

The Real Number System & the Number Line

Algebra Worksheet · Grade 6–9

Name: _____

Date: _____

Learning Objectives

- Classify real numbers as natural, whole, integer, rational, or irrational
- Place and compare real numbers on a number line using inequality symbols
- Identify which subsets of the real numbers a given value belongs to

Problems

1. Which of the following numbers is a natural number? Circle the correct answer: 0, -3, 7, $\frac{1}{2}$

0, -3, 7, $\frac{1}{2}$

2. List ALL the subsets of the real numbers that the number 0 belongs to.

0

3. Fill in the blank: A rational number is any number that can be expressed as a quotient of two integers, where the denominator is ____.

$\frac{a}{b}$, $b \neq$ ____

4. Classify each number below by placing a checkmark in the correct column(s) of the table.

Number	Natural	Whole	Integer	Rational	Irrational	Real
-5						
3						
0.75						
$\sqrt{2}$						

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5. Plot and label the following numbers on the number line: negative 4, negative 1.5, 0, 2, and 3.5. Then list them in order from least to greatest.

Locating Numbers on the Number Line



6. Write the correct inequality symbol (greater than, less than, or equal to) between each pair of numbers.

7. Determine whether the following statement is TRUE or FALSE. Explain your reasoning: 'Every integer is also a rational number.'

Every integer n can be written as $\frac{n}{1}$

8. Identify which numbers from the list below are irrational. Select all that apply: pi, the square root of 9, the square root of 5, 0.333...(repeating), and the square root of 11.

π , $\sqrt{9}$, $\sqrt{5}$, $0.\overline{3}$, $\sqrt{11}$

9. Locate the value of negative 4.8 on the number line. Between which two consecutive integers does it lie? Then write a compound inequality showing its position.

-4.8

10. Use the Venn diagram of the real number system to answer: A student says that the square root of 16 is an irrational number because it contains a square root symbol. Is the student correct? Classify the square root of 16 in ALL appropriate subsets and justify your answer.

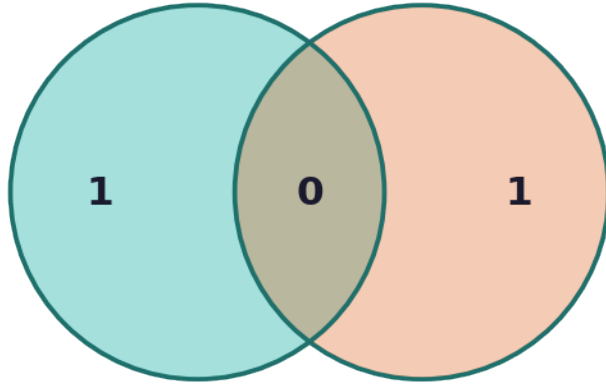
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Rational vs. Irrational Numbers (subsets of Real Numbers)

Rational Numbers

Irrational Numbers



Neither: 0

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The Real Number System & the Number Line — Answer Key

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Answer Key

1. Answer: 7

- Natural numbers are positive counting numbers starting from 1: {1, 2, 3, 4, ...}
- 0 is not a natural number (it is a whole number), -3 is negative, 1/2 is a fraction.
- 7 is a positive whole number starting from 1, so it is a natural number.

2. Answer: Whole numbers, Integers, Rational numbers, Real numbers

- 0 is NOT a natural number (natural numbers start at 1).
- 0 IS a whole number because whole numbers = {0, 1, 2, 3, ...}.
- 0 IS an integer because integers include all whole numbers and their negatives.
- 0 IS rational because $0 = 0/1$ (quotient of integers, denominator $\neq 0$).
- 0 IS a real number because real numbers include all rational numbers.

3. Answer: not equal to zero ($b \neq 0$)

- A rational number has the form a/b where a and b are integers.
- Division by zero is undefined, so the denominator b must not equal zero.
- Therefore the blank is: not equal to zero.

4. Answer: See completed table

Number	Natural	Whole	Integer	Rational	Irrational	Real
-5	No	No	Yes	Yes	No	Yes
3	Yes	Yes	Yes	Yes	No	Yes
0.75	No	No	No	Yes	No	Yes
$\sqrt{2}$	No	No	No	No	Yes	Yes

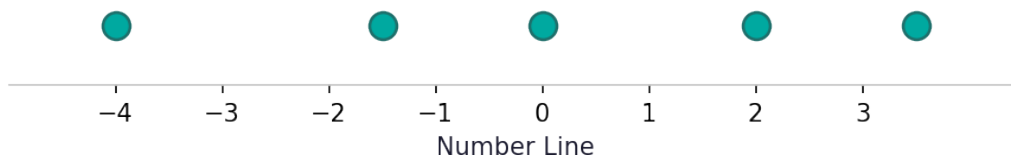
- -5 is a negative integer, so it is an integer, rational, and real number.
- 3 is a positive counting number, so it is natural, whole, integer, rational, and real.
- $0.75 = 3/4$, a fraction of two integers, so it is rational and real only.
- $\sqrt{2}$ cannot be expressed as a ratio of integers, so it is irrational and real only.

5. Answer: $-4 < -1.5 < 0 < 2 < 3.5$

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Locating Numbers on the Number Line



- On a number line, values increase from left to right.
- Negative numbers are to the left of 0; positive numbers are to the right.
- -4 is the furthest left, then -1.5 , then 0 , then 2 , then 3.5 .
- Order from least to greatest: $-4 < -1.5 < 0 < 2 < 3.5$.

6. Answer: (a) $-3 > -7$ (b) $0 > -1$ (c) $4.5 = 9/2$

- (a) On a number line -3 is to the RIGHT of -7 , so $-3 > -7$.
- (b) 0 is to the right of -1 on the number line, so $0 > -1$.
- (c) $9 \div 2 = 4.5$, so $4.5 = 9/2$.

7. Answer: TRUE

- A rational number is any number that can be expressed as a/b where $b \neq 0$.
- Any integer n can be written as $n/1$, which is a quotient of two integers with denominator $1 \neq 0$.
- Therefore every integer is also a rational number. The statement is TRUE.

8. Answer: π , $\sqrt{5}$, and $\sqrt{11}$ are irrational

- $\pi \approx 3.14159\dots$ is non-terminating and non-repeating \rightarrow irrational.
- $\sqrt{9} = 3$, a perfect square \rightarrow rational (it equals the integer 3).
- $\sqrt{5} \approx 2.2360\dots$ is non-terminating and non-repeating \rightarrow irrational.
- $0.333\dots = 1/3$, a repeating decimal \rightarrow rational.
- $\sqrt{11} \approx 3.3166\dots$ is non-terminating and non-repeating \rightarrow irrational.

9. Answer: $-5 < -4.8 < -4$

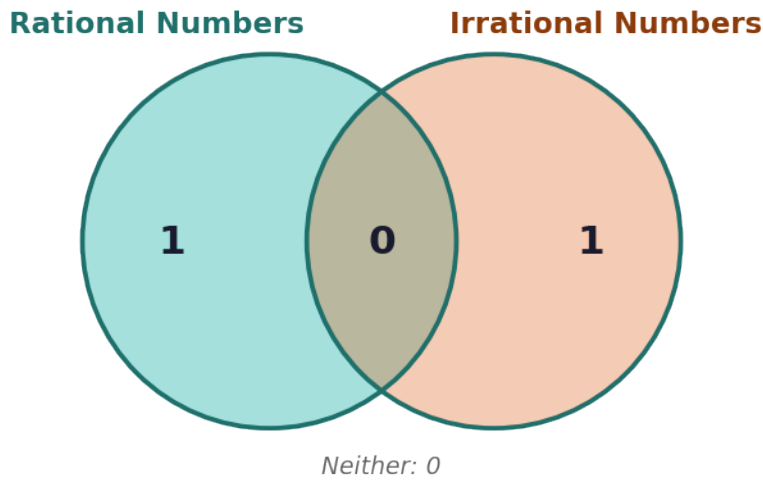
- The integers closest to -4.8 are -5 and -4 .
- Since -4.8 is between -5 and -4 on the number line, we need to check: $-5 < -4.8$ because -5 is further left.
- Also $-4.8 < -4$ because -4.8 is further left than -4 .
- Compound inequality: $-5 < -4.8 < -4$.

10. Answer: The student is INCORRECT. $\sqrt{16} = 4$, which is natural, whole, integer, rational, and real.

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Rational vs. Irrational Numbers (subsets of Real Numbers)



- Evaluate: $\sqrt{16} = 4$ because $4 \times 4 = 16$.
- 4 is a perfect square root, so the result is the integer 4.
- The square root symbol alone does not make a number irrational; what matters is whether the result can be expressed as a ratio of integers.
- $4 = 4/1$, a quotient of integers \rightarrow rational.
- 4 is also natural, whole, integer, and real.
- Rational and irrational numbers are disjoint sets — a number cannot be both.
- Conclusion: The student is INCORRECT. $\sqrt{16} = 4$ is rational, not irrational.

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