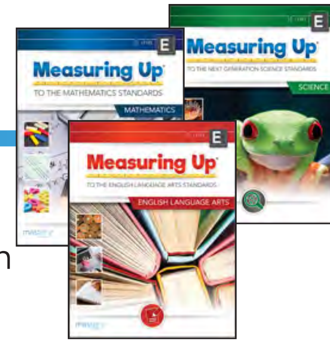
Try It Out! **Sample Pack** | Math | Grade 8 | Lesson 4

Measuring Up to the Standards



The **Try It Out!** sample pack features:

- 1 full student lesson with complete Teacher Edition lesson
- 1 full Table of Contents for your grade level
- Correlation to the standards

Developed to meet the rigor of the standards, ***Measuring Up*** employs support for using and applying critical thinking skills with direct standards instruction that elevate and engage student thinking.

Standards-based lessons feature introductions that set students up for success with:

- ✔ Vocabulary in Action
- ✔ Relevant real-world connections
- ✔ Clearly identified learning goals
- ✔ Connections to prior learning

Guided Instruction and Independent Learning strengthen learning with:

- ✔ Deep thinking prompts
- ✔ Collaborative learning
- ✔ Self-evaluation
- ✔ Demonstration of problem-solving logic
- ✔ Application of higher-order thinking

Flexible design meets the needs of whole- or small-group instruction. Use for:

- ✔ Introducing standards
- ✔ Reinforcement or standards review
- ✔ Intervention
- ✔ Remediation
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CHAPTER 1

WORDS TO KNOW

radical

square root

principal square root

perfect square

cube root

Lesson 4

UNDERSTAND AND EVALUATE SQUARE ROOTS AND CUBE ROOTS 8.EE.A.2

INTRODUCTION

Real-World Connection

Mark is making a square pen for his puppy. He wants the puppy to have 36 square feet of space to play in. He can use square roots to determine the length of one side of the square section so that he can be sure to purchase enough fencing for the pen. Let's practice the skills in **Guided Instruction** and **Independent Practice** to and see how Mark purchases enough fencing!

What I Am Going to Learn

- How to understand and evaluate square roots and cube roots
- How to classify square roots and cube roots as rational or irrational numbers

What I May Already Know 8.NS.A.1, 6.NS.C.6

- I know that numbers that are not rational are irrational.
- I know how to find, position, and order rational numbers on a number line.

Vocabulary in Action

- The symbol $\sqrt{\ }$ is called a **radical**.
- If there is no small number in front of the radical, it represents a **square root**. Finding the square root of a number is the opposite or inverse of squaring a number.
- Every number has a positive and a negative square root. For example, $8^2 = 64$ and $(-8)^2 = 64$, so the square root of 64 is equal to 8 or -8.
- The positive square root of a number is called the **principal square root**. For example, the value of $\sqrt{64}$ is 8, the principal square root, because 8 times 8 equals 64.

THINK ABOUT IT

How can a square root be the inverse of an exponent?

TURN AND TALK

The square roots of perfect squares, like 64, are rational. Are square roots of non-perfect squares, like 65, rational or irrational? Show your partner a number between 10 and 20 that answers this question.

- When you square an integer, the result is a **perfect square**. For example, 64 is a perfect square because it is the result of 8^2 and 8 is an integer.
- A small "3" in front of the radical, such as $\sqrt[3]{a}$, indicates the **cube root** of the number under the radical. Finding the cube root of a number is the inverse of cubing a number. For example, $4^3 = 64$, therefore the cube root of 64, written as $\sqrt[3]{64}$, is 4.

EXAMPLE

Solve the equation $x^2 = 81$.

Take the square root of both sides. $x = \pm 9$

In this equation, you are not being asked for only the principal square root, so the answer is $x = \pm 9$.

TURN AND TALK

When is the cube root of a number positive? When is the cube root of number negative?

EXAMPLE

Solve the equation $x^3 = 125$.

Take the cube root of both sides. $x = \sqrt[3]{125}$

$5 \times 5 \times 5$ *or* $5^3 = 125$

So, $x = 5$.

GUIDED INSTRUCTION

1. **Is $\sqrt{10}$ a rational number?**

Step One Determine if the number under the square root is a perfect square.

10 is not a perfect square.

Step Two Determine if the given number is a rational number.

Since 10 is not a perfect square, $\sqrt{10}$ is not rational, so it is irrational.

TIPS AND TRICKS

Think about what number you can multiply by itself to get the number you are looking for.

2. **Is $\sqrt{144}$ a rational number?**

Step One Determine if the number under the square root is a perfect square.

Because $12^2 = 144$, 144 is a perfect square.

Step Two Determine if the given number is a rational number.

Since 144 is a perfect square, $\sqrt{144}$ is rational.

3. Is $\sqrt{111}$ a rational number?

Step One Determine if the number under the square root is a perfect square.

111 is not a perfect square.

Step Two Determine if the given number is a rational number.

Since 111 is not a perfect square, $\sqrt{111}$ is [ ].

4. Is $\sqrt{1}$ a rational number?

Step One Determine if the number under the square root is a perfect square.

1 is a perfect square because [ ].

Step Two Determine if the given number is a rational number.

Since 1 [ ] a perfect square, $\sqrt{1}$ is [ ].

SKETCH IT

If you are stuck, sketch a square. Try labeling it with whole-number side lengths, and multiplying to find the area.

5. Which of these values could represent the area of a square picture frame with whole-number side lengths? Select the three correct answers.

Ⓐ 49 in.^{2}

Ⓑ 90 in.^{2}

Ⓒ 200 in.^{2}

Ⓓ 64 in.^{2}

Ⓔ 125 in.^{2}

Ⓕ 25 in.^{2}

6. Suppose $x^2 = 2$. Is x a rational number or an irrational number? Explain how you know.

____

____

____

How Am I Doing?

What questions do you have?

How might knowing perfect squares help with measurement?

Why is it important to know the connection between perfect squares and rational and irrational numbers?

TURN AND TALK

Work with a partner or in a small group. Draw a square with a side length that is a natural number {1, 2, 3, …}. Determine the units you will use. Find the area of this square. What are the units for the area of your square? Now draw an isosceles right triangle (right triangle with equal legs) with the same area as the square you drew. What are the dimensions of your triangle? Continue the process but now with a circle. What units will the radius have? What if you were to choose a different two-dimensional figure like a rectangle or a trapezoid? How would this change the difficulty? Discuss with your group any similarities between the figures.

Color in the traffic signal that shows how you are doing with the skill.

INDEPENDENT PRACTICE

Answer the questions.

1. What is the value of $\sqrt{100}$?

Ⓐ 10

Ⓑ 25

Ⓒ 50

Ⓓ The value is an irrational number.

2. Solve for *x*.

$x^3 = -8$

Write your answer in the box.

[ ]

HINT, HINT

Is the number inside the radical a perfect square? If so, then the square root is a rational number.

3. Is the value of the square root a rational number? Choose Yes or No.

a.	$\sqrt{11}$	○ Yes	○ No
b.	$\sqrt{100}$	○ Yes	○ No
c.	$\sqrt{81}$	○ Yes	○ No
d.	$\sqrt{50}$	○ Yes	○ No

4. Circle the number that correctly completes the statement.

The value of $\sqrt[3]{-27}$ is [−9 / −3 / 3 / 9].

5. Which expressions are rational numbers? Select the three correct answers.

Ⓐ $\sqrt{16}$

Ⓑ $\sqrt[3]{9}$

Ⓒ $\sqrt[3]{8}$

Ⓓ $\sqrt{6}$

Ⓔ $\sqrt{99}$

Ⓕ $\sqrt[3]{27}$

6. Draw lines to arrange the roots in order from least value (1) to greatest value (5).

$\sqrt{81}$	1
$\sqrt[3]{64}$	2
$\sqrt[3]{125}$	3
$\sqrt{64}$	4
$\sqrt{169}$	5

7. Use the numbers in the box to make each statement true.

The numbers cannot be used more than once. Write each number in the appropriate box.

4	8	16	64	256

$\sqrt{\square} = \square$ $\sqrt[3]{\square} = \square$

TIPS AND TRICKS

You know from the question that three of the answers are correct. Go through each answer choice and decide which ones could not be correct. Cross those out and test the other answer choices until you find three that are correct.

WORK SPACE

WORK SPACE

8. Solve for *x*.

$x^2 = 441$

Ⓐ ± 20

Ⓑ ± 21

Ⓒ ± 220

Ⓓ ± 221

9. Circle the symbol that correctly completes the statement.

$\sqrt{144}$ [$<$ / $>$ / $=$] $\sqrt[3]{343}$

10. Part A

Classify each number as rational or irrational by writing it in the correct box.

$\sqrt{1}$ $\sqrt[3]{-27}$ $\sqrt[3]{81}$ $\sqrt{2}$ $\sqrt{120}$ $\sqrt[3]{343}$

Rational	Irrational

Part B

Explain how you determined whether each expression was rational or irrational.

____

____

____

____

EXIT TICKET

8.EE.A.2

Now that you have mastered understanding and evaluating square roots and cube roots, let's solve the problem in the Real-World Connection.

Mark is making a square pen for his puppy. He wants the puppy to have 36 square feet of space to play in. He can use square roots to determine the length of one side of the square section so that he can be sure to purchase enough fencing for the pen.

How is the side of the square pen related to the area?

How long is one side of the square pen?

How much fencing will Mark need to purchase?

ANNOTATED
TEACHER EDITION

CONTENTS

Introduction

Chapter 1 NUMBER AND OPERATIONS

Chapter 2 LINEAR EQUATIONS

Chapter 3 FUNCTIONS

CONTENTS

Chapter 4 TRANSFORMATIONS

Chapter 5 GEOMETRY

Chapter 6 BIVARIATE DATA

References

CORRELATIONS

Correlation to the Common Core State Standards

This worktext is customized to the Common Core State Standards for Mathematics.
Most lessons focus on one content standard for in-depth review.
Mathematical Practices are interwoven throughout each lesson to connect practices to content at point-of-use and promote depth of understanding.

Common Core State Standards	Lessons
8.NS The Number System	
A. Know that there are numbers that are not rational, and approximate them by rational numbers.	
1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	1
2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*	2
8.EE Expressions and Equations	
A. Work with radicals and integer exponents.	
1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$.	3
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.	4
3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.*	5
4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	6
B. Understand the connections between proportional relationships, lines, and linear equations.	
5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*	7
6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.	8

Common Core State Standards	Lessons
C. Analyze and solve linear equations and pairs of simultaneous linear equations.	
7. Solve linear equations in one variable.	9, 10
a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).	9
b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	10
8. Analyze and solve pairs of simultaneous linear equations.	11, 12, 13
a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.	11
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.*	11, 12
c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*	13
8.F Functions	
A. Define, evaluate, and compare functions.	
1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	14
2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*	15
3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*	16
B. Use functions to model relationships between quantities.	
4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	17
5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	18

Common Core State Standards	Lessons
8.G Geometry	
A. Understand congruence and similarity using physical models, transparencies, or geometry software.	
1. Verify experimentally the properties of rotations, reflections, and translations:	19
a. Lines are taken to lines, and line segments to line segments of the same length.	19
b. Angles are taken to angles of the same measure.	19
c. Parallel lines are taken to parallel lines.	19
2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	20
3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	21, 22, 23, 24
4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	25
5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*	26, 27
B. Understand and apply the Pythagorean Theorem.	
6. Explain a proof of the Pythagorean Theorem and its converse.	28
7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	29
8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	30
C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.	
9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	31
8.SP Statistics and Probability	
A. Investigate patterns of association in bivariate data.	
1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	32, 33
2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	34

Common Core State Standards	Lessons
3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*	34
4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*	35, 36

CHAPTER 1

WORDS TO KNOW

radical
square root
principal square root
perfect square
cube root

Lesson 4

UNDERSTAND AND EVALUATE SQUARE ROOTS AND CUBE ROOTS 8.EE.A.2

INTRODUCTION

Real-World Connection

Mark is making a square pen for his puppy. He wants the puppy to have 36 square feet of space to play in. He can use square roots to determine the length of one side of the square section so that he can be sure to purchase enough fencing for the pen. Let's practice the skills in Guided Instruction and Independent Practice to and see how Mark purchases enough fencing!

What I Am Going to Learn

- How to understand and evaluate square roots and cube roots
- How to classify square roots and cube roots as rational or irrational numbers

What I May Already Know 8.NS.A.1, 6.NS.C.6

- I know that numbers that are not rational are irrational.
- I know how to find, position, and order rational numbers on a number line.

Vocabulary in Action

- The symbol $\sqrt{\ }$ is called a radical.
- If there is no small number in front of the radical, it represents a square root. Finding the square root of a number is the opposite or inverse of squaring a number.
- Every number has a positive and a negative square root. For example, $8^2 = 64$ and $(-8)^2 = 64$, so the square root of 64 is equal to 8 or -8.
- The positive square root of a number is called the principal square root. For example, the value of $\sqrt{64}$ is 8, the principal square root, because 8 times 8 equals 64.

THINK ABOUT IT

How can a square root be the inverse of an exponent?

TURN AND TALK

The square roots of perfect squares, like 64, are rational. Are square roots of non-perfect squares, like 65, rational or irrational? Show your partner a number between 10 and 20 that answers this question.

- When you square an integer, the result is a perfect square. For example, 64 is a perfect square because it is the result of 8^2 and 8 is an integer.
- A small "3" in front of the radical, such as $\sqrt[3]{a}$, indicates the cube root of the number under the radical. Finding the cube root of a number is the inverse of cubing a number. For example, $4^3 = 64$, therefore the cube root of 64, written as $\sqrt[3]{64}$, is 4.

EXAMPLE

Solve the equation $x^2 = 81$.

Take the square root of both sides. $x = \pm 9$

In this equation, you are not being asked for only the principal square root, so the answer is $x = \pm 9$.

EXAMPLE

Solve the equation $x^3 = 125$.

Take the cube root of both sides. $x = \sqrt[3]{125}$

$5 \times 5 \times 5$ *or* $5^3 = 125$

So, $x = 5$.

TURN AND TALK

When is the cube root of a number positive? When is the cube root of number negative?

GUIDED INSTRUCTION

1. **Is $\sqrt{10}$ a rational number?**

Step One Determine if the number under the square root is a perfect square.

10 is not a perfect square.

Step Two Determine if the given number is a rational number.

Since 10 is not a perfect square, $\sqrt{10}$ is not rational, so it is irrational.

2. **Is $\sqrt{144}$ a rational number?**

Step One Determine if the number under the square root is a perfect square.

Because $12^2 = 144$, 144 is a perfect square.

Step Two Determine if the given number is a rational number.

Since 144 is a perfect square, $\sqrt{144}$ is rational.

TIPS AND TRICKS

Think about what number you can multiply by itself to get the number you are looking for.

3. Is $\sqrt{111}$ a rational number?

Step One Determine if the number under the square root is a perfect square.

111 is not a perfect square.

Step Two Determine if the given number is a rational number.

Since 111 is not a perfect square, $\sqrt{111}$ is [irrational].

4. Is $\sqrt{1}$ a rational number?

Step One Determine if the number under the square root is a perfect square.

1 is a perfect square because [$1^2 = 1$].

Step Two Determine if the given number is a rational number.

Since 1 [is] a perfect square, $\sqrt{1}$ is [rational].

SKETCH IT

If you are stuck, sketch a square. Try labeling it with whole-number side lengths, and multiplying to find the area.

5. Which of these values could represent the area of a square picture frame with whole-number side lengths? Select the three correct answers.

- (A) 49 in.^{2}
- (B) 90 in.^{2}
- (C) 200 in.^{2}
- (D) 64 in.^{2}
- (E) 125 in.^{2}
- (F) 25 in.^{2}

6. Suppose $x^2 = 2$. Is x a rational number or an irrational number? Explain how you know.

To find x, take the square root of both sides: $x = \sqrt{2}$. Since 2 is not a perfect square, it has an irrational square root.

How Am I Doing?

What questions do you have?

How might knowing perfect squares help with measurement?

Why is it important to know the connection between perfect squares and rational and irrational numbers?

TURN AND TALK

Work with a partner or in a small group. Draw a square with a side length that is a natural number {1, 2, 3, …}. Determine the units you will use. Find the area of this square. What are the units for the area of your square? Now draw an isosceles right triangle (right triangle with equal legs) with the same area as the square you drew. What are the dimensions of your triangle? Continue the process but now with a circle. What units will the radius have? What if you were to choose a different two-dimensional figure like a rectangle or a trapezoid? How would this change the difficulty? Discuss with your group any similarities between the figures.

Color in the traffic signal that shows how you are doing with the skill.

INDEPENDENT PRACTICE

Answer the questions.

1. What is the value of $\sqrt{100}$?

   (A) 10
   (B) 25
   (C) 50
   (D) The value is an irrational number.

2. Solve for x.

   $x^3 = -8$

   Write your answer in the box.

   $x = -2$

HINT, HINT

Is the number inside the radical a perfect square? If so, then the square root is a rational number.

3. Is the value of the square root a rational number? Choose Yes or No.

a.	$\sqrt{11}$	○ Yes	● No
b.	$\sqrt{100}$	● Yes	○ No
c.	$\sqrt{81}$	● Yes	○ No
d.	$\sqrt{50}$	○ Yes	● No

4. Circle the number that correctly completes the statement.

   The value of $\sqrt[3]{-27}$ is [−9 / (−3) / 3 / 9].

5. Which expressions are rational numbers? Select the three correct answers.

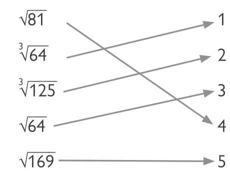
   (A) $\sqrt{16}$
   (B) $\sqrt[3]{9}$
   (C) $\sqrt[3]{8}$
   (D) $\sqrt{6}$
   (E) $\sqrt{99}$
   (F) $\sqrt[3]{27}$

TIPS AND TRICKS

You know from the question that three of the answers are correct. Go through each answer choice and decide which ones could not be correct. Cross those out and test the other answer choices until you find three that are correct.

WORK SPACE

6. Draw lines to arrange the roots in order from least value (1) to greatest value (5).



7. Use the numbers in the box to make each statement true.

   The numbers cannot be used more than once. Write each number in the appropriate box.

4	8	16	64	256

$\sqrt{256} = 16$ $\sqrt[3]{64} = 4$

WORK SPACE

8. Solve for x.

$x^2 = 441$

(A) ± 20

(B) ± 21

(C) ± 220

(D) ± 221

9. Circle the symbol that correctly completes the statement.

$\sqrt{144}$ [< / (>) / =] $\sqrt[3]{343}$

10. Part A

Classify each number as rational or irrational by writing it in the correct box.

$\sqrt{1}$ $\sqrt[3]{-27}$ $\sqrt[3]{81}$ $\sqrt{2}$ $\sqrt{120}$ $\sqrt[3]{343}$

Rational	Irrational
$\sqrt{1}$	$\sqrt{2}$
$\sqrt[3]{-27}$	$\sqrt{120}$
$\sqrt[3]{343}$	$\sqrt[3]{81}$

Part B

Explain how you determined whether each expression was rational or irrational.

Sample answer: If the number inside the radical sign is a perfect square or perfect cube, the expression is rational. If the number is not a perfect square or cube, the expression is irrational.

EXIT TICKET

8.EE.A.2

Now that you have mastered understanding and evaluating square roots and cube roots, let's solve the problem in the Real-World Connection.

Mark is making a square pen for his puppy. He wants the puppy to have 36 square feet of space to play in. He can use square roots to determine the length of one side of the square section so that he can be sure to purchase enough fencing for the pen.

How is the side of the square pen related to the area?

Sample answer: The side of the square pen is the square root of the area.

How long is one side of the square pen?

Sample answer: The area of the pen is 36 square feet, so $s^2 = 36$. You know a length must be a positive number, so the length of each side of the pen must be 6 feet.

How much fencing will Mark need to purchase?

Sample answer: He will need to purchase at least 24 feet of fencing to be able to fence all 4 sides of the square pen, because $6 \times 4 = 24$.

TEACHER NOTES

REAL-WORLD GOAL FOR STUDENTS

- Students will apply knowledge of square roots and cube roots and understand perfect squares.

TIPS FOR THE STRUGGLING LEARNER

- Students may struggle with the idea of square roots. Show students how certain single-digit numbers can be multiplied by themselves to equal that of a perfect square.
- Students may need extra practice with perfect squares and perfect cubes. Allow them time to find the integer, that when multiplied by itself, equals the square root. Letting students use calculators to find all the perfect squares and cubes up to a certain number may help.

TIPS FOR THE ENGLISH LANGUAGE LEARNER

- English learners might assume that any expression with a radical sign is irrational. Emphasize that students must try to simplify the expression before deciding whether the expression is rational or irrational.
- Point out the similarities and differences between a square and a square root. Then point out that the word “square” can refer to a shape, or can refer to an action. Have students discuss.

ACTIVITIES FOR THE ADVANCED LEARNER

- Provide students with note cards that show perfect square roots and integers. Have students match the cards.
- Challenge students to make up their own game by creating their own cards, matching square and cube roots of numbers to “number” words, like *irrational*, *rational*, *positive*, or *negative*.