Primary Type: Formative Assessment

Roots and Radicals

Students are asked to solve simple quadratic and cubic equations and represent solutions using square root and cube root symbols.

General Information

Subject(s): Mathematics
Grade Level(s): 8
Intended Audience: Educators

Freely Available: Yes

Keywords: MFAS, perfect square, perfect cube, square root, cube root

Instructional Component Type(s): Formative Assessment

Resource Collection: MFAS Formative Assessments

Attachment

MFAS_RootsAndRadicalsWorksheet.docx
MFAS_RootsAndRadicalsWorksheet.pdf

Formative Assessment Task

Instructions for Implementing the Task
This task can be implemented individually, with small groups, or with the whole class.

1. The teacher asks the student to complete the problems on the Roots and Radicals worksheet.

2. The teacher asks follow-up questions, as needed.

Note: This task assesses the student's ability to evaluate roots of small perfect squares and perfect cubes. Calculators should not be used.
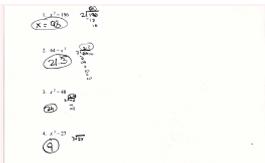
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Getting Started

Misconception/Error

The student does not understand how to solve equations of the form $x^2 = p$ and $x^3 = p$.

Examples of Student Work at this Level

The student divides by two or three instead of taking square roots or cube roots.

Questions Eliciting Thinking

What does it mean to square a number? Can you tell me the value of 5^2?

What does it mean to take a square root? Can you tell me how you would evaluate $\sqrt{16}$?

What does it mean to cube a number? Can you tell me the value of 2^3?

What does it mean to take a cube root? Can you tell me how you would evaluate $\sqrt[3]{27}$?

What does x^2 mean? What operation "undoes" squaring?

What does x^3 mean? What operation "undoes" cubing?

Instructional Implications

Review the meaning of expressions of the form p^2, $\sqrt{q}$, p^3, and $\sqrt[3]{q}$ and how to evaluate each. Emphasize the inverse relationship between squares and square roots and between cubes and cube roots. Use square root and cube root symbols and be sure the student understands the distinction between evaluating roots and dividing. Provide additional practice with evaluating square roots and cube roots of small perfect squares and perfect cubes. Encourage the student to gain a familiarity with square roots and cube roots of small perfect squares and perfect cubes.

Provide instruction on solving equations of the form $x^2 = p$ and $x^3 = p$. Guide the student to use square root and cube root symbols to represent solutions. Assist the student in distinguishing between rational and irrational solutions and ask the student to evaluate any solutions that are rational. Be sure the student understands that equations of the form $x^2 = p$ have two solutions (see Almost There Instructional Implications). Provide additional opportunities to solve equations of the form $x^2 = p$ and $x^3 = p$ and to represent solutions using square root and cube root symbols.

Moving Forward

Misconception/Error

The student is unable to use square root and cube root symbols to represent solutions of equations.

Examples of Student Work at this Level

The student can evaluate roots of small perfect squares and perfect cubes but does not know how to use square root and cube root symbols to represent solutions of equations. The student:

- Does not use radical symbols to represent the solutions of all or most of the equations or writes "irrational" when the solution is not a rational number.
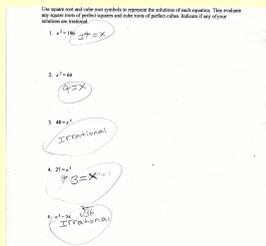
- Does not distinguish between the square root and cube root symbol.

Questions Eliciting Thinking

Do you know how to use square root and cube root symbols to represent the solutions of these equations?

What does a square root or a cube root symbol look like? How can you tell them apart?

Instructional Implications

Review the meaning of the square root and cube root symbols. Model using these symbols to represent solutions of equations. Provide additional opportunities to use square root and cube root symbols to represent solutions of equations and quantities that arise in other mathematical contexts (e.g., the length of the diagonal of a square with sides of length one unit). Be sure to address any misconceptions the student might also have regarding solutions of equations of the form $x^2 = p$ (see Almost There Instructional Implications). Provide additional opportunities to solve equations of the form $x^2 = p$ and $x^3 = p$ and to represent solutions using square root and cube root symbols.

Almost There

Misconception/Error

The student omits the negative roots of equations of the form $x^2 = p$.

Examples of Student Work at this Level

The student can use square root and cube root symbols to represent solutions of equations and can evaluate roots of small perfect squares and perfect cubes. However,

the student does not recognize that equations of the form $x^2 = p$ have two solutions. The student only represents the positive roots.

Questions Eliciting Thinking

Is there another number, which when squared, is equal to 196?

What about 16? What two numbers, when squared, both equal 16?

Instructional Implications

Remind the student that when solving an equation, all possible solutions are identified. Explain that equations of the form $x^2 = p$ typically have two solutions since there are two values that can be squared, one positive and one negative, that result in p. Guide the student to represent solutions using square root symbols. Be sure the student understands that x= $\pm\sqrt{p}$ is equivalent to x= $\sqrt{p}$ or x= $-\sqrt{p}$.

Ask the student to consider equations of the form $x^3 = p$, such as $x^3 = 8$, and to determine if, in addition to 2, -2 is a solution. Be sure the student understands that the cube of p and -p are not equal, [i.e. $2^3 \neq (-2)^3$].

Provide additional opportunities to solve equations of the form $x^2 = p$.

Got It

Misconception/Error

The student provides complete and correct responses to all components of the task.

Examples of Student Work at this Level

The student uses square root and cube root symbols to represent solutions of equations and correctly evaluates roots of small perfect squares and perfect cubes. The student correctly identifies the irrational solutions. The student provides the following answers:

1. x = $\pm\sqrt{196}$, x = 14 or x = -14
2. x = $\sqrt[3]{64}$, x = 4
3. x= $\pm\sqrt{48}$, x is irrational
4. x = $\sqrt[3]{27}$, x = 3
5. x = $\sqrt[3]{36}$, x is irrational

Questions Eliciting Thinking

Does $\sqrt{196}$ represent both 14 and -14? Why or why not?

What is the difference between $x^2 = 196$ and x = $\sqrt{196}$?

Why is $\sqrt[3]{36}$ irrational while $\sqrt{36}$ is rational?

Instructional Implications

Challenge the student to identify the value of p such that the equation $x^2 = p$ has only one solution.

Ask the student to explain why equations of the form $x^3 = p$ have at most one rational solution.

Accommodations & Recommendations

Special Materials Needed:

- Roots and Radicals worksheet

Source and Access Information

Aligned Standards

Name	Description
MAFS.8.EE.1.2:	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.