

1 Basic Concepts of Algebra

1-1 Real Numbers and Their Graphs

Objective: To graph real numbers on a number line, to compare numbers, and to find their absolute values.

Vocabulary

Real numbers The set consisting of all the rational and irrational numbers.

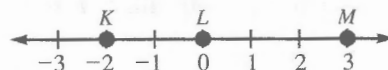
A rational number is the result of dividing an integer by a nonzero integer.

An irrational number is one that is not rational.

Examples of rational numbers: 5 0 -2 6.3 $\frac{4}{7}$ $1.33\dots$

Examples of irrational numbers: π $\sqrt{2}$ $\sqrt{5}$

Coordinate of a point The real number paired with that point on a number line. Example: The coordinate of point M is 3.



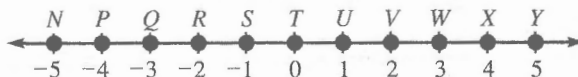
Origin The graph of zero on a number line.

Opposites On a number line, numbers that are the same distance from zero but on opposite sides of it. Example: -2 and 2

Absolute value of a number On a number line, the distance between the graph of the number and zero. Examples: The absolute value of 3 is 3 (write $|3| = 3$). The absolute value of -3 is also 3 (write $|-3| = 3$).

Symbols $-$ (opposite of) $| |$ (absolute value) $>$ (is greater than) $<$ (is less than)

Example 1 Find the coordinate of the point one fourth of the way from S to W on the number line below.



Solution The distance from S to W is 4 units. One fourth of 4 is 1. Move 1 unit to the right of S to find the desired point. The coordinate is 0.

Find the coordinate of each point using the number line in Example 1.

1. Y
2. T
3. U
4. P
5. X
6. N
7. The point halfway between Q and Y
8. The point one fourth of the way from R to V
9. The point two thirds of the way from P to V
10. The point three fourths of the way from Q to W

Example 2 Write each statement using symbols.

- a. Five is greater than negative two.
- b. Negative ten is less than zero.

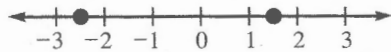
Solution a. $5 > -2$ b. $-10 < 0$

1-1 Real Numbers and Their Graphs (continued)

Write each statement using symbols.

11. Four is less than six. 12. Three is greater than negative three.
 13. Negative two is less than one. 14. Negative one is greater than negative six.
 15. Negative one half is less than zero. 16. Five is greater than negative eleven.

Example 3 Graph the numbers 1.5 and -2.5 on a number line. Then write an inequality statement comparing them. Remember: the numbers increase from left to right.

Solution

$$-2.5 < 1.5, \text{ or } 1.5 > -2.5$$

Graph each pair of numbers on a separate number line. Then write an inequality statement comparing the numbers.

17. -1 and 3 18. 0 and -3 19. $\frac{1}{3}$ and $-\frac{1}{3}$
 20. $-\frac{2}{3}$ and $-\frac{4}{3}$ 21. -1.25 and 0.75 22. -0.75 and -1.5

Example 4 Arrange -3 , 0 , 1.5 , and -2.5 in order from least to greatest.

Solution

First graph the numbers on a number line. Then write the numbers as they appear from left to right.



$$-3, -2.5, 0, 1.5$$

Arrange each list of numbers in order from least to greatest.

23. $4, -2, 0, -3, 2$ 24. $-2.6, -3.2, -1.6, -2.2$ 25. $-\frac{2}{3}, \frac{1}{6}, -1, \frac{1}{3}, -\frac{4}{3}$

Example 5 Find the value of each expression.

a. $-|-14|$ b. $|-8| - |-3|$

Solution

First find the absolute values. Then simplify.

a. $-|-14| = -(14) = -14$

b. $|-8| - |-3| = 8 - 3 = 5$

Find the value of each expression.

26. $|-12|$

27. $-|12|$

28. $|4| - |-1|$

29. $|-7| \cdot 3$

Mixed Review Exercises

Tell whether each statement is true or false.

1. $2\frac{2}{3} - \frac{1}{2} > 2$

2. $\frac{5}{4} \div \frac{1}{2} = \frac{5}{2}$

3. $\frac{1}{4} + \frac{3}{5} = \frac{4}{9}$

4. $34.6 + 5.23 = 86.9$

5. $0.3 \times 0.2 < 0.6$

6. $10 \times 0.01 < 1$