

Virginia SOL Grade 9 Math Step by Step

A Beginner Friendly Guide to Learning Math

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CHAPTER

1

Foundations of Algebra

★ What's Inside ★

1.1 Classifying Real Numbers	2
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★ 1.1 Classifying Real Numbers ★

🎯 Learning Goals

- Classify numbers into all applicable real number subsets
- Describe how the number subsets nest inside each other

🎓 The Real Number Subsets

Every number belongs to one or more subsets of the **real numbers**:

- **Natural numbers:** $1, 2, 3, \dots$ (counting numbers)
- **Whole numbers:** $0, 1, 2, 3, \dots$ (naturals plus zero)
- **Integers:** $\dots, -2, -1, 0, 1, 2, \dots$ (whole numbers and negatives)
- **Rational numbers:** any $\frac{a}{b}$ where a, b are integers and $b \neq 0$
- **Irrational numbers:** decimals that never end and never repeat ($\sqrt{2}, \pi$)

These sets nest like rings in a **Venn diagram**:

Natural \subset Whole \subset Integer \subset Rational \subset **Real**

Irrational numbers sit beside Rational, inside Real. Every real number is either rational **or** irrational—never both.

✏️ Classify Into All Subsets

Place each number in **every** subset that applies.

1. 7: Natural, Whole, Integer, Rational, Real
2. 0: Whole, Integer, Rational ($\frac{0}{1}$), Real
3. -3 : Integer, Rational ($-\frac{3}{1}$), Real
4. $\frac{2}{3} = 0.\overline{6}$: Rational (repeats), Real
5. $0.75 = \frac{3}{4}$: Rational (terminates), Real
6. $\pi = 3.14159\dots$: Irrational, Real
7. $\sqrt{3} = 1.732\dots$: Irrational, Real



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Rational Numbers

- Written as $\frac{a}{b}$, $b \neq 0$
- Decimals terminate or repeat
- Examples: $\frac{3}{4}$, -2 , $0.\overline{6}$

Irrational Numbers

- Cannot be written as $\frac{a}{b}$
- Decimals never terminate or repeat
- Examples: $\sqrt{2}$, π , $\sqrt{10}$



“ Every integer is rational! Write it over 1: $-5 = \frac{-5}{1}$, $0 = \frac{0}{1}$. ”

Classifying Real Numbers

1. Classify -7 into all applicable subsets.
2. Classify $\sqrt{3}$ into all applicable subsets.
3. Classify 0.75 into all applicable subsets.
4. List all subsets for $\sqrt{25}$.
5. Every whole number is also a rational number.

True False



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CHAPTER

2

Introduction to Functions

★ *What's Inside* ★

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★ 2.1 What Is a Function? ★

🎯 Learning Goals

- Decide whether a relation is a function using multiple representations
- Represent relations as ordered pairs, tables, mapping diagrams, and graphs

🎓 What Is a Function?

A **relation** is any set of ordered pairs (x, y) .

A **function** is a relation where every input (x) gives exactly one output (y) . No x -value may repeat with a different y -value.

Ways to represent a relation:

- **Set of ordered pairs:** $\{(1, 4), (2, 5), (3, 6)\}$
- **Table:** inputs in one row, outputs in another
- **Mapping diagram:** arrows from each input to its output
- **Graph:** points or curves on a coordinate plane

A relation is **discrete** if it has separate, countable points. A relation is **continuous** if it has a connected line or curve.

✏️ Checking Multiple Representations

Is the relation $\{(1, 5), (2, 8), (3, 10), (1, 7)\}$ a function?

Ordered pairs: $x = 1$ appears twice with outputs 5 and 7.

Mapping diagram: 1 has two arrows ($1 \rightarrow 5$ and $1 \rightarrow 7$).

One input gives two outputs, so this is **not a function**.



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The Vertical Line Test

- 1 Draw or look at the graph of the relation.
- 2 Slide a vertical line across the graph from left to right.
- 3 If the line ever hits **two or more points**, it is **not** a function.
- 4 If every vertical line hits at most one point, it **is** a function.



“ A function is like a rule: one question, one answer. In a mapping diagram, each input gets exactly one arrow! ”



TIP

Two different inputs **can** share the same output and still be a function. Only repeated inputs with different outputs break the rule.

What Is a Function?

1. Is $\{(2, 4), (3, 6), (4, 8), (5, 10)\}$ a function?
2. Is $\{(1, 3), (2, 5), (1, 7)\}$ a function?
3. A mapping diagram shows $3 \rightarrow 9$, $4 \rightarrow 16$, $5 \rightarrow 9$. Is it a function?
4. Is the relation $\{(1, 2), (3, 4), (5, 6)\}$ discrete or continuous?
5. Every function is a relation.

True False



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Answer Key



Answer Key

Try each problem on your own first, then check your work here.

Chapter 1

> Section 1.1

1 Integer, Rational, Real

2 Irrational, Real

3 Rational, Real

4 Nat, Whole, Int, Rat, Real

5 True

Explanations

1 -7 is negative, so not natural or whole. It is an integer. Since $-7 = \frac{-7}{1}$, it is also rational.

2 3 is not a perfect square. $\sqrt{3}$ is a non-repeating, non-terminating decimal—irrational and real.

3 $0.75 = \frac{3}{4}$, a terminating decimal. Rational and real, but not an integer.

4 $\sqrt{25} = 5$. Since 5 is a counting number, it belongs to every subset except irrational.

Chapter 2



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[> Section 2.1](#)

1 Yes

2 No

3 Yes

4 Discrete

5 True

 Explanations

1 Each input appears only once. Every x -value maps to exactly one y -value.

2 $x = 1$ maps to both 3 and 7. One input gives two outputs.

3 Each input maps to one output. Two inputs may share an output—that is still a function.

4 The relation is a set of separate points. Discrete means individual, countable points.



Well done checking your answers!

Keep practicing to strengthen your skills.

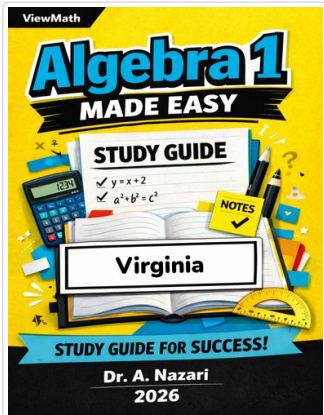


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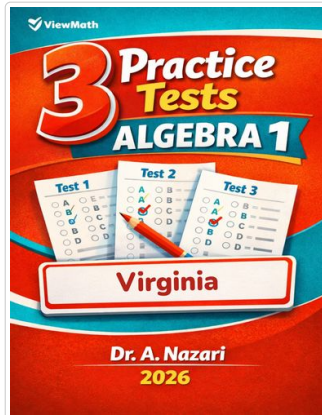
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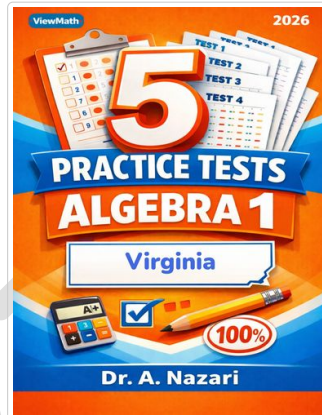
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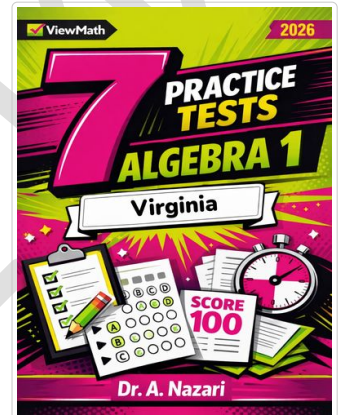
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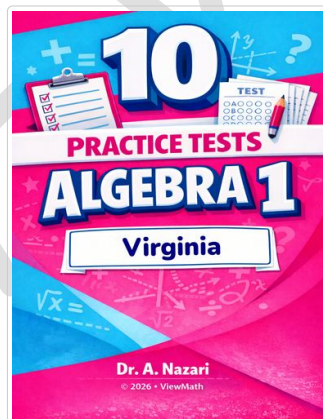
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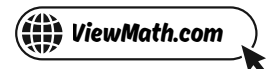
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