**Algebra 3-4**

**Unit 6: Radical Functions and Rational Exponents**

Designer(s): OPS Secondary Math Department Grade Level: Algebra 3-4

Radical Functions and Rational Exponents

Unit Overview

In this chapter, you will learn how to work with radicals, whether they occur by themselves or as parts of functions or equations; whether they appear with the symbol or as fractional exponents. In a sense, radicals are the inverses of powers. Mountain climbers need to be aware of air pressure, which can be calculated using fractional exponents.

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| --- | --- | --- |
| **Radical Functions and Rational Exponents** | | |
| **Essential Questions** | **Standard** | **Objectives**  F= Factual C=Conceptual D=Debatable |
| * 1. To simplify the *n*th root of an expression, what must be true about the expression? | 12.1.1.a  12.1.3.b  12.3.3.j, k, l | * Students will simplify radical expressions. (C) |
| * 1. When you square each side of an equation, is the resulting equation equivalent to the original? | 12.3.1.b | * Students will solve radical equations (C) * Students will determine the domain of radical functions (C) * Students will check for extraneous solutions (C) |
| * 1. How are a function and its inverse related? | 12.3.1.e, h  12.3.3.n | * Students will find inverse functions (C) * Students will graph functions and their inverses (C) |

**Radical Functions and Rational Exponents**

**Critical Content and Skills:**

|  |  |
| --- | --- |
| *Knowledge Statements*  Students will know…   1. **Vocabulary**: principal root, *n*th root, radicand, rationalize the denominator, rational exponent, square root equation, radical equation, composite function, inverse function, square root function 2. Operations with radical expressions 3. Solving square root and other radical equations 4. Function operations and inverse functions 5. Graphing radical functions | *Key Skill Statements*  Students will know how to…   1. Simplify, add, subtract, multiply and divide expressions with radicals 2. Solve equations with radicals and rational exponents and check for extraneous solutions 3. Add, subtract, multiply, divide and compose two functions and state the domain of the answer 4. Find and graph inverse functions and state the domain 5. Graph square root and cube root functions using transformations |

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| **Algebra 3-4**  **Chapter 6 Radical Functions and Rational Exponents** | | | |
| **Advanced**  **Score 4.0** | In addition to the Proficient (3.0) performance, makes ***indepth*** inferences and extended applications of what was learned, including connections to other experiences. | | * Simplify an expression with irrational exponents * Rationalize a denominator with cube or higher roots * Solve a radical equation that requires factoring and possible extraneous solutions * Solve real-world models involving radicals or rational exponents * Solve real-world models involving composition of functions * Graph a function and its inverse and state the domain and range |
|  | **Proficient +**  **Score 3.5** | In addition to the complex ideas and processes (Proficient 3.0) performance, ***partial success*** at in-depth inferences and extended applications of what was learned, including connections to other experiences. | |
| **Proficient**  **Score 3.0** | ***No major*** errors or omissions regarding any of the information and simple (Basic, 2.0) or complex processes (Proficient, 3.0) that was explicitly taught. | | * Simplify radical expressions containing variables * Divide and simplify radical expressions * Rationalize a denominator containing square roots * Add and subtract radical expressions with unlike radicals * Multiply binomial radical expressions * Solve a radical equation that has multiple *x*’s * Compose two functions * Find the inverse of a function * Graph a square root or cube root function |
|  | **Basic +**  **Score 2.5** | ***No major*** errors or omissions regarding any of the information and/or simpler details and processes (Basic, 2.0) and ***partial*** knowledge of the more complex ideas and processes (Proficient, 3.0) | |
| **Basic**  **Score 2.0** | ***No major*** errors or omissions regarding the simpler details and processes (Basic, 2.0), but ***major*** errors or omissions regarding the more complex ideas and processes (Proficient, 3.0). | | * Find perfect square, cube and fourth roots * Multiply and simplify radical expressions without variables * Add and subtract radical expressions with like radicals * Convert between radical and exponential form * Use properties of exponents to simplify a rational expression * Solve a radical equation containing only one *x* * Add, subtract, multiply and divide functions and state the domain * Find the inverse of a relation |
| **Below Basic**  **Score 1.0** | A ***partial*** understanding of ***some*** of the simpler details and processes (Basic, 2.0), but ***major*** errors or omissions regarding the more complex ideas and processes. | | |
| **Failing**  **Score 0** | ***No*** evidence or ***insufficient*** evidence of student learning. | | |

Algebra 3-4 Name

Pd Date

**Unit 6 Radical Functions and Rational Exponents**

Calculators are NOT permitted on this exam.

**Multiple Choice**

*Identify the choice that best completes the statement or answers the question.*

**Find the real-number root.**

\_\_\_\_ 1. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. |  | b. |  | c. |  | d. |  |

**Multiply and simplify if possible.**

\_\_\_\_ 2. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. |  | b. |  | c. |  | d. | not possible |

**What is the simplest form of the radical expression?**

\_\_\_\_ 3. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. | not possible to simplify |

\_\_\_\_ 4. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. | not possible to simplify |

\_\_\_\_ 5. A garden has width  and length . What is the perimeter of the garden in simplest radical form?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | units | c. | 91 units |
| b. | units | d. | units |

**Simplify.**

\_\_\_\_ 6. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. |  | b. |  | c. | 20 | d. | 1 |

\_\_\_\_ 7. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. | 4 | d. | 16 |

\_\_\_\_ 8. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 9 | c. | –28 |
| b. | 57 | d. | –18 |

\_\_\_\_ 9. Write  in simplest form.

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. | none of these |

**What is the solution of the equation?**

\_\_\_\_ 10. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. | 14 | b. | –8 | c. | 4 | d. | –6 |

\_\_\_\_ 11. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. | 14 | b. | 2 | c. | 26 | d. | 38 |

\_\_\_\_ 12. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. | –16 | b. | –13 | c. | 13 | d. | –8 |

**Perform each function operation.**

\_\_\_\_ 13. Let  and . Find *f*(*x*)  *g*(*x*).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. | 10*x* – 8 | b. | 10*x* – 2 | c. | –2*x* – 8 | d. | –2*x* – 2 |

\_\_\_\_ 14. Let  and . Find  and its domain.

|  |  |
| --- | --- |
| a. | ; all real numbers except *x*  |
| b. | ; all real numbers |
| c. | ; all real numbers |
| d. | ; all real numbers except *x*  |

\_\_\_\_ 15. Let  and . Find  and its domain.

|  |  |
| --- | --- |
| a. | 3; all real numbers |
| b. | 3; all real numbers except *x*  2 |
| c. | 1; all real numbers |
| d. | –3; all real numbers except *x*  3 |

**Level 3**

**Simplify the radical expression.**

\_\_\_\_ 16. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. |  | b. |  | c. |  | d. |  |

\_\_\_\_ 17. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. |  | b. |  | c. |  | d. |  |

\_\_\_\_ 18. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 19. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 20. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. | none of these |

\_\_\_\_ 21. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 22. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 23. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

**How can you write the expression with rationalized denominator?**

\_\_\_\_ 24.



|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 25. What is  in simplest form?

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

**What is the solution of the equation?**

\_\_\_\_ 26. 

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. |  | b. |  | c. |  | d. |  |

**Find each expression.**

\_\_\_\_ 27. Let  and . Find .

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. | 8*x* + 31 | b. | –2*x* – 4 | c. | –4*x* – 4 | d. | 8*x* – 13 |

\_\_\_\_ 28. Let  and . Find .

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| a. | *x*2 + 2 | b. | *x*2 + 4*x* + 4 | c. | *x*2 – 4*x* + 4 | d. | *x*2 + 4 |

**What is the inverse of the given relation?**

\_\_\_\_ 29. **.

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 30. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

**Graph the equation.**

\_\_\_\_ 31. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 32. 

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

**Level 4**

\_\_\_\_ 33. Find all the real square roots of 0.0004.

\_\_\_\_ 34. Solve:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |

\_\_\_\_ 35. You have a coupon good for $6 off the price of any large pizza. You also get a 20% discount on any pizza if you show your student ID. How much more would you pay for a large pizza if the cashier applies the coupon first?

Answers:

1. D
2. A
3. C
4. C
5. B
6. C
7. B
8. A
9. A
10. D
11. C
12. B
13. D
14. C
15. B
16. C
17. C
18. A
19. B
20. A
21. A
22. B
23. A
24. C
25. A
26. A
27. D
28. B
29. A
30. D
31. A
32. D
33. $1.20

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

|  |  |
| --- | --- |
| **Learning Experiences** | **Text Pages/Resources** |
| **Vocabulary (Learning goals 1, 2, and 3)**   * Word wall * Foldable – See Glencoe @2010 Foldables by Dinah Zike for more information * Matching the word to the definition, graph, or example * Anticipation guide (pre and post) |  |
| * **Lesson Resources at the end of each section** * **Online Resources at pearsonsuccessnet.com** | Pearson  Algebra 2  Sections 6-1 through 6-8 |
| **General:**  **Test-Taking Strategy**  Be sure to check the reasonableness of your answer. If students are asked for the balance of a bank account where you were dealing with amounts in the hundreds, it is not reasonable to give an answer in the millions. To make sure the answer to a problem is reasonable, you can estimate before you calculate. If the answer is close to your estimate, your answer is probably correct. |  |

**Teacher Notes/Additional Resources**

**General Algebra & Math sites:**

* AlgebraLAB: Making Math & Science Connections [www.algebralab.org](http://www.algebralab.org)
* Classzone from Holt McDougall’s free site includes really cool animations. You and your students will simply need to figure out which chapter in their book relates to what we’re studying. <http://www.classzone.com/cz/books/algebra_1_2011_na/book_home.htm?state=NE>
* Kuta software <http://www.kutasoftware.com> Excellent free worksheets (with answers) <http://www.kutasoftware.com/free.html>
* NCTM’s Figure This! Web site has several challenge problems that are designed for families to do together. <http://figurethis.org/download.htm> These challenges (there are 80 of them!) could be used for daily warm-ups in class (several involve estimation), weekly Problem-of-the-Week, and even a challenge problem along with their homework, if relevant.
* Math is Fun! Includes an illustrated math dictionary and helpful tutorials for students. [www.mathisfun.com](http://www.mathisfun.com)
* Daily Math Review <http://www.aea11.k12.ia.us/E2T2/dmr.html>
* Great online timer: <http://www.online-stopwatch.com>
* Porta Portal’s consolidated resource list <http://guest.portaportal.com/mrburke>
* Algebra2Go <http://www.saddleback.edu/faculty/lperez/algebra2go/index.html>
* About.com Education site has great warm ups <http://712educators.about.com/cs/warmups/l/blwarmmath.htm>
* Southern Regional Education Boards Instructional Resources <http://www.evalutech.sreb.org/InstResources/index.asp>

**Books:**

* Various resources provided by publishers for the book selection process

**Videos:**

* BrainPop [www.brainpop.com](http://www.brainpop.com)
* Teacher Tube [www.teachertube.com](http://www.teachertube.com)