MATHEMATICS · GRADES 10-12

Converting exponents to radicals

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you rewrite a power as a root. Turning a fractional exponent into a square root sign puts your answer in the form a test or a graph expects. It is the same value written a different way, and being fluent in both forms stops you from losing marks over notation.



Rule

A fractional exponent is a root: $x^{(\frac{m}{n})}$ is the nth root of x^m.

The denominator of the fraction tells you which root to take, and the numerator tells you the power inside. So $x^{(\frac{1}{2})}$ is $\sqrt{x}$.

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Worked examples

EXAMPLE 1

Q Convert $x^{\frac{1}{3}}$ to radical form

SOLUTION

Read the denominator as the root: 3 means cube root.

The numerator is 1, so there is no extra power.

So $x^{\frac{1}{3}} = \sqrt[3]{x}$

EXAMPLE 2

Q Convert $x^{\frac{3}{2}}$ to radical form

SOLUTION

Read the denominator as the root: 2 means square root.

The numerator is 3, so the power inside is 3.

So $x^{\frac{3}{2}} = \sqrt{x^3}$

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Practice questions

1 Write $x^{\frac{1}{2}}$ in radical form.

- **A** $\sqrt[3]{x}$
- **B** $\sqrt{x}$
- **C** x^2
- **D** $\sqrt{x^3}$

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2 Write $x^{\frac{1}{4}}$ in radical form.

- **A** the square root of x
- **B** the fourth root of x
- **C** the cube root of x
- **D** x to the fourth power

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3 Write $x^{\frac{2}{3}}$ in radical form.

A $\sqrt[3]{x^2}$

B $\sqrt{x^2}$

C $\sqrt[3]{x^3}$

D $\sqrt{x^3}$

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4 Write $x^{\frac{5}{2}}$ in radical form.

A $\sqrt{x^2}$

B $\sqrt[3]{x^5}$

C $\sqrt{x^5}$

D $\sqrt{x^3}$

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5 Write $x^{\frac{1}{5}}$ in radical form.

A the fifth root of x

B the square root of x

C the cube root of x

D x to the fifth power

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6 A cube has volume $x^{\frac{3}{2}}$. Its side length is the cube root of its volume. Write the side length in radical form.

A $\sqrt[3]{x}$

B $\sqrt{x^3}$

C $\sqrt[3]{x^2}$

D $\sqrt{x}$

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7 One of these is $\sqrt[3]{x^5}$. Which one?

A $x^{\frac{3}{5}}$

B $x^{\frac{5}{2}}$

C $x^{\frac{5}{3}}$

D $x^{\frac{2}{5}}$

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8 $x^{\frac{1}{2}}$ means $\sqrt{x}$. Why?

A The denominator 2 is the root, so $x^{\frac{1}{2}}$ is $\sqrt{x}$

B The numerator 1 is the root, so $x^{\frac{1}{2}}$ is $\sqrt{x}$

C The denominator 2 is the power, so $x^{\frac{1}{2}}$ is x^2

D The fraction $\frac{1}{2}$ means divide x by 2, so $x^{\frac{1}{2}}$ is $x \div 2$

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9 **Write $x^{\frac{1}{7}}$ in radical form.**

A the fourth root of x

B x to the seventh power

C seven times x

D the seventh root of x

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10 **Three of these are roots of x and one is not. Which one is not a root of x?**

A $x^{\frac{1}{3}}$

B $x^{\frac{2}{2}}$

C $x^{\frac{1}{2}}$

D $x^{\frac{1}{4}}$

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ANSWER KEY

1. $\sqrt{x}$

2. the fourth root of x

3. $\sqrt[3]{x^2}$

4. $\sqrt{x^5}$

5. the fifth root of x

6. $\sqrt{x}$

7. $x^{\frac{5}{3}}$

8. The denominator 2 is the root, so $x^{\frac{1}{2}}$ is $\sqrt{x}$

9. the seventh root of x

10. $x^{\frac{2}{2}}$

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