NAME CLASS DATE

Algebra 1 Unit 4 Practice

LESSON 19-1

1. The size of a text file is 3^5 kilobytes. The size of a video file is 3^{12} kilobytes. How many times greater is the size of the video file than the size of the text file?

   A. 3^{24} **B.** 3^7

   C. 3^{17} **D.** 3^{60}

2. Arrange the expressions in order from least to greatest.

   a. $4^2 \cdot 4^2$ **b.** $\frac{2^8}{2^2}$

   c. $\frac{7^5}{7^3}$ **d.** $3^3 \cdot 3$

3. The formula for density is $D = \frac{M}{V}$, where D is density, M is mass, and V is volume. The density of an object is x^4 kilograms per cubic meter. Its mass is x^7 kilograms. What is the volume of the object?

4. Simplify the expression $\frac{x^{\frac{9}{5}} \cdot x^{\frac{2}{5}}}{x^{\frac{1}{5}}}$.

5. Write an expression containing multiplication and division that simplifies to y^4.

6. **Critique the reasoning of others.** Nestor says that the value of $\frac{6^5}{6^2} \cdot \frac{6^8}{6^3}$ is 6^{15}. Is he correct? If so, explain why. If not, identify Nestor's error and give the correct value.

LESSON 19-2

7. Assume that x 0. For what value of y will $5x^y$ always be equal to 5? Explain your answer.

8. Simplify and write the expression $\frac{9a^{-4}b^3}{3a^{-5}b^{-7}}$ without negative powers.

9. For what value of n is $4m^{-n} = \frac{4}{m^5}$?

   A. -5 **B.** $\frac{1}{5}$

   C. $-\frac{1}{5}$ **D.** 5

10. For what value of a is $b^3 \cdot b^a = 1$? Justify your answer. Think Exponent Properties; What makes 1.

11. **Reason abstractly.** Determine whether the statement below is always, sometimes, or never true. Explain your reasoning.

    If x is a positive integer, then the value of a^{-x} is negative.

LESSON 19-3

12. Simplify and write each expression without negative powers.

a. $\left(x^{\frac{2}{3}}\right)^{18}$

b. $\left(x^{\frac{2}{3}}y^{\frac{1}{6}}\right)^{18}$

c. $(a^3b^2c^{-2})^4(abc^4)(ab)$

13. Which expression is **not** equal to $\left(\dfrac{x^4}{x^2}\right)^{\frac{1}{2}}$?

A. x **B.** $2x$

C. $(x^2)^{\frac{1}{2}}$ **D.** $\dfrac{x^2}{x}$

14. Write an expression involving at least one negative exponent and a power of a product that simplifies to mn^3.

15. When a quotient is raised to a negative power, Brooke claims that you can invert the quotient and write it with a positive exponent. For example, when asked to simplify $\left(\dfrac{a^4}{3b^2}\right)^{-2}$, Brooke begins by writing $\left(\dfrac{3b^2}{a^4}\right)^2$.

a. Simplify $\left(\dfrac{a^4}{3b^2}\right)^{-2}$ by using Brooke's method. Then simplify without using Brooke's method. How do your answers compare?

b. Does Brooke's method always work? Explain why or why not.

16. **Model with mathematics.** The area of a rectangle is given by the formula $A = \ell w$, where ℓ is the length and w is the width. A rectangular patio has an area of $(ab)^2$ square feet and a length of ab^2 feet. Write a simplified expression that represents the width of the patio.

LESSON 20-1

17. Kurt is cutting diagonal crossbars to stabilize a rectangular wooden frame. If the frame has dimensions of 3 feet by 5 feet, what is the length of one crossbar? Give the exact answer using simplified radicals.

$(\sqrt[n]{a})^m = a^{\frac{m}{n}}$ $\sqrt[n]{a^m} = a^{\frac{m}{n}}$

18. For each radical expression, write an equivalent expression with a fractional exponent.

a. $\sqrt{7}$

b. $\sqrt[3]{19}$

NAME CLASS DATE

19. a. What is the value of $27^{\frac{1}{3}}$?

Optional

b. **Make use of structure.** How can you use your answer to part a to help you find the value of n for which $27^{\frac{2}{n}} = 9$? Find the value of n and explain your reasoning.

20. Which of the following expressions is **not** equivalent to $(16y)^{\frac{3}{4}}$?

A. $\sqrt[4]{16y^3}$

B. $8\sqrt[4]{y^3}$

C. $8y^{\frac{3}{4}}$

D. $16^{\frac{3}{4}}y^{\frac{3}{4}}$

21. a. What is $\sqrt{1}$? What is $\sqrt[3]{1}$? Explain your answers.

b. Let n be a positive integer. What is the value of $1^{\frac{1}{n}}$? Explain your answer.

22. A cube-shaped box has a volume of 512 cubic inches. Celia has 2.5 square feet of wrapping paper. Does she have enough paper to cover the entire surface of the box? Explain your reasoning.

LESSON 20-2

23. The perimeter of a rectangle is $8\sqrt{8}$ feet and the width is $4\sqrt{2}$ feet. How many feet longer is the length of the rectangle than its width?

24. Write $\sqrt{12}+3\sqrt{48}+2\sqrt{27}$ in simplest radical form. State whether the result is rational or irrational.

Challenge - Optional

25. Find the value of a for which $5\sqrt{5}-\sqrt{a}=3\sqrt{5}$. Explain how you found your answer.

26. Which is the sum of $2\sqrt{50}$ and $\sqrt{8}$?

A. $12\sqrt{2}$

B. $13\sqrt{2}$

C. $13\sqrt{5}$

D. $15\sqrt{5}$

NAME CLASS DATE

27. Critique the reasoning of others. Identify and correct the error in each addition or subtraction problem.

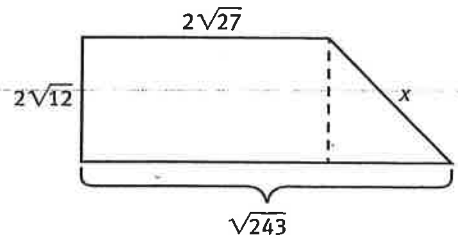
a. $7\sqrt{8} - 5\sqrt{2} = 2\sqrt{6}$

b. $9\sqrt{5} + \sqrt{5} = 9\sqrt{10}$

c. $8\sqrt{3} - \sqrt{3} + 5\sqrt{3} = 8 + 5\sqrt{3}$

28. Ted is fencing in an area composed of a rectangle and a right triangle as shown below.

Awesome Question! "Try it for Fun"



He still needs to buy fencing for the side labeled x. How much fencing does Ted need to buy for this side? Express the answer in simplest radical form.

LESSON 20-3

29. Which of the following is $\frac{3\sqrt{2}}{\sqrt{7}}$ in simplest radical form?

A. $3\sqrt{2}$ **B.** $21\sqrt{2}$

C. $\frac{3\sqrt{14}}{7}$ **D.** $\frac{3\sqrt{21}}{7}$

30. Jed has a rope that is $8\sqrt{18}$ meters long. He cuts it into smaller pieces that are each $3\sqrt{2}$ meters long. How many smaller pieces of rope does Jed now have?

Think of an easier example. How would you start?

31. a. Write $\left(\sqrt{\frac{3}{2}}\right)\left(\sqrt{\frac{12}{32}}\right)$ in simplest form. Is the result rational or irrational?

b. What can you conclude from your answer to part a about whether the irrational numbers are closed under multiplication? Explain.

32. Lorraine solved the equation $3\sqrt{x} \cdot \sqrt{24} = 12\sqrt{6}$ and found that $x = 4$. Verify that Lorraine's solution is correct.

33. Critique the reasoning of others. Deanna says that $\frac{1}{\sqrt{5}}$ is in simplified form. Is she correct? If so, explain why. If not, correct her mistake.

40. Write a geometric ~~sequence in which every term is an odd integer. Write both the explicit and the recursive formulas for your sequence. Then identify~~ the 9th term.

2.1, 6.3, 18.9, 56.7, ...

Write the explicit form of the sequence:

Use the geometric sequences below for Items 41 and 42.

Sequence 1

$a_n = 5 \cdot 2^{n-1}$

Sequence 2

$\begin{cases} a_1 = 2 \\ a_n = 5a_{n-1} \end{cases}$

41. Which statement is incorrect?

A. The terms in Sequence 2 increase more quickly than the terms in Sequence 1.

B. Both sequences have the same second term.

C. The explicit formula for Sequence 2 contains 2 raised to a power.

D. The common ratio for Sequence 2 is equal to the first term of Sequence 1.

42. **Persevere in solving problems.** How many terms in Sequence 1 are less than 500? Explain how you found your answer.

LESSON 22-1

43. ~~Rajiv bought a rare stamp for \$125. A function~~ that models the value of Rajiv's after t years is $v(t) = 125 \cdot (1.05)^t$. What is the value of Rajiv's stamp after 20 years?

A. \$131.25 **B.** \$331.66

C. \$2,625.00 **D.** \$3,316.62

44. **Attend to precision.** The function $f(t) = 40{,}000 \cdot (1.3)^t$ can be used to find the value of Sally's house between 1970 and 2010, where t is the number of decades since 1970. Decades, not years.

a. Identify the reasonable domain and range of the function. Explain your answers.

b. Sally wants to calculate the value of her house in 1995. What number should Sally substitute for t in the function? Explain.

c. Find the value of Sally's house in 1995.

45. The function $h(t) = 5{,}000 \cdot (2.1)^t$ models the value of Ms. Ruiz's house, where t represents the number of decades since 1950. In what *year* did the value of Ms. Ruiz's house first exceed \$25,000? Explain how you can use a table to find the answer.

NAME CLASS DATE

46. The function $h(t) = 15{,}000 \cdot (1.5)^t$ models the value of Sam's house, where t represents the number of decades since 1960. The value of Kendra's house has been doubling each decade since 1980. In 2010, the value of Sam's house was greater than the value of Kendra's house. Is it possible that the two houses had equal values in 1980? Explain.

LESSON 22-2

47. Identify the constant factor for the exponential function $y = \left(\frac{1}{3}\right)^x$. How can you use the constant factor to tell whether the function represents exponential growth or exponential decay?

48. Mia bought a new computer for \$1,500. A function that models the value of Mia's computer after t years is $v(t) = 1{,}500 \cdot (0.68)^t$. How much is Mia's computer worth after 2.5 years?

49. Jane bought a new car for \$30,000. A function that models the value of Jane's car after t years is $v(t) = 30{,}000 \cdot (0.85)^t$. In how many years will the car be worth less than half of what Jane paid for it?

A. 2 **B.** 3

C. 4 **D.** 5

Use the table function!

50. Compare the graph of an exponential growth function to the graph of an exponential decay function. Describe the similarities and differences.

51. **Model with mathematics.** Troy bought a book with 512 pages. The next day he read half the book. On each subsequent day, he read half of the remaining pages. The exponential decay function $y = 512(0.5)^x$ gives the number of remaining pages x days after Troy bought the book.

a. How many pages did Troy have left to read after 6 days?

b. Blake says that the value of the exponential function can never be 0, so Troy will never finish reading the book. Do you agree with Blake? Explain why or why not.

LESSON 22-3

52. Without graphing, tell which function increases more slowly. Justify your answer.

$$f(x) = 99x \qquad g(x) = 9^x$$

NAME CLASS DATE

53. Use a graphing calculator to graph the function $g(x) = \frac{1}{4}\left(\frac{1}{2}\right)^x$.

a. Identify the values of a and b (from $f(x) = ab^x$), and describe their effects on the graph.

b. Graph $f(x) = \left(\frac{1}{2}\right)^x$ on the same screen as the graph of $g(x)$. Describe the similarities and differences between the graphs.

54. Which function increases the fastest?

A. $y = 14^x$ **B.** $y = -3 \cdot 17^x$

C. $y = 120x$ **D.** $y = -275x$

55. Make sense of problems. A health club with 100 members is trying to increase its membership. Judy has a plan that will increase membership by 25 members per month, so that the number of members y after x months is given by the function $y = 100 + 25x$. Desmond has a plan that will increase membership by 10% each month, so that the number of members y after x months is given by the function $y = 100 \cdot 1.1^x$.

a. Whose plan will increase club membership more quickly? Use a graph to support your answer.

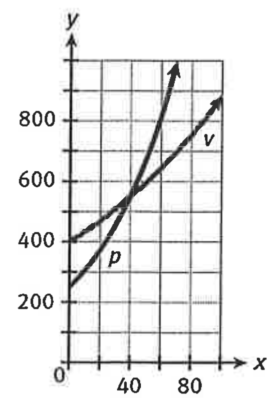
Think short term and long term

b. Whose plan would you recommend? Explain.

c. To keep the club from becoming overcrowded, the maximum club membership is 500 people. Does this additional information change your recommendation from part b? Explain why or why not.

LESSON 23-1

56. On the coordinate grid below, p represents the amount of money in Paola's savings account, and v represents the amount in Vincent's account. Whose account had a higher initial deposit, and how much was it? Use the graph to justify your answer.



Four students deposit money into accounts with interest that is compounded annually. The amount of money in each account after t years is given by the functions below. Use these functions for Items 57–59.

Look

Felicity: $f(t) = 500 \cdot (1.02)^t$

Raisa: $r(t) = 800 \cdot (1.01)^t$

Sanjay: $s(t) = 1{,}000 \cdot (1.015)^t$

Megan: $m(t) = 200 \cdot (1.025)^t$

$y = a(1+r)^t$

Think: How can you determine $\boxed{r}$ in these equations?

NAME CLASS DATE

57. Identify the constant factor in Sanjay's function and explain how it is related to his interest rate.

58. a. Write a function to represent the amount of money Felicity will have after m months if her interest were compounded monthly rather than annually.

b. Will Felicity earn more money when 2% annual interest is compounded annually or monthly? Explain.

59. Which shows the students' names in order from greatest initial deposit to least initial deposit?

A. Megan, Felicity, Raisa, Sanjay

B. Felicity, Raisa, Megan, Sanjay

C. Sanjay, Megan, Raisa, Felicity

D. Sanjay, Raisa, Felicity, Megan

60. **Use appropriate tools.** The function $t(x) = 500 \cdot (1.01)^x$ represents the amount of money in Tracy's savings account after x years. The function $j(x) = 200 \cdot (1.03)^x$ represents the amount of money in Julio's savings account after x years. Explain how to use your graphing calculator to determine when the amount in Julio's account will become greater than the amount in Tracy's account. Round to the nearest whole year.

LESSON 23-2

The population of Arizona from 1970 to 2000 is shown in the table below. Use the table for Items 61–63.

Arizona	
Year	Resident Population
1970	1,775,399
1980	2,716,546
1990	3,665,228
2000	5,130,632
2010	6,392,015

61. Use a graphing calculator to find a function that models Arizona's population growth. Write the function using the variable n to represent the number of decades since 1970.

↳ Not years

62. Use a graphing calculator to create a graph showing the data from the table and the function you wrote in Item 61. Make a sketch of the graph. Is the function a good fit for the data? Explain why or why not.

63. Before the 2012 population count was final, the Census Bureau predicted that Arizona's population in 2012 would be 6,553,255.

a. Use the function from Item 61 to predict Arizona's population in 2012. What number did you substitute into the function? Explain.

b. How does your prediction in part a compare to the prediction from the Census Bureau?

NAME CLASS DATE

64. Which function is the best model for the data in the table? Think: How is the data changing? Linear? Exponential?

x	y
0	15
1	42.5
2	108
3	264
4	688

A. $y = 16x + 2.6$ **B.** $y = 2.6 \cdot 16^x$

C. $y = 2.6x + 16$ **D.** $y = 16 \cdot 2.6^x$

~~**65.**~~ **Critique the reasoning of others.** The function $y = 10{,}942(1.175)^n$ represents the population of Nate's hometown, where n is the number of decades since 1960. Nate wants to rewrite the function to show the growth per year. He rewrites the function as $y = 10{,}942(0.1175)^n$ where n is now the number of years since 1960. Did Nate write the new function correctly? If so, explain why. If not, explain why not and write the correct function.

Stop!

LESSON 24-1

66. Copy and complete the table below.

Polynomial	$8x^2 + 2x^3$	$-9 + 23x - x^2$	$\frac{1}{3}x^5$
Number of Terms			
Name			
Leading Coefficient			
Constant Term			
Degree			

67. Write a polynomial in standard form that has an even number of terms and whose degree is 4.

68. Attend to precision. Which shows the polynomial $3a + 6a^2 - 16 - 2a^3$ written in standard form?

A. $2a^3 + 6a^2 - 16 + 3a$

B. $-2a^3 + 6a^2 + 3a - 16$

C. $-2a^3 + 6a^2 - 16 + 3a$

D. $-2a^3 + 6a^2 + 3a - 16$

69. a. Is the expression $\frac{3}{4}x^2 + \frac{5}{x} + 2$ a polynomial? Explain why or why not.

b. Karina says that the expression $\frac{1}{5}x^4 + 7 - 2x^2$ is not a polynomial because $\frac{1}{5}$ is not a whole number. Do you agree with Karina? Explain why or why not.

LESSON 24-2

70. Add. Write your answers in standard form.

a. $(2x^2 + x + 4) + (6x^2 + x - 4)$

b. $(5x^2 + x) + (7x^3 - 3x + 9)$

c. $(6x^3 - 6x + 1) + (-4x^3 + x^2 - 2)$

d. $\left(\frac{1}{2}x^2 + 6x - 12\right) + \left(\frac{3}{4}x^2 - 8x + 9\right)$