GRADE 7 ACCELERATED · UNIT 4 · LESSON 5

Evaluating Expressions with Radicals

MA.8.NSO.1.7

I can evaluate an expression that contains square roots, cube roots and integer exponents.

Warm-Up

1. How many significant digits are in 0.0250 ?
2. $(3 \times 10^{4})(2 \times 10^{-7})$
3. Find the value: $\sqrt{196}$
4. Evaluate: $20 - 3 \cdot 4$

Warm-Up

1. How many significant digits are in 0.0250 ? **3**
2. $(3 \times 10^{4})(2 \times 10^{-7})$ **6×10^{-3}**
3. Find the value: $\sqrt{196}$ **14**
4. Evaluate: $20 - 3 \cdot 4$ **8**

Vocabulary

radical

a root symbol together with everything under its bar: $\sqrt{36}$ is a square root, $\sqrt[3]{64}$ is a cube root

radicand

the number under the radical bar. The bar groups it, so whatever is under it is evaluated before the root is taken

principal square root

the nonnegative one. $\sqrt{49}$ is 7 — not −7, and not both, even though $(-7)^2$ is also 49

Notes

I. The radical bar is a grouping symbol

$$\sqrt{25} - \sqrt{36} + \sqrt{1} = 5 - 6 + 1 = 0$$

$$\sqrt{2^3 + 8} = \sqrt{16} = 4$$

$$\sqrt{9 + 16} = \sqrt{25} = 5, \quad \text{never} \quad 3 + 4$$

Everything under the bar is evaluated before the root is taken.

Notes

II. Square roots and cube roots are not the same shape

$$\sqrt{49} = 7 \qquad \sqrt[3]{64} = 4 \qquad \sqrt[3]{-64} = -4$$

$$\sqrt{\frac{1}{9}} = \frac{1}{3} \qquad \sqrt[3]{\frac{1}{125}} = \frac{1}{5}$$

An odd root keeps the sign of its radicand. A square root sign never gives a negative value.

Notes

III. Radicals alongside exponents

$$5^{-3} = \frac{1}{5^3} = \frac{1}{125} \qquad \sqrt{4^3 - 39} = \sqrt{25} = 5$$

$$\sqrt{4^3 - 39} \cdot 5^{-3} = 5 \cdot \frac{1}{125} = \frac{1}{25}$$

Finish each piece — the radical, the power — and only then put them together.

Example 1

$$\left(-\frac{1}{2}\right)^2 + \sqrt{2^3 + 8}$$

Evaluate.

Example 1

$$\left(-\frac{1}{2}\right)^2 = \frac{1}{4}$$

$$\sqrt{2^3 + 8} = \sqrt{16} = 4$$

$$\frac{1}{4} + 4 = \frac{17}{4}$$

Answer: 17/4

Your Turn

$$\left(-\frac{1}{3}\right)^2 - \sqrt[3]{2^2 + 4}$$

Evaluate.

Your Turn

$$\left(-\frac{1}{3}\right)^2 - \sqrt[3]{2^2 + 4}$$

Evaluate.

$$\left(-\frac{1}{3}\right)^2 = \frac{1}{9}$$

$$\sqrt[3]{2^2 + 4} = \sqrt[3]{8} = 2$$

$$\frac{1}{9} - 2 = -\frac{17}{9}$$

Answer: –17/9

Example 2

$$\sqrt[3]{27} - 1.4\left(\sqrt{3^2 - 5}\right)$$

Evaluate.

Example 2

$\sqrt[3]{27} = 3, \qquad 3^2 - 5 = 4$

$\sqrt{4} = 2, \qquad 1.4(2) = 2.8$

$3 - 2.8 = 0.2$

Answer: 0.2

Your Turn

$$\sqrt[3]{-8} + 2.5\left(\sqrt{5^2 - 9}\right)$$

Evaluate.

Your Turn

$$\sqrt[3]{-8} + 2.5\left(\sqrt{5^2 - 9}\right)$$

Evaluate.

$\sqrt[3]{-8} = -2$

$\sqrt{5^2 - 9} = \sqrt{16} = 4$

$-2 + 2.5 \times 4 = -2 + 10 = 8$

Answer: 8

Whiteboards · Question 1 of 9

$$\sqrt{121}$$

Answer it.

Whiteboards · Question 1 of 9

$$\sqrt{121}$$

$11 \times 11 = 121$, so $\sqrt{121} = 11$

Answer: 11

Whiteboards · Question 2 of 9

A square patio has an area of 169 square feet.

Fencing for it costs 12 dollars a foot.

How long is one side of the patio?

Answer it.

Whiteboards · Question 2 of 9

A square patio has an area of 169 square feet.

Fencing for it costs 12 dollars a foot.

How long is one side of the patio?

$$\text{Side} \times \text{side} = 169$$

$$13 \times 13 = 169, \quad \text{so} \quad \sqrt{169} = 13$$

Answer: 13 feet

Whiteboards · Question 3 of 9

$$\sqrt[3]{-125}$$

Answer it.

Whiteboards · Question 3 of 9

$$\sqrt[3]{-125}$$

$$(-5)\times(-5)\times(-5) = -125, \quad \text{so} \quad \sqrt[3]{-125} = -5$$

Answer: −5

Whiteboards · Question 4 of 9

$$\sqrt{2^3 + 17}$$

Answer it.

Whiteboards · Question 4 of 9

$$\sqrt{2^3 + 17}$$

Under the bar first: $2^3 + 17 = 8 + 17 = 25$

$\sqrt{25} = 5$

Answer: 5

Whiteboards · Question 5 of 9

$$\sqrt{25 + 144}$$

Which is the value?

A. 17

B. 169

C. 84.5

D. 13

Answer it.

Whiteboards · Question 5 of 9

$$\sqrt{25 + 144}$$

Which is the value?

Under the bar first: $25 + 144 = 169$

$\sqrt{169} = 13$

Answer: D — 13

Whiteboards · Question 6 of 9

$$\sqrt[3]{-\frac{1}{64}}$$

Which is the value?

A. −1/4

B. not a real number

C. −1/8

D. 1/4

Answer it.

Whiteboards · Question 6 of 9

$$\sqrt[3]{-\frac{1}{64}}$$

Which is the value?

$$\left(-\frac{1}{4}\right) \times \left(-\frac{1}{4}\right) \times \left(-\frac{1}{4}\right) = -\frac{1}{64}$$

so $\sqrt[3]{-\frac{1}{64}} = -\frac{1}{4}$

Answer: A — –1/4

Whiteboards · Question 7 of 9

$$\sqrt{\frac{4}{9}} + \sqrt[3]{\frac{8}{27}}$$

Answer it.

Whiteboards · Question 7 of 9

$$\sqrt{\frac{4}{9}} + \sqrt[3]{\frac{8}{27}}$$

$\sqrt{\frac{4}{9}} = \frac{2}{3}$ and $\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$

$\frac{2}{3} + \frac{2}{3} = \frac{4}{3}$

Answer: 4/3

Whiteboards · Question 8 of 9

$$\sqrt{5^3 - 25} \cdot 10^{-3}$$

Answer it.

Whiteboards · Question 8 of 9

$$\sqrt{5^3 - 25} \cdot 10^{-3}$$

$$\sqrt{5^3 - 25} = \sqrt{125 - 25} = \sqrt{100} = 10$$

$$10^{-3} = \frac{1}{1{,}000}$$

$$10 \times \frac{1}{1{,}000} = \frac{10}{1{,}000} = \frac{1}{100}$$

Answer: 1/100

Whiteboards · Question 9 of 9

Simon says that $\sqrt[3]{-27}$ is not a real number,

because you cannot take the root of a negative.

Explain why he is wrong, and give the value.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Simon says that $\sqrt[3]{-27}$ is not a real number,

because you cannot take the root of a negative.

Explain why he is wrong, and give the value.

A cube root can be negative: three negatives multiply to a negative.

$(-3) \times (-3) \times (-3) = -27$, so $\sqrt[3]{-27} = -3$

Answer: -3

Independent Set

1. $\sqrt{225}$
2. $\sqrt[3]{-1}$
3. $\sqrt{6^2 + 13}$
4. $\sqrt[3]{\frac{1}{8}}$
5. $\sqrt{144} \cdot 2^{-3}$
6. $\left(-\frac{1}{2}\right)^3 + \sqrt{4^2 + 9}$

IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. This skill continues tomorrow: one assignment, due at the start of the class after 4.06.

Today's skills — all required

Evaluate radical expressions — D8J