2021 MCAS Sample Student Work and Scoring Guide

Grade 10 Mathematics
Question 13: Constructed-Response

Reporting Category: Number and Quantity
Standards: AI.N-RN.A.1, MII.N-RN.A.1 - Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5.
Item Description: Translate between radical and exponential representations of different expressions and create a radical expression based on stated parameters.
Calculator: Not allowed

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Scoring Guide

Select a score point in the table below to view the sample student response.

Score*	Description
4A 4B	The student response demonstrates an exemplary understanding of the Number and Quantity concepts involved in explaining how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. The student constructs and evaluates expressions involving radicals and rational exponents.
3	The student response demonstrates a good understanding of the Number and Quantity concepts involved in explaining how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result, the response merits 3 points.
2	The student response demonstrates a fair understanding of the Number and Quantity concepts involved in explaining how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
1	The student response demonstrates a minimal understanding of the Number and Quantity concepts involved in explaining how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
0	The student response contains insufficient evidence of an understanding of the Number and Quantity concepts involved in explaining how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. As a result, the response does not merit any points.

*Letters are used to distinguish between sample student responses that earned the same score (e.g., 4A and 4B).

Score Point 4A

This question has four parts.

Nora, Owen, and Peyton are studying expressions.

Part A

Nora writes this expression.

$$(\sqrt{3})^2$$

What is the value of Nora's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$$\left(\sqrt{3}\right)^2 = \left(\sqrt{3}\right)\left(\sqrt{3}\right) = \left(\sqrt{9}\right) = 3$$

Part B

Owen writes this expression.

$$\sqrt[3]{2^6}$$

What is the value of Owen's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$$\sqrt[3]{2^6} = \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2} = \sqrt[3]{64} = 4$$

Part C

Owen writes a second expression in this form.

$$\sqrt{x}$$

What value should Owen use for x to make his second expression equivalent to his first expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$$\sqrt{16} = 4$$

Therefore Owen should use 16 as the value of x to make the expressions equivalent.

Part D

Peyton writes a different expression that contains a cube root and an exponent. Peyton's expression is equivalent to **Nora's** expression.

Write an expression that could be Peyton's expression. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$\sqrt[3]{\left(\sqrt{27}\right)^2} = 3$

$\left(\sqrt{27}\right)^2$ is equal to 27 and $\sqrt[3]{27} = 3$, therefore $\sqrt[3]{\left(\sqrt{27}\right)^2} = 3$. This is equivalent to Nora's expression and contains a cube root and an exponent.

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Score Point 4B

This question has four parts.

Nora, Owen, and Peyton are studying expressions.

Part A

Nora writes this expression.

$$(\sqrt{3})^2$$

What is the value of Nora's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

The answer to Nora's expression is 3. I know this because any sqaure root then raised to the power of 2 is going to just be that number. So $\sqrt{3}$ then raised to the power of two is still going to be 3.

Part B

Owen writes this expression.

$$\sqrt[3]{2^6}$$

What is the value of Owen's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

The answer to Owen's expression is 4. I know this because 2^6 is $2 \times 2 \times 2 \times 2 \times 2 \times 2$ which is equivelant to $4 \times 4 \times 4$. So the cubed root of whatever $4 \times 4 \times 4$ is is just going to be 4.

Part C

Owen writes a second expression in this form.

$$\sqrt{x}$$

What value should Owen use for x to make his second expression equivalent to his first expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

Owen should make $x = 16$. I know this because the answer to Part B was 4 so we want the answer to this Part to be 4 as well. $4 \times 4 = 16$ so therefore the squareroot of 16 will be 4, making $x = 16$.

Part D

Peyton writes a different expression that contains a cube root and an exponent. Peyton's expression is equivalent to **Nora's** expression.

Write an expression that could be Peyton's expression. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

One expression that could be Peyton's is $\sqrt[3]{3^3}$. I know this because Nora's expression equals 3 meaning this equation will also have to equal 3 and 3 cubed and then cube rooted will end up just being 3.

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Score Point 3

This question has four parts.

Nora, Owen, and Peyton are studying expressions.

Part A

Nora writes this expression.

$$(\sqrt{3})^2$$

What is the value of Nora's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

The value of Nora's expression is 3. I got this answer because $\left(\sqrt{3}\right)^2$ is the same as $\left(\sqrt{3}\right) \times \left(\sqrt{3}\right)$. This would then equal $\sqrt{9}$ which could then be simplified to 3.

Part B

Owen writes this expression.

$$\sqrt[3]{2^6}$$

What is the value of Owen's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

The value of Owen's expression is 4. I got this answer by first simplifying 2^6 which is equal to 64. Then I did $\sqrt[3]{64}$ which equals 4.

Part C

Owen writes a second expression in this form.

$$\sqrt{x}$$

What value should Owen use for x to make his second expression equivalent to his first expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

If Owen used the value 16 for x then it would make both equations equivalent. I know this because the squareroot of 16 is 4.

Part D

Peyton writes a different expression that contains a cube root and an exponent. Peyton's expression is equivalent to **Nora's** expression.

Write an expression that could be Peyton's expression. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

Peyton's expression could be $\sqrt[3]{12^2}$. I got this answer because it is divisible by 3.

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Score Point 2

This question has four parts.

Nora, Owen, and Peyton are studying expressions.

Part A

Nora writes this expression.

$$(\sqrt{3})^2$$

What is the value of Nora's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

the value of Nora's expression is 3. The square root of 3 to the second power would be the square root of 9, which is 3.

Part B

Owen writes this expression.

$$\sqrt[3]{2^6}$$

What is the value of Owen's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

The value of Owen's expression is the cube root of 128. This is because 2 to the 6th power would be 128 and then the 3 on the outside means to divide by the cube root.

Part C

Owen writes a second expression in this form.

$$\sqrt{x}$$

What value should Owen use for x to make his second expression equivalent to his first expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

128 to the third power so the answer would be the cube root.

Part D

Peyton writes a different expression that contains a cube root and an exponent. Peyton's expression is equivalent to **Nora's** expression.

Write an expression that could be Peyton's expression. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$\sqrt[3]{3^3}$this is equivalent because 3 to the third power equals 27, and then cube rooted would be 3.

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Score Point 1

This question has four parts.

Nora, Owen, and Peyton are studying expressions.

Part A

Nora writes this expression.

$$(\sqrt{3})^2$$

What is the value of Nora's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

3 to the 2nd power is 9 and the root of 9 is 3. 3 is the answer.

Part B

Owen writes this expression.

$$\sqrt[3]{2^6}$$

What is the value of Owen's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

the answer is 128 because 2 to the 6th power is 128.

Part C

Owen writes a second expression in this form.

$$\sqrt{x}$$

What value should Owen use for x to make his second expression equivalent to his first expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

owen should make x = 36 because the square root of 36 is 6 which is equivalent to 3.

Part D

Peyton writes a different expression that contains a cube root and an exponent. Peyton's expression is equivalent to **Nora's** expression.

Write an expression that could be Peyton's expression. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

peyton's expression should be $\sqrt{6^2}$ because this is equals to 3 which is equivilalent to Nora's expression.

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Score Point 0

This question has four parts.

Nora, Owen, and Peyton are studying expressions.

Part A

Nora writes this expression.

$$(\sqrt{3})^2$$

What is the value of Nora's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

it would be 9 because $\sqrt{3} \cdot \sqrt{3}$ is 9

Part B

Owen writes this expression.

$$\sqrt[3]{2^6}$$

What is the value of Owen's expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$2^6 = 12$

$\sqrt[3]{12} = 28$

Part C

Owen writes a second expression in this form.

$$\sqrt{x}$$

What value should Owen use for x to make his second expression equivalent to his first expression? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

owens first expression was equal too 28 so the x value for this eqation should be 56

Part D

Peyton writes a different expression that contains a cube root and an exponent. Peyton's expression is equivalent to **Nora's** expression.

Write an expression that could be Peyton's expression. Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$\sqrt[3]{3^2}$ because the value has to be equal to 9

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