Serial No. Of the Answer Book 176

Roll No. (in figure)_____

(in Words)_____

Superintendent Seal & Signature

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MATHEMATICS (Fresh) - II

Total Time: 3 Hours **Max: Marks: 100**

Note: There are THREE Sections of this Paper i.e. A,B and C, attempt each according to the given instructions.

Time: 20 Minutes **SECTION-A** **Marks: 20**

Note: Attempt all parts of Section – A. Section –A must be return to the superintendent after 20 minutes even if you have not attempted any question. Overwriting/ defacing/Cutting etc is prohibited in Section-A and no credit will be given to such answer.

I. **Write the correct option i.e. A/B/C/D in the empty boxes.**

i. Range of function $y = |3x+4|$ is_____.

(A)$(-\infty, \infty)$ (B)$(-\infty, 0)$ (C)$(0, \infty)$ (D) None of these

ii. *If* $f(x) = 2 \ \forall x \in R$, *then* $f(x+2) =$ _____.

(A) 0 (B) 2 (C) 4 (D) None of these

iii. If $f(x) = \sqrt{x}$, then $f'(0) =$ _____.

(A) 0 (B) -1 (C) $\frac{1}{2}$ (D) ∞

iv. $\frac{d}{dx}\left(\frac{1}{x}\right) =$ _____.

(A) $-x^{-2}$ (B) $\ln x$ (C) x^{-2} (D) 0

v. $e^1 =$ _____.

(A) $1+1+\frac{1}{2!}+\frac{1}{3!}$ (B) $1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\ldots$ (C) $1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$ (D) None of these

vi. A function $f(x)$ is said to be concave down in an internal $[a,b]$ if _____.

(A) $f'(x) < 0$ (B) $f''(x) < 0$ (C) $f''(x) > 0$ (D) None of these

vii. A suitable substitute for $\sqrt{a^2+x^2}$ in the integration method of substitution is _____.

(A) $x = a\sec\theta$ (B) $x = a\sin\theta$ (C) $x = a\tan\theta$ (D) All of these

viii. The domain of $F(t) = 2t\hat{i} - 3t\hat{j} + \frac{1}{t}\hat{k}$ is _____.

(A) *All* $t \neq 0$ (B) *All* t (C) *All* $t > 0$ (D) None of these

ix. $\int \cot x \, dx$ _____.

(A) $\ln[\cos x] + c$ (B) $\ln[\sin x] + c$ (C) $\ln[\sec x] + c$ (D) $-\cos ec^2 x + c$

x. Any line equation in two variables that passes through origin is called a _____.

(A) Homogenous (B) Quadratic equation

(B) Non-homogeneous (D) Joint equation

xi. Homogenous equation of degree "2" represents _____.

(A) a circle (B) two straight line (C) Ellipse (D) Parabola

xii. An angle in a semicircle is _____ angle.

(A) acute (B) obtuse (C) right (D) None of these

xiii. If a point $P(x, y)$ is out sides of the circle, then there will be _____ tangents.

(A) 1 (B) 0 (C) 3 (D) 2

xiv. In hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, $a^2 =$_____

(A) $a^2 + b^2$ (B) $a^2 - b^2$ (C) $b^2 - 9^2$ (D) None of these

xv. If $e = \frac{5}{3}$, then the conic will be a _____.

(A) Circle (B) Ellipse (C) Parabola (D) Hyperbola

xvi. The solution of differential equation $\frac{dy}{y} = dx$ is_____.

(A) $y = x + c$ (B) $y = ce^x$ (C) $y = \ln[x] + c$ (D) None of these

xvii. Differential equation of the form $\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} + y = 3$ is____ deferential equation.

(A) Linear (B) Non Linear (C) Partial (D) None of these

xviii. If $f(x, y) = 2xy + y^2$ is a homogenious function of degree _____.

(A) 2 (B) 1 (C) 0 (D) 3

xix. The _____ method always used the midpoint of the interval as the next iterate.

(A) Newton-Raphson (B) Bisection (C) Regular-Falsi (D) None of these

xx. Newton-Raphson formula for iteration is given by _____.

(A) $x_{i+1} = x_i - f(x_i)$ (B) $x_{i+1} = xi - f'(x_i)$ (C) $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$ (D) None of these

MATHEMATICS (Fresh) - II

Note: Time allowed for section B and C is 2 hours and 40 minutes.

SECTION "B"

Marks: 50

II. Attempt any TEN Parts out of the following. Each Part carries equal marks.

i. Evaluate $\lim_{x\to 5}\left(\frac{\sqrt{x}-\sqrt{5}}{x-5}\right)$

ii. Find the average rate of change for the function $y = x^2 + 4$ from $x = 2$ to $x = 3$

iii. Differentiate $f(x) = \frac{3}{x+3}$ by first principle rule (ab-initio method).

iv. Evaluate $\lim_{t\to 0}\left[\frac{\sin t}{t}\hat{i} + \frac{1-\cos t}{t}\hat{j} + e^{t-1}\hat{k}\right]$

v. Evaluate $\int e^x \sin(e^x)\, dx$

vi. Determine the actual integral using definition $\int_{x=0}^{x=3} 3x\, dx$

vii. Find a join equation of the straight line that passes through the origin and perpendicular to the lines represented by $ax^2 + 2hxy + by^2 = 0$

viii. Find the first two derivatives of $f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$

ix. Differentiate $y = \sin x$ by ab-initio method.

x. Find an equation of a circle which passes through the three points $(1, 2)$, $(3, -4)$ and $(5, -6)$

xi. Find equation of a parabola with focus at F(4, 0) & directrix is $x = -4$

xii. Verify Euler,s theorem for the homogenous function $f(x, y) = ax^2 + 2hxy + by^2$

xiii. Approximate by Simpson's rule the definite integral $I = \int_2^4 x^2\, dx$, n=3

SECTION "C"

Marks: 30

Note: Attempt any THREE questions of the following. Each question carries equal Marks.

III. (a) Find x so that $\frac{3}{2}\log_b 4 - \frac{2}{3}\log_b 8 + \log_b 2 = \log_b x$

(b) Use Maclaurin,s series to approximate the value of a function $f(x) = \cos(x)$ at a point $x_0 = 0$

IV. (a) Find the angles of the triangle Δ ABC, whose vertices are $A(3, -4)$, $B(1, 5)$ *and* $C(2, -4)$.

(b) Find the equation of the tangent to the circle $x^2 + y^2 = 2$, which makes an angle of 45^0 with $x-axis$

V. (a) Solve the differential equation $Cosec^2 x\, dy + Secy\, dx = 0$

(b) Find the equation of the hyperbola with vertices at $(2, -2)$, $(-4, -2)$ and that passes through the point with coordinates (5, 1).

VI. (a) Evaluate the integral $\int \frac{x^2-1}{x^2-2x-15}$

(b) Show that the rational function $f(x, y) = \frac{\sqrt{y}+\sqrt{x}}{y+x}$ is a homogenous function.