

**Relation**

- Given the domain  $[-1, 2]$  and the relation containing ordered pairs of the form  $(x, y)$  such that  $y = x + 1$ . Represent the relation by a list.
- List the following relations which have ordered pairs in form  $(x, y)$ 
  - $y = x^2$ , the domain is  $\{0, 1, 2, 3\}$
  - $2x - 3y = 1$ , the domain is  $-3 < x < 4$  such that  $x \in \mathbb{Z}$
- Plot all pairs  $(x, y)$  that satisfy the equation  $y = x - 1$  on an analytic plane.
- Represent the following relations having ordered pairs of the form  $(x, y)$  by mapping.
  - $\{(1, b), (2, d), (3, c), (5, e)\}$
  - $x - y = 1$ , the domain is  $\{1, 2, 3, 4, 5\}$

**Defining a Function**

- State whether the following relations define a function or not. Why?
  - $\{(0, 2), (0, 3), (1, 6), (2, 4), (3, 5)\}$
  - $\{(-3, 1), (-1, -1), (0, 1), (1, 3), (2, -2)\}$
  - A relation having ordered pairs of the form (radius, area of circle)
  - $\{(1, z), (2, d), (4, f)\}$  with the domain  $\{1, 2, 3, 4\}$
- Given the function  $f(x) = |2x - 3|$  find  $f(1)$  and find  $x$ , if  $f(x) = 0$
- If  $f(x) = x^2 - 3x$ , find  $f(-2) + f(4)$ ?
- If  $f(2x+1) = 2x + 6$ , find  $f(3) = ?$

9. If  $f\left(\frac{1}{x}\right) = x - 1$ , find

$f(2) = ?$        $f(x) = ?$

10.  $f(x) = x^2 - 5x$ , find

$f(0) = ?$        $f(-a) = ?$

$f(3) = ?$        $f(x+1) = ?$        $f(a) + f(b) = ?$

11.

$$f(x) = \begin{cases} x^2 - x, & \text{if } x > 0 \\ 4, & \text{if } x \leq 0 \end{cases} \quad \text{find } f(-2) + f(0) = ?$$

12. If  $\forall x \in \mathbb{Z}^+$  and  $f(x) = f(x+1) + x$

then find the value  $f(1) - f(9) = ?$

13. If  $\forall x \in \mathbb{Z}^+$   $f(x+1) = x \cdot f(x)$  find the ratio

$$\frac{f(6)}{f(1)} = ?$$

14. Determine whether the given relation is a function or not. Why?

a)  $A = \{0, 1, 2, 3\}$  and  $B = \{-1, 2, 5\}$ ,  $f: A \rightarrow B$

$$f(x) = 3x - 1$$

b)  $A = \{-2, -1, 0, 1, 2\}$  and  $B = \{-1, 0, 1, 2\}$ ,  $f: A \rightarrow B$

$$f(x) = x^2$$

c)  $A = \{-1, 0, 1, 4\}$  and  $B = \{-1, 0, 1, 2, 5\}$ ,  $f: A \rightarrow B$

$$f(x) = \sqrt{x}$$

15.  $f(m) = \frac{3}{m+2}$  then find  $f(3), f(x), f(x+1)$ ?

16.  $f(x) = ax^3 + bx + 1$ ,  $a \neq 0$ ,  $b \neq 0$  and  $f(1) = 4$ , find  $f(-1) = ?$

17.

$$f(x) = \begin{cases} x - 1, & \text{if } x > 3 \\ x^2 - 2x - 3, & \text{if } 1 < x \leq 3 \\ x + 4, & \text{if } x \leq 1 \end{cases}$$

find  $f(f(f(\dots f(0))))$

18. If  $f\left(x - \frac{1}{x}\right) = x^3 - \frac{1}{x^3}$ , find  $f(-x)$

19. If  $f: \mathbb{Z}^+ \rightarrow \mathbb{R}$ ,  $f(25) = 1$

$f(x) = \frac{2 \cdot f(x+1) + 1}{2}$ , find  $f(3)$ .

20. If  $g(x) + 2 \cdot g\left(\frac{1}{x}\right) = x$  find  $g(x)$  in terms of  $x$ .

21. Find the function  $f(x-1)$  in terms of  $f(x)$ ,

$f(x): \mathbb{R} - \{0\} \rightarrow \mathbb{R} - \{1\}$ ,  $f(x) = \frac{x+1}{x}$

22. Find the value of  $f(2x)$  in terms of  $f(x)$ , if  $f(x) = 2^{3x+1}$

### Domain of a Function

23. Find the domain of the following functions.

a)  $f(x) = x^2 + 2x - 8$

b)  $f(x) = \frac{1}{x+2}$

c)  $f(x) = \sqrt{2x+1}$

d)  $f(x) = \sqrt[3]{x-7}$

e)  $g(x) = \sqrt{x-1} + \frac{x+4}{x^2-4}$

24. Find the domain of the following.

a)  $f(x) = 2x+1$

b)  $f(x) = 2x^2 - 4x + 5$

c)  $f(x) = \frac{x+1}{x-4}$

d)  $g(x) = \frac{1}{x} - \frac{2}{x+3}$

e)  $g(x) = \frac{1}{\sqrt{5x-1}} + \sqrt{1-x}$

f)  $f(a) = \frac{1}{a^3-1} + \sqrt{1+a} - \sqrt{3-2a}$

g)  $f(u) = \frac{3u-4}{u-2} + \frac{1}{3u-10} + \sqrt{u-5}$

### Properties of Functions

25. Classify whether the following functions are even or odd.

a)  $f(x) = 3x^4 - 4$

b)  $f(x) = 5x^3 - 2x$

c)  $f(x) = \frac{2}{2x-7}$

d)  $f(x) = \frac{x^2+1}{3x}$

e)  $f(x) = \sqrt{x+2}$

f)  $f(x) = \frac{2^x-1}{2^x+1}$

26. Are the functions  $f(x) = \sqrt{(x-3)(x+6)}$  and  $g(x) = \sqrt{x-3} \sqrt{x+6}$  equal? Explain why?

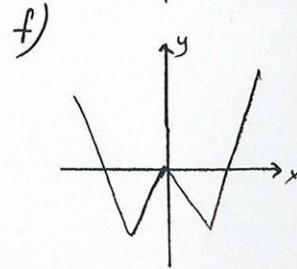
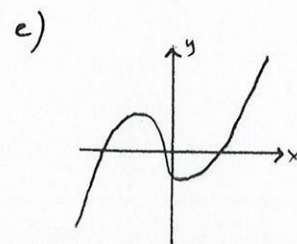
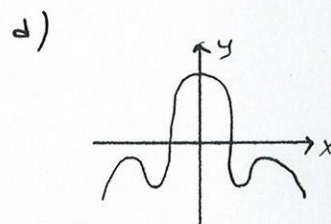
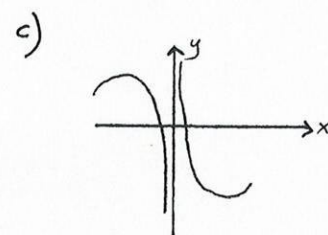
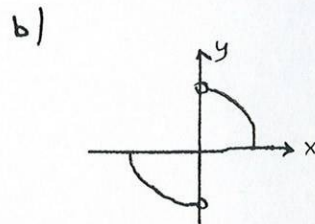
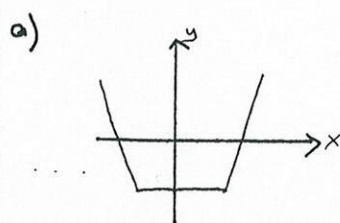
27. Investigate the following functions for increase and decrease

a)  $f(x) = 4$

b)  $f(x) = 2x+5$

c)  $f(x) = -x$

28. Given their graphs classify whether the following functions are even, odd or neither.



29. Given that  $a \cdot f(x) = x \cdot f(x) + bx + 2$  and  $g(x) = x+5$ , find  $g(ab)$  if  $f$  is a constant function.

30. Find the intervals on which the function  $f(x) = x^2 + |5x+1| + 5$  is increasing and decreasing.