Unit 5 Review – Exponents

1. Simplify the following using exponent laws. Express your final answers using only positive exponents.

   a) $\dfrac{\left(4^3\right)^{-5}\left(4\right)^9}{\left(4^{-3}\right)\left(4\right)^{10}}$

   b) $\dfrac{\left(x^2\right)\left(x^5\right)\left(y^4\right)}{\left(x^{-4}\right)^2\left(y\right)^2}$

   c) $\dfrac{3x^2y^{-1}z^{-2}}{4}$

   d) $\dfrac{\left(4x^2y^3\right)^3}{8x^9y^4}$

2. Evaluate the following. Begin by simplifying using exponent laws, if possible.

   a) $(3)^{-9}\times\left(3^{-2}\right)^{-3}\div(3)^{-7}$

   b) $(25)^3\div(5)^4$

   c) $(-6)^{-2}$

   d) -6^{-2}

   e) $3^{-1}-2^{-4}$

   f) $2(-3)^{-3}$

   g) $\dfrac{\left(2^{20}\right)\left(16\right)^{-4}}{\left(32\right)^2}$

3. Simplify the following.

   a) $2x\left(3x^2-3x+1\right)-4x\left(3-2x-x^2\right)$

   b) $\dfrac{12x^5y^3-8x^4y^2+4x^2y}{-4x^2y}$

4. a) Express 0.000 000 000 012 6 using scientific notation.

   b) Express 6.023×10^{12} in standard form.

   c) Evaluate $\dfrac{30\ 000\ 000\ 000\times0.000\ 000\ 000\ 000\ 4}{0.000\ 006}$ by first converting to scientific notation.

   Express your final answer to standard form.

5. Examine the following tables of values. Classify each relationship as linear, non-linear, or non-linear exponential. Show calculations to justify your reasoning.

   a)

x	y
0	-2
1	-1
2	2
3	7

   b)

x	y
-1	10
0	6
1	2
2	-2

   c)

x	y
1	100
3	2500
0	20
2	500

   d) Write the equation for the linear relationship above.

   e) Write the equation for the exponential relationship above.

6. A Petrie dish is inoculated with 300 bacteria. The number of bacteria in the medium is doubling every hour.
   a) How many bacteria are present after 4 hours?
   b) How many bacteria are present after 24 hours?

7. A student doing a genetics study in grade 11 biology, discovers that the number of fruit flies in a flask will triple every 16 hours. If 10 fruit flies are placed in the flask at 1:00 pm on Thursday, how many fruit flies will be present by 1:00 pm the following Monday?

8. In 2016 the population of Toronto was approximately 2 750 000 people. The growth rate was estimated to be 0.85%. Use these values to predict the population of Toronto in the year 2025.

9. An elementary school currently has a population of 550 students. It has been estimated that the population of the school will decrease by 1.1% each year.

   a) Find an equation that will give the number of students at the school each year.
   b) Use your equation to predict the population in 1 year, 5 years and 10 years.

10. Plutonium is a radioactive metal with a half-life of 88 years.

   a) How much will 1 kg of plutonium weigh in 88 years?
   b) How much will 1 kg of plutonium weigh in 176 years?
   c) How much will 1 kg of plutonium weigh in 250 years?

11. Suppose the population of a town is recorded in the table as follows:

Year	2015	2016	2017	2018
Population	59 500	60 690	61 904	63 142

   a) Find the growth rate of the population.
   b) By what percent each year is the population increasing by?
   c) Predict the population of the town in the year 2025.
   d) Estimate the population of the town in the year 2010.

12. Simplify each of the following.

   a) $(4xy^4)^{-3}$ c) $(-4a^2b^{-5})^{-2}$

13. Evaluate the following expressions for $x = -1$, $y = 2$, and $z = -3$. When possible simplify before substituting for the variable.

   a) $x^{-1}yz^{-2}$ b) $5x(3x^2 - 2xy) - 6x^2(3y - 2x)$ c) $(4x^5y)(-2xy^2z)$ d) $y^{-2} + z^{-1}$

ANSWERS

1. a) $\frac{1}{4^{13}}$ b) $x^{15}y^2$ c) $\frac{3x^2}{4yz^2}$ d) $\frac{8y^5}{x^3}$ 2. a) 81 b) 25 c) 1/36 d) -1/36   e) 13/48 f) -2/27 g) 1/64

3. a) $10x^3 + 2x^2 - 10x$ b) $-3x^3y^2 + 2x^2y - 1$ 4. a) 1.26×10^{-11} b) 6 023 000 000 000 c) 2 000

5. a) non linear b) linear c) exponential d) y = -4x + 6 e) $y = 20(5)^x$ 6. a) 4800 b) 5 000 000 000 7. 7300

8. 2 967 671   9. a) P = $550(0.989)^t$ b) 1 year – 544, 5 years – 520 and 10 years – 492   10. a) 0.5kg b) 0.25kg c) 0.14kg

11. a) 1.02 b) 2% c) 72, 530 d) 53 891 12. a) $\frac{1}{64x^3y^{12}}$ b) $\frac{b^{10}}{16a^4}$

13. a) simplified: $\frac{y}{xz^2}$, evaluated: -2/9   b) simplified: $27x^3 - 28x^2y$ evaluated: -83

   c) simplified: $-8x^6y^3z$ evaluated: 192   d) simplified: $\frac{1}{y^2} + \frac{1}{z}$, evaluated: -1/12