IM2 Problem Set 5.9 - 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 is a data set, showing how the value of Mr R's car changes over the years he has owned it.

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010
Value	40	36	32.4	29.2	26.2	23.6	21.3	19.1	17.2

   a. Determine an equation of an exponential model that fits the data set.
   b. What is is car currently worth? Show/explain how you determined your answer.

2. **(CI)** Evaluate each of the following expressions:
   a. $\sqrt[9]{512} + \sqrt[3]{27^2} - \sqrt[3]{-216}^{\,5}$ b. $\sqrt[5]{\frac{-32}{243}} \times \sqrt[4]{\left(\frac{16}{81}\right)^{-1}}$

3. **(CA)** An experiment starts off with X bacteria. This population of bacteria will double every 7 days and grows to 11,888 in 32 days.
   a. How many bacteria were present at the start of the experiment?
   b. How many bacteria were present after 16 days?
   c. When will the population of bacteria reach 100,000?

4. **(CA)** A bacteria culture grows according to the formula: $P(t) = 12000\left(\frac{1}{2}\right)^{\frac{t}{4}}$ where t is time in hours. How many bacteria are present:
   a. at the beginning of the experiment?
   b. after 12 hours?
   c. after 19 days?
   d. What is the doubling time of the bacteria?

5. **(CI)** Given the function $g(x) = 3(2)^{x-2} + 2$:
   a. Evaluate $g(-2)$, $g(-1)$, $g(0)$, $g(1)$, $g(2)$, $g(3)$
   b. determine the x- and y-intercept(s) - if they exist
   c. determine the equation of the asymptote of $g(x)$
   d. sketch $g(x)$, labelling the data points and intercept(s) and the asymptote.

6. **<u>(CA)</u>** On July 1, 1996, Anna invested \$2000 in an account that earned 6%/a compounded monthly. On July 1st, 2006, she moved the balance into a new account that earns 8% compounded monthly. Determine the balance in her account on July 1st, 2016.

Part 2 - Skills/Concepts Application Problems

7. **<u>(CA)</u>** Determine the value of the following investments, given the conditions specified:

   a. I invested \$10,000 at 4%/a compounded monthly for 8 years.
   b. I invested \$25,000 at 3.25%/a compounded quarterly for 10 years.
   c. I invested \$5,000 at 7.25%/a compounded daily for 12 years.

8. **<u>(CI)</u>** Simplify the following expressions, leaving all final answers with positive exponents.

   a. $\dfrac{3x^{-\frac{1}{2}} \times 3x^{\frac{1}{2}}y^{-\frac{1}{3}}}{3y^{-\frac{7}{4}}}$ b. $\dfrac{\left(x^{-\frac{1}{2}}y^{2}\right)^{-\frac{5}{4}}}{x^{2}y^{\frac{1}{2}}}$ c. $\dfrac{\left(x^{-\frac{1}{2}}y^{4}\right)^{\frac{1}{4}}}{x^{\frac{2}{3}}y^{\frac{3}{2}} \times x^{-\frac{3}{2}}y^{\frac{1}{2}}}$

9. **<u>(CA)</u>** Sally invests some money at 6%/a compounded annually. After 5 years, she takes the principal and the interest earned and reinvests it all at 7.2%/a compounded quarterly for 6 more years. At the end of this time, her investment is worth 14, 784.56. How much did Sally invest initially?

10. **<u>(CA)</u>** On the day Rachel was born, her grandparents deposited \$5000 into a savings account that earns 4.8%/a compounded monthly. They deposit the same amount on her 5th, 10th and 15th birthdays. Determine the balance in the account on Rachel's 18th birthday.

11. **<u>(CA)</u>** Solve for *t* in each of the following questions:

    a. You buy a new computer for \$2100. The computer decreases in value by 50% annually. When will the computer be worth \$600?
    b. The population of HS students at CAC since the year 2000 can be modeled with an exponential function. The number of students continues to decline at an annual rate of 11%. How long would it take for the student population to decline from 350 students to 250 students?
    c. The value of land in New Cairo grows exponentially. Today 10 hectares of land cost 2.5 million LE and the value of the land is increasing at an annual rate of 17.5%. How long will it take for the land value to be 4.0 million LE?