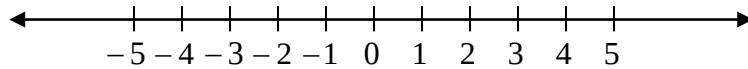


REAL NUMBERS, THE NUMBER LINE, ORDER RELATIONS, AND ABSOLUTE VALUE

When talking about numbers, there are different types of categories in which digits can be classified. The graphical representation of numbers is called the **number line**.



Integers are whole numbers; that is, numbers that contain no decimal point or numbers that are not in fraction form.

Example: ... , -4, -3, -2, -1, 0, 1, 2, 3, ...

Integers are classified as positive or negative. **Positive integers** are numbers that contain no negative sign. These numbers are placed to the right of zero on the number line. **Negative integers** are numbers that contain a negative sign; these are placed to the left of zero on the number line. Zero is neither positive or negative.

Examples: Positive integers: 1, 2, 3, 4, 5, ...

Negative integers: -1, -2, -3, -4, -5, ...

Even integers are those integers which can be evenly divided by 2. Those integers which cannot be evenly divided by 2 are called **odd integers**.

Examples: Even integers: 2, 4, 8, 10, 12, -24

Odd integers: 3, 7, 15, 21, 25, -27

Prime numbers are integers that are greater than 1, but that are not divisible by any integer other than themselves and 1.

Examples: Prime integers: 2, 5, 7, 17, 19, 23, 29

When numbers are presented in the form of a fraction they are called **rational numbers**. When a number cannot be represented in fraction form this number is called an **irrational number**.

Examples: Rational numbers: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{8}$

Irrational numbers: $\pi, \sqrt{2}, \sqrt{3}$

When comparing any two real numbers, refer to the number line to see which number is greater or smaller. The number to the left is always the smaller number; while the number to the right is always the greater number of the two. This comparison is called **order relations**.

Examples:

$$\begin{array}{ll} 1 > -1 & -15 < 15 \\ 8 > 0 & -2 > -6 \\ 3 < 9 & -5 < -4 \end{array}$$

If comparing two fractions, it is always easier to convert the fraction into a decimal and then compare. Decimals are easier to compare than fractions.

Examples:

$$\begin{array}{l} \frac{1}{2} < \frac{5}{6} \rightarrow 0.50 < 0.833 \\ \frac{3}{8} > \frac{3}{4} \rightarrow 0.375 > 0.75 \end{array}$$

The **absolute value** of a number is always the positive value of that number. Since the absolute value is the distance of a number from the origin, and since distances are always positive, the absolute value is always a positive value.

Examples:

$$\begin{array}{ll} |3| = 3 & |-3| = 3 \\ \left| -\frac{3}{4} \right| = \frac{3}{4} & |-0.25| = 0.25 \end{array}$$

Reciprocals

The reciprocal of a number is the number to which the first number is multiplied against and the yield is one.

For example,

$$\begin{array}{l} 5 \cdot \frac{1}{5} = 1 \\ -4 \cdot \frac{-1}{4} = 1 \\ x \cdot \frac{1}{x} = 1 \end{array}$$

The reciprocal of 5 is $\frac{1}{5}$

The reciprocal of -4 is $-\frac{1}{4}$

The reciprocal of x is $\frac{1}{x}$

Just the same way, the reciprocal of $\frac{1}{x}$ is: x.

**REAL NUMBERS, THE NUMBER LINE, ORDER RELATIONS, AND ABSOLUTE
VALUE – EXERCISES**

1. For the set $\{-1, 0, \frac{1}{2}, 4.3, \sqrt{7}, \pi, -\pi, 1, 7, -18, -\sqrt{2}, \frac{7}{8}, -1.8, 3\}$ list all of the

- | | |
|-----------------------|------------------------|
| (a) counting numbers | (e) real numbers |
| (b) integers | (f) irrational numbers |
| (c) negative integers | (g) even numbers |
| (d) rational numbers | (h) prime numbers |

2. Locate the following numbers on a number line:

- | | | |
|--------------------|-------------------|---------|
| (a) 4 | (b) $\frac{3}{4}$ | (c) -3 |
| (d) $-\frac{1}{2}$ | (e) -2.7 | (f) 4.1 |

3. Fill in the appropriate sign (< or >):

- | | | |
|----------------|---------------|---------------|
| (a) 5 ____ 1 | (b) -1 ____ 3 | (c) 0 ____ -2 |
| (d) -3 ____ -7 | (e) -2 ____ 6 | (f) 5 ____ -4 |

4. Express the following without absolute value symbols:

- | | | |
|------------|-------------|---------------------------------|
| (a) $ 8 $ | (b) $ -1 $ | (c) $\left \frac{-8}{9}\right $ |
| (d) $- 3 $ | (e) $- -5 $ | (f) $ \sqrt{-2} $ |

5. What is the reciprocal of $-\frac{5}{4}$?

6. Which real number has no reciprocal?

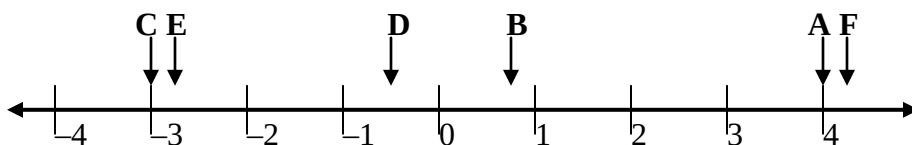
7. Which two real numbers are their own reciprocals?

8. What is the reciprocal of $\sqrt{2}$?

**REAL NUMBERS, THE NUMBER LINE, ORDER RELATIONS, AND ABSOLUTE
VALUE –
ANSWERS TO EXERCISES**

1. (a) 1, 7, 3 (e) All numbers in the set are real numbers.
 (b) -1, 0, 1, 7, -18, 3 (f) $\sqrt{7}, \pi, -\pi, -\sqrt{2}$
 (c) -1, -18 (g) 0, -18
 (d) $-1, 0, \frac{1}{2}, 4.3, 1, 7, -18, \frac{7}{8}, -1.8, 3$ (h) 7, 3

2.



- (a) 4 (b) $\frac{3}{4} = 0.75$ (c) -3 (d) $-\frac{1}{2} = 0.5$ (e) -2.7
 (f) 4.1

3. (a) $5 > 1$ (b) $-1 < 3$ (d) $-3 > -7$
 (e) $-2 < 6$ (c) $0 > -2$ (f) $5 > -4$

4. (a) $|8| = 8$ (b) $|-1| = 1$ (d) $-|3| = -3$
 (e) $-|-5| = -5$ (c) $\left|-\frac{8}{9}\right| = \frac{8}{9}$ (f) $|\sqrt{2}| = \sqrt{2}$

5. $-\frac{4}{5}$

6. 0

7. 1, -1

8. $\frac{1}{\sqrt{2}}$