GRADE 7 ACCELERATED · UNIT 4 · LESSON 6

Order of Operations with Radicals

MA.8.NSO.1.7

I can evaluate a multi-step expression with rational numbers, exponents and radicals by reading its structure.

Warm-Up

1. $\sqrt{5^2 - 9}$
2. How many significant digits are in 1.020 ?
3. Find the value: $\left(\frac{2}{3}\right)^{-2}$
4. Evaluate: $12 \div 3 \cdot 2$

Warm-Up

1. $\sqrt{5^2 - 9}$ **4**
2. How many significant digits are in 1.020 ? **4**
3. Find the value: $\left(\frac{2}{3}\right)^{-2}$ **9/4**
4. Evaluate: $12 \div 3 \cdot 2$ **8**

Vocabulary

grouping symbol

anything that holds part of an expression together and is finished first: parentheses, brackets, the radical bar and the fraction bar

nested

one grouping symbol inside another. The innermost one is finished first

multi-step expression

one that takes more than one operation to evaluate. Everything in this unit takes six steps or fewer

Notes

I. The structure, not a mnemonic

	Level	What it means
1	Grouping symbols	( ), [ ], the radical bar, the fraction bar
2	Powers and roots	the same level as each other
3	Multiply and divide	left to right
4	Add and subtract	left to right

Innermost grouping symbol first, then out.

Notes

II. Left to right means left to right

$$12 \div 3 \cdot 2 = 4 \cdot 2 = 8, \quad \text{never} \quad 12 \div 6 = 2$$

$$10 - 4 + 3 = 6 + 3 = 9, \quad \text{never} \quad 10 - 7 = 3$$

Multiplication and division are one level. Addition and subtraction are one level. Left to right, both times.

Notes

III. The fraction bar groups, top and bottom

$$\frac{2^3 - 5}{6^2 - 27} = \frac{3}{9} = \frac{1}{3}$$

$$\frac{2^3 - 5}{6^2} - \sqrt{\frac{4}{9} - \frac{1}{3}} = \frac{1}{12} - \frac{1}{3} = -\frac{1}{4}$$

Finish the numerator and finish the denominator before you divide.

Example 1

$$4\left(8.63 - (3.2)^2\right) + \sqrt[3]{125}$$

Evaluate.

Example 1

$(3.2)^2 = 10.24$

$8.63 - 10.24 = -1.61, \qquad 4(-1.61) = -6.44$

$-6.44 + 5 = -1.44$

Answer: -1.44

Your Turn

$$3\left(5.4 - (2.1)^2\right) + \sqrt{49}$$

Evaluate.

Your Turn

$$3\left(5.4 - (2.1)^2\right) + \sqrt{49}$$

Evaluate.

Powers and roots: $(2.1)^2 = 4.41$ and $\sqrt{49} = 7$

Inside the parentheses: $5.4 - 4.41 = 0.99$

$3 \times 0.99 + 7 = 2.97 + 7 = 9.97$

Answer: 9.97

Example 2

$$\frac{2^3 - 5}{6^2} - \sqrt{\frac{4}{9} - \frac{1}{3}}$$

Evaluate.

Example 2

$$\frac{2^3 - 5}{6^2} = \frac{3}{36} = \frac{1}{12}$$

$$\frac{4}{9} - \frac{1}{3} = \frac{1}{9}, \qquad \sqrt{\frac{1}{9}} = \frac{1}{3}$$

$$\frac{1}{12} - \frac{1}{3} = -\frac{1}{4}$$

Answer: –1/4

Your Turn

$$\frac{3^2 - 1}{4^2} + \sqrt{\frac{7}{16} - \frac{3}{16}}$$

Evaluate.

Your Turn

$$\frac{3^2 - 1}{4^2} + \sqrt{\frac{7}{16} - \frac{3}{16}}$$

Evaluate.

$$\frac{3^2 - 1}{4^2} = \frac{8}{16} = \frac{1}{2}$$

$$\sqrt{\frac{7}{16} - \frac{3}{16}} = \sqrt{\frac{4}{16}} = \frac{2}{4} = \frac{1}{2}$$

$$\frac{1}{2} + \frac{1}{2} = 1$$

Answer: 1

Whiteboards · Question 1 of 9

$$90 \div 5 \cdot 3$$

Answer it.

Whiteboards · Question 1 of 9

$$90 \div 5 \cdot 3$$

Left to right: $90 \div 5 = 18$

$18 \cdot 3 = 54$

Answer: 54

Whiteboards · Question 2 of 9

A square tile has side $\sqrt{196}$ centimeters.

Its diagonal is about 19.8 centimeters.

What is the perimeter of the tile?

Answer it.

Whiteboards · Question 2 of 9

A square tile has side $\sqrt{196}$ centimeters.

Its diagonal is about 19.8 centimeters.

What is the perimeter of the tile?

$$\sqrt{196} = 14$$

Perimeter: $4 \times 14 = 56$

Answer: 56 centimeters

Whiteboards · Question 3 of 9

$$16 - 5 + 4$$

Answer it.

Whiteboards · Question 3 of 9

$$16 - 5 + 4$$

Left to right: $16 - 5 = 11$

$11 + 4 = 15$

Answer: 15

Whiteboards · Question 4 of 9

$$\frac{3^3 - 21}{5^2 - 15}$$

Answer it.

Whiteboards · Question 4 of 9

$$\frac{3^3 - 21}{5^2 - 15}$$

Top: $3^3 - 21 = 27 - 21 = 6$

Bottom: $5^2 - 15 = 25 - 15 = 10$

$\frac{6}{10} = \frac{3}{5}$

Answer: 3/5

Whiteboards · Question 5 of 9

$$2 + 3 \cdot 4^2$$

Which is the value?

A. 146

B. 50

C. 26

D. 80

Answer it.

Whiteboards · Question 5 of 9

$$2 + 3 \cdot 4^2$$

Which is the value?

Power first: $4^2 = 16$

Then multiply: $3 \cdot 16 = 48$

Then add: $2 + 48 = 50$

Answer: B — 50

Whiteboards · Question 6 of 9

$$\frac{6^2 - 4}{2^3}$$

Which is the value?

A. 4

B. 35.5

C. 0.5

D. 256

Answer it.

Whiteboards · Question 6 of 9

$$\frac{6^2 - 4}{2^3}$$

Which is the value?

Top: $6^2 - 4 = 36 - 4 = 32$

Bottom: $2^3 = 8$

$32 \div 8 = 4$

Answer: A — 4

Whiteboards · Question 7 of 9

$$-2^2 + (-2)^2$$

Answer it.

Whiteboards · Question 7 of 9

$$-2^2 + (-2)^2$$

$-2^2 = -4$ (the exponent is on the 2 only)

$(-2)^2 = 4$

$-4 + 4 = 0$

Answer: 0

Whiteboards · Question 8 of 9

$$12\left(\left(\frac{1}{2}\right)^3 + 3^{-2}\right)$$

Answer it.

Whiteboards · Question 8 of 9

$$12\left(\left(\frac{1}{2}\right)^3 + 3^{-2}\right)$$

$\left(\frac{1}{2}\right)^3 = \frac{1}{8}$ and $3^{-2} = \frac{1}{9}$

$\frac{1}{8} + \frac{1}{9} = \frac{9}{72} + \frac{8}{72} = \frac{17}{72}$

$12 \times \frac{17}{72} = \frac{17}{6}$

Answer: 17/6

Whiteboards · Question 9 of 9

Roscoe says that $\left(\sqrt{n} - 11\right)^2$ is always positive,

because a square is always positive.

Is he right? Give a value of n that settles it.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Roscoe says that $(\sqrt{n} - 11)^2$ is always positive,

because a square is always positive.

Is he right? Give a value of n that settles it.

When $n = 121$: $\sqrt{121} - 11 = 11 - 11 = 0$

$0^2 = 0$, and 0 is not positive.

Answer: No — at n = 121 the value is 0

Independent Set

1. $30 - 4 \cdot 5 + 2$
2. $36 \div 6 \cdot 2$
3. $3 + 5(6 - 2)^2$
4. $\dfrac{5^2 - 1}{2^2 + 2}$
5. $-4^2 + (-4)^2$
6. $\sqrt{100 - 19} + 2^{-2}$

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. Due by the Unit 4 test.

Today's skills — all required

Evaluate radical expressions — D8J