MAP 4CI 6.5 Construct and Apply Exponential Models

Method – create a table of values, graph and estimate the solution.

Example 1: Simple and Compound Interest

Jason has $500 to invest and is considering two investment options.

- Option A: A treasury bond that pays 8% simple interest. The amount, A, after n years is given by the equation $A = 500 + 40n$
- Option B: A savings account that pays 6.5% per year, compounded annually. The amount, A, after n years is given by the equation $A = 500(1.065)^n$

a) Graph each relation on the same set of axes. **Use ~~TI83+~~ Desmos to help you,** if necessary Describe each relation.

A_1 is linear

A_2 is exponential growth.

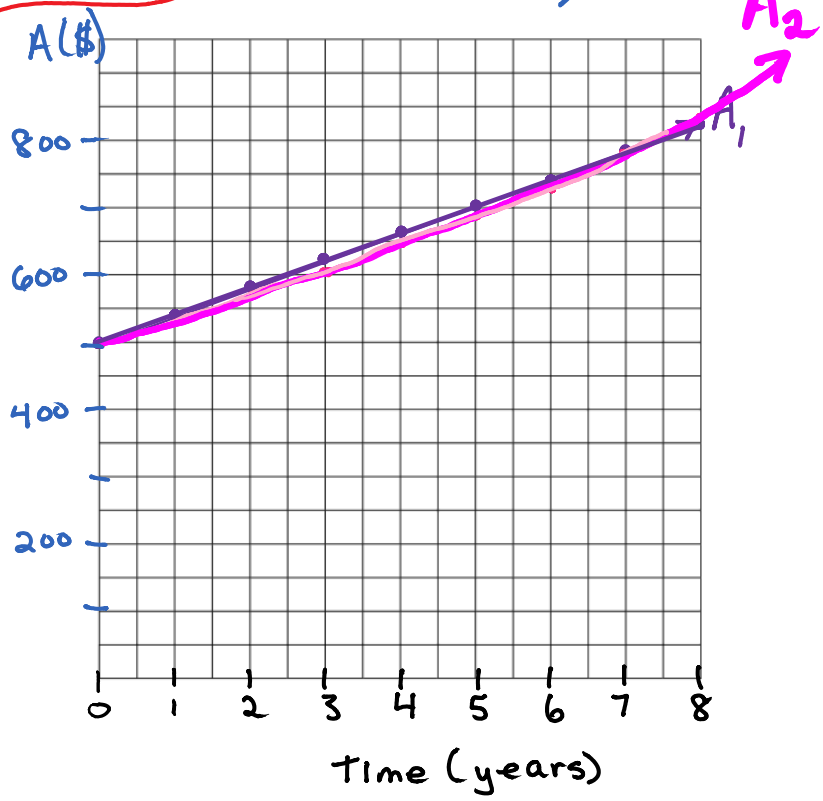
b) Compare the options. Which is the better investment? Why?

If investing more than 7 years, exponential growth gives you more money.

500+40n

$500(1.065)^n$

n	A_1	A_2
0	500	500
1	540	532.5
2	580	567.11
3	620	603.97
4	660	643.23
5	700	685.04
6	740	729.57
7	780	776.99
8	820	827.50



Example 2: Half-life.

An important property of a radioactive substance is its **half-life**, the time it takes for a radioactive sample to decay to half its original mass. For example, iodine-131 is a radioactive substance with a half-life of eight days. This material is commonly used for thyroid analysis.

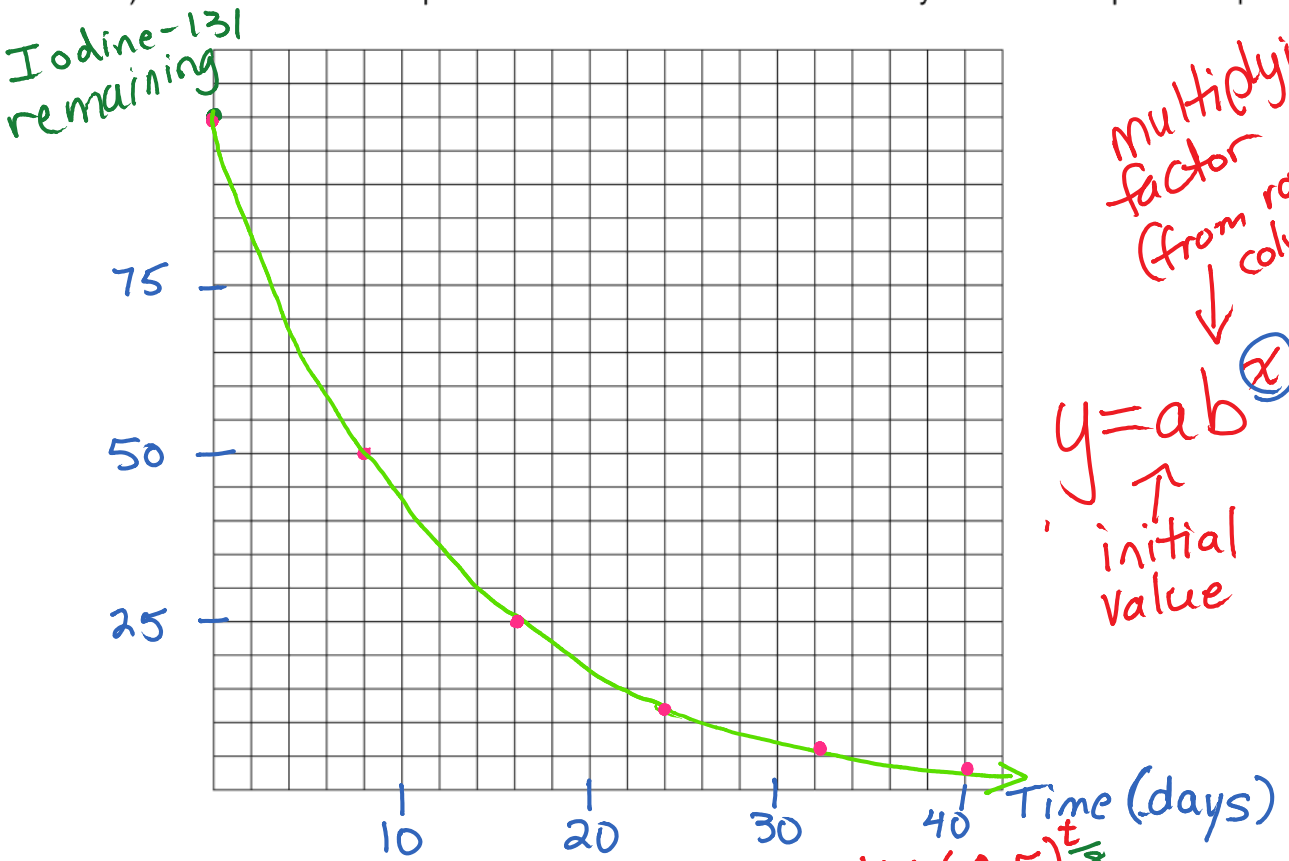
a) Complete the table of values for an initial dose of 100 units of iodine-131.

Number of half-life intervals	Time (Days)	Units Remaining in the Bloodstream	First Differences	Second Differences	Percent Differences (Ratios)
0	0	100	−50	25	0.5
1	8	50	−25	12.5	0.5
2	16	25	−12.5	6.25	0.5
3	24	12.5	−6.25	3.125	0.5
4	32	6.25	−3.125		0.5
5	40	3.125			

b) Is this relation linear or non-linear? Is this relation exponential? Explain.

Yes - ratio column is 0.5

c) Construct a scatter plot of the data. Does the trend confirm your answer to part b? Explain.



multiplying factor (from ratio column).

$y = ab^{\frac{t}{h}}$

initial value

d) Determine an equation for the curve of best fit. $y = 100(0.5)^{\frac{t}{8}}$

e) Determine how long it will take for the initial dose of iodine-131 to decay to one unit. 53 days

**Practice: Pg. 385–387 # 1 – 4, 7 ✓Answers Pg. 560

$y = 100 \times 0.5 \wedge (t/8)$ (1)