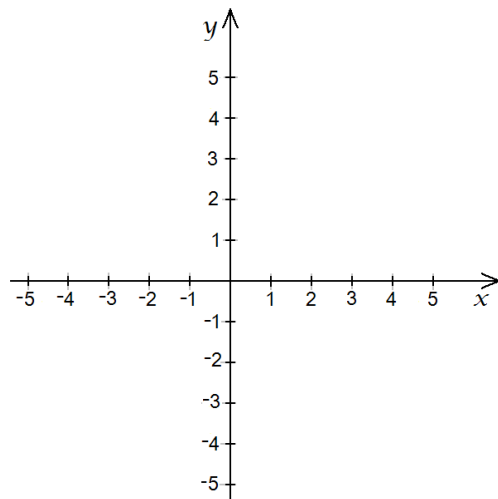
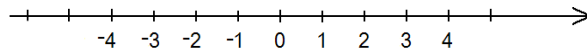


In mathematics, we often deal with algebraic objects such as numbers and equations. We also deal with geometric objects such as lines, points, or triangles. The relationship between things of algebraic and geometric nature is an important recurring theme within mathematics. We will discuss how algebraic properties manifest geometrically and vice versa. The beautiful and fascinating relationship between geometry and algebra starts with the concept of the number line.

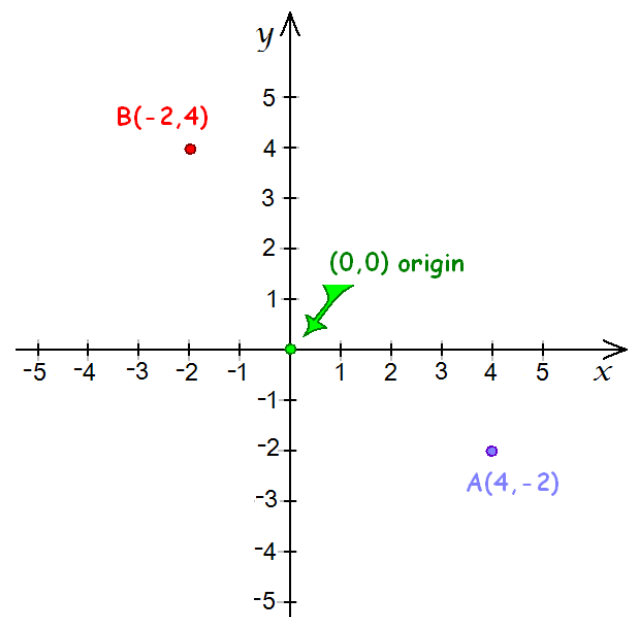
There is a one-to-one correspondence between the set of all real numbers and the set of points on a straight line. In other words, for every real number, there exists exactly one point on the line; and for every point on the line, there exists exactly one real number. We display this correspondence using the **number line**, representing the set of all real numbers.



When we use two identical copies of the real number line, we create a **rectangular coordinate system**. This type of a coordinate system is also called a **Cartesian coordinate system**, after French mathematician and philosopher René Descartes who published this idea first in 1637. The horizontal line is called the **x-axis**, and the vertical line the **y-axis**. The arrows on the axes indicate the positive direction.

Every point in the plane can be uniquely described by an **ordered pair of real numbers** such as  $(4, -2)$ . The first number in the pair describes the **x-coordinate** (or horizontal address) of the point. The second number in the pair describes the **y-coordinate** (or vertical address) of the point. The word *ordered* is important since  $A(4, -2)$  and  $B(-2, 4)$  are different points. The point  $(0, 0)$ , where the two axes intersect each other, is called the **origin**.

Suprising facts: the **x-axis** is the set of all points whose **y-coordinate** is zero. Similarly, the **y-axis** is the set of all points whose **x-coordinate** is zero.



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