

QUESTION 2014

Group - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

i) If $a = (1, 0, 3)$ and $b = (-1, 2, 5)$ then $a + 3b$ is equal to

- a) $(-2, 6, 18)$ b) $(2, -6, -18)$ c) $(2, -6, 18)$ d) $(1, 3, 5)$

ii) If $\sum_n |a_n|$ is convergent, then $\sum_n a_n$ is

- a) convergent b) divergent c) oscillatory d) none of these

iii) A bounded sequence is

- a) convergent b) divergent c) oscillatory d) none of these

iv) The series $\sum \frac{1}{n\sqrt{n+1}}$ is

- a) convergent b) divergent c) oscillatory d) none of these

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v) The integrating factor of $\frac{dy}{dx} + 2xy = x^3$ is

a) x^3

b) x^2

c) e^{x^2}

d) e^{x^3}

vi) The infinite series $\sum_{n=1}^{\infty} \frac{n}{n+1}$ is

a) Convergent

b) Divergent

c) Oscillatory

d) None of these

vii) If the vectors $(5, 2, 3), (7, 3, a), (9, 4, 5)$ of a vector space R^3 over R be linearly independent, then the value of a is not equal to

a) 2

b) 3

c) 1

d) 0

viii) The sequence $1, \frac{1}{2}, \frac{1}{3}, \dots, \frac{1}{n}$ converges to

a) ∞

b) 0

c) 1

d) $\frac{1}{2}$

ix) The order and degree of the differential equation

$$\frac{d^2 y}{dx^2} = 1 + 2 \left(\frac{dy}{dx} \right) + \left(\frac{dy}{dx} \right)^3 \text{ are}$$

a) 2, 1

b) 1, 2

c) 1, 3

d) 3, 1

x) The sequence $\{(-1)^n\}$ is

a) Convergent

b) Oscillatory

c) Divergent

d) None of these

xi) The general solution of $\log \frac{dy}{dx} = x - y$ is

a) $e^y - e^x = c$

b) $e^y + e^x = c$

c) $e^{y+x} = c$

d) $e^{x-y} = c$

xii) Which of the following pair can form a basis of R^2 ?

a) $\{(1, 2), (2, 4)\}$

b) $\{(0, 0), (3, 33)\}$

c) $\{(2, 2), (3, 3)\}$

d) $\{(1, 1), (1, 2)\}$

8. a) Solve $\frac{dy}{dx} = \sin(x+y)$
- b) Let $T: R^2 \rightarrow R^2$ be a linear transformation such that $T(1,1) = (2,-3)$ and $T(1,-1) = (4,7)$. Find the matrix of T .

c) Prove that the sequence $\left\{ \frac{1}{(n+1)^2} + \frac{1}{(n+2)^2} + \dots + \frac{1}{(2n)^2} \right\}$ is convergent. Find its limit

a) See Topic: DIFFERENTIAL EQUATIONS, Long Answer Type Question No. 14.

b) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 19.

c) See Topic: SEQUENCE, Long Answer Type Question No. 6.

9. a) Form a differential equation by eliminating A and B from the following:

$$y = A \cos x + B \sin x$$

- b) Find whether the following vectors are linearly dependent or not $\{(1, 2, 3), (2, 3, 1), (3, 2, 1)\}$

c) Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{\cos n\pi}{n^2 + 1}$

a) See Topic: DIFFERENTIAL EQUATIONS, Long Answer Type Question No. 15.

b) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 20.

c) See Topic: SERIES, Long Answer Type Question No. 10.

10. a) Solve: $\frac{dy}{dx} + y \tan x = y^3 \cos x$

- b) For what values of x the three vectors $(1, 1, 2), (x, 1, 1), (1, 2, 1)$ are linearly independent.

c) Solve: $y = px + \sqrt{1+p^2}$

a) & c) See Topic: DIFFERENTIAL EQUATIONS, Long Answer Type Question No. 16(a) & (b).

b) See Topic: LINEAR ALGEBRA, Long Answer Type Question No. 21.

11. a) Prove that the vectors (x_1, y_1) and (x_2, y_2) are linearly dependent, if and only if $x_1 y_2 - x_2 y_1 = 0$

b) Test the convergence of the series $\sum \frac{x^n}{n\sqrt{n+1}}$

- c) Find the linear transformations T , where $T: R^3 \rightarrow R^2$ such that $T(1, 0, 0) = (1, 2)$, $T(0, 1, 0) = (1, -1)$ and $T(0, 0, 1) = (1, 0)$.

MATHEMATICS - II

- a) See Topic: **LINEAR ALGEBRA**, Long Answer Type Question No. 5(c).
- b) See Topic: **SERIES**, Long Answer Type Question No. 11.
- c) See Topic: **LINEAR ALGEBRA**, Long Answer Type Question No. 22.