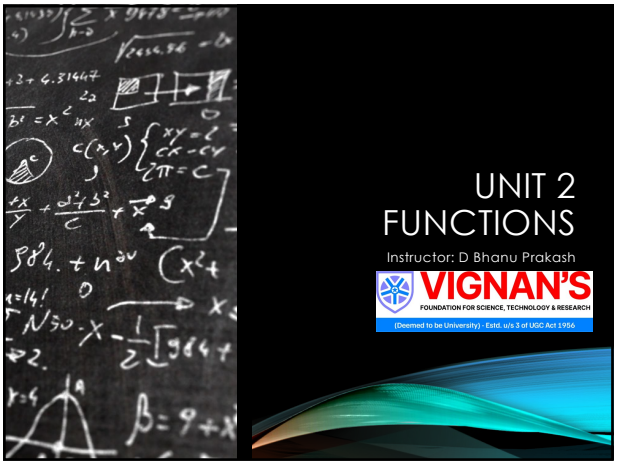


UNIT 2 FUNCTIONS

Instructor: D Bhanu Prakash

VIGNAN'S
FOUNDATION FOR SCIENCE, TECHNOLOGY & RESEARCH
(Deemed to be University) - Estd. u/s 3 of UGC Act 1956

1

WHAT IS A FUNCTION?

- A function is a relation where each input has exactly one output.
- Example: f(x) = x + 2

2

REPRESENTING FUNCTIONS

- - Set of ordered pairs
- - Tables
- - Graphs
- - Arrow Diagrams

3

QUIZ 1: FUNCTION OR NOT?

- 1. {(1,2), (2,3), (1,4)}
- 2. {(a,b), (c,d), (e,f)}

4

REAL-LIFE EXAMPLES OF FUNCTIONS

- - Speed = f(time)
- - Temperature = f(location)

5

INJECTIVE (ONE-TO-ONE)

- Each output is mapped from a unique input
- Eg: f(x) = 2x

6

SURJECTIVE (ONTO)

- Every element in codomain has at least one preimage

7

BIJECTIVE

- Both one-to-one and onto
- Has an inverse

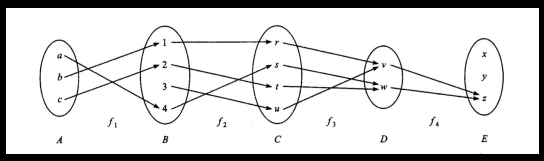
8

QUIZ 2: WHICH TYPE?

- Determine if f(x) = x^2 is injective/surjective/bijective on $\mathbb{R}$

9

QUIZ 2: WHICH TYPE?



10

DOMAIN AND RANGE

- Domain: Input values (x)
- Range: Output values (f(x))

11

FINDING DOMAIN

- - Watch for division by zero
- - Watch for square roots of negatives

12

FINDING RANGE

- Depends on output of function and domain
- Graph helps!

13

QUIZ 3: DOMAIN & RANGE

- Find domain and range of:
- 1. $f(x) = \sqrt{(x-2)}$
- 2. $f(x) = 1/(x-1)$

14

COMPOSITION OF FUNCTIONS

- $(f \circ g)(x) = f(g(x))$
- Evaluate inner function first

15

WORKED EXAMPLE

- Let $f(x) = x+3$, $g(x) = 2x$
- Find $(f \circ g)(2)$, $(g \circ f)(2)$

16

QUIZ 4: COMPOSITION

- Given $f(x) = x^2$, $g(x) = x+1$:
- 1. $(f \circ g)(x) = ?$
- 2. $(g \circ f)(x) = ?$

17

LINEAR FUNCTIONS

- $f(x) = mx + b$
- Graph is a straight line

18

QUADRATIC FUNCTIONS

- $f(x) = ax^2 + bx + c$
- Parabolic graph

19

POLYNOMIAL FUNCTIONS

- Includes terms with x^n
- $f(x) = 4x^3 - x + 7$

20

QUIZ 5: IDENTIFY TYPE

- Match the function to its type:
- 1. x^2+3x+1
- 2. $5x-2$
- 3. $x^5 + x^2$

21

INVERSE FUNCTION

- Reverses a function: $f^{-1}(y) = x$ such that $f(x) = y$

22

FINDING THE INVERSE

- 1. Replace f(x) with y
- 2. Swap x and y
- 3. Solve for y

23

GRAPH OF INVERSE

- Reflection over line $y = x$

24

QUIZ 6: INVERSE

- Find inverse of f(x) = (x−3)/2

25

WHAT IS A POLYNOMIAL?

- Expression with powers of x and constant coefficients

26

FACTORIZATION METHODS

- - Common factor
- - Splitting middle term
- - Quadratic formula

27

WORKED EXAMPLE

- Factor: $x^2 - 5x + 6$
- = $(x-2)(x-3)$

28

QUIZ 7: FACTOR

- Factor the following:
- 1. $x^2 + 7x + 12$
- 2. $x^2 - 9$

29

QUADRATIC EQUATION

- $ax^2 + bx + c = 0$
- Solutions using:
- 1. Factorization
- 2. Quadratic formula

30

QUADRATIC FORMULA

- $x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$

31

NATURE OF ROOTS

- Discriminant $D = b^2 - 4ac$
- $D > 0 \rightarrow$ real & distinct
- $D = 0 \rightarrow$ real & equal
- $D < 0 \rightarrow$ complex

32

QUIZ 8: QUADRATIC

- Solve: $x^2 - 4x + 3 = 0$
- Also classify its roots

33

LINEAR INEQUALITIES

- Example: $2x + 3 < 7$
- Solve like equations, reverse sign if multiplying by −1

34

GRAPHING INEQUALITIES

- Use open/closed circles
- Arrow shows direction

35

COMPOUND INEQUALITIES

- $-3 < 2x < 5 \rightarrow$ solve both sides

36

QUIZ 9: INEQUALITY

- Solve:
- 1. $3x - 2 > 7$
- 2. $-2x < 4$

37

CHALLENGE QUESTION

- If $f(x) = 2x+1$ and $f^{-1}(x) = (x-1)/2$,
- What is $f(f^{-1}(5))$ and $f^{-1}(f(3))$?

38

PUZZLE TIME

- You have a function $g(x) = ax + b$ such that $g(2) = 10$, $g(4) = 16$. Find a and b.

39

APPLICATION IN AI

- Activation functions in neural networks (ReLU, sigmoid)
- Function composition models decision layers

40