McKeesport Area School District

Flexible Instruction Days – High School Lesson Plan

SUBJECT: Algebra 1			**LESSON TITLE:** Operations with Real Numbers	
☒ **LESSON 1:** 1st or 2nd 9-Weeks	☐ **LESSON 2:** 2nd or 3rd 9-Weeks	☐ **LESSON 3:** 2nd or 3rd 9-Weeks	☐ **LESSON 4:** 2nd or 3rd 9-Weeks	☐ **LESSON 5:** 3rd or 4th 9-Weeks

STANDARD(S):

- **CCSS. A1.1.1.1.2**
  Simplify square roots

- **CCSS. A1.1.1.1.3**
  Simplify/evaluate expressions involving properties/laws of exponents, roots, and/or absolute values to solve problems

Students must be able to follow the order of operations to properly evaluate expressions and understand the rules for simplifying a square root.

INSTRUCTIONAL OUTCOMES:

Students will:

- Understand the procedures to follow when simplifying a square root
- Be able to evaluate a numeric or algebraic expression using properties/laws of addition, multiplication, exponents and/or roots
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STUDENT PARTICIPATION *(Lesson steps):*

Students will:

1. Review notes on simplifying square roots
2. Review notes on evaluating expressions following the order of operations.
3. Complete part 1: Simplifying Square Roots
4. Complete part 2: Evaluating Numeric Expressions
5. Complete part 3: Substitution and Evaluation
6. Optional part 4: Identifying properties.
7. Optional: Khan Academy: Simplifying Square Roots.

ACCOMMODATIONS:

For struggling learners:

- Provide a list of perfect squares up to 400 and their square roots
- Provide a calculator to students who struggle with basic math facts
- Reduce the number and complexity of questions asked

For advanced learners:

- Require students to complete part 4 of the handout.

HANDOUTS *(exact names of ALL accompanying handouts)* **& RESOURCES** *(materials, websites, books, etc.)*

- Worksheet parts 1 – 4 Operations with Real Numbers
- Guided Notes on Simplifying Square Roots
- Guided Notes on Order of Operations

EVIDENCE OF LEARNING

Students will demonstrate their:

- Understanding of how to simplify square roots

- By being able to correctly simplify an expression following the properties/laws of addition, multiplication, exponents and radicals.

NOTES FOR ORDER OF OPERATIONS

1. Work inside grouping symbols first beginning with the inner most grouping symbol:

   Grouping symbols include parentheses, brackets, braces, and the fraction bar

2. Exponents – exponents are to be simplified next.

3. Multiplication and division in order from left to right.

4. Addition and subtraction from left to right.

Example 1:

$$25-2\left(12-2\cdot 5\right)^2\div 4+4^3$$

$$25-2\left(12-10\right)^2\div 4+4^3$$

$$25-2\cdot 2^2\div 4+4^3$$

$$25-2\cdot 4\div 4+64$$

$$25-8\div 4+64$$

$$25-2+64$$

$$23+64$$

$$87$$

Example 2:

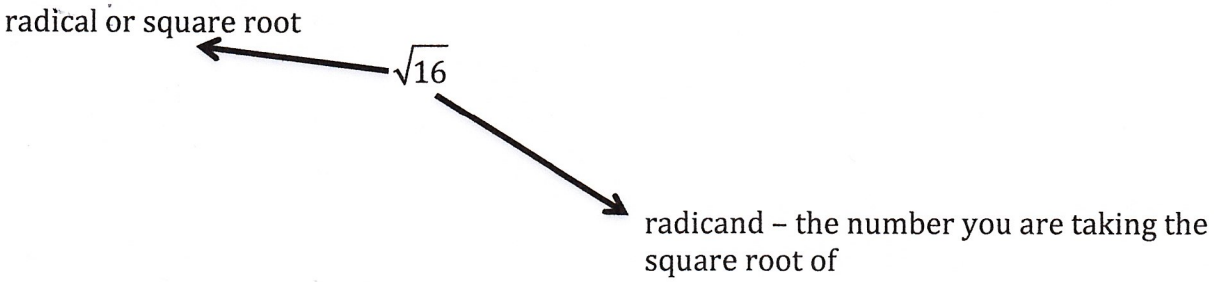
$$\frac{17+2^3}{8-3}$$

$$\frac{17+8}{8-3}$$

$$\frac{25}{5}$$

$$5$$

GUIDED NOTES OF SIMPLIFYING SQUARE ROOTS



Definition: A square root is simplified when:

1) the radicand is not a perfect square

2) no factor of the radicand (other than one) is a perfect square.

Examples when the radicand is a perfect square.

Example 1. $\sqrt{16}=4$ since $4\cdot4=16$ **NOTE:** The radical is not in the answer!!!

Example 2. $\sqrt{121}=11$ since $11\cdot11=121$

Examples when the radicand is not a perfect square.

Example 3. **Steps:**

$\sqrt{24}$

1. Find the largest perfect square the divides into the radicand evenly. Begin with the largest perfect square less than the radicand.

   24 is not evenly divisible by 16
   24 is not evenly divisible by 9
   24 is evenly divisible by 4

$\sqrt{4\cdot6}$

2. Express the radicand as the product of the perfect square and the other factor

$\sqrt{4} \cdot \sqrt{6}$

3. Separate the product into separate radicals.

$2\sqrt{6}$

4. Take the square root of the perfect square and leave the other factor under the radical.

Example 2:

$\sqrt{108}$

Step 1: 100 is the largest perfect square less than 108 so we start here

108 is not evenly divisible by 100
108 is not evenly divisible by 81
108 is not evenly divisible by 64
108 is not evenly divisible by 49
108 **is** evenly divisible by 36

Step 2: $\sqrt{36 \cdot 3}$

Step 3: $\sqrt{36} \cdot \sqrt{3}$

Step 4: $6\sqrt{3}$

Example 3:

$\sqrt{29}$

Step 1: 25 is the largest perfect square less than 29 so we start here.

29 is not evenly divisible by 25
29 is not evenly divisible by 16
29 is not evenly divisible by 9
29 is not evenly divisible by 4

29 **is evenly divisible by 1, however, since there are no other perfect squares that divide evenly into 29, this square root cannot be simplified and the simplest form of** $\sqrt{29}$ **is** $\sqrt{29}$**.**

TO FIND A LIST OF PERFECT SQUARES AND THEIR SQUARE ROOTS: type into google List of perfect squares. Then scroll down to find List of perfect squares for the first 100 number and click on that.

NAME _____ Algebra I: Operations with Real Numbers

Part I: Simplify each of the following radicals completely. Show your work.

1. $\sqrt{75}$ $\sqrt{25 * 3}$ $\sqrt{25} * \sqrt{3}$ $5\sqrt{3}$

1. Find the highest perfect square that the number is divisible by
2. Pull out the square root of the perfect square
3. Keep the other factor inside the square root symbol

2. $\sqrt{16}$

$\sqrt{1} = 1$ since $1^2 = 1$
$\sqrt{4} = 2$ since $2^2 = 4$
$\sqrt{9} = 3$ since $3^2 = 9$
$\sqrt{16} = 4$ since $4^2 = 16$
$\sqrt{25} = 5$ since $5^2 = 25$
$\sqrt{36} = 6$ since $6^2 = 36$
$\sqrt{49} = 7$ since $7^2 = 49$
$\sqrt{64} = 8$ since $8^2 = 64$
$\sqrt{81} = 9$ since $9^2 = 81$
$\sqrt{100} = 10$ since $10^2 = 100$

3. $\sqrt{80}$ $\sqrt{16 * 5}$ $\sqrt{16} * \sqrt{5}$ $4\sqrt{5}$

4. $\sqrt{30}$

5. $\sqrt{32}$

6. $\sqrt{18}$

7. $\sqrt{108}$

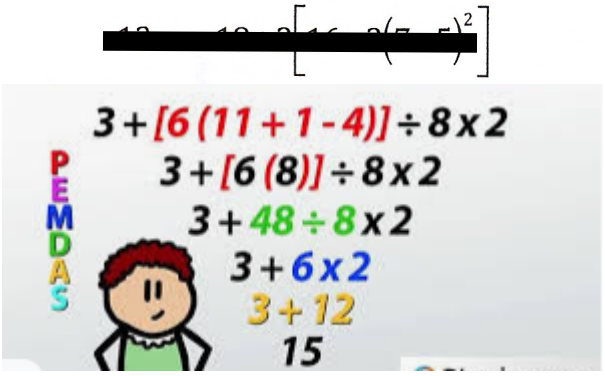
8. $\sqrt{72}$

9. $\sqrt{175}$

10. $\sqrt{12}$

Part 2: Evaluate each of the following using the order of operations. Show your work.

11. $8+9\left(3^2-5\right)-7\cdot 3$



13. $4 \cdot 6 \cdot 2 \div 3 \div 2 + 4 \cdot 8 \div 2 - 4 \cdot 3$

P	Parentheses	( )		
E	Exponents	e^2		
M	Multiplication	×	whichever comes first	
D	Division	÷	Left $M^{\times}$	Right $D^{\div}$
A	Addition	+	whichever comes first	
S	Subtraction	−	Left A^{+}	Right S^{-}

15. $4 \cdot 6 \div 8 \div 3 \cdot 10 \cdot 2 \div 4 - 1$

17. $\dfrac{15 - 2^3 \cdot 2}{1 \quad (15 - 2 \cdot 5)}$

18. $\dfrac{5 \quad 3^2 + 2^3}{2^4 \quad 25 + 2 -}$

Part 3: In each of the following, evaluate the expression when $a = 2$, $b = 5$, $c = 4$, and $d = 10$. Show the substitution and all work.

19. $8a + b$

$8\,(2) + (5)$

$16 + 5$

21

20. $48 + ab$

$48 + (2)(5)$

$48 + 10$

58

21. $a(6-3d)$

22. $bc+ad$

23. c^2-4d

24. $3b+16a-9d$

25. [illegible]

Part 4: Name the property illustrated in each statement.

26. If $a=b$, then $b=a$.

27. If $3x=$ [illegible] then $3x-2$ [illegible] 16.

28. If $a=b$ and b [illegible] c, then $a=c$.

29. $a+0=a$

30. $a\cdot 0=0\cdot a=0$