IM2 Problem Set 5.2 - Working with Exponential Functions

BIG PICTURE of this UNIT:	- How can we analyze growth or decay patterns in data sets & contextual problems? - How can we algebraically & graphically summarize growth or decay patterns? - How can we compare & contrast linear and exponential models for growth and decay problems. - How can we extend basic function concepts using exponential functions?

Part 1 - Skills/Concepts Review

1. **(CA)** Here are four data sets. Describe each pattern, predict the next 4 terms and then determine the 15th term of each set.

a. Set 1 ⇒

x	0	1	2	3	4	5
y	5	10	20	40	80	160

b. Set 2 ⇒

x	0	1	2	3	4	5
y	10	13	16	19	22	25

c. Set 3 ⇒

x	0	1	2	3	4	5
y	10000	5000	2500	1250	625	312.5

d. Set 4 ⇒

x	0	1	2	3	4	5
y	120	110	100	90	80	70

2. **(CI)** Evaluate the following numerical expressions:

a. (i) 4^{-3} (ii) 5^{-2} (iii) 2×5^0 (iv) 10^{-2}

b. (i) $2^{-1} + 2^2 + 2^3 - 2^{-2}$ (ii) $3^{-2} + 3^0 + 3(3^{-1} + 3^1)$

3. **(CI)** Using your knowledge of the "Exponent Laws", simplify each expression. All final answers should only have positive exponents.

a. (i) $(x^{-2}x^{-4}y^2)^3$ (ii) $(-3a^3)^{-4} \times 2a^4$ (iii) $(2p^5)^{-2} \times -3p^{-2}$

b. (i) $\dfrac{2x^3y^2 \times 4x^2y^{-2}}{3x^{-2}y^3}$ (ii) $\dfrac{a^3b^3 \times a^{-1}b^2}{2a^{-2}b^4}$ (iii) $\dfrac{(2x^{-1})^{-2}y^4}{8x^4y^5 \times 2x^2y^{-2}}$

4. **(CA)** Youssef's mark in SEM 2 started at 40% but has been increasing by 4% every week.

a. Complete this table of values for this relationship between Youssef's mark and the number of weeks since the start of the semester.

Week number	0	1	2	3	4	5
Mark	40					

b. Determine his mark: (i) in week 5 (ii) in week 10 (iii) in week 15

5. **(CA)** Mr Santowski's investments have been decreasing by 2% every month since January 1st, 2019. The total value of his investments were 250,000 USD on March 1st, 2019.

   a. Complete this table of values for this relationship between the value of Mr. S investments and the number of months since January 1st, 2019.

Month	Jan	Feb	Mar	Apr	May	June
Value			250000			

   b. Determine the value of his investments on (i) July 1st, 2019 and (ii) on Jan 1st, 2020

6. **(CI)** A relation is defined by the following description: To generate the numbers in this relation, the **starting number** will be 200. Every subsequent number is made by always **increasing the previous number** by a factor of $\frac{3}{2}$. Create a table of values for this relation and then graph this relation. Predict an equation for this relation.

Part 2 - Skills/Concepts Application Problems

7. **(CA)** From 1990 to 1997, the number of cell phone subscribers S (in thousands) in the US can be modeled by the equation $S = 5535.33(1.413)^t$ where t is number of years since 1990.

   a. BEFORE you graph the function, explain how you know that this is a growth curve.
   b. Sketch a graph of the model. Label three points on the function
   c. In what year was the number of cell phone subscribers about 31 million?
   d. According to the model, in what year will the number of cell phone subscribers exceed 90 million?
   e. Estimate the number of subscribers in 2010.
   f. Do you think this model can be used to predict future number of cell phone subscribers? Explain

8. **(CA)** Your new computer was initially valued at $1500 but its value, V in dollars, over time, t in years, is modelled by the equation $V(t) = 1500(0.82)^t$.

   a. Graph the function on your calculator, sketch the graph in your notes and use the TABLE feature on your calculator to record the value of the computer in the first 4 years.
   b. How much will your computer be worth in 6 years?
   c. How long will it take before the value of your computer is half of its original value?

9. **(CI)** Given the function $h(x) = 4 - 2^{x+3}$.

   a. Without using your calculator, evaluate the following:
      i. $h(0)$ ii. $h(-1)$ iii. $h(-2)$ iv. $h(1)$ v. $h(2)$

   b. Find the value for x for which:
      i. $h(x) = 0$ ii. $h(x) = -4$ iii. $h(x) = -12$

   c. Will h(x) ever equal 4? Why or why not?

   d. Using your answers from these three questions, sketch the function $h(x)$.

   e. Use your calculator and graph $h(x)$.

10. **(CA)** A population of 800 beetles is growing each month at a rate of 5%. Hanna wants to write an equation that equation that can be used to model the number of beetles, B, as a function of the number of months, n ⇒ so she wants an equation for $B(n)$.

    a. Shivani says that the equation includes the 5%, so she writes $B(n) = 500(0.05)^n$. Paula sees the 5% and writes her equation as $B(n) = 500(5)^n$ whereas Vittoria also sees the 5%, so she writes her equation as $B(n) = 500(1.05)^n$.
       i. How can you determine which equation is correct?
       ii. Which equation is correct and how did you determine the correct equation?

    b. How many beetles will there be in 8 months?

    c. When will there be 1600 beetles?

HOMEWORK PROBLEMS:

11. From the Nelson 9 textbook, Chap 2.2 ⇒ starting on page 90, Q5,6,7

12. From the Nelson 9 textbook, Chap 2.3 ⇒ starting on page 96, Q6,7,8