



Architecture Mathematics Classes

NEAR SHIV MANDIR KORRAH CHOWK, HAZARIBAG

BY:- Ujjwal Sir (M.Sc+B.Ed(GTTC-HG)) Time-3 hours

F.Marks-80

Class-12th

Relations, Functions & I. T. F.

Mob:-8002890523

➤ . General instruction:-

- Candidates should answer in their own words as much as possible.
- All questions are compulsory.
- Total number of questions is 52.
- Questions No. 1 to 30 are multiple choice questions, each question has four options. Select the correct option. Each question carries 01 marks.
- Questions numbers 31 to 38 are very short answer questions. Out of which it is mandatory to answer any 6 questions. Each questions carries 02 marks.
- Question numbers 39 to 46 are short answer questions. Out of which it is mandatory to answer any 6 questions. Each question carries 03 marks.
- Question numbers 47 to 52 are long answer questions. It is mandatory to answer any 4 questions. Each question carries 05 marks.

PART-A

$30 \times 1 = 30$

❖ . MCQ Based Questions:-

01. What type of relation is $R = \{(1,3), (2,4), (4,2), (3,1)\}$ on the Set $A = \{1,2,3,4\}$

a) Reflexive b) Transitive c) Symmetric d) None of these

02. Relation R in the set A of human being in a town is given by $R = \{(x,y) : x \text{ is}$

wife of $y\}$

a) Reflexive b) Transitive c) Symmetric d) None of these

03. Let R be the relation in the set N given by $R = \{(a, b) : a = b - 2, b > 6\}$. Choose the correct answer

a) $(2, 4) \in R$ b) $(3, 8) \in R$ c) $(6, 8) \in R$ d) $(8, 7) \in R$

04. Let $A = \{1, 2, 3\}$. Then number of relations containing $(1, 2)$ and $(1, 3)$ Which are reflexive and symmetric but not transitive is

a) 1 b) 2 c) 3 d) 4

05 Let $A = \{1, 2, 3\}$. Then number of equivalence relations containing $(1, 2)$ is

a) 1 b) 2 c) 3 d) 4

06. Let f, g and h be functions from R to R then

I) $(f + g)oh = foh + goh$

II) $(f.g)oh = (foh).(goh)$

a) only I is correct b) only II is correct c) Both correct d) Neither I nor II correct

07. If $f : R \rightarrow R$ be given by $f(x) = (3 - x^3)^{\frac{1}{3}}$ then $f \circ f(x)$ is

a) $\frac{1}{x^3}$ b) x^3 c) x d) $(3 - x^3)$

08. On z^+ : '*' is defined by $a * b = 2^{ab}$ then $2 * 2 =$

a) 16 b) 32 c) 64 d) 28

09. Find the principal value of $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) None

10. If $\cot^{-1}(-1) = x$, where $x \in [0, \pi]$ then value of x is -

a) $\frac{\pi}{2}$ b) $\frac{3\pi}{4}$ c) π d) $\frac{3\pi}{2}$

11. If $y = \sin^{-1} x$ then

a) $0 \leq y \leq \pi$ b) $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$ c) $0 < y < \pi$ d) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

Full course, Full marks
By:- Ujjwal sir
Mob.no :- 8002890523

12. If $f : R \rightarrow R$ be such that $f(x) = 5x + 4$, then $f^{-1}(x) =$

- a) $\frac{x-4}{5}$ b) $\frac{4-x}{5}$ c) $\frac{x-5}{4}$ d) None of these

13. $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) =$

- a) $2\cos^{-1}x$ b) $2\sin^{-1}x$ c) $2\tan^{-1}x$ d) $\cos^{-1}(2x)$

14. Total number of binary operation on set $A = \{a, b, c\}$ is

- a) 8 b) 3^9 c) 2^9 d) None of these

15. . If $y = \cos^{-1}x$ then

- a) $0 \leq y \leq \pi$ b) $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$ c) $0 \leq y < \pi$ d) $0 < y \leq \pi$

16. $3\tan^{-1}x =$

- a) $\tan^{-1}\left[\frac{3x-x^3}{1-3x^2}\right]$ b) $\sin^{-1}[3x-4x^3]$ c) $\cos^{-1}[4x^3-3x]$ d) None of these

17. If f and g are two real valued function then $g \circ f$ defined is :

- a) domain of $g \subset$ Range of f b) domain of $g =$ Range of f
 c) Range of $g \subset$ Domain of f d) Range of $f \subset$ domain of g

18. If $A = \{1, 2, 3\}$ then total number of relation on set A is

- a) 2^9 b) 2^6 c) 2^3 d) None of these

19. A relation R in male human being defined as $R = \{(a, b) : a, b, \in \text{male human Beings} : a \text{ is brother of } b\}$ is :

- a) Equivalence b) Symmetric c) Reflexive, symmetric but not Transitive
 d) Symmetric, Transitive but not Reflexive.

20. If R being the set of all real numbers, then the function $f : R \rightarrow R$ defined by $f(x) = |x|$ is

- a) one-one only b) onto only c) neither one-one and onto

Full course, Full marks
 By:- Ujwal sir
 Mob.no :- 8002890523

d) both one-one and onto

21. $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ is equal to

- a) $\frac{7\pi}{6}$ b) $\frac{5\pi}{6}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{6}$

22. $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ is equal to

- a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) 1

23. $\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$ is equal to

- a) π b) $-\frac{\pi}{2}$ c) 0 d) $2\sqrt{3}$

24. $\sin(\tan^{-1}x), |x| < 1$ is equal to

- a) $\frac{x}{\sqrt{1-x^2}}$ b) $\frac{1}{\sqrt{1-x^2}}$ c) $\frac{1}{\sqrt{1+x^2}}$ d) $\frac{x}{\sqrt{1+x^2}}$

25. $\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$, then x is equal to

- a) 0, $\frac{1}{2}$ b) 1, $\frac{1}{2}$ c) 0

26. $\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\frac{x-y}{x+y}$ is equal to

- a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $-\frac{3\pi}{4}$

27. Find the value of $\cot [\text{arc tan } a + \text{arc cot } a]$ -

- a) 1 b) 0 c) 2 d) None of these

28. Let the function f and g be one-one and onto, then gof is

- a) One-one onto b) One-one but not one-one onto
c) One-one into d) Many-one onto

29. Find gof (x), if $f: R \rightarrow R$ and $g: R \rightarrow R$ are given by $f(x) = \cos x$ and $g(x) = 3x^2$ respectively.

Full course, Full marks
By:- Ujjwal sir
Mob.no :- 8002890523

- a) $\cos(3x^2)$ b) $3(\cos x)^2$ c) $\cos x$ d) $3x^2$

30. $\sin^{-1}\left(\sin \frac{2\pi}{3}\right) =$

- a) $\frac{2\pi}{3}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{6}$ d) $\frac{\pi}{2}$

PART-B

Sections-I

$6 \times 2 = 12$

Subjective based questions

❖ . Very Short Answer type :-

31. Relation R on the set $\{1, 2, 3\}$ is given by

$$R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)\}$$

then show that R is reflexive but neither symmetric nor transitive.

32. Let $f: N \rightarrow N$ be defined by $f(x) = 2x$ show that f is one-one but not onto function.

33. If $f: R \rightarrow R$ and $g: R \rightarrow R$ are defined by $f(x) = \sqrt{x}$ and $g(x) = x^2$, then find fog(x).

34. Let $f(x) = x + 7$ and $g(x) = x - 7$, $x \in R$, Find fog(7).

35. Find the value of $\cos^{-1}\left(\frac{1}{2}\right) + 2\sin^{-1}\left(\frac{1}{2}\right)$

36. Let * be a binary operation on N given by $a * b = \text{HCF of } a \text{ and } b$
Find the value of $22 * 4$.

37. Write the value of $\sin\left[\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right]$.

38. Find the value of $\sin(\tan^{-1} x + \cot^{-1} x)$.

Full course, Full marks
By:- Ujjwal sir
Mob.no :- 8002890523

Section-II

$6 \times 3 = 18$

➤ . Short Answer type:-

39. If $f(x) = \frac{4x+3}{6x-4}, x \neq \frac{2}{3}$, prove that $f \circ f(x) = x$.

40. Prove that $\cot^{-1}7 + \cot^{-1}8 + \cot^{-1}18 = \cot^{-1}3$.

41. Find gof and fog , if

i) $f(x) = |x|$ and $g(x) = |5x-2|$

42. Consider $f: R_+ \rightarrow [-5, \infty)$ given by $f(x) = 9x^2 + 6x - 5$. Show that f is invertible

With $f^{-1}(y) = \left[\frac{(\sqrt{y+6}-1)}{3} \right]$.

43. If $f: R \rightarrow R$ be given by $f(x) = (7-x^4)^{\frac{1}{4}}$ then find the value of $f \circ f(x)$.

44. Let T be the set of all triangles in a plane with R a relation in T given

by $R = \{(T_1, T_2) : T_1 \text{ is congruent to } T_2\}$. Show that R is an equivalence relation.

45. Show that the relation R in the set Z of integers given by

$R = \{(a, b) : 2 \text{ divides } a - b\}$ is an equivalence relation.

46. Prove that $2 \tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{7}\right) = \tan^{-1}\left(\frac{31}{17}\right)$

Section-III

$4 \times 5 = 20$

❖ . Long Answer type:-

47. Show that : $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\frac{1}{8} = \pi/4$

$$48. \tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right) = \frac{\pi}{4} - \frac{1}{2}\cos^{-1}x, -\frac{1}{\sqrt{2}} \leq x \leq 1$$

$$49. \text{ Show that } \sin^{-1}\frac{12}{13} + \cos^{-1}\frac{4}{5} + \tan^{-1}\frac{63}{16} = \pi$$

$$50. \tan^{-1}\left(\frac{3a^2x-x^3}{a^3-3ax^2}\right), a > 0; \frac{-a}{\sqrt{3}} \leq x \leq \frac{a}{\sqrt{3}}$$

51. Let * be a binary operation on R

I). Defined by $a*b = a^b$ then find $2*3$.

II). Defined by $a*b = a+b-ab$ find $2*3$.

III). Defined by $a*b = \text{l.c.m}(a, b)$, find $20*16$.

IV). Defined by $a*b = \text{inferior}(a, b)$, find $2*2024$.

V). Defined by $a*b = \text{maximum}(a, b)$, find $2*205$.

$$52. \frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\frac{1}{3} = \frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$$

: The End :

जिसकी जिंदगी मे रहो, दिल बन कर रहो,

अगर उसकी जिंदगी से हट जाव, तो उसका जीवन खत्म हो जाय ॥

Full course, Full marks
By:- Ujjwal sir
Mob.no :- 8002890523

-----: Rough Work :-----

AMC HIG

Best of luck