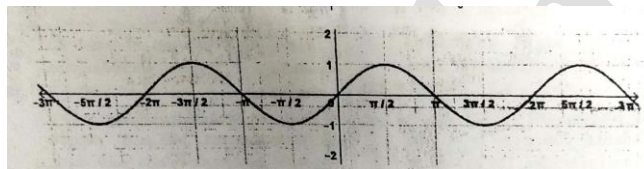**CHAPTER 2**

RELATIONS & FUNCTIONS

IMPROVEMENT 2019

1. a) If f f is a signum function, then Consider a real valued function $f(100) = \ldots\ldots$ (1)

   b) Let $f = \{(1,1), (2,3), (0,-1), (-1,-3)\}$ be a function from Z to Z defined by $f(x) = ax + b$, for some integers a and b. Determine a and b. (2)

   c) Let $g(x) = 2 - 3x, x \in R, x > 0$ and $h(x) = x^2 - 3x + 2, x \in R$ be two functions.

   Find: i) the range of $g(x)$ (2)
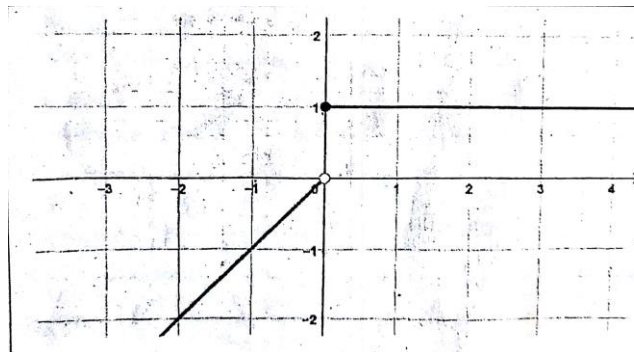
   ii) domain of $\dfrac{g(x)}{h(x)}$. (1)

MARCH 2019

2. Consider the graph of the function $f(x)$

   a) Identify the function $f(x) = \ldots\ldots$ (1)

   i) $f(x) = \sin x$

   ii) $f(x) = \cos x$

   iii) $f(x) = \tan x$

   iv) $f(x) = cosec x$

   b) Using the function $f(x)$ find:

   $$\lim_{x \to \frac{\pi}{2}} \frac{f(x) - f\left(\dfrac{\pi}{2}\right)}{x - \dfrac{\pi}{2}}$$ (2)

3. The figure shows the graph of the function $f(x)$.

   a) Write the domain and range of $f(x)$. (2)

   b) Find $f(0)$ and $f(-0.01)$. (1)

   c) Check the existence existence of $\lim_{x \to 0} f(x)$. [Chapter 13] (1)

IMPROVEMENT 2018
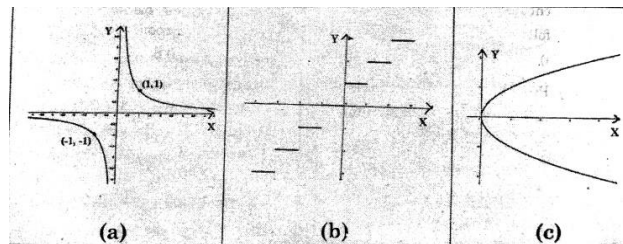
4. Consider a real valued function $f(x) = \dfrac{x-3}{x^2 - x - 6}$.
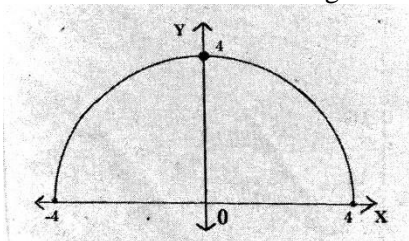
   a) Find the domain of $f(x)$ (2)

   b) Evaluate: $\lim_{x \to 3} f(x)$ (1) [Chapter 13]

5. a) If $\left(\dfrac{x+3}{2}, \dfrac{y-1}{3}\right) = (4, 2)$, find the value of x and y. (2)

   b) Consider the function $f(x) = |x| - 3$, draw the graph of $f(x)$. (2)

   c) Write the domain and range of $f(x)$. (2)

MARCH 2018

6. Consider the following graphs:

(a)   (b)   (c)

a) Which graph does not represent a function? (1)

b) Identify the function $f(x) = \dfrac{1}{x}$ from the above graph. (1)

c) Draw the graph of the function
   $f(x) = (x-1)^2$ (2)

7. The figure shows the graph of a function $f(x)$ which is a semi-circle centred at origin.

a) Write the domain and range of $f(x)$. (2)

b) Define the function $f(x)$. (2)

IMPROVEMENT 2017

8. a) $A = \{2,3\}$, $B = \{1,3,5\}$ then the number of relations from A to B is …… (1)
   i) 2   ii) 32
   iii) 64   iv) 62

   b) R is a relation defined on the set
      $A = \{1,2,3,......,14\}$ by
      $R = \{(x,y) : 3x - y = 0, xy \in A\}$
      Write the domain, co-domain and the range. (3)

   c) Let $f(x) = x^2$ and $g(x) = 2x + 1$ be two real functions. Find $(f.g)(x)$ and $(f+g)(x)$. (2)

MARCH 2017

9. a) The domain of the function $f(x) = \dfrac{1}{x-1}$ is ………..

   i) $\{1\}$ ii) R

iii) $R - \{1\}$ iv) $R - \{0\}$ (1)

b) A relation R on the set of natural numbers is defined by $R = \{(x,y) : y = x; x \text{ is a natural number less than } 4, \ x,y \in N\}$
   i) Write the relation in Roster form. (1)
   ii) Write the domain and range of the relation. (2)

c) Draw the graph of the function
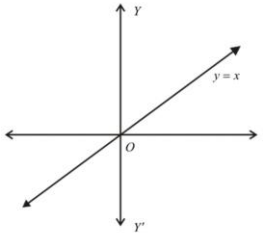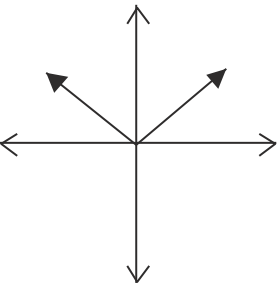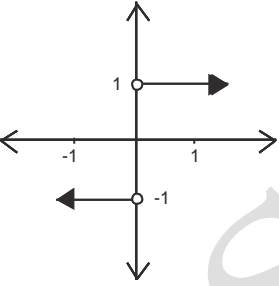 $f(x) = |x|, x \in R$ (2)

IMPROVEMENT 2016

10. a) If $P = \{m,n\}$, $Q = \{n,m\}$; State whether the following is TRUE or FALSE.
    $P \times Q = \{(m,n),(n,m)\}$. (1)

    b) Write the relation
       $R = \{(x, x^3) : x \text{ is a prime number} < 10\}$, in roster form. (2)

    c) Let $A = \{1,2,3,4\}$, $B = \{1,5,9,11,15,16\}$ and $f = \{(1,5),(2,9),(3,1),(4,5),(2,1)\}$. State with the reason whether f is a relation or a function. (3)

MARCH 2016

11. a) If $(x+1, y-2) = (3,1)$, write the values of x and y. (1)

    b) Let $A = \{1,2,3,4,5\}$ and $B = \{4,6,9\}$ be two sets. Define a relation R from A to B by $R = \{(x,y) : x - y \text{ is a positive integer}\}$, find $(x+1, y-2) = (3,1)$, and hence write R in the Roster form. (2)

    c) Define the modulus function. What is its domain? Draw a rough sketch. (3)

IMPROVEMENT 2015

12. a) Match the following: (3)

i)	1) Modulus function $f : R \to R$ by $f(x) = |x|$
ii)	2) Signum function $f : R \to R$ by $f(x) = \begin{cases} \dfrac{|x|}{x}; & x \neq 0 \\ 0; & x = 0 \end{cases}$
iii)	3) Identity function $f : R \to R$ by $f(x) = x$
	4) Greatest integer function $f : R \to R$ by $f(x) = [x]$

b) $A = \{1, 2, 3, \dots, 14\}$. R is a relation from A to A defined by $R = \{(x, y) / 3x - y = 0; \ x, y \in A\}$. Write the domain, range and co-domain of R. (3)

MARCH 2015

13. a) Find the domain and range of function

$$f(x) = \frac{x^2 + 3x + 5}{x^2 - 5x + 4} \quad (2)$$

b) Sketch the graph of the function $f(x) = |x + 1|$ (1)

c) Consider A={1,2,3,5} and B={4,6,9}. Define a relation $R : A \to B$ by $R = \{(x, y) : x - y \ is \ odd, \ x \in A, y \in B\}$. Write R in roster form and find the range of R. (3)

IMPROVEMENT 2014

14. Let A={1,2,3,4,5,6} be a set. Define a relation R from A to A by $R = \{(x, y) : y = x + 1\}$.

   a) Express R in roster form. (1)
   b) Represent the relation R using an arrow diagram. (1)
   c) Write the domain and range of R (1)

15. a) Let A={1,2,3,4}, B={1,5,9,11,15,16} and $f = \{(1,5), (2,9), (3,1), (4,5), (2,11)\}$
   Is f a function from A to B? Why? (1)

   b) Draw the graph of the function, $y = |x|$ (2)

MARCH 2014

16. a) Let $P = \{1, 2\}$ Find $P \times P \times P$.

   b) Let $A = \{1, 2, 3, \dots 13, 14\}$. R is a relation on A defined by $R = \{(x, y) : 3x - y = 0; \ x, y \in A\}$
   i) Write R in roster form (1)
   ii) Find the domain and range of R (1)

17. a) Draw the graph of the function
$$f(x) = \begin{cases} 1, & if \ x > 0 \\ 0, & if \ x = 0 \\ -1, & if \ x < 0 \end{cases} \quad (3)$$

b) Write the range of the above function. (1)

IMPROVEMENT 2013

18. Consider the function $f : R \to R$ defined by $f(x) = -|x|$.
    a) Find the domain and range of f. (2)
    b) Draw the graph of f. (2)

MARCH 2013

19. a) Let $A = \{7, 8\}\, and\, B = \{5, 4, 2\}$,
    Find $A \times B$ (1)
    b) Determine the domain and range of the relation R defined by
    R= $\{(x, y) : y = x + 1,\ \ x \in \{0, 1, 2, 3, 4, 5\}\}$ (2)

20. Draw the graph of the function:
    $f(x) = |x| + 1, x \in R$ (3)

IMPROVEMENT 2012

21. i) If $\left(\dfrac{2x}{5} + 1, y - \dfrac{3}{4} \right) = \left(\dfrac{1}{5}, \dfrac{1}{4} \right)$ find x and y. (1)

    ii) If $f = \{(2, 5), (3, 1), (5, 2), (8, 5), (10, 2), (11, 5)\}$ is a function, write its range. (1)

2012 MARCH

22. Let $A = \{1, 2, 3, 4, 5\}\, and\, R$ be relation on A defined by $R = \{(a, b) : b = a^2\}$
    a) Write R in the roster form. (1)
    b) Find the range of R (1)

23. Consider the real function $f(x) = \dfrac{x + 2}{x - 2}$
    a) Find the domain and range of the function. (1)
    b) Prove that $f(x).f(-x) + f(0) = 0$ (2)

IMPROVEMENT 2011

24. Let A={1,2,3}, B={a,b} be two sets.
    a) Write the universal relation from A to B. (1)
    b) What is the number of non-empty relations from A to B? (1)

25. a) Find the range of the function
    $f(x) = [2x], -\dfrac{1}{3} \le x \le \dfrac{8}{3}$

    b) Draw the graph of the function:
    $f(x) = \begin{cases} 1 + x, & -1 \le x \le 0 \\ 1 - x, & 0 < x \le 1 \end{cases}$

MARCH 2011

26. Let A=$\{1, 2, 3, 4, 6\}$ and R be a relation on A defined by
    R=$\{(a, b) : a, b \in A; b\, is\, exactly\, divisible\, by\, a\}$
    a) Write R in the roster form
    b) Find the domain and range of R

27. Consider the real function $f(x) = \dfrac{x^2 + 2x + 3}{x^2 - 8x + 12}$
    a) Find the value of x if $f(x) = 1$
    b) Find the domain of f.

IMPROVEMENT 2010

28. The Cartesian product $P \times P$ has 9 elements among which are found (−a,0) and (0, a).

    A relation from P to P is defined as $R = \{(x, y) : x + y = 0\}$

    a) Find P.
    b) Depict the relation using an arrow diagram.
    c) Write down the domain and range of R.
    d) How many relations are possible from P to P?

Page 4

MARCH 2010

29. Consider the functions

$$f(x) = \sqrt{x-2}, \quad g(x) = \frac{x+1}{x^2 - 2x + 1}$$

   a) Domain of f (1)

   b) Domain of g (1)

   c) $(f+g)(x)$ (1)

   d) $(fg)(x)$ (1)
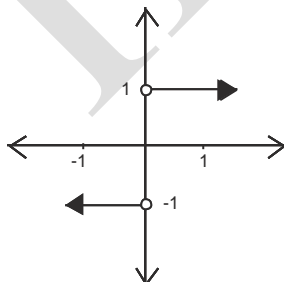
IMPROVEMENT 2009

30. Let $A = \{1, 2, 3, ..., 14\}$ R is a relation on A defined

   by $R = \{(x, y) : 3x - y = 0, x, y \in A\}$ [2015 Improvement]

   a) Write R in tabular form.   (1)

   b) Find the domain and range of R.   (1)

31. Consider the function

$$f(x) = 2 - 3x, \quad x \in R, \ x \geq 0$$

   a) Find its range.   (1)

   b) Draw its graph in the given domain.   (2)

MARCH 2009

32. a) Let $A = \{1, 2\}, B = \{3, 4\}$. Choose the number of relations from A to B from the bracket: (4,16,32,64).   (1)

   c) Determine the domain and range of the relation R, where $R = \{(x, x^3) : x$ is a prime number less than $15\}$ (2)

   d) From the below graph, write the name and equation of the function.   (2)

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