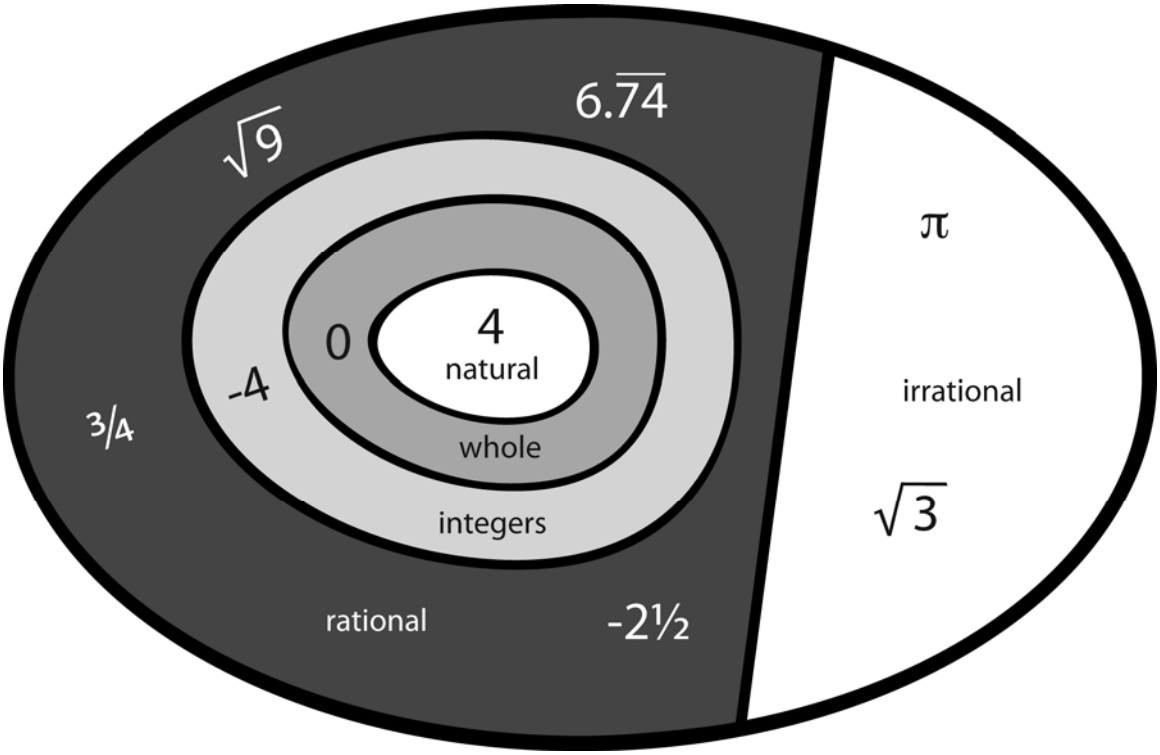
Real Number System

After defining the different subsets of the real number system, students need to use the diagram and/or their notes to answer the questions on the accompanying page. NOTE: The first diagram page has blanks for the students to complete the definitions as they are discussed in class; the second diagram page has the definitions.

NOTE: This is the first introduction of irrational numbers. Although students may have been told that Pi is irrational, they have also used 3.14 or $\frac{22}{7}$ to represent Pi.and often struggle with the idea that it is irrational. One way to counter this is to go to http://www.joyofpi.com/pi.html to show students the first 10,000 digits of Pi.

Real Numbers



Natural Numbers: _____

_____

Whole Numbers: _____

_____

Integers: _____

_____

Rational Numbers: _____

_____

_____

Irrational Numbers: _____

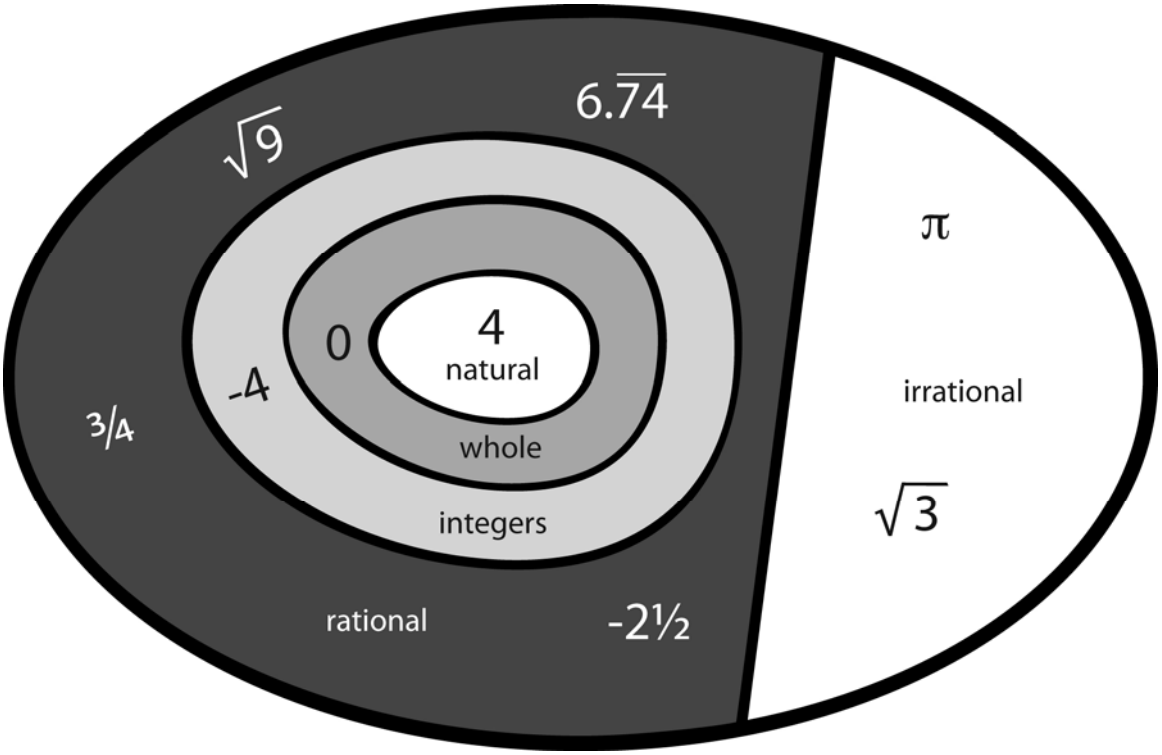
_____

_____

Real Numbers: _____

_____

Real Numbers



Natural Numbers: The counting numbers: {1, 2, 3 …}

Whole Numbers: The set of counting numbers plus zero: {0, 1, 2, 3 …}

Integers: The set of natural numbers and their opposites plus zero:

{…–3, –2, –1, 0, 1, 2, 3 …} The set of integers does not include decimals or fractions.

Rational Numbers: Numbers that can be expressed as the ratio of two integers.

Decimal representations of rational numbers either terminate or repeat.

Examples: 2.375, 4, –0.25, $-0.\overline{14}$

Irrational Numbers: Numbers that cannot be expressed as a ratio of two integers.

Their decimal representations neither terminate nor repeat.

Examples: π, $\sqrt{3}$, 0.14114111411114…

Real Numbers: The set of rational and irrational numbers

Real Number System

1. How are the natural and whole numbers different?
2. How are the integers and rational numbers different?
3. How are the integers and rational numbers the same?
4. How are integers and whole numbers the same?
5. Can a number be both rational and irrational? Use the diagram to explain your answer.

Answer **True** or **False** to the statements below. If the statement is False, explain why.

6. -5 is a rational number. 6. _____
7. 0 is an integer. 7. _____
8. $\sqrt{16}$ is a natural number 8. _____
9. $-3.\overline{25}$ is an integer 9. _____
10. $\sqrt{8}$ is rational 10. _____
11. $\sqrt{7}$ is a Real number 11. _____
12. 18 is a whole number 12. _____
13. $-\frac{2}{3}$ is an integer 13. _____
14. 2.434434443… is a rational number 14. _____
15. 6.57 is an integer 15. _____
16. $5.\overline{7}$ is rational. 16. _____
17. All fractions are rational numbers. 17. _____
18. All integers are whole numbers. 18. _____
19. All irrational numbers are Real numbers. 19. _____
20. All negative numbers are integers. 20. _____

Real Number System Answer Key

1. How are the natural and whole numbers different? *The whole numbers contain 0.*

2. How are the integers and rational numbers different? *The integers are whole numbers while the rational numbers include fractions and decimals.*

3. How are the integers and rational numbers the same? *The rational numbers include all the integers.*

4. How are integers and whole numbers the same? *Both sets of numbers contain the negative and positive whole numbers, and zero.*

5. Can a number be both rational and irrational? Use the diagram to explain your answer. *No. The diagram illustrates this by having the irrational and rational numbers separated.*

Answer **True** or **False** to the statements below. If the statement is False, explain why.

6. -5 is a rational number. — 6. True

7. 0 is an integer. — 7. True

8. $\sqrt{16}$ is a natural number — 8. True

9. $-3.\overline{25}$ is an integer — 9. False; the integers are negative whole numbers.

10. $\sqrt{8}$ is rational — 10. False, the square root of 8 is not a repeating or terminating decimal

11. $\sqrt{7}$ is a Real number — 11. True

12. 18 is a whole number — 12. True

13. $-\frac{2}{3}$ is an integer — 13. False, integers do not include fractions or decimals

14. 2.434434443… is a rational number — 14. False, rational decimals must terminate or repeat

15. 6.57 is an integer — 15. False, integers do not include decimals or fractions

16. $5.\overline{7}$ is rational. — 16. True

17. All fractions are rational numbers. — 17. True

18. All integers are whole numbers. — 18. False, integers include negative whole numbers which are not part of the whole number set.

19. All irrational numbers are Real numbers. — 19. True

20. All negative numbers are integers. — 20. False, negative fractions and decimals are not integers