



The Real Number System

KEY IDEA

Every real number sits inside a family of nested sets. Natural numbers (N) are the counting numbers 1, 2, 3, ... Add zero and you have the whole numbers (W). Add the negatives and you have the integers (Z). Any number you can write as a fraction of two integers is rational (Q) — this includes every terminating and every repeating decimal. Anything that cannot be written as such a fraction is irrational (I). Together, Q and I make up all the real numbers (R).

How to do it

1. Ask first: can this be written as a fraction of two whole numbers? If yes it is rational; if no it is irrational.
2. A square root is rational only when the number under it is a perfect square. $\sqrt{49} = 7$ is rational; $\sqrt{50}$ is not.
3. Work outward from the smallest set that fits, then list every larger set that contains it.
4. Remember the nesting: every natural number is also whole, integer, rational, and real.

Worked examples**Example 1.** $\sqrt{49}$

N, W, Z, Q, R

Example 2. 2.9191...

Q, R

Example 3. $\sqrt{15}$

I, R

Example 4. -7.12

Q, R





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Directions: List every set each number belongs to. Use N, W, Z, Q, I, and R.

1. 34	2. 3.78	3. 41
4. 0	5. 0.5555...	6. 1.7777...
7. $\sqrt{4}$	8. 16	9. $\sqrt{5}$
10. $\sqrt{9}$	11. 60	12. -21
13. -39	14. $\sqrt{144}$	15. 3.6565...
16. -18	17. -34	18. $\sqrt{6}$
19. 0.3333...	20. $\frac{1}{5}$	21. 0.7777...
22. -16	23. -37	24. $\frac{1}{6}$
25. $\sqrt{13}$	26. -28	27. 11
28. $\frac{2}{9}$	29. 3.96	30. π

