Just in Time Quick Check

Standard of Learning A2.EO.2

Strand: Expressions and Operations

Standard of Learning A2.EO.2

The student will perform operations on and simplify radical expressions.

Students will demonstrate the following Knowledge and Skills:

a) Simplify and determine equivalent radical expressions that include numeric and algebraic radicands.
b) Add, subtract, multiply, and divide radical expressions that include numeric and algebraic radicands, simplifying the result. Simplification may include rationalizing the denominator.
c) Convert between radical expressions and expressions containing rational exponents.

Just in Time Quick Check

Just in Time Quick Check Teacher Notes

Supporting and Prerequisite SOL: A.EO.4

Just in Time Quick Check A2.EO.2

1. Simplify the expression completely.

$$\sqrt[4]{256a^8b^{16}}$$

2. Rewrite the expression $6^{\frac{1}{5}}x^{\frac{9}{5}}y^{\frac{4}{5}}$ in simplest radical form.

3. What is the simplified radical form of the expression below?

$$2\sqrt{28x^3} + 7x\sqrt[3]{8x} - 2\sqrt[3]{27x^4} + 3x\sqrt{63x}$$

4. Express the product of $-\sqrt[5]{27xy^2}$ and $2\sqrt[5]{9x^4y}$ in simplest radical form.

5. Simplify the expression $(2+\sqrt{5})^2$. Write your answer in simplest radical form.

6. Explain your reasoning to show that $\sqrt[4]{x^2} = \sqrt{x}$ using the definition of the fourth root.

7. Explain your reasoning to show $\sqrt[4]{x^2} = \sqrt[2]{x}$ by rewriting $\sqrt[4]{x^2}$ in exponential form.

A2.EO.2 Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. Simplify the expression completely.

$$\sqrt[4]{256a^8b^{16}}$$

A common error some students may make is calculating the square root of the expression instead of the fourth root. This may indicate that some students do not understand the meaning of the index in a radical expression. Teachers may want to encourage students to circle the index, then make a factor tree and circle the same number of groups of factors that are equivalent to the value of the index. For a fourth root, students should make groups of four factors each. For example, 256 = $2^8 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$ *therefore, students can make two groups of four. Another common error is for students to only simplify part of the radicand (e.g., simplifying 256 but neglecting to simplify* a^8 *or* b^{16}*. Students should be encouraged to check that they have simplified both the numeric and algebraic parts of the radicand.*

2. Rewrite the expression $6^{\frac{1}{5}}x^{\frac{9}{5}}y^{\frac{4}{5}}$ in simplest radical form.

A common error some students may make is to rewrite the expression as a fifth root without fully simplifying. This may indicate that students do not understand that terms with common bases inside the radicand must be simplified according to the root's index. It may also indicate that students do not understand that a radical is in simplest form when the exponent of each base inside the radical is less than the value of the index. Students may benefit from writing the expression in expanded form as $\sqrt[5]{6 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y}$*. This may help students identify that a group of five x terms can be simplified as x because* $\sqrt[5]{x^5} = x$*.*

3. What is the simplified radical form of the expression below?

$$2\sqrt{28x^3} + 7x\sqrt[3]{8x} - 2\sqrt[3]{27x^4} + 3x\sqrt{63x}$$

A common error some students may make is to combine radicals with different indices. This may indicate that students may not understand the meaning of the radical index. Teachers may find it beneficial to have students circle or color-code radicals with the same index to identify which terms can be combined. It may also be helpful to have students create graphic organizers to help outline the steps to adding/subtracting radicals. In addition, it may be beneficial to reinforce the concept that radicals must have the same index before combining by revisiting problems such as $\sqrt{24} + \sqrt[3]{24}$ *prior to simplifying and performing operations on radicals with different indices involving algebraic expressions.*

4. Express the product of $-\sqrt[5]{27xy^2}$ and $2\sqrt[5]{9x^4y}$ in simplest radical form.

A common error some students may make is to correctly multiply the coefficients and radicands but not simplify the resulting expression, resulting in $-2\sqrt[5]{243x^5y^3}$*. This may indicate that some students believe writing the product as a single fifth root is the same as expressing the answer in simplest radical form. Students may benefit from using a graphic organizer to guide them through* *the steps of simplifying each radicand. It may also be helpful to use a factor tree or grouping strategy to ensure all numeric and algebraic factors are fully simplified.*

5. Simplify the expression $(2+\sqrt{5})^2$. Write your answer in simplest radical form.

   A common error some students may make is to only square the first and second term of the binomial resulting in a value of 9. This may indicate that some students do not understand that the expression is equivalent to $\left(2+\sqrt{5}\right)\left(2+\sqrt{5}\right)$ *before applying the distributive property. Students may benefit from writing out each step of their work as* $2(2)+2\sqrt{5}+2\sqrt{5}+\left(\sqrt{5}\right)^2$ *and then circling like terms as they combine them. Teachers may also want to have students compare the difference between* $\left(2+\sqrt{5}\right)\left(2+\sqrt{5}\right)$ *and* $\left(2+\sqrt{5}\right)\left(2-\sqrt{5}\right)$ *to reinforce the importance of signs and the structure of binomial products.*

6. Explain your reasoning to show that $\sqrt[4]{x^2}=\sqrt{x}$ using the definition of the fourth root.

   A common error students may make when simplifying $\sqrt[4]{x^2}$ *is to assume the 4 and the 2 can be simplified resulting in* $\sqrt{x}$ *without justification from the definition. This indicates that students may not understand the meaning of the radical index. Teachers can help by emphasizing the definition of a fourth root using additional guidance such as* $\sqrt[4]{a}=b$ *means* $b\geq 0$ *and* $b^4=a$. *It may also be helpful to reinforce that even-index roots always produce nonnegative results.*

7. Explain your reasoning to show $\sqrt[4]{x^2}=\sqrt[2]{x}$ by rewriting $\sqrt[4]{x^2}$ in exponential form.

   A common error students may make is to ignore domain restriction of fractional exponents. Students forget that $x^{1/2}$ *(or* $\sqrt{x}$*) is defined only for x* ≥ 0 *within real numbers, while* $\sqrt[4]{x^2}$ *is defined for all real values of x. Therefore, two expressions that have the same simplified versions may have different domains. Teachers can help by connecting fractional exponents to radical definitions by explicitly showing that* $x^{m/n}=\sqrt[n]{x^m}$ *where* $x\geq 0$ *when n is even. Teachers should also encourage students to check values to determine where* $\sqrt{x}$ *fails to exist for negative inputs, while* $\sqrt[4]{x^2}$ *exists for both negative and positive inputs.*