Lesson 17 Practice Problems

1. The population of a city in 2010 is 50,000, and it grows by 5% each year after.

   a. Write a function f which models the population of the city t years after 2010.

   b. What is the population of the city in 2017?

   c. What will the population of the city be in 2020? What about in 2030?

   d. By what factor does the population grow between 2010 and 2020? What about between 2020 and 2030?

2. A person charges $100 to a credit card with a 24% nominal annual interest rate.

   Assuming no other charges or payments are made, find the balance on the card, in dollars, after 1 year if interest is calculated:

   a. annually

   b. every 6 months

   c. every 3 months

   d. monthly

   e. daily

3. A couple has $5,000 to invest and has to choose between three investment options.

   ○ Option A: $2\frac{1}{4}\%$ interest applied each quarter

   ○ Option B: 3% interest applied every 4 months

   ○ Option C: $4\frac{1}{2}\%$ interest applied twice each year

   If they plan on no deposits and no withdrawals for 5 years, which option will give them the largest balance after 5 years? Use a mathematical model for each option to explain your choice.

4. Elena says that 6% interest applied semi-annually is the same as 1% interest applied every month: she reasons they are the same because they are both a 12% nominal annual interest rate.

   a. Is Elena correct that these two situations both offer a 12% nominal annual interest rate?

   b. Is Elena correct that the two situations pay the same amount of interest?

5. A bank pays 8% nominal annual interest, compounded at the end of each month. An account starts with $600, and no further withdrawals or deposits are made.

   a. What is the monthly interest rate?

   b. Write an expression for the account balance, in dollars, after one year.

   c. What is the effective annual interest rate?

   d. Write an expression for the account balance, in dollars, after t years.

6. At the end of each year, 10% interest is charged on a $500 loan. The interest applies to any unpaid balance on the loan, including previous interest.

   Select **all** the expressions that represent the loan balance after two years if no payments are made.
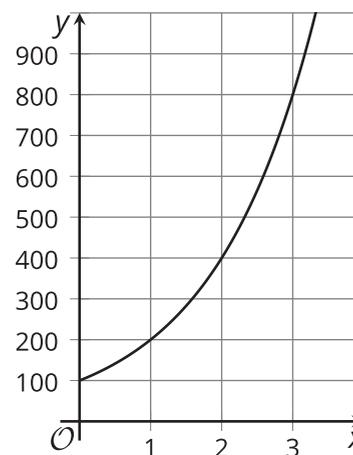
   A. $500 + 2 \cdot (0.1) \cdot 500$

   B. $500 \cdot (1.1) \cdot (1.1)$

   C. $500 + (0.1) + (0.1)$

   D. $500 \cdot (1.1)^2$

   E. $(500 + 50) \cdot (1.1)$

   (From Unit 5, Lesson 15.)

7. Here is a graph of the function f given by $f(x) = 100 \cdot 2^x$.

Suppose g is the function given by $g(x) = 50 \cdot (1.5)^x$.

Will the graph of g meet the graph of f for any positive value of x? Explain how you know.

(From Unit 5, Lesson 12.)

8. Suppose m and c each represent the position number of a letter in the alphabet, but m represents the letters in the original message, and c represents the letters in a secret code.

The equation $c = m + 7$ is used to encode a message.

a. Write an equation that can be used to decode the secret code into the original message.

b. What does this code say: "AOPZ PZ AYPJRF!"?

(From Unit 4, Lesson 15.)