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? • How can we extend basic function concepts using exponential functions?

Part 1 - Skills/Concepts Review

1. **(CI)** Exponential functions can be written in the form of $f(x) = ab^x$. Write the equation of the exponential function that go through the following pairs of points:

   a. W(1, 12) and X(3, 108)   b. $f(2) = 2$ and $f(5) = 128$

2. **(CI)** Use the exponent laws to write each expression with a single, simplified base. All exponents must be positive in your final answers.

   a. (i) $a^4 \times a^5 \times a^6$ (ii) $\frac{a^4}{a^{10}}$ (iii) $\frac{d}{d^{-5}}$ (iv) $(2a^2 b^{-3})^2$

   b. (i) $a^4 \times a^{-5} \times a^{-3}$ (ii) $(3a^{-2}b^3)^{-2}$ (iii) $\frac{a^4 \times b^3}{b^5 \times a^{-2}}$ (iv) $\frac{(K^a)^b \cdot K^{ab}}{K^{4ab}}$

3. **(CI)** Evaluate (simplify as a number) the following:

   a. (i) -3^2 (ii) $(-3)^2$ (iii) -3^{-2} (iv) $(-3)^{-2}$ (v) $(3^{-2} + 3^{-1})^{-1}$

   b. (i) $\left(\frac{-2}{5}\right)^2$ (ii) $\left(\frac{-2}{5}\right)^{-2}$ (iii) $\left[\left(\frac{-2}{5}\right)^{-2}\right]^{-1}$ (iv) $-\left(\frac{-2}{5}\right)^2$ (v) $\left(\frac{-2}{5}\right)^3$

4. **(CA)** Youssef's mark in SEM 2 started at 40% but has been increasing by 8% 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 7   (ii) in week 10   (iii) in week 15

Part 2 - Skills/Concepts Application Problems

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)** Solve the following equations for x.

   a. (i) $2x + 4 = 5$ (ii) $2^x + 4 = 5$
   b. (i) $2x + 15 = 15.5$ (ii) $2^x + 15 = 15.5$
   c. (i) $2(x + 1) + 15 = 15.5$ (ii) $2^{x+1} + 15 = 15.5$
   d. (i) $2(x + 1) + 5 = -11$ (ii) $2^{x+1} + 5 = -11$

7. **(CI)** Difference Analysis of a Data Set. Mr S. gives you this data set and is asking you to analyze patterns in the data set in order to determine an equation in the form of $f(x) = mx + b$ for the data set.

x	-2	-1	0	1	2	3	4
$f(x)$	-1	2	5	8	11	14	17

   a. Determine the "common difference" between each pair of terms (you do this by subtracting the successive y terms ==> difference $= y_2 - y_1$; $d = y_3 - y_2$; $d = y_4 - y_3$; etc .....
   b. This value for the common difference is the **slope** or m in the equation. How can you use the data set to find the value for b?
   c. Finally, what is the equation for this data set?

8. **(CA)** A colony of 1000 ants is growing at a rate of 15% every month.

   a. How many ants will be in the colony after 10 months? What assumptions are you making?
   b. How long will it take to get a population of 7500 ants?
   c. Mr. S would like to predict the number of ants present in one week. Explain how he could do this.

9. **(CA)** Ratio Analysis of a Data Set. Mr S. gives you this data set and is asking you to analyze patterns in the data set in order to determine an equation in the form of $f(x) = ab^x$ for the data set.

x	-2	-1	0	1	2	3	4
$f(x)$	$\frac{8}{9}$	$\frac{4}{3}$	2	3	4.5	6.75	10.125

    a. Determine the "common ratio" between each pair of terms (you do this by dividing the successive y terms ==> ratio = $\frac{y_2}{y_1}$; ratio = $\frac{y_3}{y_2}$; $r = \frac{y_4}{y_3}$; etc …..

    b. This value for the common ratio is the **base** or b in the equation. How can you use the data set to find the value for a?

    c. Finally, what is the equation for this data set?

10. **(CA)** Ten grams of a chemical - Mathonium - is stored in a container. The amount of Mathonium present in the container can be modeled by $C(t) = 12.5(0.975)^t$, where C is the amount of Mathonium, in grams, and t is time in years from 2019.

    a. By considering only the equation, is the amount of Mathonium increasing or decreasing over time?

    b. Evaluate and interpret $C(0)$ and $C(100)$.

    c. Find the value of t where $C(t) = 10$. Round your final answer to the nearest year.

11. **(CA)** At the beginning of an experiment, there are 212 bacteria. The population of bacteria will double every 2 days. How many bacteria will be present in:

    a. 8 days   b. 11 days   c. 2 months   d. 1 day   e. 12 hours

12. **(CA)** A population of hamsters will triple every year. Initially, the population started with 10 hamsters.

    a. What will be the population of hamsters after 4 years? What assumptions are you making? Are these assumptions reasonable?

    b. How long will it take to get a population of 1500 hamsters?

    c. Mr. S would like to predict the number of hamsters present in 6 months. Explain how he could do this.

Part 3 - Extension Problems

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