

# 2024 MCAS Sample Student Work and Scoring Guide

## Grade 10 Mathematics

### Question 13: Constructed-Response

**Reporting Category:** Number and Quantity

**Standards:** [AI.N-RN.A.2](#) - Rewrite expressions involving radicals and rational exponents using the properties of exponents.

[MII.N-RN.A.2](#) - Rewrite expressions involving radicals and rational exponents using the properties of exponents.

**Item Description:** Equate various radical expressions to exponential expressions and evaluate a claim based on the properties of exponents.

**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
<a href="#">4A</a>	The student response demonstrates an exemplary understanding of the Number and Quantity concepts involved in rewriting expressions involving radicals and rational exponents using the properties of exponents. The student correctly identifies an equivalent radical expression and evaluates it, determines an equivalent exponential expression, and evaluates a claim based on the properties of exponents.
<a href="#">4B</a>	
<a href="#">3</a>	The student response demonstrates a good understanding of the Number and Quantity concepts involved in rewriting expressions involving radicals and rational exponents using the properties of 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.
<a href="#">2</a>	The student response demonstrates a fair understanding of the Number and Quantity concepts involved in rewriting expressions involving radicals and rational exponents using the properties of exponents. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
<a href="#">1</a>	The student response demonstrates a minimal understanding of the Number and Quantity concepts involved in rewriting expressions involving radicals and rational exponents using the properties of exponents.
<a href="#">0</a>	The student response contains insufficient evidence of an understanding of the Number and Quantity concepts involved in rewriting expressions involving radicals and rational exponents using the properties of 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.**

Three students, Alice, Clive, and Denise, are studying exponential and radical expressions and equations.

**Part A**

Alice writes this expression.

$$64^{\frac{1}{3}}$$

Which of the following is equivalent to the expression?

- A.  $\sqrt{8}$ 
 B.  $\sqrt[3]{8}$   
 C.  $\sqrt{64}$ 
 D.  $\sqrt[3]{64}$

**Part B**

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

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

$$4 \times 4 \times 4 = 64$$

$$4^3 = 64$$

$$4 = \sqrt[3]{64}$$

Alice's expression is equal to 4 because  $4^3$  is 64.

**Part C**

Clive writes this expression.

$$\sqrt[5]{x^7}$$

Clive will rewrite the expression, using a rational exponent, in the form  $x^p$ . What is the value of  $p$  in Clive's rewritten expression? Show or explain how you got your answer.

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

$\frac{7}{5}$  because the 5th root of x is equivalent to x to the  $\frac{1}{5th}$  power, and because the exponents would look like  $(x^7)^{\frac{1}{5}}$ , the exponents would multiply, leaving us with  $x^{\frac{7}{5}}$

**Part D**

Denise writes this equation.

$$(n^{\frac{1}{2}})^{\frac{2}{5}} = n^{\frac{1}{2}} \cdot n^{\frac{2}{5}}$$

Denise claims the equation is true for all positive values of  $n$ . Is Denise's claim correct? Explain your reasoning.

Enter your answer and your explanation in the space provided.

this is not correct because the left side of the equation would equal  $n^{\frac{2}{10}}$  because you are putting  $n$  to multiple exponents, so you multiply them, and the right side would equal  $n^{\frac{9}{10}}$  because two seperate like terms are being multiplied, you would add the exponents. These two values are not equal, so this equation cannot be true for all values of  $n$

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**Score Point 4B**

**This question has four parts.**

Three students, Alice, Clive, and Denise, are studying exponential and radical expressions and equations.

**Part A**

Alice writes this expression.

$$64^{\frac{1}{3}}$$

Which of the following is equivalent to the expression?

- A.  $\sqrt{8}$                        B.  $\sqrt[3]{8}$
- C.  $\sqrt{64}$                        D.  $\sqrt[3]{64}$

**Part B**

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

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

4

$$4^3 = 64$$

Cubes go 1, 8, 27, 64, etc.

**Part C**

Clive writes this expression.

$$\sqrt[5]{x^7}$$

Clive will rewrite the expression, using a rational exponent, in the form  $x^p$ . What is the value of  $p$  in Clive's rewritten expression? Show or explain how you got your answer.

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

$$x^{\frac{7}{5}}$$

The value of P, equals the power of the variable divided by the root.

**Part D**

Denise writes this equation.

$$(n^{\frac{1}{2}})^{\frac{2}{5}} = n^{\frac{1}{2}} \cdot n^{\frac{2}{5}}$$

Denise claims the equation is true for all positive values of  $n$ . Is Denise's claim correct? Explain your reasoning.

Enter your answer and your explanation in the space provided.

Denise is not correct, according to the rules of exponents, when an exponent is raised to the power of another, they are multiplied, in this case, it would give us  $n^{\frac{1}{5}}$ . If the same base is being multiplied by itself, the powers are added, in this case, giving us  $n^{\frac{9}{10}}$ .

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**Score Point 3**

**This question has four parts.**

Three students, Alice, Clive, and Denise, are studying exponential and radical expressions and equations.

**Part A**

Alice writes this expression.

$$64^{\frac{1}{3}}$$

Which of the following is equivalent to the expression?

- A.  $\sqrt{8}$ 
 B.  $\sqrt[3]{8}$   
 C.  $\sqrt{64}$ 
 D.  $\sqrt[3]{64}$

**Part B**

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

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

4 because  $4 \times 4 \times 4 = 64$

**Part C**

Clive writes this expression.

$$\sqrt[5]{x^7}$$

Clive will rewrite the expression, using a rational exponent, in the form  $x^p$ . What is the value of  $p$  in Clive's rewritten expression? Show or explain how you got your answer.

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

$\frac{7}{5}$  because when removing the irrational exponent you get  $(x^7)^{\frac{1}{5}}$  and when the exponents are multiplied you get  $x^{\frac{7}{5}}$ .

**Part D**

Denise writes this equation.

$$(n^{\frac{1}{2}})^{\frac{2}{5}} = n^{\frac{1}{2}} \cdot n^{\frac{2}{5}}$$

Denise claims the equation is true for all positive values of  $n$ . Is Denise's claim correct? Explain your reasoning.

Enter your answer and your explanation in the space provided.

Yes because a positive exponent produces a positive answer.

## Score Point 2

### This question has four parts.

Three students, Alice, Clive, and Denise, are studying exponential and radical expressions and equations.

#### Part A

Alice writes this expression.

$$64^{\frac{1}{3}}$$

Which of the following is equivalent to the expression?

- A.  $\sqrt{8}$ 
 B.  $\sqrt[3]{8}$   
 C.  $\sqrt{64}$ 
 D.  $\sqrt[3]{64}$

#### Part B

What is the value of Alice'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 4. I know this because 4 multiplied by itself is 16, but when you multiply 16 by 4 you get 64.

#### Part C

Clive writes this expression.

$$\sqrt[5]{x^7}$$

Clive will rewrite the expression, using a rational exponent, in the form  $x^p$ . What is the value of  $p$  in Clive's rewritten expression? Show or explain how you got your answer.

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

The value of the expression is  $x^{\frac{7}{5}}$ . I know this because inside of the root, there is a 7, and outside of the root there is a 5. You may simplify the equation to make it simpler and that is what I have done.

#### Part D

Denise writes this equation.

$$(n^{\frac{1}{2}})^{\frac{2}{5}} = n^{\frac{1}{2}} \cdot n^{\frac{2}{5}}$$

Denise claims the equation is true for all positive values of  $n$ . Is Denise's claim correct? Explain your reasoning.

Enter your answer and your explanation in the space provided.

The answer is true. Using 10 as an example, one half of 10 is 5 and  $\frac{2}{5}$  of 10 is 4. In the equation on both sides the two numbers are multiplied together. Therefore the answer would be 20 and both sides of the equation would be true.

**Score Point 1**

**This question has four parts.**

Three students, Alice, Clive, and Denise, are studying exponential and radical expressions and equations.

**Part A**

Alice writes this expression.

$$64^{\frac{1}{3}}$$

Which of the following is equivalent to the expression?

- A.  $\sqrt{8}$ 
 B.  $\sqrt[3]{8}$   
 C.  $\sqrt{64}$ 
 D.  $\sqrt[3]{64}$

**Part B**

What is the value of Alice'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 the equation is 64. It is 64 because you do the square root of 64 which is 8, then square root 8 which is 4, then you multiply  $4^3$ .

**Part C**

Clive writes this expression.

$$\sqrt[5]{x^7}$$

Clive will rewrite the expression, using a rational exponent, in the form  $x^p$ . What is the value of  $p$  in Clive's rewritten expression? Show or explain how you got your answer.

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

$p$  will equal 2 because when you divide exponents you subtract the exponents from the given variables which gives you 2.

**Part D**

Denise writes this equation.

$$(n^{\frac{1}{2}})^{\frac{2}{5}} = n^{\frac{1}{2}} \cdot n^{\frac{2}{5}}$$

Denise claims the equation is true for all positive values of  $n$ . Is Denise's claim correct? Explain your reasoning.

Enter your answer and your explanation in the space provided.

denise is right because the variable  $n$  has to be all true numbers.



**Score Point 0****This question has four parts.**

Three students, Alice, Clive, and Denise, are studying exponential and radical expressions and equations.

**Part A**

Alice writes this expression.

$$64^{\frac{1}{3}}$$

Which of the following is equivalent to the expression?

- A.  $\sqrt{8}$ 
 B.  $\sqrt[3]{8}$   
 C.  $\sqrt{64}$ 
 D.  $\sqrt[3]{64}$

**Part B**

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

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

$$\sqrt{8} = 64$$

**Part C**

Clive writes this expression.

$$\sqrt[5]{x^7}$$

Clive will rewrite the expression, using a rational exponent, in the form  $x^p$ . What is the value of  $p$  in Clive's rewritten expression? Show or explain how you got your answer.

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

the value of  $p = 7$

**Part D**

Denise writes this equation.

$$\left(n^{\frac{1}{2}}\right)^{\frac{2}{5}} = n^{\frac{1}{2}} \cdot n^{\frac{2}{5}}$$

Denise claims the equation is true for all positive values of  $n$ . Is Denise's claim correct? Explain your reasoning.

Enter your answer and your explanation in the space provided.

yes it is correct both of the equations are equal to each other