Exercise 2.3                                                                          Page No: 44

**1. Which of the following relations are functions? Give reasons. If it is a function, determine its domain and range.**
**(i) {(2, 1), (5, 1), (8, 1), (11, 1), (14, 1), (17, 1)}**
**(ii) {(2, 1), (4, 2), (6, 3), (8, 4), (10, 5), (12, 6), (14, 7)}**
**(iii) {(1, 3), (1, 5), (2, 5)}**
**Solution:**

(i) {(2, 1), (5, 1), (8, 1), (11, 1), (14, 1), (17, 1)}
As 2, 5, 8, 11, 14, and 17 are the elements of the domain of the given relation having their unique
images, this relation can be called as a function.
Here, domain = {2, 5, 8, 11, 14, 17} and range = {1}

(ii) {(2, 1), (4, 2), (6, 3), (8, 4), (10, 5), (12, 6), (14, 7)}
As 2, 4, 6, 8, 10, 12, and 14 are the elements of the domain of the given relation having their unique
images, this relation can be called as a function.
Here, domain = {2, 4, 6, 8, 10, 12, 14} and range = {1, 2, 3, 4, 5, 6, 7}

(iii) {(1, 3), (1, 5), (2, 5)}
It's seen that the same first element i.e., 1 corresponds to two different images i.e., 3 and 5, this relation
cannot be called as a function.

**2. Find the domain and range of the following real function:**
**(i) $f(x) = -|x|$            (ii) $f(x) = \sqrt{(9 - x^2)}$**
**Solution:**

(i) Given,
$f(x) = -|x|$, $x \in R$
We know that,

$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

$$\therefore f(x) = -|x| = \begin{cases} -x, & x \geq 0 \\ x, & x < 0 \end{cases}$$

As $f(x)$ is defined for $x \in R$, the domain of $f$ is R.
It is also seen that the range of $f(x) = -|x|$ is all real numbers except positive real numbers.
Therefore, the range of $f$ is given by $(-\infty, 0]$.

(ii) $f(x) = \sqrt{(9 - x^2)}$
As $\sqrt{(9 - x^2)}$ is defined for all real numbers that are greater than or equal to $-3$ and less than or equal to
3, for $9 - x^2 \geq 0$.
So, the domain of $f(x)$ is {$x$: $-3 \leq x \leq 3$} or $[-3, 3]$.
Now,
For any value of $x$ in the range $[-3, 3]$, the value of $f(x)$ will lie between 0 and 3.
Therefore, the range of $f(x)$ is {$x$: $0 \leq x \leq 3$} or $[0, 3]$.

**3. A function $f$ is defined by $f(x) = 2x - 5$. Write down the values of**
**(i) $f(0)$,          (ii) $f(7)$,          (iii) $f(-3)$**
**Solution:**

Given,
Function, $f(x) = 2x - 5$.
Therefore,
(i) $f(0) = 2 \times 0 - 5 = 0 - 5 = -5$
(ii) $f(7) = 2 \times 7 - 5 = 14 - 5 = 9$
(iii) $f(-3) = 2 \times (-3) - 5 = -6 - 5 = -11$

**4. The function '$t$' which maps temperature in degree Celsius into temperature in degree Fahrenheit is**

**defined by** $t(C) = \dfrac{9C}{5} + 32$ **.**

**Find (i) $t(0)$     (ii) $t(28)$        (iii) $t(-10)$        (iv) The value of C, when $t(C) = 212$**
**Solution:**

Given function, $t(C) = \dfrac{9C}{5} + 32$
So,

(i) $t(0) = \dfrac{9 \times 0}{5} + 32 = 0 + 32 = 32$

(ii) $t(28) = \dfrac{9 \times 28}{5} + 32 = \dfrac{252 + 160}{5} = \dfrac{412}{5}$

(iii) $t(-10) = \dfrac{9 \times (-10)}{5} + 32 = 9 \times (-2) + 32 = -18 + 32 = 14$

(iv) Given that, $t(C) = 212$

$\therefore 212 = \dfrac{9C}{5} + 32$

$\Rightarrow \dfrac{9C}{5} = 212 - 32$

$\Rightarrow \dfrac{9C}{5} = 180$

$\Rightarrow 9C = 180 \times 5$

$\Rightarrow C = \dfrac{180 \times 5}{9} = 100$

Therefore, the value of $t$ when $t(C) = 212$, is 100.

**5. Find the range of each of the following functions.**
**(i) $f(x) = 2 - 3x, x \in R, x > 0$.**
**(ii) $f(x) = x^2 + 2$, $x$ is a real number.**
**(iii) $f(x) = x$, $x$ is a real number.**

**Solution:**

(i) Given,
f(x) = 2 – 3$x$, $x$ ∈ R, $x$ > 0.
We have,
x > 0
So,
3x > 0
-3x < 0          [Multiplying by -1 both the sides, the inequality sign changes]
2 – 3x < 2
Therefore, the value of 2 – 3x is less than 2.
Hence, Range = (–∞, 2)

(ii) Given,
$f(x) = x^2 + 2$, $x$ is a real number
We know that,
$x^2 \geq 0$
So,
$x^2 + 2 \geq 2$       [Adding 2 both the sides]
Therefore, the value of $x^2 + 2$ is always greater or equal to 2 for x is a real number.
Hence, Range = [2, ∞)

(iii) Given,
$f(x) = x,$ $x$ is a real number
Clearly, the range of $f$ is the set of all real numbers.
Thus,
Range of $f$ = R