



A group of ordered pairs in the form of a set is called a relation. For example, all the sets below are relations.

$$S = \{(-3, 5), (6, 21), (63, -12), (0, 0), (21, -21)\}$$

$$T = \{(0, -21), (21, 0), (-92, 89), (-32, 75), (4, 5)\}$$

$$U = \{(a, b), (-a, c), (-d, c), (-b, -a)\}$$

The set of all the first elements of the pairs of a relation is called the domain of the relation. The domains of S, T, and U are as below.

$$\text{Domain of } S = \{-3, 6, 63, 0, 21\}$$

$$\text{Domain of } T = \{0, 21, -92, -32, 4\}$$

$$\text{Domain of } U = \{a, -a, -d, -b\}$$

The set of all the second elements of the pairs of a relation is called its range. The ranges of the above relations are as follows.

$$\text{Range of } S = \{5, 21, -12, 0, -21\}$$

$$\text{Range of } T = \{-21, 0, 89, 75, 5\}$$

$$\text{Range of } U = \{b, c, -a\}$$

Practice 3

Determine domain and range of each relation.

$$D = \{(a, ab), (-a, cd), (d, ad)\}$$

$$E = \{(-11, b), (-3, m), (m, -21), (a, 21)\}$$

$$F = \{3, 2a), (2a, -3), (-3, 4a), (5, -4a)\}$$



Solution

Domain of $D = \{a, -a, d\}$

Range of $D = \{ab, cd, ad\}$

Domain of $E = \{-11, -3, m, a\}$

Range of $E = \{b, m, -21, 21\}$

Domain of $F = \{3, 2a, -3, 5\}$

Range of $F = \{2a, -3, 4a, -4a\}$

Practice 4

Write a relation whose domain and range are $\{1, 2, 3\}$ and $\{5, 6, 7\}$, respectively.

Solution

$\{(1, 5), (1, 6), (1, 7), (2, 5), (2, 6), (2, 7), (3, 5), (3, 6), (3, 7)\}$

Practice 5

The coordinates of points A , B , C , and D form a relation called S (Figure 10.6). Find the domain and the range of S .

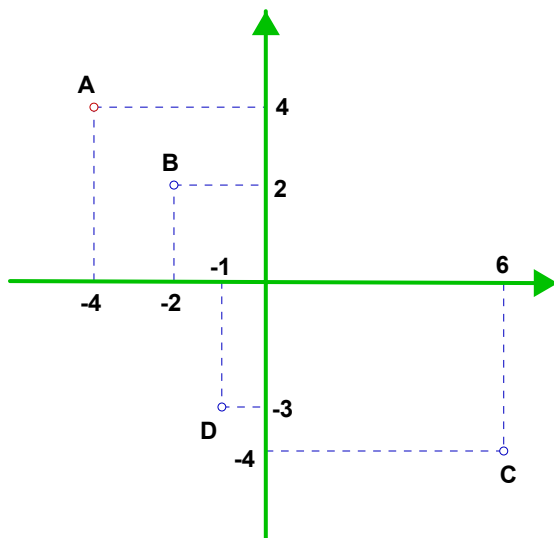


Figure 10.6



Solution

Domain of S = $\{-4, -1, -2, 6\}$

Range of S = $\{-4, -3, 2, 4\}$

Practice 6

In which relation the domain and the range are the same?

$$A = \{(-2, 2), (3, -3), (4, -4)\}$$

$$B = \{(5, 5), (6, 6), (1, 1)\}$$

$$C = \{(3, 6), (6, 3), (5, -6)\}$$

$$D = \{(1, 2), (2, 3), (3, 4), (4, 1)\}$$

Answer

In relations B and D

Practical Exercise 2

Find domain and range of each relation.

$$K = \{(a, a + b), (c, c + d), (a - b, a)\}$$

$$L = \{(-2, m), (m, 2), (n, 3), (3, n)\}$$

$$M = \{(x, 2y), (3x, 6y), (-x, -2y), (0, 0)\}$$

$$N = \{(5, 5a), (6, 12a), (7a, 14a)\}$$

Answer

Domain of K = $\{a, c, a - b\}$

Range of K = $\{a + b, c + d, a\}$

Domain of L = $\{-2, m, n, 3\}$

Range of L = $\{m, 2, 3, n\}$

Domain of M = $\{x, 3x, -x, 0\}$

Range of M = $\{2y, 6y, -2y, 0\}$

Domain of N = $\{5, 6, 7a\}$

Range of N = $\{5a, 12a, 14a\}$