Alaska AK STAR Grade 8 Math Step by Step

A Beginner Friendly Guide to Learning Math

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PREVIEW

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Published by View Math Education
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Let's learn and have fun!

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CHAPTER

1

Irrational Numbers

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1.1 Rational and Irrational Numbers

What You'll Learn

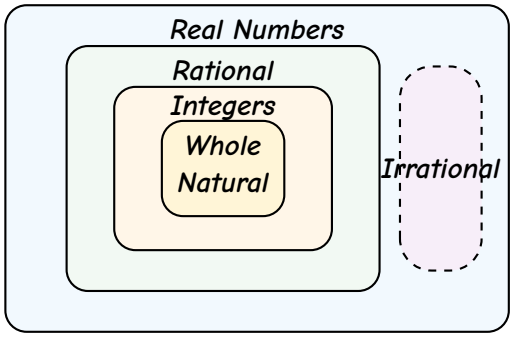
- Classify a real number as rational or irrational
- List all real number subsets a number belongs to

Words to Know

- **Real Number** — Any number on the number line.
- **Integer** — A whole number or its opposite, such as -3, 0, or 8.
- **Whole Number** — 0 or any positive counting number.
- **Natural Number** — A positive counting number such as 1, 2, or 3.

How to Classify a Real Number into Subsets

1. Decide first whether the number is rational or irrational.
2. If it is rational, check whether it is also an integer, a whole number, or a natural number.
3. Remember that every rational number and every irrational number is also a real number.
4. List every set that fits the number, not just one of them.



Example: Classify 7, 0, -3, $\frac{2}{3}$, and $\sqrt{5}$ into all real number subsets.

Step 1 *Decide whether each number is rational or irrational. The numbers 7, 0, -3, and $\frac{2}{3}$ are rational. The number $\sqrt{5}$ is irrational.*

Step 2 *Check the rational numbers more closely. The number 7 is an integer, whole number, and natural number. The number 0 is an integer and whole number. The number -3 is an integer. The number $\frac{2}{3}$ is not an integer.*

Step 3 *Every one of these numbers is real because all rational and irrational numbers are real.*

Step 4 *List every set that fits each number.*

✔ *7: natural, whole, integer, rational, real; 0: whole, integer, rational, real; -3: integer, rational, real; $\frac{2}{3}$: rational, real; $\sqrt{5}$: irrational, real.*

Example: Classify $\sqrt{49}$ and $0.\overline{3}$ into all real number subsets.

Step 1 *Rewrite the numbers in a helpful form: $\sqrt{49} = 7$ and $0.\overline{3} = \frac{1}{3}$.*

Step 2 *Since 7 is a counting number, it fits the natural, whole, integer, rational, and real sets.*

Step 3 *Since $\frac{1}{3}$ is a repeating decimal, it is rational, and all rational numbers are real.*

Step 4 *The decimal $0.\overline{3}$ is not an integer, whole number, or natural number.*

✔ *$\sqrt{49}$ is natural, whole, integer, rational, and real. The number $0.\overline{3}$ is rational and real.*

⚠ ***Watch Out!*** *The number 0 is whole, integer, rational, and real, but it is usually not counted as a natural number in this book.*

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Real Number Subsets Practice

Rational or Irrational

1. Is $\sqrt{49}$ rational or irrational? _____

2. Is $\sqrt{11}$ rational or irrational? _____

List All Subsets

3. Classify -8 into all real number subsets.

_____

4. Classify $0.\overline{3}$ into all real number subsets.

_____

Check Perfect Squares

5. Classify $\sqrt{64}$ into all real number subsets. _____

Use the Diagram Idea

6. A student says every whole number is also rational. Is the student correct? _____

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CHAPTER

2

Lines and Linear Equations

What's Inside

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2.1 Graphing Proportional Relationships

What You'll Learn

- Graph proportional relationships and interpret the unit rate as slope
- Compare proportional relationships shown in different ways

Words to Know

- **Proportional Relationship** — A relationship where $y = kx$ and the line passes through the origin.
- **Unit Rate** — The constant k in $y = kx$; also called the constant of proportionality.

How to Find and Compare Unit Rates

1. Pick any point (x, y) on the line or from the table and divide: $k = \frac{y}{x}$.
2. Write the equation $y = kx$.
3. To compare two relationships, find k for each and see which is larger or smaller.

Example: A car travels 150 miles in 3 hours at constant speed. Find the unit rate and write the equation.

Step 1 $k = \frac{150}{3} = 50$ miles per hour.

Step 2 The equation is $y = 50x$.

Step 3 Not comparing here — just one relationship.

✔ **Unit rate $= \ 50$ mph; equation: $y \ = \ 50x$**

Example: Runner A: $y = 8x$. Runner B covers 35 miles in 5 hours. Who is faster?

Step 1 Runner A: $k = 8$. Runner B: $k = \frac{35}{5} = 7$.

Step 2 Runner A: $y = 8x$. Runner B: $y = 7x$.

Step 3 Compare: $8 > 7$, so Runner A is faster.

✔ **Runner A is faster (8 mph vs. 7 mph).**

A proportional relationship always passes through the origin $(0, 0)$. If it doesn't, it's not proportional!

Graphing Proportional Relationships Practice

Find the Unit Rate

1. A graph passes through $(4, 12)$. What is k? _____

2. A table shows $(5, 20)$. What is k? _____

Write the Equation

3. Store A charges \$3 per pound. Write the equation. _____

Compare

4. Store A: $y = 3x$. Store B charges \$2.50 per pound. Which is cheaper? _____

5. A recipe uses 2 cups of flour for every 3 cookies. How many cups are needed for 12 cookies?

Answer: _____ cups

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