Name _____ Class _____ Date _____

Practice 7-4

Rational Exponents

Simplify each expression. Assume that all variables are positive.

1. $27^{\frac{1}{3}}$
2. $\left(81^{\frac{1}{4}}\right)^4$
3. $\left(32^{\frac{1}{5}}\right)^5$
4. $(256^4)^{\frac{1}{4}}$
5. 7^0
6. $8^{\frac{2}{3}}$
7. $(-1)^{\frac{1}{5}}$
8. $(-27)^{\frac{2}{3}}$
9. $16^{\frac{1}{4}}$
10. $x^{\frac{1}{2}} \cdot x^{\frac{1}{3}}$
11. $2y^{\frac{1}{2}} \cdot y$
12. $(8^2)^{\frac{1}{3}}$
13. 3.6^0
14. $\left(\frac{1}{16}\right)^{\frac{1}{4}}$
15. $\left(\frac{27}{8}\right)^{\frac{2}{3}}$
16. $\sqrt[8]{0}$
17. $\left(3x^{\frac{1}{2}}\right)\left(4x^{\frac{2}{3}}\right)$
18. $\frac{12y^{\frac{1}{3}}}{4y^{\frac{1}{2}}}$
19. $\left(3a^{\frac{1}{2}}b^{\frac{1}{3}}\right)^2$
20. $\left(y^{\frac{2}{3}}\right)^{-9}$
21. $\left(a^{\frac{2}{3}}b^{-\frac{1}{2}}\right)^{-6}$
22. $y^{\frac{2}{5}} \cdot y^{\frac{3}{8}}$
23. $\left(\frac{x^{\frac{4}{7}}}{x^{\frac{2}{3}}}\right)$
24. $\left(2a^{\frac{1}{4}}\right)^3$
25. $81^{-\frac{1}{2}}$
26. $\left(2x^{\frac{2}{5}}\right)\left(6x^{\frac{1}{4}}\right)$
27. $\left(9x^4y^{-2}\right)^{\frac{1}{2}}$

28. The interest rate r required to increase your investment p to the amount a in t years is found by $r = \left(\frac{a}{p}\right)^{\frac{1}{t}} - 1$. What interest rate would be required to increase your investment of \$2700 to \$3600 over three years? Round your answer to the nearest tenth of a percent.

Write each expression in radical form.

29. $x^{\frac{4}{3}}$
30. $(2y)^{\frac{1}{3}}$
31. $a^{1.5}$
32. $b^{\frac{1}{5}}$
33. $z^{\frac{2}{3}}$
34. $(ab)^{\frac{1}{4}}$
35. $m^{2.4}$
36. $t^{-\frac{2}{7}}$
37. $a^{-1.6}$

Write each expression in exponential form.

38. $\sqrt{x^3}$
39. $\sqrt[3]{m}$
40. $\sqrt{5y}$
41. $\sqrt[3]{2y^2}$
42. $\left(\sqrt[4]{b}\right)^3$
43. $\sqrt{-6}$
44. $\sqrt{(6a)^4}$
45. $\sqrt[5]{n^4}$
46. $\sqrt[4]{(5ab)^3}$

Name _____ Class _____ Date _____

Practice 7-8

Graphing Radical Functions

Graph each function.

1. $y = -\sqrt{x + 2}$
2. $y = \sqrt{x - 3}$
3. $y = \sqrt{x} + 1$
4. $y = -\sqrt{x} - 1$
5. $y = \sqrt{x - 4} + 2$
6. $y = \sqrt{x + 1} - 3$
7. $y = \sqrt{x + 2} - 6$
8. $y = -\sqrt{x - 2} + 3$
9. $y = -\sqrt{x - 3} + 3$
10. $y = \sqrt{x + 3} - 2$
11. $y = \sqrt{x - 1} - 5$
12. $y = -\sqrt{x - 2} + 5$
13. $y = -\sqrt{x + 1} - 4$
14. $y = -\sqrt{x - 1} + 2$
15. $y = \sqrt{x - 1} + 3$
16. $y = \sqrt{x - 2} + 1$
17. $y = \sqrt{x + 2} - 2$
18. $y = \sqrt{x - 1} + 2$
19. $y = \sqrt{x + 1} + 4$
20. $y = \sqrt{x - 3} + 3$
21. $y = \sqrt{x + 1} - 2$
22. $y = \sqrt{x - 1} - 1$
23. $y = \sqrt{x + 3} - 3$
24. $y = \sqrt{x + 4} - 1$
25. $y = \sqrt{x - 2} - 4$
26. $y = \sqrt{x + 2} + 1$
27. $y = \sqrt{x - 2} + 3$

28. If you know the area A of a circle, you can use the equation $r = \sqrt{\frac{A}{\pi}}$ to find the radius r.
    a. Graph the equation.
    b. What is the radius of a circle with an area of 350 ft^2?

Rewrite each function to make it easy to graph using a translation. Describe the graph.

29. $y = \sqrt{81x + 162}$
30. $y = -\sqrt{4x + 20}$
31. $y = \sqrt[3]{125x - 250}$
32. $y = -\sqrt{64x + 192}$
33. $y = -\sqrt[3]{8x - 56} + 4$
34. $y = \sqrt{25x + 75} - 1$

Graph each function.

35. $y = \sqrt[3]{x - 1}$
36. $y = \sqrt[3]{x + 2} - 3$
37. $y = \sqrt[3]{x + 1} - 2$
38. $y = -\sqrt[3]{x} + 2$
39. $y = 2\sqrt[3]{x - 3}$
40. $y = \sqrt[3]{x + 3} - 1$

Name _____ Class _____ Date _____

Practice 7-5

Solving Radical Equations

Solve. Check for extraneous solutions.

1. $(x-2)^{\frac{1}{3}} = 5$
2. $3x^{\frac{4}{3}} + 5 = 53$
3. $4x^{\frac{3}{2}} - 5 = 103$
4. $\sqrt{x+1} = x - 1$
5. $\sqrt{2x+1} = -3$
6. $x^{\frac{1}{2}} - 5 = 0$
7. $\sqrt{x+7} = x - 5$
8. $(2x+1)^{\frac{1}{3}} = -3$
9. $2x^{\frac{1}{3}} - 2 = 0$
10. $\sqrt{2x-5} = 7$
11. $\sqrt{2x-4} = x - 2$
12. $\sqrt{x} + 6 = x$
13. $\sqrt{x+2} = 10 - x$
14. $\sqrt{4x+2} = \sqrt{3x+4}$
15. $(7x-3)^{\frac{1}{2}} = 5$
16. $(x-2)^{\frac{2}{3}} - 4 = 5$
17. $2\sqrt{x-1} = \sqrt{26+x}$
18. $2x^{\frac{3}{4}} = 16$
19. $\sqrt{7x-6} - \sqrt{5x+2} = 0$
20. $\sqrt{3x-3} - 6 = 0$
21. $5\sqrt{x} + 2 = 12$
22. $2x^{\frac{4}{3}} - 2 = 160$
23. $4x^{\frac{1}{2}} - 5 = 27$
24. $\sqrt{x+1} = x + 1$
25. $\sqrt{2x+1} = -5$
26. $x^{\frac{1}{6}} - 2 = 0$
27. $\sqrt{x+2} = x - 18$
28. $(2x+1)^{\frac{1}{3}} = 1$
29. $x^{\frac{1}{4}} + 3 = 0$
30. $\sqrt[3]{2x-4} = -2$
31. $x^{\frac{1}{4}} - 1 = 0$
32. $(x-2)^{\frac{1}{3}} = -5$
33. $x^{\frac{1}{3}} - 2 = 0$
34. $\sqrt{3x} = 6$
35. $(2x+7)^{\frac{1}{2}} - x = 2$
36. $\sqrt{4x} - 8 = 0$
37. $\sqrt{3x+1} - 5 = 0$
38. $3(2x+4)^{\frac{4}{3}} = 48$
39. $2\sqrt{x} = \sqrt{x+6}$
40. $(2x+1)^{\frac{1}{2}} = (5-2x)^{\frac{1}{2}}$
41. $(x+14)^{\frac{1}{4}} = (2x)^{\frac{1}{2}}$
42. $\sqrt[3]{x-2} = 4$

Name _____ Class _____ Date _____

Practice 7-7

Inverse Relations and Functions

Graph each relation and its inverse.

1. $y = \frac{x + 3}{3}$
2. $y = \frac{1}{2}x + 5$
3. $y = 2x + 5$
4. $y = 4x^2$
5. $y = \frac{1}{2}x^2$
6. $y = \frac{2}{3}x^2$

Find the inverse of each function. Is the inverse a function?

7. $y = x^2 + 2$
8. $y = x + 2$
9. $y = 3(x + 1)$
10. $y = -x^2 - 3$
11. $y = 2x - 1$
12. $y = 1 - 3x^2$
13. $y = 5x^2$
14. $y = (x + 3)^2$
15. $y = 6x^2 - 4$
16. $y = 3x^2 - 2$
17. $y = (x + 4)^2 - 4$
18. $y = -x^2 + 4$

For each function f, find f^{-1} and the domain and range of f and f^{-1}. Determine whether f^{-1} is a function.

19. $f(x) = \frac{1}{6}x$
20. $f(x) = -\frac{1}{5}x + 2$
21. $f(x) = x^2 - 2$
22. $f(x) = x^2 + 4$
23. $f(x) = \sqrt{x - 1}$
24. $f(x) = \sqrt{3x}$

Find the inverse of each relation. Graph the given relation and its inverse.

25.

x	−2	−1	0	1
y	−3	−2	−1	0

26.

x	0	1	2	3
y	−3	−1	0	−2

Let $f(x) = 2x + 5$. Find each value.

27. $(f^{-1} \circ f)(-1)$
28. $(f \circ f^{-1})(3)$
29. $(f \circ f^{-1})\left(-\frac{1}{2}\right)$

30. The equation $f(x) = 198{,}900x + 635{,}600$ can be used to model the number of utility trucks under 6000 pounds that are sold each year in the U.S. with $x = 0$ representing the year 1992. Find the inverse of the function. Use the inverse to estimate in which year the number of utility trucks under 6000 pounds sold in the U.S. will be 4,000,000.
Source: *www.infoplease.com*

Name _____ Class _____ Date _____

Practice 9-1

Inverse Variation

Each ordered pair is from an inverse variation. Find the constant of variation.

1. $\left(3, \frac{1}{3}\right)$
2. $(0.2, 6)$
3. $(10, 5)$
4. $\left(\frac{5}{7}, \frac{2}{5}\right)$
5. $(3.5, 1.2)$

Suppose that x and y vary inversely. Write a function that models each inverse variation.

6. $x = 7$ when $y = 2$
7. $x = 4$ when $y = 9$
8. $x = -3$ when $y = 8$
9. $x = 5$ when $y = -6$
10. $x = 1$ when $y = 0.8$
11. $x = -4$ when $y = -2$
12. $x = \frac{3}{5}$ when $y = 5$
13. $x = 3$ when $y = 2.1$
14. $x = -\frac{1}{3}$ when $y = \frac{9}{10}$

Describe the combined variation that is modeled by each formula.

15. $I = \frac{120}{R}$
16. $A = \frac{1}{2}bh$
17. $h = \frac{3V}{B}$
18. $V = \frac{4}{3}\pi r^3$

Each pair of values is from an inverse variation. Find the missing value.

19. $(2, 4)$ and $(6, y)$
20. $\left(\frac{1}{3}, 6\right)$ and $\left(x, -\frac{1}{2}\right)$
21. $(1.2, 4.5)$ and $(2.7, y)$

Suppose that x and y vary inversely. Write a function that models each inverse variation, and find y when $x = 8$.

22. $x = 4$ when $y = 2$
23. $x = -3$ when $y = \frac{1}{3}$
24. $x = 6$ when $y = 1.2$

Write the function that models each relationship. Find z when $x = 6$ and $y = 4$.

25. z varies jointly with x and y. When $x = 7$ and $y = 2$, $z = 28$.
26. z varies directly with x and inversely with the cube of y. When $x = 8$ and $y = 2$, $z = 3$.

Is the relationship between the values in each table a direct variation, an inverse variation, or neither? Write equations to model the direct and inverse variations.

27.

x	2	4	5	20
y	10	5	4	1

28.

x	1	3	7	10
y	2	8	20	29

29.

x	1	2	5	7
y	6	12	30	42

30.

x	0.2	0.5	2	3
y	25	62.5	250	375

31.

x	0.1	0.5	1.5	2
y	31	7	3	2.5

32.

x	3	1.5	0.5	0.3
y	5	10	30	50

Name _____ Class _____ Date _____

Practice 9-2

Graphing Inverse Variations

Write an equation for a translation of $y = -\frac{3}{x}$ that has the given asymptotes.

1. $x = 2; y = 1$
2. $x = -1; y = 3$
3. $x = 4; y = -2$
4. $x = 0; y = 6$
5. $x = 3; y = 0$
6. $x = 1; y = 2$
7. $x = -3; y = -1$
8. $x = -2; y = 1$

Sketch the asymptotes and the graph of each equation.

9. $y = \frac{3}{x-1} + 2$
10. $y = \frac{2}{x+1}$
11. $y = \frac{11}{x+3} - 3$
12. $y = -\frac{4}{x-2} - 2$
13. $y = \frac{1}{x} + 3$
14. $y = \frac{1}{x+1} - 2$
15. $y = \frac{1}{x-2} + 1$
16. $y = \frac{1}{x-1} - 1$
17. $y = \frac{2}{x}$
18. $y = -\frac{3}{x-3} + 1$
19. $y = \frac{1}{x+1} + 2$
20. $y = \frac{3}{4x} + \frac{1}{2}$
21. $y = \frac{3}{x+3} - 1$
22. $y = \frac{2}{x-5}$
23. $y = -\frac{6}{x-3} - 2$
24. $y = \frac{5}{x}$
25. $y = \frac{1}{x-1} + 1$
26. $y = \frac{1}{x}$
27. $y = -\frac{3}{x-4} - 2$
28. $y = -\frac{1}{x-2} - \frac{1}{2}$

The length of a panpipe p (in feet) is inversely proportional to its pitch ℓ (in hertz). The inverse variation is modeled by the equation $p = \frac{495}{\ell}$.

29. Find the length required to produce a pitch of 220 Hz.
30. What pitch would be produced by a pipe with a length of 1.2 ft?
31. Find the pitch of a 0.6-ft pipe.
32. Find the pitch of a 3-ft pipe.

The junior class is buying keepsakes for the junior-senior prom. The price of each keepsake p is inversely proportional to the number of keepsakes s bought. The equation $p = \frac{1800}{s}$ models this inverse variation.

33. If they buy 240 keepsakes, how much can the class spend for each?
34. If they spend \$5.55 for each keepsake, how many can the class buy?
35. If 400 keepsakes are bought, how much can be spent for each?
36. If the class buys 50 keepsakes, how much can be spent for each?

Compare the graphs of the inverse variations.

37. $y = \frac{1}{x}$ and $y = \frac{5}{x}$
38. $y = \frac{3}{x}$ and $y = -\frac{3}{x}$
39. $y = \frac{2}{x}$ and $y = \frac{20}{x}$
40. $y = -\frac{1}{x}$ and $y = -\frac{10}{x}$
41. $y = \frac{6}{x}$ and $y = -\frac{6}{x}$
42. $y = \frac{0.2}{x}$ and $y = \frac{0.02}{x}$

Day 9 Homework

Solve each system symbolically. Then represent the solution on a graph. Label any key points.

1. $\begin{cases} xy = \frac{4}{3} \\ 3x + 2y = 9 \end{cases}$

2. $\begin{cases} y = \sqrt{2x} \\ x - y = 4 \end{cases}$

3. $\begin{cases} y = \sqrt{x} \\ x - y = 6 \end{cases}$

4. $\begin{cases} 4x - 9y = 9 \\ xy = 1 \end{cases}$

5. $\begin{cases} 2x + 2y = 3 \\ xy = -1 \end{cases}$

6. $\begin{cases} y = \sqrt{x} \\ y = x^2 \end{cases}$

Solve each system symbolically.

7. $\begin{cases} \frac{1}{x} + \frac{1}{y} = 5 \\ \frac{1}{x} - \frac{1}{y} = -3 \end{cases}$

8. $\begin{cases} \frac{1}{x} - \frac{1}{y} = 4 \\ \frac{1}{x} + \frac{1}{y} = -2 \end{cases}$

Applications.

9. Find the lengths of the legs of a right triangle whose hypotenuse is $\sqrt{15}$ feet and whose area is 3 square feet.

10. A small television is advertised to have a picture with a diagonal measure of 5 inches and a viewing area of 12 square inches. What are the length and width of the screen?