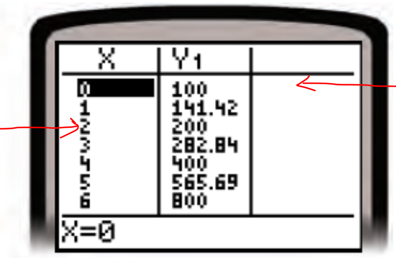
$t = 1.65$

7. The table shows the growth of a culture of bacteria over time under laboratory conditions. The variable X represents the time in hours and the variable Y_1 represents the number of bacteria.

a) How many bacteria were present initially? How do you know? 100

b) How long does it take for the population to double? Justify your answer.

2 h



X	Y_1
0	100
1	141.42
2	200
3	282.84
4	400
5	565.69
6	800

X=0

initial value

8. A principal of \$500 is invested at 8% per year, compounded annually. After n years, the amount of the investment, A dollars, is given by $A = 500(1.08)^n$. Write an exponential equation that can be used to determine how long it takes for the investment to:

a) grow to \$600 b) double in value c) triple in value

$600 = 500(1.08)^n$

$1.2 = 1.08^n$

$n = 2.37$

$1000 = 500(1.08)^n$

$2 = 1.08^n$

$n = 9$

$1500 = 500(1.08)^n$

$3 = 1.08^n$

$n = 14.3$

Seatwork

Pg. 391 # 1, 4, 7, 8, 10