

Kerala Board



Question Paper

First Term

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SECOND YEAR HIGHER SECONDARY
FIRST TERMINAL EXAMINATION-2024

PART-III
MATHEMATICS(COMMERCE)
Maximum :60 Scores

Time :2hrs
Cool-off time :15 Minutes

Part A

Answer any 6 questions from 1 to 8. Each carries 3 score.

(6 × 3 = 18)

1. Construct a 3×2 matrix $A = [a_{ij}]$ whose elements are given by $a_{ij} = i + 2j$. (3)
2. Show that the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 5x + 2$ is bijective.
3. If $X + Y = \begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix}$ and $X - Y = \begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$. Find X and Y. (3)
4. (a) Find the principal value of $\cos^{-1} \left(\frac{1}{2} \right)$. (1)
(b) Find the value of $\tan^{-1} \left[2 \sin \left(\cos^{-1} \left(\frac{\sqrt{3}}{2} \right) \right) \right]$ (2)
5. Simplify $\tan^{-1} \left(\frac{\cos x - \sin x}{\cos x + \sin x} \right)$, $-\frac{\pi}{4} < x < \frac{3\pi}{4}$. (3)
6. Find all points of discontinuity of the function $f(x) = \begin{cases} 2x + 3 & , \text{if } x \leq 2 \\ 2x - 3 & , \text{if } x > 2 \end{cases}$ (3)
7. Find $\frac{dy}{dx}$, where $x^2 + xy + y^2 = 100$, (3)
8. Consider the relation R on Q defined by $R = \{(x, y) : x - y \text{ is divisible by } 4\}$. Show that R is an equivalence relation. (3)

Part B

Answer any 6 questions from 9 to 16. Each carries 4 score.

(6 × 4 = 24)

9. Express the matrix $A = \begin{bmatrix} 2 & -1 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix. (4)
10. (a) if A is a 2×2 matrix with $|A| = 5$, then $|adj A|$ is (1)
a) 5 b) 25 c) $\frac{1}{5}$ d) $\frac{1}{25}$
(b) If the area of a triangle whose vertices are $(k, 0)$, $(5, 0)$, $(0, 1)$ is 10 square units, then find the value of k. (3)
11. (a) consider the function $f : R \rightarrow R$, by $f(x) = |x|$, Show that f is neither one one nor onto. (2)
(b) If $f(x) = 8x^3$ and $g(x) = x^{1/3}$ then find $f \circ g$ and $g \circ f$ (2)
12. (a) Find the value of $\cos^{-1} \left(\cos \left(\frac{7\pi}{6} \right) \right)$. (2)

- (b) Show that $3\sin^{-1}x = \sin^{-1}(3x - 4x^3)$, $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$ (2)
13. (a) Find the value of $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ (1)
- (b) Write $\tan^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$ in the simplest form. (3)
14. (a) Which of the following function is not continuous ? (1)
- A) $f(x) = x^2$ B) $f(x) = |x|$ C) $f(x) = [x]$ D) $f(x) = \sin x$
- (b) Find the value of k so that $f(x) = \begin{cases} kx+1 & , \text{if } x \leq 5 \\ 3x-5 & , \text{if } x > 5 \end{cases}$ is continuous at $x = 5$. (3)
15. (a) Differentiate $\sin(\cos(x^2))$ with respect to x . (2)
- (b) if $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ then find $\frac{dy}{dx}$. (2)
16. (a) If $y = \tan^{-1}x$, $\frac{dy}{dx} = \underline{\hspace{2cm}}$ (1)
- (b) If $y = (\tan^{-1})^2$, Show that $(x^2+1)^2 y_2 + 2x(x^2+1) y_1 = 2$. (3)

Part C

Answer any 3 questions from 17 to 20. Each carries 6 score.

(6 × 3 = 18)

17. (a) If $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$, then prove that $A^2 = \begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$. (2)
- (b) If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, Show that $A^2 - 5A + 7I = 0$. (3)
18. Solve the system of equations using matrix method (6)
- $$\begin{aligned} x - y + z &= 4 \\ 2x + y - 3z &= 0 \\ x + y + z &= 2. \end{aligned}$$



19. (a) The figure represents graph of a function $f(x)$ (2)
- i) Write the domain and range of f (2)
- ii) How can we restrict the domain of f to make it invertible in the above range. (2)
- (b) Write a relation R on the set $A = \{1, 2, 3\}$ which is reflexive and symmetric but not transitive. (2)
20. (a) Find the derivative of $x^{\sin x} + 2^x$. (3)
- (b) If $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$, Find $\frac{dy}{dx}$ (3)

Name :

Class No. :

HIGHER SECONDARY
FIRST TERMINAL EXAMINATION, SEPTEMBER - 2024

Second Year

Part III
MATHEMATICS (SCIENCE)

Max. Score : 60

Time : 2 Hrs

Cool-off Time : 15 Mts

General Instructions

- * There is a **cool-off time** of 15 minutes in addition to the writing time of 2 hours .
- * You are not allowed to write your answer nor to discuss anything with others during the **cool-off time**.
- * Use cool-off time to get familiar with questions and to plan your answers.
- * Read questions carefully before answering.
- * All questions are compulsory and only internal choice is allowed.

Answer any 6 questions from 1 to 8. Each carries 3 scores

1. 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. [3]

2. Find all points of discontinuity of the function, $f(x) = \begin{cases} 2x - 3, & \text{if } x \leq 2 \\ 2x + 1 & \text{if } x > 2 \end{cases}$ [3]

3. (a) Write an example of a relation on set $A = \{a, b, c\}$ which is reflexive and symmetric [1]
(b) Show that the function $f(x) = 3x - 4$ is one - one and onto [2]

4. Consider the matrix $A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$
(a) Find A^2 [2]
(b) Find k so that $A^2 = kA - 7I$ [1]

1. $R = \{(a, b) : 2 \text{ divides } a - b\}$ എന്ന ഇൻറീജർ Z ൽ നന്നിർവ്വചിച്ച relation equivalence ആണെന്നു തെളിയിക്കുക. [3]

2. $f(x) = \begin{cases} 2x - 3, & \text{if } x \leq 2 \\ 2x + 1 & \text{if } x > 2 \end{cases}$
എന്ന ഫങ്ഷന്റെ എല്ലാ ഡിസ്കണ്ടിന്യൂസ് പോയിന്റുകളും കാണുക. [3]

3. (a) $A = \{a, b, c\}$ എന്ന സെറ്റിലുള്ള റിഫ്ലക്സിവും, സിമട്രിക്കും ആയ റിലേഷൻ ഉദാഹരണം എഴുതുക [1]
(b) $f(x) = 3x - 4$ എന്ന ഫങ്ഷൻ one - one, onto എന്നു തെളിയിക്കുക. [2]

4. $A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$ എന്നു പരിഗണിക്കുക
(a) A^2 കാണുക. [2]
(b) $A^2 = kA - 7I$ ആയാൽ k യുടെ വില കാണുക [1]

5. (a) If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$

the value of $x = \dots\dots\dots$

(-6, 6, 0, ± 6)

(b) Find the area of a triangle whose vertices are (3, 8), (-4, 2) and (5, 1)

[1]

[2]

5. (a) $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ ആയാൽ

x ന്റെ വില $\dots\dots\dots$

(-6, 6, 0, ± 6)

(b) (3, 8), (-4, 2), (5, 1) എന്നിവ ഒരു

ത്രികോണത്തിന്റെ ശീർഷകങ്ങളായാൽ

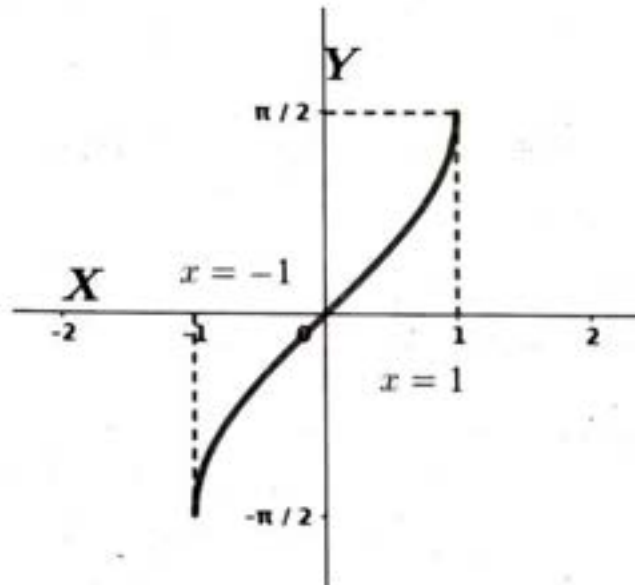
അതിന്റെ വിസ്തീർണ്ണം കാണുക

[1]

[2]

6. Consider the graph of a function given below

6. ചുവടെ കൊടുത്ത ഫങ്ഷന്റെ ഗ്രാഫ് പരിഗണിക്കുക



(a) Write the domain of the function

(b) Write the range of the function

(c) Write the name of the function

[1]

[1]

[1]

(a) ഫങ്ഷന്റെ ഡൊമൈൻ എഴുതുക

(b) ഫങ്ഷന്റെ റേഞ്ച് എഴുതുക

(c) ഫങ്ഷന്റെ പേര് എഴുതുക

[1]

[1]

[1]

7. (a) What is the value of $\sin^{-1}\left(\sin \frac{3\pi}{5}\right)$

(i) $\frac{3\pi}{5}$

(ii) $\frac{2\pi}{5}$

(iii) $-\frac{3\pi}{5}$

(iv) $-\frac{2\pi}{5}$

(b) Show that

$\sin^{-1}(2x\sqrt{1-x^2}) = 2\cos^{-1}x$

[1]

[2]

7. (a) $\sin^{-1}\left(\sin \frac{3\pi}{5}\right)$

ന്റെ വില എന്ത്?

(i) $\frac{3\pi}{5}$

(ii) $\frac{2\pi}{5}$

(iii) $-\frac{3\pi}{5}$

(iv) $-\frac{2\pi}{5}$

(b) $\sin^{-1}(2x\sqrt{1-x^2}) = 2\cos^{-1}x$

എന്നു തെളിയിക്കുക.

[1]

[2]

8. Find $\frac{dy}{dx}$,

where $x^3 + x^2y + xy^2 + y^3 = 81$

[3]

8. $x^3 + x^2y + xy^2 + y^3 = 81$ ആയാൽ

കാണുക

$\frac{dy}{dx}$,

(2)

P.T.O

Answer any 6 questions from 9 to 16. Each carries 4 scores

9. (a) If $n(A) = 3$, $n(B) = 4$, then the number of one - one functions from A to B is [1]

(b) Find $f \circ g$ and $g \circ f$ for the real functions

$f(x) = \sin x$ and $g(x) = x^2$ [3]

10. (a) If A is a singular matrix then

$|A| = \dots\dots\dots$ [1]

(b) Given that $\begin{bmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & 5 \end{bmatrix}$

is a singular matrix.

Find the value of x . [3]

11. Find 'a' and 'b' such that the function

defined by $f(x) = \begin{cases} 5, & x \leq 2 \\ ax + b, & 2 < x < 10 \\ 21, & x \geq 10 \end{cases}$ is a continuous function [4]

12. (a) Construct a 2×2 matrix $A = [a_{ij}]$, where $a_{ij} = |2i + j|$ [2]

(b) Express A as the sum of symmetric and skew symmetric matrices [2]

13. (a) Write the principal value branch of $\cos^{-1}(x)$ [1]

$\tan^{-1}(-1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(\frac{1}{2}\right)$

(b) Find the value of [3]

14. (a) $\tan^{-1}(\sqrt{3}) - \cot^{-1}(-\sqrt{3}) = \dots\dots\dots$ [1]

(i) π (ii) $-\frac{\pi}{2}$

(iii) 0 (iv) $2\sqrt{3}$

(b) Write following in simplest form [3]

$\tan^{-1}\left[\frac{3a^2x-x^3}{a^3-3ax^2}\right], a > 0; -\frac{a}{\sqrt{3}} < x < \frac{a}{\sqrt{3}}$

9. (a) $n(A) = 3$, $n(B) = 4$ ആയാൽ A ൽ നിന്ന് B യിലേക്കുള്ള വൺ - വൺ ഏറ്റവും [1]

(b) $f(x) = \sin x$ and $g(x) = x^2$ എന്നിവ റിയൽ

ഫങ്ഷൻ ആയാൽ $f \circ g$, $g \circ f$ എന്നിവ കാണുക [3]

10. (a) A ഒരു സിങ്കുലർ മെട്രിക്സ് ആയാൽ

$|A| = \dots\dots\dots$ [1]

(b) $\begin{bmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & 5 \end{bmatrix}$ എന്നത്

ഒരു സിങ്കുലർ മെട്രിക്സ് എന്നു തന്നിരിക്കുന്നു.

x ന്റെ വില കാണുക [3]

11.

$f(x) = \begin{cases} 5, & x \leq 2 \\ ax + b, & 2 < x < 10 \\ 21, & x \geq 10 \end{cases}$ ഒരു കണ്ടിന്യൂസ്

ഫങ്ഷൻ ആയാൽ 'a', 'b' എന്നിവ കാണുക [4]

12. (a) $a_{ij} = |2i + j|$ ആയാൽ, $A = [a_{ij}]$ എന്ന

2×2 മെട്രിക്സ് നിർമ്മിക്കുക [2]

A യെ സിമെട്രിക് മെട്രിക്സിന്റെയും സ്ക്യൂ സിമെട്രിക് മെട്രിക്സിന്റെയും തുകയായി എഴുതുക. [2]

13. (a) $\cos^{-1}(x)$

ന്റെ പ്രിൻസിപ്പൽ വാല്യൂ ബ്രാഞ്ച് എഴുതുക. [1]

(b) $\tan^{-1}(-1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(\frac{1}{2}\right)$

x ന്റെ വില കാണുക [3]

14. (a) $\tan^{-1}(\sqrt{3}) - \cot^{-1}(-\sqrt{3}) = \dots\dots\dots$

(i) π (ii) $-\frac{\pi}{2}$

(iii) 0 (iv) $2\sqrt{3}$

$\tan^{-1}\left[\frac{3a^2x-x^3}{a^3-3ax^2}\right], a > 0; -\frac{a}{\sqrt{3}} < x < \frac{a}{\sqrt{3}}$

(b) താഴെ കൊടുത്തതിനെ ലഘൂകരിക്കുക

15. (a) Using chain rule, find the derivative of $\cos(\sqrt{x})$

(b) Find $\frac{dy}{dx}$ if $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$

16. Find $\frac{dy}{dx}$ if $y^x = x^y$

[2] 15. (a) ചെരിൻ റൂൾ ഉപയോഗിച്ച് $\cos(\sqrt{x})$

ന്റെ ഡെറിവേറ്റീവ് കാണുക [2]

[2] (b) $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$

ആയാൽ $\frac{dy}{dx}$ കാണുക [2]

[4] 16. $y^x = x^y$ ആയാൽ $\frac{dy}{dx}$ കാണുക [4]

Answer any 3 questions from 17 to 20. Each carries 6 scores

17. (a) Show that the system of equations

$$3x - 2y + 3z = 8$$

$$2x + y - z = 1$$

$$4x - 3y + 2z = 4 \quad \text{is consistent} \quad [1]$$

(b) Solve the above system using matrix method [5]

17. (a) $3x - 2y + 3z = 8$

$$2x + y - z = 1$$

$$4x - 3y + 2z = 4$$

എന്നി സമവാക്യങ്ങൾ കൺസിസ്റ്റന്റ് ആണെന്നു തെളിയിക്കുക. [1]

(b) മുകളിൽ കൊടുത്തിട്ടുള്ള സമവാക്യങ്ങൾ മെട്രിക് രീതിയിൽ നിർദ്ധാരണം ചെയ്യുക. [5]

18. (a) Find $\frac{dy}{dx}$ if $x = a(\cos\theta + \theta\sin\theta)$, [3]

$$y = a(\sin\theta - \theta\cos\theta),$$

(b) If $y = \sin^{-1}(x)$, [3]
prove that $(1 - x^2)y'' - xy' = 0$

18. (a) $x = a(\cos\theta + \theta\sin\theta)$, [3]

$$y = a(\sin\theta - \theta\cos\theta), \quad \text{ആയാൽ } \frac{dy}{dx} \text{ കാണുക}$$

(b) $y = \sin^{-1}(x)$, ആയാൽ [3]
 $(1 - x^2)y'' - xy' = 0$ എന്നു തെളിയിക്കുക.

19. (a) If $F(x) = \begin{bmatrix} \cos x & \sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$, [3]
then show that $F(x) \cdot F(y) = F(x+y)$

(b) If $A = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$, [3]
then verify that $A' A = I$

19. (a) $F(x) = \begin{bmatrix} \cos x & \sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$ ആയാൽ [3]
 $F(x) \cdot F(y) = F(x+y)$ എന്നു തെളിയിക്കുക.

(b) $A = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$, ആയാൽ [3]
 $A' A = I$ എന്നു പരിശോധിക്കുക.

20. Let $f: N \rightarrow Y$ be a function defined as $f(x) = 4x+3$, where $Y = \{y \in N : y = 4x+3 \text{ for some } x \in N\}$

(a) Express x in terms of y . [1]

(b) Show that f is invertible. [4]

(c) Find the inverse. [1]

20. $f: N \rightarrow Y$ ൽ നിന്നും നിർവ്വചിച്ചിട്ടുള്ള $f(x) = 4x+3$, where $Y = \{y \in N : y = 4x+3 \text{ for some } x \in N\}$ എന്ന ഫങ്ഷൻ പരിഗണിക്കുക

(a) x നെ y യുടെ രൂപത്തിൽ എഴുതുക. [1]

(b) f ഇൻവെർട്ടിബിൾ എന്നു തെളിയിക്കുക. [4]

(c) ഇൻവേഴ്സ് കാണുക. [1]

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