

COMMON HALF YEARLY EXAMINATION - 2025

Standard XI

Reg.No.

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MATHEMATICS

Time : 3.00 hrs

Part - I

Marks : 90

20 x 1 = 20

I. Choose the correct answer:

- The number of relations on a set containing 3 elements is
a) 9 b) 81 c) 512 d) 1024
- The function $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = \sin x + \cos x$ is
a) an odd function b) neither odd nor even
c) an even function d) both odd and even
- The value of $\log_a b \log_b c \log_c a$ is
a) 2 b) 1 c) 3 d) 4
- $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \dots + \cos 179^\circ =$
a) 0 b) 1 c) -1 d) 89
- The number of 5 digit numbers all digits of which are odd is
a) 25 b) 5^5 c) 5^6 d) 625
- $1 + 3 + 5 + 7 + \dots + 19$ is equal to
a) 101 b) 81 c) 71 d) 100
- The H.M of two positive numbers whose AM and GM are 16, 8 respectively is
a) 10 b) 6 c) 5 d) 4
- Value of $\sin^2 \theta - \cos^2 \theta$ is
a) $\sin 2\theta$ b) $-\cos 2\theta$ c) $\cos 2\theta$ d) $-\sin 2\theta$
- The area of triangle formed by the lines $x^2 - 4y^2 = 0$ and $x = a$ is
a) $2a^2$ b) $\frac{\sqrt{3}}{2} a^2$ c) $\frac{1}{2} a^2$ d) $\frac{2}{\sqrt{3}} a^2$
- The length of $\perp$ from the origin to the line $\frac{x}{3} - \frac{y}{4} = 1$ is
a) $\frac{11}{5}$ b) $\frac{5}{12}$ c) $\frac{12}{5}$ d) $\frac{-5}{12}$
- If the points $(x, -2)$, $(5, 2)$, $(8, 8)$ are collinear, then x is equal to
a) -3 b) $\frac{1}{3}$ c) 1 d) 3
- If $\lambda \hat{i} + 2\lambda \hat{j} + 2\lambda \hat{k}$ is a unit vector, then the value of λ is
a) $\frac{1}{3}$ b) $\frac{1}{4}$ c) $\frac{1}{9}$ d) $\frac{1}{2}$
- If $\vec{a} + 2\vec{b}$ and $3\vec{a} + m\vec{b}$ are parallel, then the value of m is
a) 3 b) $\frac{1}{3}$ c) 6 d) $\frac{1}{6}$

- 15 If $pv = 81$, then $\frac{dp}{dv}$ at $v = 9$ is

- a) 1 b) -1 c) 2 d) -2

16. If $y = mx + c$ and $f(0) = f'(0) = 1$, then $f(2)$ is
- a) 1 b) -1 c) 2 d) -2
- b) 2 c) 3 d) -3

17. $\int e^{\sqrt{x}} dx$ is

- a) $2\sqrt{x}(1 - e^{\sqrt{x}}) + c$ b) $2\sqrt{x}(e^{\sqrt{x}} - 1) + c$

- c) $2\sqrt{x}(1-\sqrt{x})+c$ d) $2\sqrt{x}(\sqrt{x}-1)+c$

18. If $\int f(x) dx = g(x) + c$, then $\int f(x) g'(x) dx =$

- a) $\int (f(x))^2 dx$ b) $\int f(x) g(x) dx$ c) $\int f'(x) g(x) dx$ d) $\int (g(x))^2 dx$

19. Ten coins are tossed. The probability of getting at least 8 heads is

- a) $\frac{7}{64}$ b) $\frac{7}{32}$ c) $\frac{7}{16}$ d) $\frac{7}{128}$

20. If two events A and B are independent such that $P(A) = 0.35$ and $P(A \cup B) = 0.6$, then $P(B)$ is

- a) $\frac{5}{13}$ b) $\frac{1}{13}$ c) $\frac{4}{13}$ d) $\frac{7}{13}$

II. Answer any 7 questions. (Q.No.30 is compulsory)

21. Find the number of subsets of A if $A = \{x : x = 4n+1, 2 \leq n \leq 5, n \in \mathbb{N}\}$

22. Find the real roots of $x^4 = 16$

- 23. Find the rank of the word "TABLE"**

24. If θ is a parameter, find the equation of the locus of a moving point, whose co-ordinates are $x = a \cos^3 \theta$ and $y = a \sin^3 \theta$

25. Show that
$$\begin{vmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{vmatrix}^2 = \begin{vmatrix} b^2 + c^2 & ab & ac \\ ab & c^2 + a^2 & bc \\ ac & bc & a^2 + b^2 \end{vmatrix}$$

26. Find the angle between the Vectors $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$

27. Find the positive integer n , so that $\lim_{x \rightarrow 3} \frac{x^n - 3^n}{x - 3} = 27$

28. Evaluate $\int e^{3x} \cos 2x \, dx$

29. What is the chance that leap year should have fifty three Sundays?

30. If $y = \tan^{-1}x$, find y''

Part - III

7 x 3 = 21

III. Answer any 7 questions. (Q.No.40 is compulsory)

31. In the $\mathbb{Z}$ of integers, define mRn if $m-n$ is divisible by 7, prove that R is an equivalence.

32. Resolve into partial fractions : $\frac{x}{(x+3)(x-4)}$

33. Prove that $\tan(315^\circ) \cot(-405^\circ) + \cot(495^\circ) \tan(-585^\circ) = 2$

34. ${}_{np}P_r = 11880$ and ${}_{nc}_r = 495$, find n and r

35. Find $\frac{d^2y}{dx^2}$ if $x^2 + y^2 = 4$

36. Show that collinear $(1, 3), (2, 1), (\frac{1}{2}, 4)$

37. Show that the vectors are coplanar: $4\hat{i} + 5\hat{j} + \hat{k}, -\hat{j} - \hat{k}, 3\hat{i} + 9\hat{j} + 4\hat{k}$ and $-4\hat{i} + 4\hat{j} + 4\hat{k}$

38. Prove that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc \left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c} \right)$

39. Evaluate $\int x \cos x \, dx$

40. Find $\sqrt[3]{999}$ approximately (two decimal places)

Part - IV

IV. Answer all the questions.

7 x 5 = 35

41. a) Let $f, g : \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = 2x - |x|$ and $g(x) = 2x + |x|$ find $f \circ g$
(OR)

b) Simplify $\frac{1}{3-\sqrt{8}} - \frac{1}{\sqrt{8}-\sqrt{7}} + \frac{1}{\sqrt{7}-\sqrt{6}} - \frac{1}{\sqrt{6}-\sqrt{5}} + \frac{1}{\sqrt{5}-2}$

42. a) If $A+B = 45^\circ$, then prove that $(1 + \tan A)(1 + \tan B) = 2$

(OR)

b) If $\frac{\log x}{y-z} = \frac{\log y}{z-x} = \frac{\log z}{x-y}$, then prove that $xyz = 1$

43. a) By Mathematical induction method, Prove that

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

(OR)

b) State and prove Napier's Theorem for $\triangle ABC$

44. a) Evaluate $\int \frac{5x-7}{\sqrt{3x-x^2-2}} dx$

(OR)

b) $y = e^{\tan^{-1} x}$, show that $(1+x^2) y'' + (2x-1) y' = 0$

45. a) Using factor theorem, Prove that

$$\begin{vmatrix} (q+r)^2 & p^2 & p^2 \\ q^2 & (r+p)^2 & q^2 \\ r^2 & r^2 & (p+q)^2 \end{vmatrix} = 2pqr(p+q+r)^3$$

(OR)

b) If $\sin y = x \sin(a+y)$, then prove that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$, $a \neq n\pi$

46. a) Prove that the medians of triangle are concurrent

(OR)

b) A factory has two machines I and II. Machine-I produces 40% of items of the output and Machine-II produces 60% of the items. Further 4% of items produced by Machine-I are defective and 5% produced by Machine-II are defective. If an item is drawn at random, find the probability that it is a defective item.

47. a) The slope of one of the straight lines $ax^2+2hxy+by^2=0$ is twice that of the other, show that $8h^2=9ab$.

(OR)

b) Prove that $\sqrt[3]{x^3+6} - \sqrt[3]{x^3+3}$ is approximately equal to $\frac{1}{x^2}$ when x is sufficiently large.

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