PSC Mathematics Examination Previous Year Question Paper

Exam Name: Mathematics

Date of Test : n/a

Question Paper Code: 071/2015

Medium of Questions: English

71/2015 (Pages : 4)

Maximum : 200 marks

Time : 1½ hours

PART I

A. Write the definition of the following terms. Each question carries 4 marks.

1. Open interval (a,b).

2. Limit point of a subset of real numbers.

3. Orthogonal matrix.

4. Curl of a vector point function $f(x, y, z)$.

5. Even function.

6. Monotonically increasing sequence.

7. Hyperbolic function $\cosh x$.

8. Symmetric relation.

9. Perfect number.

10. Finite set.

B. State True or False. Each question carries 4 marks.

11. Every convergent sequence is bounded.

12. Every continuous function is differentiable.

13. A set which is not open is always closed.

14. An analytic function always satisfies Cauchy-Riemann equations.

15. $x^2 + x$ is an odd function.

[P.T.O.]

16. Sequence $((-1)^n)$ is convergent.

17. Every Lipschitz function is uniformly continuous.

18. Uniform convergence of a sequence of functions does not imply pointwise convergence.

19. A group always satisfies commutativity.

20. Every field is an integral domain.

C. Choose the correct answer. Each question carries 4 marks.

21. The equation $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ represents ————.

(a) parabola (b) ellipse

(c) hyperbola (d) circle

22. The residue of $f(z)=\frac{4}{1-z}$ at its singular point is, ————.

(a) 4 (b) −4

(c) 1 (d) −1

23. Which of the following is not an entire function?

(a) e^z (b) $\sin z$

(c) $\cos z$ (d) $\tan z$

24. ———— gives a result by which a volume integral is transformed into a surface integral.

(a) Gauss's divergence theorem (b) Stoke's thoerem

(c) Green's theorem (d) Morera's theorem

25. Which of the following is true?

(a) $\cosh^2 x+\sinh^2 x=1$ (b) $\cosh^2 x-\sinh^2 x=1$

(c) $\frac{d}{dx}(\cosh x)=-\sinh x$ (d) $\frac{d}{dx}(\sinh x)=-\cosh x$

26. Which of the following is a divergent sequence?

(a) $(1, 1, 1, ...)$
(b) $(-1, 1, -1, 1, ...)$
(c) $\left(1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, ...\right)$
(d) $\left(\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, ...\right)$

27. Which of the following is a first order linear differential equation?

(a) $\frac{dy}{dx} + y \tan x = e^x y^3$
(b) $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \sin x$
(c) $\left(\frac{dy}{dx}\right)^2 + y \cos x = x^3$
(d) $\frac{dy}{dx} + y \sin x = e^x$

28. Laplace transform of cos at is,

(a) $\frac{a}{s^2 + a^2}$
(b) $\frac{s}{s^2 + a^2}$
(c) $\frac{a}{s^2 - a^2}$
(d) $\frac{s}{s^2 - a^2}$

29. The relation '<' (less than) is ———— relation.

(a) reflexive
(b) symmetric
(c) transitive
(d) equivalence

30. $\int \sin^n x \, dx =$ ————.

(a) $\frac{\sin^{n-1} x \cos x}{n} + \frac{n-1}{n} \int \sin^{n-2} x \, dx$

(b) $\frac{-\sin^{n-1} x \cos x}{n} + \frac{n-1}{n} \int \sin^{n-2} x \, dx$

(c) $\frac{-\sin^{n-1} x \cos x}{n} - \frac{n-1}{n} \int \sin^{n-2} x \, dx$

(d) $\frac{\sin^{n-1} x \cos x}{n} - \frac{n-1}{n} \int \sin^{n-2} x \, dx$

(30 × 4 = 120)

PART II

Each question carries 10 marks.

31. Test for continuity the function

$$f(x)=\begin{cases} x\sin\frac{1}{x} & \text{for } x\neq 0 \\ 0 & \text{for } x=0 \end{cases}$$

at $x=0$.

32. If $\bar{f}$ is a vector point function, prove that $div(curl\,\bar{f})=0$ i.e. $\nabla\cdot(\nabla\times\bar{f})=0$.

33. Express the complex number $1+i$ in modulus amplitude form (polar form).

34. Evaluate $\int_C |z|\,dz$ where C is the unit circle in the left half plane.

35. Using Mathematical induction, prove that $\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\ldots\frac{1}{n(n+1)}=\frac{n}{n+1}$ for all $n\in N$.

36. Solve the differential equation,

$x(1+y^2)dx+y(1+x^2)dy=0$.

37. Find the equation of the line perpendicular to the line $2x+3y+7=0$ and passing through the point $(1, 1)$.

38. Find the inverse of the matrix $\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$.

(8 × 10 = 80)
