PM SHRI KENDRIYA VIDYALAYA TIKAMGARH

CLASS – 12 (2026-27)

Autumn Break Homework

PHYSICS

1	Write the following 8 - Experiments in your Physics practical copy (Note – Exp 4,5,7,8 Reading/Observation will be done in Laboratory, so leave them blank) **Section A** 1. To determine resistivity of two / three wires by plotting a graph for potential difference versus current. 2. To find resistance of a given wire / standard resistor using metre bridge. 3. To verify the laws of combination (series) of resistances using a metre bridge. 4. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit. **Section B** 5. To find the value of v for different values of u in case of a convex lens and to find the focal length. 6. To find the focal length of a convex mirror, using a convex lens. 7. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation. 8. To draw the I-V characteristic curve for a p-n junction diode in forward and reverse bias.
2	Write the following 6 – Activities in another Physics Practical copy. Note – Reading/Observation will be done in Lab, so leave them blank) **Section A** 1. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multi-meter. 2. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source. 3. To assemble the components of a given electrical circuit. **Section B** 4. To identify a diode, an LED, a resistor and a capacitor from a mixed collection of such items. 5. Use of multi-meter to see the unidirectional flow of current in case of a diode and an LED and check whether a given electronic component (e.g., diode) is in working order. 6. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab.

3 Prepare a project for Practical Examination consist of Project file and Project model.

Roll no	Project Topic
1	To study various factors on which the internal resistance/EMF of a cell depends.
2	Eddy Current
3	Electromagnetic Induction
4	Full Wave rectifier
5	To investigate the relation between the ratio of (i) output and input voltage and (ii) number of turns in the secondary coil and primary coil of a transformer.
6	Eddy Current
7	Electromagnetic Induction
8	Full Wave rectifier
9	Half Wave rectifier
10	Diffraction of Light
11	Eddy Current
12	Diffraction of Light
13	Full Wave rectifier
14	Diffraction of Light
15	To investigate the relation between the ratio of (i) output and input voltage and (ii) number of turns in the secondary coil and primary coil of a transformer.
16	Eddy current
17	Electromagnetic Induction
18	Full Wave rectifier
19	Transformer working – Electromagnetic induction
20	Electromagnetic Induction
21	Full Wave rectifier
22	Half Wave rectifier
23	Diffraction of Light
24	Eddy Current
25	Diffraction of Light
26	Full Wave rectifier
27	To investigate the relation between the ratio of (i) output and input voltage and (ii) number of turns in the secondary coil and primary coil of a transformer.

3 Solve the following CBSE SQP (Sample Question Paper) in separate copy.

SQP1 (2025-26)

Que Paper Link- https://cbseacademic.nic.in/web_material/SQP/ClassXII_2025_26/Physics-SQP.pdf

Ans Key Link- https://cbseacademic.nic.in/web_material/SQP/ClassXII_2025_26/Physics-MS.pdf

SQP1 (2026-27)

Que Paper Link - https://cbseacademic.nic.in/web_material/SQP/ClassXII_2026_27/Physics-SQP.pdf

Ans Key Link - https://cbseacademic.nic.in/web_material/SQP/ClassXII_2026_27/Physics-MS.pdf

4 Describe the following topics on a chart paper with proper diagram.

Roll no- 1 to 5 – Compound Microscope

Roll no- 6 to 10 – Astronomical Telescope

Roll no- 11 to 15 – Cassegrainian Telescope

Roll no- 16 to 19 – Lens Maker's formula

Roll no- 20 to 27 – Simple Microscope

पीएम श्री केंद्रीय विद्यालय, टीकमगढ़

शरदकालीन अवकाश गृहकार्य – सत्र 2026–27

कक्षा: 12वीं विषय: हिंदी (आधार)

1. आरोह भाग–2 : काव्य खंड

1. किसी एक कविता के आधार पर कवि के संदेश एवं जीवन-मूल्यों को स्पष्ट कीजिए।
2. पढ़ाए गए किसी एक काव्य-पाठ से पाँच महत्त्वपूर्ण प्रश्नोत्तर तैयार कीजिए।

2. आरोह भाग–2 : गद्य खंड

1. किसी एक गद्य-पाठ के प्रमुख पात्र की चारित्रिक विशेषताएँ लिखिए।
2. पढ़ाए गए किसी एक पाठ से प्राप्त संदेश को लगभग 150 शब्दों में लिखिए।

3. अभिव्यक्ति और माध्यम

1. विभिन्न जनसंचार माध्यमों का परिचय देते हुए उनके महत्त्व को स्पष्ट कीजिए।
2. फीचर लेखन क्या है? इसकी प्रमुख विशेषताएँ लिखिए।
3. संपादकीय लेखन की विशेषताएँ बताइए।
4. रेडियो नाटक और सामान्य नाटक में अंतर स्पष्ट कीजिए।
5. विशेष लेखन से क्या अभिप्राय है? उदाहरण सहित समझाइए।

4. अपठित बोध एवं लेखन-कौशल

1. निम्नलिखित में से किसी एक विषय पर लगभग 120 शब्दों में रचनात्मक लेख लिखिए:
    - विकसित भारत 2047 में युवाओं की भूमिका
    - डिजिटल शिक्षा: अवसर एवं चुनौतियाँ

5. परियोजना कार्य

निम्नलिखित में से किसी एक विषय पर परियोजना तैयार कीजिए।

- हिंदी भाषा का विकास और वर्तमान स्वरूप
- हिंदी साहित्य में कबीर का योगदान
- डिजिटल युग में हिंदी भाषा एवं साहित्य
- जनसंचार माध्यमों में हिंदी की भूमिका
- कृत्रिम बुद्धिमत्ता (AI) और हिंदी भाषा
- भारतीय समाज में साहित्य की भूमिका

परियोजना में आवरण पृष्ठ, प्रमाण-पत्र, आभार, विषय-सूची, उद्देश्य, विषय-वस्तु, निष्कर्ष एवं संदर्भ सूची शामिल करें। CBSE के निर्देशों के अनुसार परियोजना में मौलिकता, शोध और प्रस्तुतीकरण पर विशेष ध्यान दें।

1.RELATIONS AND FUNCTIONS

QNO	CBSE 2024 QUESTIONS	MARKS
1.	A function $f : R_+ \to R$ (where R_+ is the set of all non-negative real numbers) defined by $f(x) = 4x + 3$ is : (A) one-one but not onto (B) onto but not one-one (C) both one-one and onto (D) neither one-one nor onto	1
2.	A relation R defined on set $A = \{x : x \in Z \text{ and } 0 \le x \le 10\}$ as $R = \{(x, y) : x = y\}$ is given to be an equivalence relation. The number of equivalence classes is : (A) 1 (B) 2 (C) 10 (D) 11	1
3.	A relation R defined on a set of human beings as $R = \{(x, y) : x \text{ is 5 cm shorter than } y\}$ is : (A) reflexive only (B) reflexive and transitive (C) symmetric and transitive (D) neither transitive, nor symmetric, nor reflexive	1
4.	Let $f : R_+ \to [-5, \infty)$ be defined as $f(x) = 9x^2 + 6x - 5$, where R_+ is the set of all non-negative real numbers. Then, f is : (A) one-one (B) onto (C) bijective (D) neither one-one nor onto	1
5.	Which of the following statements is ***not*** true about equivalence classes A_i (i = 1, 2, ... n) formed by an equivalence relation R defined on a set A ? (A) $\bigcup_{i=1}^{n} A_i = A$ (B) $A_i \cap A_j \neq \phi, i \neq j$ (C) $x \in A_i$ and $x \in A_j \Rightarrow A_i = A_j$ (D) All elements of A_i are related to each other, for all i	1

6.	Let $f : R_+ \to [-5, \infty)$ be defined as $f(x) = 9x^2 + 6x - 5$, where R_+ is the set of all non-negative real numbers. Then, f is : (A) one-one (B) onto (C) bijective (D) neither one-one nor onto	1
7.	Let R_+ denote the set of all non-negative real numbers. Then the function $f : R_+ \to R_+$ defined as $f(x) = x^2 + 1$ is : (A) one-one but not onto (B) onto but not one-one (C) both one-one and onto (D) neither one-one nor onto	1
8.	A function $f : R \to A$ defined as $f(x) = x^2 + 1$ is onto, if A is : (A) $(-\infty, \infty)$ (B) $(1, \infty)$ (C) $[1, \infty)$ (D) $[-1, \infty)$	1
9.	Let Z denote the set of integers, then function $f : Z \to Z$ defined as $f(x) = x^3 - 1$ is : (A) both one-one and onto (B) one-one but not onto (C) onto but not one-one (D) neither one-one nor onto	1
10.	A function $f : \mathbb{R} \to \mathbb{R}$ defined as $f(x) = x^2 - 4x + 5$ is : (A) injective but not surjective. (B) surjective but not injective. (C) both injective and surjective. (D) neither injective nor surjective.	1
11.	**Assertion (A) :** The relation $R = \{(x, y) : (x + y)$ is a prime number and $x, y \in N\}$ is not a reflexive relation. **Reason (R) :** The number '2n' is composite for all natural numbers n.	1
12.	Find the domain of the function $f(x) = \sin^{-1}(x^2 - 4)$. Also, find its range.	2
13.	Express $\tan^{-1}\left(\frac{\cos x}{1 - \sin x}\right)$, where $\frac{-\pi}{2} < x < \frac{\pi}{2}$ in the simplest form.	2
14.	Find the principal value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{\sqrt{2}}\right)$.	2
15.	Show that a function $f : R \to R$ defined as $f(x) = x^2 + x + 1$ is neither one-one nor onto. Also, find all the values of x for which $f(x) = 3$.	3

16.	A function f is defined from $R \to R$ as $f(x) = ax + b$, such that $f(1) = 1$ and $f(2) = 3$. Find function $f(x)$. Hence, check whether function $f(x)$ is one-one and onto or not.	3
17.	A relation R on set $A = \{1, 2, 3, 4, 5\}$ is defined as $R = \{(x, y) : \lvert x^2 - y^2 \rvert < 8\}$. Check whether the relation R is reflexive, symmetric and transitive.	3
18.	A function f is defined from $R \to R$ as $f(x) = ax + b$, such that $f(1) = 1$ and $f(2) = 3$. Find function $f(x)$. Hence, check whether function $f(x)$ is one-one and onto or not.	3
19.	Show that a function $f : R \to R$ defined by $f(x) = \frac{2x}{1+x^2}$ is neither one-one nor onto. Further, find set A so that the given function $f : R \to A$ becomes an onto function.	5
20.	A relation R is defined on $N \times N$ (where N is the set of natural numbers) as : $(a, b)\ R\ (c, d) \Leftrightarrow a - c = b - d$ Show that R is an equivalence relation.	5
21.	A relation R on set $A = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$ be defined as $R = \{(x, y) : x + y$ is an integer divisible by $2\}$. Show that R is an equivalence relation. Also, write the equivalence class [2].	5
22.	Let $A = R - \{3\}$ and $B = R - \{a\}$. Find the value of 'a' such that the function $f : A \to B$ defined by $f(x) = \frac{x-2}{x-3}$ is onto. Also, check whether the given function is one-one or not.	5
23.	Let $A = R - \{5\}$ and $B = R - \{1\}$. Consider the function $f : A \to B$, defined by $f(x) = \frac{x-3}{x-5}$. Show that f is one-one and onto.	5
24.	Check whether the relation S in the set of real numbers R defined by $S = \{(a, b) :$ where $a - b + \sqrt{2}$ is an irrational number$\}$ is reflexive, symmetric or transitive.	5

25

Students of a school are taken to a railway museum to learn about railways heritage and its history.



An exhibit in the museum depicted many rail lines on the track near the railway station. Let L be the set of all rail lines on the railway track and R be the relation on L defined by

$R = \{(l_1, l_2) : l_1 \text{ is parallel to } l_2\}$

On the basis of the above information, answer the following questions :

(i) Find whether the relation R is symmetric or not.

(ii) Find whether the relation R is transitive or not.

(iii) If one of the rail lines on the railway track is represented by the equation $y = 3x + 2$, then find the set of rail lines in R related to it.

OR

Let S be the relation defined by $S = \{(l_1, l_2) : l_1 \text{ is perpendicular to } l_2\}$ check whether the relation S is symmetric and transitive.

2.INVERSE TRIGONOMETRIC FUNCTIONS

	CBSE 2024 QUESTIONS	MARKS
1.	**Assertion (A)** : Domain of $y = \cos^{-1}(x)$ is $[-1, 1]$. **Reason (R)** : The range of the principal value branch of $y = \cos^{-1}(x)$ is $[0,\pi]-\left\{\frac{\pi}{2}\right\}$.	1
2.	**Assertion (A)** : Domain of $y = \cos^{-1}(x)$ is $[-1, 1]$. **Reason (R)** : The range of the principal value branch of $y = \cos^{-1}(x)$ is $[0,\pi]-\left\{\frac{\pi}{2}\right\}$.	1
3.	Find the value of $\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left[\sin\left(-\frac{\pi}{2}\right)\right]$.	2
4.	Find the domain of the function $f(x) = \sin^{-1}(x^2 - 4)$. Also, find its range.	2
5.	Find the value of $\sin^{-1}\left(-\frac{1}{2}\right) + \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) + \cot^{-1}\left(\tan\frac{4\pi}{3}\right)$.	2
6.	Find the domain of $f(x) = \cos^{-1}(1 - x^2)$. Also, find its range.	2
7.	**Evaluate :** $\sec^2\left(\tan^{-1}\frac{1}{2}\right) + \text{cosec}^2\left(\cot^{-1}\frac{1}{3}\right)$	2
8.	Find the value of $\left[\sin^2\left\{\cos^{-1}\left(\frac{3}{5}\right)\right\} + \tan^2\left\{\sec^{-1}(3)\right\}\right]$.	2
9.	**Evaluate :** $\cot^2\left\{\text{cosec}^{-1}3\right\} + \sin^2\left\{\cos^{-1}\left(\frac{1}{3}\right)\right\}$	2
10.	**Find value of k if** $\sin^{-1}\left[k\tan\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right] = \frac{\pi}{3}$.	2
11.	If $a = \sin^{-1}\left(\frac{\sqrt{2}}{2}\right) + \cos^{-1}\left(-\frac{1}{2}\right)$ and $b = \tan^{-1}\left(\sqrt{3}\right) - \cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ then find the value of a + b.	2
12.	Simplify : $\cos^{-1}x + \cos^{-1}\left[\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right]$; $\frac{1}{2} \le x \le 1$	2

3 MATRICES

	CBSE 2024 QUESTIONS	MARKS
1.	If a matrix has 36 elements, the number of possible orders it can have, is : (A) 13 (B) 3 (C) 5 (D) 9	1
2.	If $\begin{bmatrix} x+y & 2 \\ 5 & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$, then the value of $\left(\frac{24}{x} + \frac{24}{y}\right)$ is : (A) 7 (B) 6 (C) 8 (D) 18	1
3.	If A and B are two non-zero square matrices of same order such that $(A + B)^2 = A^2 + B^2$, then : (A) $AB = O$ (B) $AB = -BA$ (C) $BA = O$ (D) $AB = BA$	1
4.	If matrices A and B are of order 1×3 and 3×1 respectively, then the order of $A'B'$ is : (A) 1×1 (B) 3×1 (C) 1×3 (D) 3×3	1
5.	If the sum of all the elements of a 3×3 scalar matrix is 9, then the product of all its elements is : (A) 0 (B) 9 (C) 27 (D) 729	1
6.	If $A = [a_{ij}]$ be a 3×3 matrix, where $a_{ij} = i - 3j$, then which of the following is ***false*** ? (A) $a_{11} < 0$ (B) $a_{12} + a_{21} = -6$ (C) $a_{13} > a_{31}$ (D) $a_{31} = 0$	1
7.	If $F(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $[F(x)]^2 = F(kx)$, then the value of k is : (A) 1 (B) 2 (C) 0 (D) -2	1
8.	The number of all scalar matrices of order 3, with each entry -1, 0 or 1, is : (A) 1 (B) 3 (C) 2 (D) 3^9	1

9.	If for the matrix $A = \begin{bmatrix} \tan x & 1 \\ -1 & \tan x \end{bmatrix}$, $A + A' = 2\sqrt{3}\, I$, then the value of $x \in \left[0, \frac{\pi}{2}\right]$ is : (A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$	1
10.	If $A = [a_{ij}]$ is an identity matrix, then which of the following is true ? (A) $a_{ij} = \begin{cases} 0, & \text{if } i = j \\ 1, & \text{if } i \neq j \end{cases}$ (B) $a_{ij} = 1, \forall\, i, j$ (C) $a_{ij} = 0, \forall\, i, j$ (D) $a_{ij} = \begin{cases} 0, & \text{if } i \neq j \\ 1, & \text{if } i = j \end{cases}$	1
11.	Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a square matrix such that adj A = A. Then, $(a + b + c + d)$ is equal to : (A) 2a (B) 2b (C) 2c (D) 0	1
12.	If A and B are two skew symmetric matrices, then (AB + BA) is : (A) a skew symmetric matrix (B) a symmetric matrix (C) a null matrix (D) an identity matrix	1
13.	For any square matrix A, $(A - A')$ is always (A) an identity matrix (B) a null matrix (C) a skew symmetric matrix (D) a symmetric matrix	1
14.	If $\begin{bmatrix} a & c & 0 \\ b & d & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a scalar matrix, then the value of $a + 2b + 3c + 4d$ is : (A) 0 (B) 5 (C) 10 (D) 25	1
15.	If $A = \begin{bmatrix} 2 & 1 \\ -4 & -2 \end{bmatrix}$, then the value of $I - A + A^2 - A^3 + \ldots$ is : (A) $\begin{bmatrix} -1 & -1 \\ 4 & 3 \end{bmatrix}$ (B) $\begin{bmatrix} 3 & 1 \\ -4 & -1 \end{bmatrix}$ (C) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	1

16.	Given that $[1 \quad x]\begin{bmatrix} 4 & 0 \\ -2 & 0 \end{bmatrix} = 0$, the value of x is : (A) -4 (B) -2 (C) 2 (D) 4	1
17.	If $A = \begin{bmatrix} 1 & 3 \\ 3 & 4 \end{bmatrix}$ and $A^2 - kA - 5I = O$, then the value of k is : (A) 3 (B) 5 (C) 7 (D) 9	1
18.	If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ and $A^2 + 7I = kA$, then the value of k is : (A) 1 (B) 2 (C) 5 (D) 7	1
19.	Let $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$ and $B = \frac{1}{3}\begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & \lambda \end{bmatrix}$. If AB = I, then the value of λ is : (A) $\frac{-9}{4}$ (B) -2 (C) $\frac{-3}{2}$ (D) 0	1
20.	If $A = \begin{bmatrix} a & c & -1 \\ b & 0 & 5 \\ 1 & -5 & 0 \end{bmatrix}$ is a skew-symmetric matrix, then the value of $2a - (b + c)$ is : (A) 0 (B) 1 (C) -10 (D) 10	1

21.	If $\begin{bmatrix} x & 2 & 0 \end{bmatrix} \begin{bmatrix} 5 \\ -1 \\ x \end{bmatrix} = \begin{bmatrix} 3 & 1 \end{bmatrix} \begin{bmatrix} -2 \\ x \end{bmatrix}$, then value of x is : (A) -1 (B) 0 (C) 1 (D) 2	1
22.	Find the matrix A^2, where $A = [a_{ij}]$ is a 2×2 matrix whose elements are given by a_{ij} = maximum (i, j) – minimum (i, j) : (A) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$	1
23.	If A is a square matrix of order 2 and $\lvert A \rvert = -2$, then value of $\lvert 5A' \rvert$ is : (A) -50 (B) -10 (C) 10 (D) 50	1
24.	The product of matrix P and Q is equal to a diagonal matrix. If the order of matrix Q is 3×2, then order of matrix P is : (A) 2×2 (B) 3×3 (C) 2×3 (D) 3×2	1
25.	If $A = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 \\ -1 & 1 \end{bmatrix}$, then value of x for which $A^2 = B$ is : (A) -2 (B) 2 (C) 2 or -2 (D) 4	1
26.	*Assertion (A) :* For any symmetric matrix A, B′AB is a skew-symmetric matrix. *Reason (R) :* A square matrix P is skew-symmetric if $P' = -P$.	1
27.	(a) If $A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & -1 & -1 \\ 0 & -2 & 1 \end{bmatrix}$, find A^{-1} and use it to solve the following system of equations : $x - 2y = 10$, $2x - y - z = 8$, $-2y + z = 7$	5

28.	If $A = \begin{bmatrix} -1 & a & 2 \\ 1 & 2 & x \\ 3 & 1 & 1 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & -1 & 1 \\ -8 & 7 & -5 \\ b & y & 3 \end{bmatrix}$, find the value of $(a + x) - (b + y)$.	5
29	A scholarship is a sum of money provided to a student to help him or her pay for education. Some students are granted scholarships based on their academic achievements, while others are rewarded based on their financial needs.   Every year a school offers scholarships to girl children and meritorious achievers based on certain criteria. In the session 2022 – 23, the school offered monthly scholarship of ₹ 3,000 each to some girl students and ₹ 4,000 each to meritorious achievers in academics as well as sports. In all, 50 students were given the scholarships and monthly expenditure incurred by the school on scholarships was ₹ 1,80,000. Based on the above information, answer the following questions : (i) Express the given information algebraically using matrices. *1* (ii) Check whether the system of matrix equations so obtained is consistent or not. *1* (iii) (a) Find the number of scholarships of each kind given by the school, using matrices. *2* **OR** (iii) (b) Had the amount of scholarship given to each girl child and meritorious student been interchanged, what would be the monthly expenditure incurred by the school ? *2*	

COMPILED BY RAGI UDAYKUMAR PGT MATHS

4 DETERMINANTS

	CBSE 2024 QUESTIONS	MARKS
1.	$\begin{vmatrix} x+1 & x-1 \\ x^2+x+1 & x^2-x+1 \end{vmatrix}$ is equal to : (A) $2x^3$ (B) 2 (C) 0 (D) $2x^3 - 2$	1
2.	If a_{ij} and A_{ij} represent the $(ij)^{th}$ element and its cofactor of $\begin{bmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{bmatrix}$ respectively, then the value of $a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23}$ is : (A) 0 (B) -28 (C) 114 (D) -114	1
3.	If a matrix has 36 elements, the number of possible orders it can have, is : (A) 13 (B) 3 (C) 5 (D) 9	1
4.	If $\begin{vmatrix} -a & b & c \\ a & -b & c \\ a & b & -c \end{vmatrix} = kabc$, then the value of k is : (A) 0 (B) 1 (C) 2 (D) 4	1
5.	If $\begin{vmatrix} -a & b & c \\ a & -b & c \\ a & b & -c \end{vmatrix} = kabc$, then the value of k is : (A) 0 (B) 1 (C) 2 (D) 4	1
6.	If $\begin{vmatrix} 1 & 3 & 1 \\ k & 0 & 1 \\ 0 & 0 & 1 \end{vmatrix} = \pm 6$, then the value of k is : (A) 2 (B) -2 (C) ± 2 (D) ∓ 2	1

7.	If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A^{-1} is : (A) $\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ (B) $30\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ (C) $\frac{1}{30}\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ (D) $\frac{1}{30}\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$	1
8.	The value of $\begin{vmatrix} 8 & 2 & 7 \\ 12 & 3 & 5 \\ 16 & 4 & 3 \end{vmatrix}$ is : (A) 0 (B) 2 (C) 7 (D) – 2	1
9.	Given that $A^{-1} = \frac{1}{7}\begin{bmatrix} 2 & 1 \\ -3 & 2 \end{bmatrix}$, matrix A is : (A) $7\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (C) $\frac{1}{7}\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (D) $\frac{1}{49}\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$	1
10	If $A = \begin{bmatrix} -2 & 0 & 0 \\ 1 & 2 & 3 \\ 5 & 1 & -1 \end{bmatrix}$, then the value of | A (adj. A) | is : (A) 100 I (B) 10 I (C) 10 (D) 1000	1
11	If $A = [a_{ij}] = \begin{bmatrix} 2 & -1 & 5 \\ 1 & 3 & 2 \\ 5 & 0 & 4 \end{bmatrix}$ and c_{ij} is the cofactor of element a_{ij}, then the value of $a_{21} \cdot c_{11} + a_{22} \cdot c_{12} + a_{23} \cdot c_{13}$ is : (A) –57 (B) 0 (C) 9 (D) 57	1

12	If A is a square matrix of order 3 such that the value of $\lvert \text{adj}\cdot A \rvert = 8$, then the value of $\lvert A^T \rvert$ is : (A) $\sqrt{2}$ (B) $-\sqrt{2}$ (C) 8 (D) $2\sqrt{2}$	1
13	If inverse of matrix $\begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ is the matrix $\begin{bmatrix} 1 & 3 & 3 \\ 1 & \lambda & 3 \\ 1 & 3 & 4 \end{bmatrix}$, then value of λ is : (A) –4 (B) 1 (C) 3 (D) 4	1
14	Let $f(x) = \begin{vmatrix} x^2 & \sin x \\ p & -1 \end{vmatrix}$, where p is a constant. The value of p for which $f'(0) = 1$ is : (A) $\mathbb{R}$ (B) 1 (C) 0 (D) –1	1
15	*Assertion (A) :* Every scalar matrix is a diagonal matrix. *Reason (R) :* In a diagonal matrix, all the diagonal elements are 0.	1
16	*Assertion (A) :* For matrix $A = \begin{bmatrix} 1 & \cos\theta & 1 \\ -\cos\theta & 1 & \cos\theta \\ -1 & -\cos\theta & 1 \end{bmatrix}$, where $\theta \in [0, 2\pi]$, $\lvert A \rvert \in [2, 4]$. *Reason (R) :* $\cos\theta \in [-1, 1], \forall\, \theta \in [0, 2\pi]$.	1
17	Solve the following system of equations, using matrices : $\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4, \quad \frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1, \quad \frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2$ where $x, y, z \neq 0$	5
18	If $A = \begin{bmatrix} 1 & \cot x \\ -\cot x & 1 \end{bmatrix}$, show that $A'A^{-1} = \begin{bmatrix} -\cos 2x & -\sin 2x \\ \sin 2x & -\cos 2x \end{bmatrix}$.	5
19	If $A = \begin{bmatrix} 5 & 0 & 4 \\ 2 & 3 & 2 \\ 1 & 2 & 1 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$, find $(AB)^{-1}$. Also, find $\lvert (AB)^{-1} \rvert$.	5

20	Given $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 2 \\ 1 & 1 & 2 \end{bmatrix}$, find A^{-1}. Use it to solve the following system of equations : $x + y + z = 1$ $2x + 3y + 2z = 2$ $x + y + 2z = 4$	5
21	If $A = \begin{bmatrix} 2 & 1 & -3 \\ 3 & 2 & 1 \\ 1 & 2 & -1 \end{bmatrix}$, find A^{-1} and hence solve the following system of equations : $2x + y - 3z = 13$ $3x + 2y + z = 4$ $x + 2y - z = 8$	5
22	Use the product of matrices $\begin{pmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{pmatrix}\begin{pmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{pmatrix}$ to solve the following system of equations : $x + 2y - 3z = 6$ $3x + 2y - 2z = 3$ $2x - y + z = 2$	5
23	If $A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 0 & -3 \\ 1 & 2 & 0 \end{bmatrix}$, then find A^{-1} and hence solve the following system of equations : $x + 2y - 3z = 1$ $2x - 3z = 2$ $x + 2y = 3$	5
24	Find the product of the matrices $\begin{bmatrix} 1 & 2 & -3 \\ 2 & 3 & 2 \\ 3 & -3 & -4 \end{bmatrix}\begin{bmatrix} -6 & 17 & 13 \\ 14 & 5 & -8 \\ -15 & 9 & -1 \end{bmatrix}$ and hence solve the system of linear equations : $x + 2y - 3z = -4$ $2x + 3y + 2z = 2$ $3x - 3y - 4z = 11$	5

5 CONTINUITY & DIFFERENTIABILITY

	CBSE 2024 QUESTIONS	MARKS
1.	Which of the following statements is true for the function $f(x) = \begin{cases} x^2+3, & x \neq 0 \\ 1, & x = 0 \end{cases}$? (A) $f(x)$ is continuous and differentiable $\forall\, x \in \mathbb{R}$ (B) $f(x)$ is continuous $\forall\, x \in \mathbb{R}$ (C) $f(x)$ is continuous and differentiable $\forall\, x \in \mathbb{R} - \{0\}$ (D) $f(x)$ is discontinuous at infinitely many points	1
2.	Let $f(x)$ be a continuous function on $[a, b]$ and differentiable on (a, b). Then, this function $f(x)$ is strictly increasing in (a, b) if (A) $f'(x) < 0, \forall\, x \in (a, b)$ (B) $f'(x) > 0, \forall\, x \in (a, b)$ (C) $f'(x) = 0, \forall\, x \in (a, b)$ (D) $f(x) > 0, \forall\, x \in (a, b)$	1
3.	The derivative of $\sin(x^2)$ w.r.t. x, at $x = \sqrt{\pi}$ is : (A) 1 (B) -1 (C) $-2\sqrt{\pi}$ (D) $2\sqrt{\pi}$	1
4.	The number of points, where $f(x) = [x]$, $0 < x < 3$ ($[\cdot]$ denotes greatest integer function) is not differentiable is : (A) 1 (B) 2 (C) 3 (D) 4	1
5.	Let $f(x)$ be a continuous function on $[a, b]$ and differentiable on (a, b). Then, this function $f(x)$ is strictly increasing in (a, b) if (A) $f'(x) < 0, \forall\, x \in (a, b)$ (B) $f'(x) > 0, \forall\, x \in (a, b)$ (C) $f'(x) = 0, \forall\, x \in (a, b)$ (D) $f(x) > 0, \forall\, x \in (a, b)$	1
6.	If $x = at$, $y = \frac{a}{t}$, then $\frac{dy}{dx}$ is : (A) t^2 (B) $-t^2$ (C) $\frac{1}{t^2}$ (D) $-\frac{1}{t^2}$	1
7.	The number of points of discontinuity of $f(x) = \begin{cases} \lvert x\rvert+3, & \text{if } x \leq -3 \\ -2x, & \text{if } -3<x<3 \\ 6x+2, & \text{if } x \geq 3 \end{cases}$ is : (A) 0 (B) 1 (C) 2 (D) infinite	1

8.	The derivative of $\tan^{-1}(x^2)$ w.r.t. x is : (A) $\frac{x}{1+x^4}$ (B) $\frac{2x}{1+x^4}$ (C) $-\frac{2x}{1+x^4}$ (D) $\frac{1}{1+x^4}$	1
9.	$\frac{d}{dx}[\cos(\log x + e^x)]$ at x = 1 is : (A) $-\sin e$ (B) $\sin e$ (C) $-(1+e)\sin e$ (D) $(1+e)\sin e$	1
10	The function $f(x) = x^3 - 3x^2 + 12x - 18$ is : (A) strictly decreasing on R (B) strictly increasing on R (C) neither strictly increasing nor strictly decreasing on R (D) strictly decreasing on $(-\infty, 0)$	1
11	If $y = \cos^{-1}(e^x)$, then $\frac{dy}{dx}$ is : (A) $\frac{1}{\sqrt{e^{-2x}+1}}$ (B) $-\frac{1}{\sqrt{e^{-2x}+1}}$ (C) $\frac{1}{\sqrt{e^{-2x}-1}}$ (D) $-\frac{1}{\sqrt{e^{-2x}-1}}$	1
12	A function $f(x) = \lvert 1 - x + \lvert x \rvert \rvert$ is : (A) discontinuous at x = 1 only (B) discontinuous at x = 0 only (C) discontinuous at x = 0, 1 (D) continuous everywhere	1
13	The derivative of 2^x w.r.t. 3^x is : (A) $\left(\frac{3}{2}\right)^x \frac{\log 2}{\log 3}$ (B) $\left(\frac{2}{3}\right)^x \frac{\log 3}{\log 2}$ (C) $\left(\frac{2}{3}\right)^x \frac{\log 2}{\log 3}$ (D) $\left(\frac{3}{2}\right)^x \frac{\log 3}{\log 2}$	1
14	The derivative of 5^x w.r.t. e^x is : (A) $\left(\frac{5}{e}\right)^x \frac{1}{\log 5}$ (B) $\left(\frac{e}{5}\right)^x \frac{1}{\log 5}$ (C) $\left(\frac{5}{e}\right)^x \log 5$ (D) $\left(\frac{e}{5}\right)^x \log 5$	1
15	If $y = \sin^{-1} x$, then $\frac{d^2y}{dx^2}$ is : (A) sec y (B) sec y tan y (C) $\sec^2 y \tan y$ (D) $\tan^2 y \sec y$	1
16	Derivative of e^{2x} with respect to e^x, is : (A) e^x (B) $2e^x$ (C) $2e^{2x}$ (D) $2e^{3x}$	1

17	For what value of k, the function given below is continuous at $x = 0$? $f(x) = \begin{cases} \frac{\sqrt{4+x}-2}{x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ (A) 0 (B) $\frac{1}{4}$ (C) 1 (D) 4	1
18	If $e^{x^2y} = c$, then $\frac{dy}{dx}$ is : (A) $\frac{xe^{x^2y}}{2y}$ (B) $\frac{-2y}{x}$ (C) $\frac{2y}{x}$ (D) $\frac{x}{2y}$	1
19	The value of constant c that makes the function f defined by $f(x) = \begin{cases} x^2 - c^2, & \text{if } x < 4 \\ cx + 20, & \text{if } x \geq 4 \end{cases}$ continuous for all real numbers is : (A) –2 (B) –1 (C) 0 (D) 2	1
20	The function $f(x) = \mid x \mid + \mid x - 2 \mid$ is (A) continuous, but not differentiable at $x = 0$ and $x = 2$. (B) differentiable but not continuous at $x = 0$ and $x = 2$. (C) continuous but not differentiable at $x = 0$ only. (D) neither continuous nor differentiable at $x = 0$ and $x = 2$.	1
21	Derivative of x^2 with respect to x^3, is : (A) $\frac{2}{3x}$ (B) $\frac{3x}{2}$ (C) $\frac{2x}{3}$ (D) $6x^5$	1
22	If $xe^y = 1$, then the value of $\frac{dy}{dx}$ at $x = 1$ is : (A) –1 (B) 1 (C) –e (D) $-\frac{1}{e}$	1
23	Derivative of $e^{\sin^2 x}$ with respect to cos x is : (A) $\sin x\, e^{\sin^2 x}$ (B) $\cos x\, e^{\sin^2 x}$ (C) $-2 \cos x\, e^{\sin^2 x}$ (D) $-2 \sin^2 x \cos x\, e^{\sin^2 x}$	1
24	If $\sin(xy) = 1$, then $\frac{dy}{dx}$ is equal to : (A) $\frac{x}{y}$ (B) $-\frac{x}{y}$ (C) $\frac{y}{x}$ (D) $-\frac{y}{x}$	1

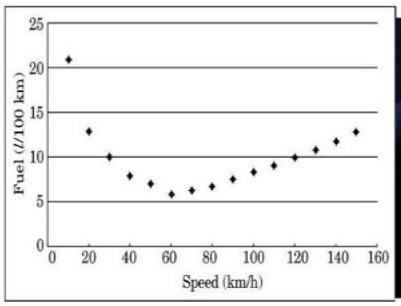
25	Check whether the function $f(x) = x^2 \lvert x \rvert$ is differentiable at x = 0 or not.	2
26	If $y = \sqrt{\tan \sqrt{x}}$, prove that $\sqrt{x}\ \frac{dy}{dx} = \frac{1+y^4}{4y}$.	2
27	If $y = \sqrt{\cos x + y}$, prove that $\frac{dy}{dx} = \frac{\sin x}{1-2y}$.	2
28	Show that the function $f(x) = \lvert x \rvert^3$ is differentiable at all points of its domain.	2
29	Check the differentiability of function f(x) = [x] at x = – 3, where [·] denotes greatest integer function.	2
30	If $x^{1/3} + y^{1/3} = 1$, find $\frac{dy}{dx}$ at the point $\left(\frac{1}{8}, \frac{1}{8}\right)$.	2
31	If $y = \text{cosec}(\cot^{-1} x)$, then prove that $\sqrt{1+x^2}\ \frac{dy}{dx} - x = 0$.	2
32	If $f(x) = \lvert \tan 2x \rvert$, then find the value of $f'(x)$ at $x = \frac{\pi}{3}$.	2
33	Check the differentiability of $f(x) = \lvert \cos x \rvert$ at $x = \frac{\pi}{2}$.	2
34	If y = A sin 2x + B cos 2x and $\frac{d^2y}{dx^2} - ky = 0$, find the value of k.	2
35	If $x = e^{x/y}$, prove that $\frac{dy}{dx} = \frac{\log x - 1}{(\log x)^2}$	2
36	Check the differentiability of $f(x) = \begin{cases} x^2+1, & 0 \le x < 1 \\ 3-x, & 1 \le x \le 2 \end{cases}$ at x = 1.	2
37	If $y = \cos^3 (\sec^2 2t)$, find $\frac{dy}{dt}$.	2
38	If $x^y = e^{x-y}$, prove that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$.	2
39	Given that $y = (\sin x)^x \cdot x^{\sin x} + a^x$, find $\frac{dy}{dx}$.	2
40	If $y = \cos^3 (\sec^2 2t)$, find $\frac{dy}{dt}$.	2
41	If $x^y = e^{x-y}$, prove that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$.	2
42	Given that $x^y + y^x = a^b$, where a and b are positive constants, find $\frac{dy}{dx}$.	2

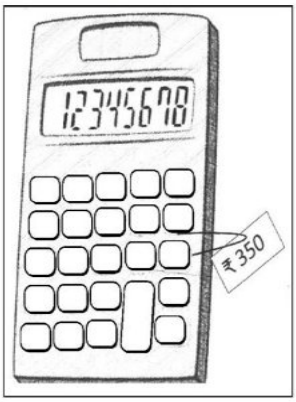
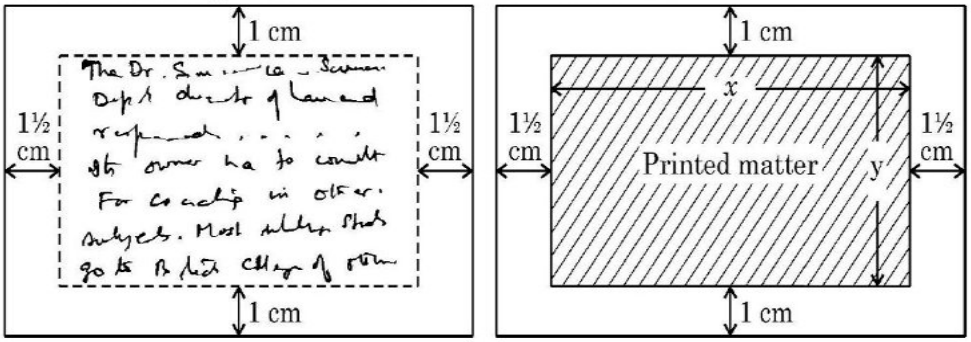
43	Verify whether the function f defined by $f(x) = \begin{cases} x \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$ is continuous at $x = 0$ or not.	2
44	Check for differentiability of the function f defined by $f(x) = \lvert x - 5 \rvert$, at the point $x = 5$.	2
45	The area of the circle is increasing at a uniform rate of 2 cm^2/sec. How fast is the circumference of the circle increasing when the radius r = 5 cm ?	2
46	Find $\frac{dy}{dx}$, if $(\cos x)^y = (\cos y)^x$.	2
47	If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$, prove that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$.	3
48	If $y = (\tan x)^x$, then find $\frac{dy}{dx}$.	3
49	If $x = e^{\cos 3t}$ and $y = e^{\sin 3t}$, prove that $\frac{dy}{dx} = -\frac{y \log x}{x \log y}$.	3
50	Show that : $\frac{d}{dx}(\lvert x \rvert) = \frac{x}{\lvert x \rvert}, x \neq 0$	3
51	If $f(x) = \lvert \tan 2x \rvert$, then find the value of $f'(x)$ at $x = \frac{\pi}{3}$.	3
52	If $x \cos(p + y) + \cos p \sin(p + y) = 0$, prove that $\cos p \frac{dy}{dx} = -\cos^2(p + y)$, where p is a constant.	3
53	Find the value of a and b so that function f defined as : $f(x) = \begin{cases} \frac{x-2}{\lvert x-2 \rvert} + a, & \text{if } x < 2 \\ a + b, & \text{if } x = 2 \\ \frac{x-2}{\lvert x-2 \rvert} + b, & \text{if } x > 2 \end{cases}$ is a continuous function.	3
54	Find $\frac{dy}{dx}$, if $(\cos x)^y = (\cos y)^x$.	3
55	Find the values of a and b so that the following function is differentiable for all values of x : $f(x) = \begin{cases} ax + b, & x > -1 \\ bx^2 - 3, & x \leq -1 \end{cases}$	3
56	If $x = a \sin^3 \theta$, $y = b \cos^3 \theta$, then find $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{4}$.	3

6 APPLIVATIONS OF DERIVATIVES

	CBSE 2024 QUESTIONS	MARKS
1.	The function $f(x) = x^3 - 3x^2 + 12x - 18$ is : (A) strictly decreasing on R (B) strictly increasing on R (C) neither strictly increasing nor strictly decreasing on R (D) strictly decreasing on $(-\infty, 0)$	1
2.	If the sides of a square are decreasing at the rate of 1·5 cm/s, the rate of decrease of its perimeter is : (A) 1·5 cm/s (B) 6 cm/s (C) 3 cm/s (D) 2·25 cm/s	1
3.	The point of inflexion of a function f(x) is the point where (A) $f'(x) = 0$ and $f'(x)$ changes its sign from positive to negative from left to right of that point. (B) $f'(x) = 0$ and $f'(x)$ changes its sign from negative to positive from left to right of that point. (C) $f'(x) = 0$ and $f'(x)$ does not change its sign from left to right of that point. (D) $f'(x) \neq 0$.	1
4.	The rate of change of surface area of a sphere with respect to its radius 'r', when r = 4 cm, is : (A) 64π cm^2/cm (B) 48π cm^2/cm (C) 32π cm^2/cm (D) 16π cm^2/cm	1
5.	The function $f(x) = kx - \sin x$ is strictly increasing for (A) $k > 1$ (B) $k < 1$ (C) $k > -1$ (D) $k < -1$	1
6.	The function $f(x) = \frac{x}{2} + \frac{2}{x}$ has a local minima at x equal to : (A) 2 (B) 1 (C) 0 (D) –2	1
7.	Given a curve $y = 7x - x^3$ and x increases at the rate of 2 units per second. The rate at which the slope of the curve is changing, when $x = 5$ is : (A) –60 units/sec (B) 60 units/sec (C) –70 units/sec (D) –140 units/sec	1

8.	Show that the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ has neither maxima nor minima.	2
9.	Find the absolute maximum and minimum values of the function $f(x) = 12x^{4/3} - 6x^{1/3}$, $x \in [0, 1]$.	2
10.	Find local maximum value and local minimum value (whichever exists) for the function $f(x) = 4x^2 + \frac{1}{x}$ $(x \neq 0)$.	2
11.	If M and m denote the local maximum and local minimum values of the function $f(x) = x + \frac{1}{x}$ $(x \neq 0)$ respectively, find the value of $(M - m)$.	2
12.	Show that $f(x) = e^x - e^{-x} + x - \tan^{-1} x$ is strictly increasing in its domain.	2
13.	Determine whether the function $f(x) = x^2 - 6x + 3$ is increasing or decreasing in $[4, 6]$.	2
14.	Find the interval in which the function $f(x) = x^4 - 4x^3 + 10$ is strictly decreasing.	2
15.	The volume of a cube is increasing at the rate of 6 cm^3/s. How fast is the surface area of cube increasing, when the length of an edge is 8 cm ?	2
16.	Show that $f(x) = \frac{4 \sin x}{2 + \cos x} - x$ is an increasing function of x in $\left[0, \frac{\pi}{2}\right]$.	2
17.	Sand is pouring from a pipe at the rate of 15 cm^3/minute. The falling sand forms a cone on the ground such that the height of the cone is always one-third of the radius of the base. How fast is the height of the sand cone increasing at the instant when the height is 4 cm ?	2
18.	The surface area of a cube increases at the rate of 72 cm^2/sec. Find the rate of change of its volume, when the edge of the cube measures 3 cm.	2
19.	Find the intervals in which the function $f(x) = \frac{\log x}{x}$ is strictly increasing or strictly decreasing.	3
20.	Find the absolute maximum and absolute minimum values of the function f given by $f(x) = \frac{x}{2} + \frac{2}{x}$, on the interval $[1, 2]$.	3

21.	It is given that function $f(x) = x^4 - 62x^2 + ax + 9$ attains local maximum value at $x = 1$. Find the value of 'a', hence obtain all other points where the given function $f(x)$ attains local maximum or local minimum values.	5
22.	The perimeter of a rectangular metallic sheet is 300 cm. It is rolled along one of its sides to form a cylinder. Find the dimensions of the rectangular sheet so that volume of cylinder so formed is maximum.	5
23.	Overspeeding increases fuel consumption and decreases fuel economy as a result of tyre rolling friction and air resistance. While vehicles reach optimal fuel economy at different speeds, fuel mileage usually decreases rapidly at speeds above 80 km/h.   The relation between fuel consumption F (l/100 km) and speed V (km/h) under some constraints is given as $F = \frac{V^2}{500} - \frac{V}{4} + 14$. On the basis of the above information, answer the following questions : (i) Find F, when V = 40 km/h. *1* (ii) Find $\frac{dF}{dV}$. *1* (iii) (a) Find the speed V for which fuel consumption F is minimum. *2* **OR** (iii) (b) Find the quantity of fuel required to travel 600 km at the speed V at which $\frac{dF}{dV} = -0{\cdot}01$. *2*	

23	A store has been selling calculators at ₹ 350 each. A market survey indicates that a reduction in price (p) of calculator increases the number of units (x) sold. The relation between the price and quantity sold is given by the demand function $p = 450 - \frac{1}{2}x$.  Based on the above information, answer the following questions : (i) Determine the number of units (x) that should be sold to maximise the revenue $R(x) = xp(x)$. Also, verify the result. (ii) What rebate in price of calculator should the store give to maximise the revenue ?	
24	A rectangular visiting card is to contain 24 sq.cm. of printed matter. The margins at the top and bottom of the card are to be 1 cm and the margins on the left and right are to be 1½ cm as shown below :  On the basis of the above information, answer the following questions : (i) Write the expression for the area of the visiting card in terms of x. (ii) Obtain the dimensions of the card of minimum area.	

7 INTEGRALS

	CBSE 2024 QUESTIONS	MARKS
1.	$\int_0^{\pi/2} \frac{\sin x - \cos x}{1+\sin x \cos x}\,dx$ is equal to : (A) π (B) Zero (0) (C) $\int_0^{\pi/2} \frac{2\sin x}{1+\sin x \cos x}\,dx$ (D) $\frac{\pi^2}{4}$	1
2.	$\int_{-a}^{a} f(x)\,dx = 0$, if : (A) $f(-x) = f(x)$ (B) $f(-x) = -f(x)$ (C) $f(a-x) = f(x)$ (D) $f(a-x) = -f(x)$	1
3.	The value of $\int_0^3 \frac{dx}{\sqrt{9-x^2}}$ is : (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{18}$	1
4.	The value of $\int_{-1}^{1} \lvert x \rvert\,dx$ is : (A) -2 (B) -1 (C) 1 (D) 2	1
5.	The value of $\int_0^{\pi} \tan^2\left(\frac{\theta}{3}\right) d\theta$ is : (A) $\pi + \sqrt{3}$ (B) $3\sqrt{3} - \pi$ (C) $\sqrt{3} - \pi$ (D) $\pi - \sqrt{3}$	1

6.	$\int \frac{1}{x(\log x)^2}\,dx$ is equal to : (A) $2\log(\log x)+c$ (B) $-\frac{1}{\log x}+c$ (C) $\frac{(\log x)^3}{3}+c$ (D) $\frac{3}{(\log x)^3}+c$	1
7.	The value of $\int_{-1}^{1} x\,\lvert x\rvert\,dx$ is : (A) $\frac{1}{6}$ (B) $\frac{1}{3}$ (C) $-\frac{1}{6}$ (D) 0	1
8.	The value of $\int_{\pi/4}^{\pi/2} \cot\theta\,\text{cosec}^2\theta\,d\theta$ is : (A) $\frac{1}{2}$ (B) $-\frac{1}{2}$ (C) 0 (D) $-\frac{\pi}{8}$	1
9.	The integral $\int \frac{dx}{\sqrt{9-4x^2}}$ is equal to : (A) $\frac{1}{6}\sin^{-1}\left(\frac{2x}{3}\right)+c$ (B) $\frac{1}{2}\sin^{-1}\left(\frac{2x}{3}\right)+c$ (C) $\sin^{-1}\left(\frac{2x}{3}\right)+c$ (D) $\frac{3}{2}\sin^{-1}\left(\frac{2x}{3}\right)+c$	1
10.	If $\int_{-2}^{3} x^2\,dx = k\int_{0}^{2} x^2\,dx + \int_{2}^{3} x^2\,dx$, then the value of k is : (A) 2 (B) 1 (C) 0 (D) $\frac{1}{2}$	1

11.	The value of $\int_1^e \log x \, dx$ is : (A) 0 (B) 1 (C) e (D) e log e	1
12.	Find : $\int x\sqrt{1+2x}\ dx$	2
13.	$\int_0^{\frac{\pi^2}{4}} \frac{\sin\sqrt{x}}{\sqrt{x}}\ dx$	2
14.	Find : $\int \frac{e^{4x}-1}{e^{4x}+1}\, dx$	2
15.	Evaluate : $\int_0^{\pi/2} \sin 2x \cos 3x \, dx$	2
16.	Given $\frac{d}{dx} F(x) = \frac{1}{\sqrt{2x-x^2}}$ and $F(1) = 0$, find $F(x)$.	2
17.	Find : $\int \frac{1}{x(x^2-1)}\ dx.$	2
18.	Evaluate : $\int_{-\frac{1}{2}}^{\frac{1}{2}} \cos x \cdot \log\left(\frac{1+x}{1-x}\right) dx$	2
19.	Find : $\int \cos^3 x \, e^{\log \sin x}\, dx$	2
20.	Find : $\int \frac{1}{5+4x-x^2}\, dx$	2

21.	Find : $\int \frac{x^2}{(x^2+4)(x^2+9)}\,dx$	3
22.	Evaluate : $\int_1^3 (\lvert x-1\rvert + \lvert x-2\rvert + \lvert x-3\rvert)\,dx$	3
23.	Evaluate : $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{9 + 16\sin 2x}\,dx$	3
24.	Evaluate : $\int_0^{\frac{\pi}{2}} \sin 2x \tan^{-1}(\sin x)\,dx$	3
25.	Evaluate : $\int_{-2}^{2} \sqrt{\frac{2-x}{2+x}}\,dx$	3
26.	Find : $\int \frac{1}{x[(\log x)^2 - 3\log x - 4]}\,dx$	3
27.	Find : $\int x^2 \cdot \sin^{-1}(x^{3/2})\,dx$	3
28.	Find : $\int \frac{x^2+1}{(x^2+2)(x^2+4)}\,dx$	3
29.	Find : $\int \frac{2+\sin 2x}{1+\cos 2x} e^x\,dx$	3
30.	Evaluate : $\int_0^{\pi/4} \frac{1}{\sin x + \cos x}\,dx$	3

31.	Evaluate : $\int_0^{\frac{\pi}{4}} \frac{x\,dx}{1+\cos 2x+\sin 2x}$	3
32.	Find : $\int e^x \left[\frac{1}{(1+x^2)^{\frac{3}{2}}}+\frac{x}{\sqrt{1+x^2}}\right] dx$	3
33.	Find : $\int \frac{3x+5}{\sqrt{x^2+2x+4}}\,dx$	3
34.	Find : $\int \frac{2x+3}{x^2(x+3)}\,dx$	3
35.	Evaluate : $\int_0^{\pi} \frac{e^{\cos x}}{e^{\cos x}+e^{-\cos x}} dx$	3
36.	Find : $\int \frac{2x+1}{(x+1)^2(x-1)} dx$	3

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8.APPLICATIONS OF INTEGRALS

	CBSE 2024 QUESTIONS	MARKS
1.	Area of the region bounded by curve $y^2 = 4x$ and the X-axis between $x = 0$ and $x = 1$ is : (A) $\frac{2}{3}$ (B) $\frac{8}{3}$ (C) 3 (D) $\frac{4}{3}$	1
2.	The area bounded by the curve $y = \sqrt{x}$, Y-axis and between the lines $y = 0$ and $y = 3$ is : (A) $2\sqrt{3}$ (B) 27 (C) 9 (D) 3	1
3.	Using integration, find the area of the ellipse $\frac{x^2}{16} + \frac{y^2}{4} = 1$, included between the lines $x = -2$ and $x = 2$.	3
4.	If A_1 denotes the area of region bounded by $y^2 = 4x$, $x = 1$ and x-axis in the first quadrant and A_2 denotes the area of region bounded by $y^2 = 4x$, $x = 4$, find $A_1 : A_2$.	5
5.	Using integration, find the area of the region enclosed between the circle $x^2 + y^2 = 16$ and the lines $x = -2$ and $x = 2$.	5
6.	Sketch the graph of $y = x\|x\|$ and hence find the area bounded by this curve, X-axis and the ordinates $x = -2$ and $x = 2$, using integration.	5
6	Using integration, find the area bounded by the ellipse $9x^2 + 25y^2 = 225$, the lines $x = -2$, $x = 2$, and the X-axis.	5
7	Find the area of the region bounded by the curve $4x^2 + y^2 = 36$ using integration.	5

9. DIFFERENRTIAL EQUATIONS

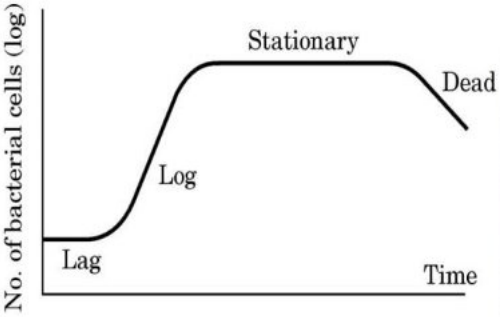
	CBSE 2024 QUESTIONS	MARKS
1.	The order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^3 = \frac{d^2y}{dx^2}$ respectively are : (A) 1, 2 (B) 2, 3 (C) 2, 1 (D) 2, 6	1
2.	The integrating factor of the differential equation $x\frac{dy}{dx} - y = x^4 - 3x$ is : (A) x (B) $-x$ (C) x^{-1} (D) $\log(x^{-1})$	1
3.	The differential equation $\frac{dy}{dx} = F(x, y)$ will not be a homogeneous differential equation, if $F(x, y)$ is : (A) $\cos x - \sin\left(\frac{y}{x}\right)$ (B) $\frac{y}{x}$ (C) $\frac{x^2+y^2}{xy}$ (D) $\cos^2\left(\frac{x}{y}\right)$	1
4.	The degree of the differential equation $(y'')^2 + (y')^3 = x \sin(y')$ is : (A) 1 (B) 2 (C) 3 (D) not defined	1
5.	$x \log x \frac{dy}{dx} + y = 2 \log x$ is an example of a : (A) variable separable differential equation. (B) homogeneous differential equation. (C) first order linear differential equation. (D) differential equation whose degree is not defined.	1
6.	The general solution of the differential equation $x\,dy + y\,dx = 0$ is : (A) $xy = c$ (B) $x + y = c$ (C) $x^2 + y^2 = c^2$ (D) $\log y = \log x + c$	1

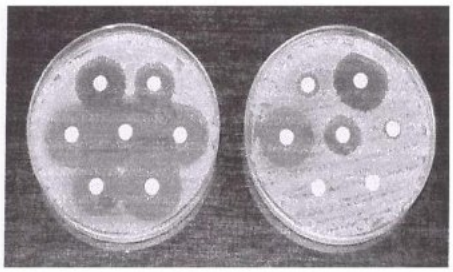
7.	The integrating factor of the differential equation $(x + 2y^2)\frac{dy}{dx} = y\ (y > 0)$ is : (A) $\frac{1}{x}$ (B) x (C) y (D) $\frac{1}{y}$	1
8.	The number of arbitrary constants in the particular solution of the differential equation $\log\left(\frac{dy}{dx}\right) = 3x + 4y;\ y(0) = 0$ is/are (A) 2 (B) 1 (C) 0 (D) 3	1
9.	The integrating factor of the differential equation $\frac{dy}{dx} + \frac{2}{x}y = 0,\ x \neq 0$ is : (A) $\frac{2}{x}$ (B) x^2 (C) $e^{\frac{2}{x}}$ (D) $e^{\log(2x)}$	1
10.	The order of the differential equation $\frac{d^4y}{dx^4} - \sin\left(\frac{d^2y}{dx^2}\right) = 5$ is : (A) 4 (B) 3 (C) 2 (D) not defined	1
11.	The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is : (A) $e^x + e^{-y} = c$ (B) $e^{-x} + e^{-y} = c$ (C) $e^{x+y} = c$ (D) $2e^{x+y} = c$	1
12.	The order of the following differential equation $\frac{d^3y}{dx^3} + x\left(\frac{dy}{dx}\right)^5 = 4\log\left(\frac{d^4y}{dx^4}\right)$ is : (A) not defined (B) 3 (C) 4 (D) 5	1
13.	Find the particular solution of the differential equation given by $x^2\frac{dy}{dx} - xy = x^2\cos^2\left(\frac{y}{2x}\right)$, given that when $x = 1$, $y = \frac{\pi}{2}$.	3

14.	Find the particular solution of the differential equation given by $2xy + y^2 - 2x^2 \frac{dy}{dx} = 0$; y = 2, when x = 1.	3
15.	Find the general solution of the differential equation : $y\,dx = (x + 2y^2)\,dy$	3
16.	Find the particular solution of the differential equation $\frac{dy}{dx} = y \cot 2x$, given that $y\left(\frac{\pi}{4}\right) = 2$.	3
17.	Find the particular solution of the differential equation $(xe^{\frac{y}{x}} + y)\,dx = x\,dy$, given that y = 1 when $x = 1$.	3
18.	Find the particular solution of the differential equation $\frac{dy}{dx} - 2xy = 3x^2 e^{x^2}$; y(0) = 5.	3
19.	Solve the following differential equation : $x^2\,dy + y(x + y)\,dx = 0$	3

20.

37. A bacteria sample of certain number of bacteria is observed to grow exponentially in a given amount of time. Using exponential growth model, the rate of growth of this sample of bacteria is calculated.





The differential equation representing the growth of bacteria is given as :

$\frac{dP}{dt} = kP$, where P is the population of bacteria at any time 't'.

Based on the above information, answer the following questions :

(i) Obtain the general solution of the given differential equation and express it as an exponential function of 't'. *2*

(ii) If population of bacteria is 1000 at t = 0, and 2000 at t = 1, find the value of k. *2*

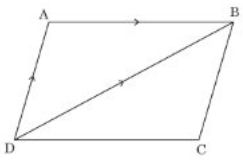
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10.VECTORS

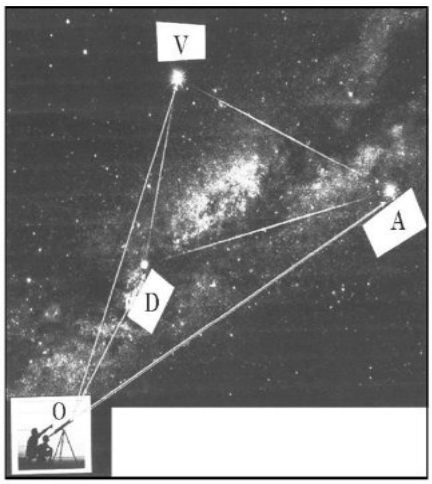
	CBSE 2024 QUESTIONS	MARKS
1.	Let θ be the angle between two unit vectors $\hat{a}$ and $\hat{b}$ such that $\sin\theta = \frac{3}{5}$. Then, $\hat{a} \cdot \hat{b}$ is equal to : (A) $\pm\frac{3}{5}$ (B) $\pm\frac{3}{4}$ (C) $\pm\frac{4}{5}$ (D) $\pm\frac{4}{3}$	1
2.	The vector with terminal point A (2, – 3, 5) and initial point B (3, – 4, 7) is : (A) $\hat{i} - \hat{j} + 2\hat{k}$ (B) $\hat{i} + \hat{j} + 2\hat{k}$ (C) $-\hat{i} - \hat{j} - 2\hat{k}$ (D) $-\hat{i} + \hat{j} - 2\hat{k}$	1
3.	For any two vectors $\vec{a}$ and $\vec{b}$, which of the following statements is always true ? (A) $\vec{a} \cdot \vec{b} \geq \lvert\vec{a}\rvert\lvert\vec{b}\rvert$ (B) $\vec{a} \cdot \vec{b} = \lvert\vec{a}\rvert\lvert\vec{b}\rvert$ (C) $\vec{a} \cdot \vec{b} \leq \lvert\vec{a}\rvert\lvert\vec{b}\rvert$ (D) $\vec{a} \cdot \vec{b} < \lvert\vec{a}\rvert\lvert\vec{b}\rvert$	1
4.	The unit vector perpendicular to both vectors $\hat{i} + \hat{k}$ and $\hat{i} - \hat{k}$ is : (A) $2\hat{j}$ (B) $\hat{j}$ (C) $\frac{\hat{i} - \hat{k}}{\sqrt{2}}$ (D) $\frac{\hat{i} + \hat{k}}{\sqrt{2}}$	1
5.	If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - \hat{k}$, then $\vec{a}$ and $\vec{b}$ are : (A) collinear vectors which are not parallel (B) parallel vectors (C) perpendicular vectors (D) unit vectors	1
6.	If $\lvert\vec{a}\rvert = 2$ and $-3 \leq k \leq 2$, then $\lvert k\vec{a}\rvert \in$: (A) $[-6, 4]$ (B) $[0, 4]$ (C) $[4, 6]$ (D) $[0, 6]$	1

7.	If $\vec{a}$ and $\vec{b}$ are two vectors such that $\lvert \vec{a} \rvert = 1$, $\lvert \vec{b} \rvert = 2$ and $\vec{a} \cdot \vec{b} = \sqrt{3}$, then the angle between $2\vec{a}$ and $-\vec{b}$ is : (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{5\pi}{6}$ (D) $\frac{11\pi}{6}$	1
8.	The vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - 3\hat{j} - 5\hat{k}$ and $\vec{c} = -3\hat{i} + 4\hat{j} + 4\hat{k}$ represents the sides of (A) an equilateral triangle (B) an obtuse-angled triangle (C) an isosceles triangle (D) a right-angled triangle	1
9.	Let $\vec{a}$ be any vector such that $\lvert \vec{a} \rvert = a$. The value of $\lvert \vec{a} \times \hat{i} \rvert^2 + \lvert \vec{a} \times \hat{j} \rvert^2 + \lvert \vec{a} \times \hat{k} \rvert^2$ is : (A) a^2 (B) $2a^2$ (C) $3a^2$ (D) 0	1
10.	A vector perpendicular to the line $\vec{r} = \hat{i} + \hat{j} - \hat{k} + \lambda(3\hat{i} - \hat{j})$ is : (A) $5\hat{i} + \hat{j} + 6k$ (B) $\hat{i} + 3\hat{j} + 5\hat{k}$ (C) $2\hat{i} - 2\hat{j}$ (D) $9\hat{i} - 3\hat{j}$	1
11.	The Cartesian equation of a line passing through the point with position vector $\vec{a} = \hat{i} - \hat{j}$ and parallel to the line $\vec{r} = \hat{i} + \hat{k} + \mu(2\hat{i} - \hat{j})$, is (A) $\frac{x-2}{1} = \frac{y+1}{0} = \frac{z}{1}$ (B) $\frac{x-1}{2} = \frac{y+1}{-1} = \frac{z}{0}$ (C) $\frac{x+1}{2} = \frac{y+1}{-1} = \frac{z}{0}$ (D) $\frac{x-1}{2} = \frac{y}{-1} = \frac{z-1}{0}$	1

12.	The position vectors of points P and Q are $\vec{p}$ and $\vec{q}$ respectively. The point R divides line segment PQ in the ratio 3 : 1 and S is the mid-point of line segment PR. The position vector of S is : (A) $\frac{\vec{p}+3\vec{q}}{4}$ (B) $\frac{\vec{p}+3\vec{q}}{8}$ (C) $\frac{5\vec{p}+3\vec{q}}{4}$ (D) $\frac{5\vec{p}+3\vec{q}}{8}$	1
13.	*Assertion (A) :* For two non-zero vectors $\vec{a}$ and $\vec{b}$, $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$. *Reason (R) :* For two non-zero vectors $\vec{a}$ and $\vec{b}$, $\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$.	1
14.	*Assertion (A) :* Projection of $\vec{a}$ on $\vec{b}$ is same as projection of $\vec{b}$ on $\vec{a}$. *Reason (R) :* Angle between $\vec{a}$ and $\vec{b}$ is same as angle between $\vec{b}$ and $\vec{a}$ numerically.	1
15.	**Assertion (A) :** The vectors $\vec{a} = 6\hat{i} + 2\hat{j} - 8\hat{k}$ $\vec{b} = 10\hat{i} - 2\hat{j} - 6\hat{k}$ $\vec{c} = 4\hat{i} - 4\hat{j} + 2\hat{k}$ represent the sides of a right angled triangle. **Reason (R) :** Three non-zero vectors of which none of two are collinear forms a triangle if their resultant is zero vector or sum of any two vectors is equal to the third.	1
16.	**Assertion (A) :** The vectors $\vec{a} = 6\hat{i} + 2\hat{j} - 8\hat{k}$ $\vec{b} = 10\hat{i} - 2\hat{j} - 6\hat{k}$ $\vec{c} = 4\hat{i} - 4\hat{j} + 2\hat{k}$ represent the sides of a right angled triangle. **Reason (R) :** Three non-zero vectors of which none of two are collinear forms a triangle if their resultant is zero vector or sum of any two vectors is equal to the third.	1
17.	If $\vec{a}$ and $\vec{b}$ are two non-zero vectors such that $(\vec{a} + \vec{b}) \perp \vec{a}$ and $(2\vec{a} + \vec{b}) \perp \vec{b}$, then prove that $\lvert\vec{b}\rvert = \sqrt{2}\,\lvert\vec{a}\rvert$.	2

18.	In the given figure, ABCD is a parallelogram. If $\vec{AB} = 2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{DB} = 3\hat{i} - 6\hat{j} + 2\hat{k}$, then find $\vec{AD}$ and hence find the area of parallelogram ABCD. 	2
19.	Find the position vector of point C which divides the line segment joining points A and B having position vectors $\hat{i} + 2\hat{j} - \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ respectively in the ratio 4 : 1 externally. Further, find $\lvert\vec{AB}\rvert : \lvert\vec{BC}\rvert$.	2
20.	Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors. Prove that $\lvert\vec{a} \times \vec{b}\rvert \leq \lvert\vec{a}\rvert\lvert\vec{b}\rvert$. State the condition under which equality holds, i.e., $\lvert\vec{a} \times \vec{b}\rvert = \lvert\vec{a}\rvert\lvert\vec{b}\rvert$.	2
21.	Find the vector equation of the line passing through the point (2, 3, –5) and making equal angles with the co-ordinate axes.	2
22.	Find the projection of vector $(\vec{b} + \vec{c})$ on vector $\vec{a}$, where $\vec{a} = 2\hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + \hat{k}$.	2
23.	The position vectors of vertices of Δ ABC are $A(2\hat{i} - \hat{j} + \hat{k})$, $B(\hat{i} - 3\hat{j} - 5\hat{k})$ and $C(3\hat{i} - 4\hat{j} - 4\hat{k})$. Find all the angles of Δ ABC.	3
24.	Find a vector of magnitude 4 units perpendicular to each of the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + \hat{j} - \hat{k}$ and hence verify your answer.	3
25.	Given $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} - \hat{k}$ and $\vec{c} = 2\hat{i} + \hat{j} - 2\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 3$.	3

26. An instructor at the astronomical centre shows three among the brightest stars in a particular constellation. Assume that the telescope is located at O(0, 0, 0) and the three stars have their locations at the points D, A and V having position vectors $2\hat{i} + 3\hat{j} + 4\hat{k}$, $7\hat{i} + 5\hat{j} + 8\hat{k}$ and $-3\hat{i} + 7\hat{j} + 11\hat{k}$ respectively.



Based on the above information, answer the following questions :

(i) How far is the star V from star A ? **1**

(ii) Find a unit vector in the direction of $\overrightarrow{DA}$. **1**

(iii) Find the measure of $\angle VDA$. **2**

OR

(iii) What is the projection of vector $\overrightarrow{DV}$ on vector $\overrightarrow{DA}$? **2**

11. 3 Dimensional geometry

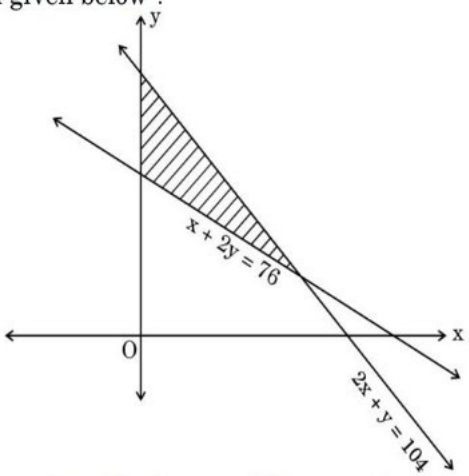
	CBSE 2024 QUESTIONS	MARKS
1.	If the direction cosines of a line are $\sqrt{3}$ k, $\sqrt{3}$ k, $\sqrt{3}$ k, then the value of k is : (A) ± 1 (B) $\pm \sqrt{3}$ (C) ± 3 (D) $\pm \frac{1}{3}$	1
2.	The distance of point P(a, b, c) from y-axis is : (A) b (B) b^2 (C) $\sqrt{a^2 + c^2}$ (D) $a^2 + c^2$	1
3.	The coordinates of the foot of the perpendicular drawn from the point (0, 1, 2) on the x-axis are given by : (A) (1, 0, 0) (B) (2, 0, 0) (C) ($\sqrt{5}$, 0, 0) (D) (0, 0, 0)	1
4.	Direction ratios of a vector parallel to line $\frac{x-1}{2} = -y = \frac{2z+1}{6}$ are : (A) 2, – 1, 6 (B) 2, 1, 6 (C) 2, 1, 3 (D) 2, – 1, 3	1
5.	Direction ratios of a vector parallel to line $\frac{x-1}{2} = -y = \frac{2z+1}{6}$ are : (A) 2, – 1, 6 (B) 2, 1, 6 (C) 2, 1, 3 (D) 2, – 1, 3	1
6.	If a line makes an angle of 30° with the positive direction of x-axis, 120° with the positive direction of y-axis, then the angle which it makes with the positive direction of z-axis is : (A) 90° (B) 120° (C) 60° (D) 0°	1
7.	If α, β and γ are the angles which a line makes with positive directions of x, y and z axes respectively, then which of the following is ***not*** true ? (A) $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$ (B) $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$ (C) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = -1$ (D) $\cos \alpha + \cos \beta + \cos \gamma = 1$	1
8.	If a line makes an angle of $\frac{\pi}{4}$ with the positive directions of both x-axis and z-axis, then the angle which it makes with the positive direction of y-axis is : (A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π	1

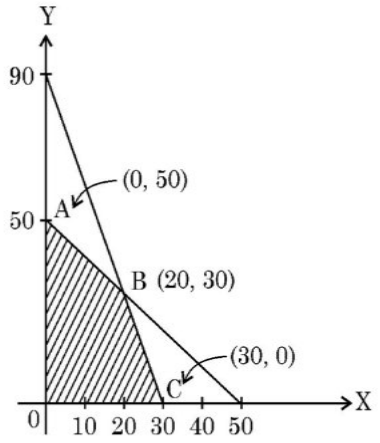
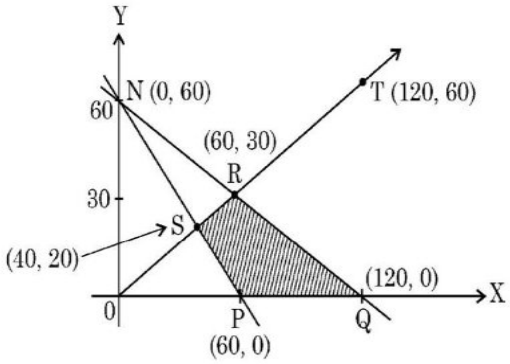
9.	The vector equation of a line passing through the point (1, –1, 0) and parallel to Y-axis is : (A) $\vec{r} = \hat{i} - \hat{j} + \lambda(\hat{i} - \hat{j})$ (B) $\vec{r} = \hat{i} - \hat{j} + \lambda\hat{j}$ (C) $\vec{r} = \hat{i} - \hat{j} + \lambda\hat{k}$ (D) $\vec{r} = \lambda\hat{j}$	1
10	The lines $\frac{1-x}{2} = \frac{y-1}{3} = \frac{z}{1}$ and $\frac{2x-3}{2p} = \frac{y}{-1} = \frac{z-4}{7}$ are perpendicular to each other for p equal to : (A) $-\frac{1}{2}$ (B) $\frac{1}{2}$ (C) 2 (D) 3	1
11	The angle which the line $\frac{x}{1} = \frac{y}{-1} = \frac{z}{0}$ makes with the positive direction of Y-axis is : (A) $\frac{5\pi}{6}$ (B) $\frac{3\pi}{4}$ (C) $\frac{5\pi}{4}$ (D) $\frac{7\pi}{4}$	1
12	The Cartesian equation of the line passing through the point (1, –3, 2) and parallel to the line : $\vec{r} = (2+\lambda)\hat{i} + \lambda\hat{j} + (2\lambda - 1)\hat{k}$ is (A) $\frac{x-1}{2} = \frac{y+3}{0} = \frac{z-2}{-1}$ (B) $\frac{x+1}{1} = \frac{y-3}{1} = \frac{z+2}{2}$ (C) $\frac{x+1}{2} = \frac{y-3}{0} = \frac{z+2}{-1}$ (D) $\frac{x-1}{1} = \frac{y+3}{1} = \frac{z-2}{2}$	1
13	*Assertion (A) :* A line in space cannot be drawn perpendicular to x, y and z axes simultaneously. *Reason (R) :* For any line making angles, α, β, γ with the positive directions of x, y and z axes respectively, $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$.	1
14	The image of point P(x, y, z) with respect to line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ is P′ (1, 0, 7). Find the coordinates of point P.	5

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15	Find the equation of the line which bisects the line segment joining points A(2, 3, 4) and B(4, 5, 8) and is perpendicular to the lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$.	5
16	Find the equation of the line passing through the point of intersection of the lines $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ and $\frac{x-1}{0} = \frac{y}{-3} = \frac{z-7}{2}$ and perpendicular to these given lines.	5
17	Two vertices of the parallelogram ABCD are given as A(−1, 2, 1) and B(1, −2, 5). If the equation of the line passing through C and D is $\frac{x-4}{1} = \frac{y+7}{-2} = \frac{z-8}{2}$, then find the distance between sides AB and CD. Hence, find the area of parallelogram ABCD.	5
18	Find the distance between the line $\frac{x}{2} = \frac{2y-6}{4} = \frac{1-z}{-1}$ and another line parallel to it passing through the point (4, 0, –5).	5
19	If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-7}$ are perpendicular to each other, find the value of k and hence write the vector equation of a line perpendicular to these two lines and passing through the point (3, –4, 7).	5
20	Find the co-ordinates of the foot of the perpendicular drawn from the point (2, 3, –8) to the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$. Also, find the perpendicular distance of the given point from the line.	5
21	Find the shortest distance between the lines L_1 & L_2 given below : L_1 : The line passing through (2, –1, 1) and parallel to $\frac{x}{1} = \frac{y}{1} = \frac{z}{3}$ L_2 : $\vec{r} = \hat{i} + (2\mu + 1)\hat{j} - (\mu + 2)\hat{k}$.	5

12. LINEAR PROGRAMMIMG PROBLEM

	CBSE 2024 QUESTIONS	MARKS
1.	A linear programming problem deals with the optimization of a/an : (A) logarithmic function (B) linear function (C) quadratic function (D) exponential function	1
2.	The number of corner points of the feasible region determined by constraints $x \geq 0, y \geq 0, x + y \geq 4$ is : (A) 0 (B) 1 (C) 2 (D) 3	1
3.	The common region determined by all the constraints of a linear programming problem is called : (A) an unbounded region (B) an optimal region (C) a bounded region (D) a feasible region	1
4.	The restrictions imposed on decision variables involved in an objective function of a linear programming problem are called : (A) feasible solutions (B) constraints (C) optimal solutions (D) infeasible solutions	1
5.	Of the following, which group of constraints represents the feasible region given below ?  (A) $x + 2y \leq 76, 2x + y \geq 104, x, y \geq 0$ (B) $x + 2y \leq 76, 2x + y \leq 104, x, y \geq 0$ (C) $x + 2y \geq 76, 2x + y \leq 104, x, y \geq 0$ (D) $x + 2y \geq 76, 2x + y \geq 104, x, y \geq 0$	1

6.	The maximum value of Z = $4x$ + y for a L.P.P. whose feasible region is given below is :  (A) 50 (B) 110 (C) 120 (D) 170	1
7.	**Assertion (A) :** The corner points of the bounded feasible region of a L.P.P. are shown below. The maximum value of Z = x + 2y occurs at infinite points.  **Reason (R) :** The optimal solution of a LPP having bounded feasible region must occur at corner points.	1
8.	Solve the following linear programming problem graphically : Maximise z = 500x + 300y, subject to constraints $x + 2y \leq 12$ $2x + y \leq 12$ $4x + 5y \geq 20$ $x \geq 0, y \geq 0$	3
9.	Solve the following linear programming problem graphically : Maximise z = 4x + 3y, subject to the constraints $x + y \leq 800$ $2x + y \leq 1000$ $x \leq 400$ $x, y \geq 0$.	3

10	Solve the following linear programming problem graphically : Maximise $Z = 2x + 3y$ subject to the constraints : $x + y \leq 6$ $x \geq 2$ $y \leq 3$ $x, y \geq 0$	3
11	Solve the following L.P.P. graphically : Maximise $Z = x + 3y$ subject to the constraints : $x + 2y \leq 200$ $x + y \leq 150$ $y \leq 75$ $x, y \geq 0$	3
12	Solve the following L.P.P. graphically : Maximise $Z = 60x + 40y$ Subject to $x + 2y \leq 12$ $2x + y \leq 12$ $4x + 5y \geq 20$ $x, y \geq 0$	5
13	The month of September is celebrated as the Rashtriya Poshan Maah across the country. Following a healthy and well-balanced diet is crucial in order to supply the body with the proper nutrients it needs. A balanced diet also keeps us mentally fit and promotes improved level of energy.	

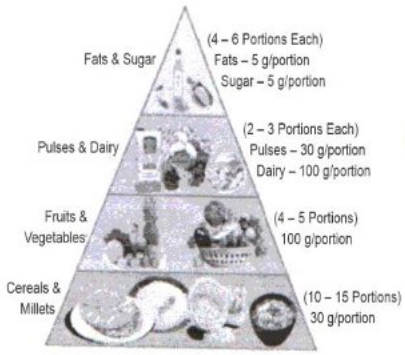


Figure-1

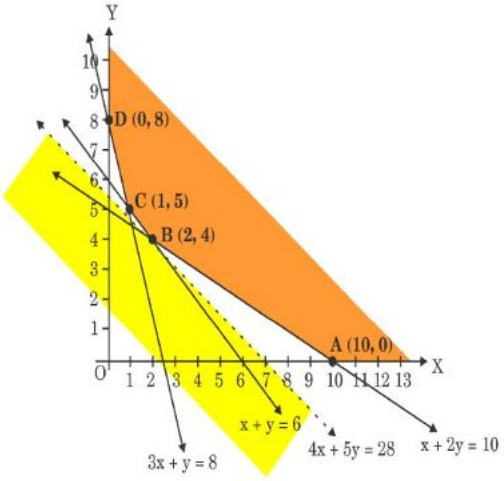


Figure-2

A dietician wishes to minimize the cost of a diet involving two types of foods, food X (x kg) and food Y (y kg) which are available at the rate of ₹ 16/kg and ₹ 20/kg respectively. The feasible region satisfying the constraints is shown in Figure-2.

On the basis of the above information, answer the following questions :

(i) Identify and write all the constraints which determine the given feasible region in Figure-2. *2*

(ii) If the objective is to minimize cost Z = 16x + 20y, find the values of x and y at which cost is minimum. Also, find minimum cost assuming that minimum cost is possible for the given unbounded region. *2*

13.PROBABILITY

CBSE 2024 QUESTIONS

		MARKS
1.	If $P(A \mid B) = P(A' \mid B)$, then which of the following statements is true ? (A) $P(A) = P(A')$ (B) $P(A) = 2\,P(B)$ (C) $P(A \cap B) = \frac{1}{2} P(B)$ (D) $P(A \cap B) = 2\,P(B)$	1
2.	Let E be an event of a sample space S of an experiment, then $P(S \mid E)$ = (A) $P(S \cap E)$ (B) $P(E)$ (C) 1 (D) 0	1
3.	Let E and F be two events such that $P(E) = 0{\cdot}1$, $P(F) = 0{\cdot}3$, $P(E \cup F) = 0{\cdot}4$, then $P(F \mid E)$ is : (A) 0·6 (B) 0·4 (C) 0·5 (D) 0	1
4.	The probability distribution of a random variable X is : **X** 0 1 2 3 4 **P(X)** 0.1 k 2k k 0.1 where k is some unknown constant. The probability that the random variable X takes the value 2 is : (A) $\frac{1}{5}$ (B) $\frac{2}{5}$ (C) $\frac{4}{5}$ (D) 1	1
5.	If A and B are events such that $P(A/B) = P(B/A) \neq 0$, then : (A) $A \subset B$, but $A \neq B$ (B) $A = B$ (C) $A \cap B = \phi$ (D) $P(A) = P(B)$	1
6.	E and F are two independent events such that $P(\bar{E}) = 0{\cdot}6$ and $P(E \cup F) = 0{\cdot}6$. Find P(F) and $P(\bar{E} \cup \bar{F})$.	3
7.	A pair of dice is thrown simultaneously. If X denotes the absolute difference of the numbers appearing on top of the dice, then find the probability distribution of X.	3

8.	The chances of P, Q and R getting selected as CEO of a company are in the ratio 4 : 1 : 2 respectively. The probabilities for the company to increase its profits from the previous year under the new CEO, P, Q or R are 0·3, 0·8 and 0·5 respectively. If the company increased the profits from the previous year, find the probability that it is due to the appointment of R as CEO.	3
9.	A card from a well shuffled deck of 52 playing cards is lost. From the remaining cards of the pack, a card is drawn at random and is found to be a King. Find the probability of the lost card being a King.	3
10.	A biased die is twice as likely to show an even number as an odd number. If such a die is thrown twice, find the probability distribution of the number of sixes. Also, find the mean of the distribution.	3
11.	The random variable X has the following probability distribution where a and b are some constants : **X** 1 2 3 4 5 **P(X)** 0.2 a a 0.2 b If the mean E(X) = 3, then find values of a and b and hence determine $P(X \geq 3)$.	3
12.	Bag I contains 3 red and 4 black balls, Bag II contains 5 red and 2 black balls. Two balls are transferred at random from Bag I to Bag II and then a ball is drawn at random from Bag II. Find the probability that the drawn ball is red in colour.	3
13.	An urn contains 3 red and 2 white marbles. Two marbles are drawn one by one with replacement from the urn. Find the probability distribution of the number of white balls. Also, find the mean of the number of white balls drawn.	3

14. According to recent research, air turbulence has increased in various regions around the world due to climate change. Turbulence makes flights bumpy and often delays the flights.

Assume that, an airplane observes severe turbulence, moderate turbulence or light turbulence with equal probabilities. Further, the chance of an airplane reaching late to the destination are 55%, 37% and 17% due to severe, moderate and light turbulence respectively.

On the basis of the above information, answer the following questions :

(i) Find the probability that an airplane reached its destination late. *2*

(ii) If the airplane reached its destination late, find the probability that it was due to moderate turbulence. *2*

15. Self-study helps students to build confidence in learning. It boosts the self-esteem of the learners. Recent surveys suggested that close to 50% learners were self-taught using internet resources and upskilled themselves.





A student may spend 1 hour to 6 hours in a day in upskilling self. The probability distribution of the number of hours spent by a student is given below :

$$P(X = x) = \begin{cases} kx^2, & \text{for } x = 1, 2, 3 \\ 2kx, & \text{for } x = 4, 5, 6 \\ 0, & \text{otherwise} \end{cases}$$

where x denotes the number of hours.

Based on the above information, answer the following questions :

(i) Express the probability distribution given above in the form of a probability distribution table. *1*

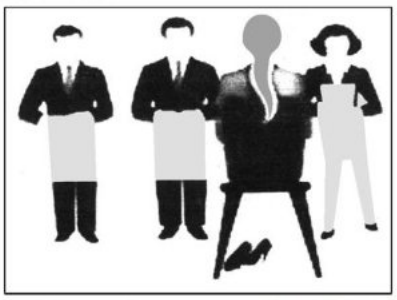
(ii) Find the value of k. *1*

(iii) (a) Find the mean number of hours spent by the student. *2*

OR

(iii) (b) Find $P(1 < X < 6)$. *2*

16. Rohit, Jaspreet and Alia appeared for an interview for three vacancies in the same post. The probability of Rohit's selection is $\frac{1}{5}$, Jaspreet's selection is $\frac{1}{3}$ and Alia's selection is $\frac{1}{4}$. The event of selection is independent of each other.



Based on the above information, answer the following questions :

(i) What is the probability that at least one of them is selected ? **1**

(ii) Find $P(G \mid \overline{H})$ where G is the event of Jaspreet's selection and $\overline{H}$ denotes the event that Rohit is not selected. **1**

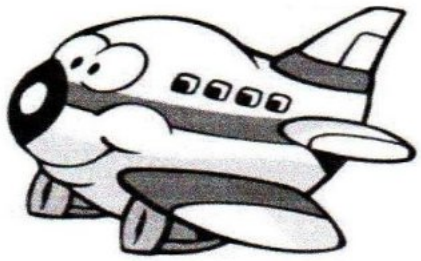
(iii) Find the probability that exactly one of them is selected. **2**

OR

(iii) Find the probability that exactly two of them are selected. **2**

17. Airplanes are by far the safest mode of transportation when the number of transported passengers are measured against personal injuries and fatality totals.





Previous records state that the probability of an airplane crash is 0·00001%. Further, there are 95% chances that there will be survivors after a plane crash. Assume that in case of no crash, all travellers survive.

Let E_1 be the event that there is a plane crash and E_2 be the event that there is no crash. Let A be the event that passengers survive after the journey.

On the basis of the above information, answer the following questions :

(i) Find the probability that the airplane will not crash. *1*

(ii) Find $P(A \mid E_1) + P(A \mid E_2)$. *1*

(iii) (a) Find P(A). *2*

OR

(iii) (b) Find $P(E_2 \mid A)$. *2*

17	A departmental store sends bills to charge its customers once a month. Past experience shows that 70% of its customers pay their first month bill in time. The store also found that the customer who pays the bill in time has the probability of 0.8 of paying in time next month and the customer who doesn't pay in time has the probability of 0.4 of paying in time the next month. Based on the above information, answer the following questions : (i) Let E_1 and E_2 respectively denote the event of customer paying or not paying the first month bill in time. Find $P(E_1)$, $P(E_2)$. (ii) Let A denotes the event of customer paying second month's bill in time, then find $P(A\|E_1)$ and $P(A\|E_2)$. (iii) Find the probability of customer paying second month's bill in time. **OR** (iii) Find the probability of customer paying first month's bill in time if it is found that customer has paid the second month's bill in time.		

PM SHRI KV TIKAMGARH (2026-27)

Autumn Holidays Homework

SUBJECT-CHEMISTRY CLASS-12

Prepare following chapters for Prevoard exam

ALCOHAL PHENOL. and ETHER

- Practice for Nomenclature
- Practice for classification on the basis of type of carbon atom containing OH group
- Practice for complete the reactions based on preparation
- Practice for identification of ABC in given word problem based on preparation
- Practice for the steps in involve in the mechanism of Hydrolysis if of alkenes
- Properties of alcohal and variation in the solubility and boiling point of given samples also arranging them in increasing or decreasing order
- Chemical properties of alcohal
- Oxidation products of Primary Secondary and Tertiary Alcohal
- Reactions in which C—O bond cleavage
- Reactions involved in O—H bond cleavage and acidity of alcohal
- Preparation if PHENOL
- Physical properties of phenol
- Comparison of acidic nature of alcohal and phenol
- Effect of electron withdrawing group and electron donating group on acidic nature of phenol and arranging them

HALO ALKANE and HALOARENE

- Nomenclature practice
- Classification based on type of hybridization if C cantaing galogen as functional group
- Preparation of haloalkane and ghaloarene
- Name reaction based on preparation
- Markonikovs rule and Saytzef rule

- Physical properties of haloalkane and haloarene
- Chemical properties if haloalkane and haloarene
- Reactions fir SN mechanism practice for both mechanism
- SN1 and SN 2 nechanism
- Dehydrohalofenation
- Reaction with metals and name reactions
- Polyhalogen compound andtheir applications

- Important note solve all exampler and intext problem of NCERT book part 2 based on alcohal chapter in C.W note book of chemistry

Important note solve all exampler and intext problem of NCERT book on chapter Haloalkane and haloarenes

- **Complete exercise questions of chapter amines and biomolecules**

PM SHRI KENDRIYA VIDYALAYA TIKAMGARH

AUTUMN BREAK HOMEWORK (2026-27)

CLASS 12 – COMPUTER SCIENCE (083)

Part 1: Python Programming&File Handling (Text, Binary, and CSV)

Complete the following practice programs in your practical record notebook:

- **Text File Operations**:
    - Read a text file line-by-line and display each word separated by a # symbol.
    - Write a program to count and display the number of vowels, consonants, uppercase letters, and lowercase letters in a text file.
    - Read a text file and remove all lines containing the character'a'(or'A'), then write the remaining lines to a new file.
- **Binary File Operations**:
    - Create a binary file using pickle to store student records (Roll Number, Name, Marks). Write functions to append, search, and display records from the binary file.
- **CSV File Operations**:
    - Write a Python script using the csv module to write and read employee details (EmpID, Name, Salary) to/from a .csv file.

Part 2: Data Structures (Stack Implementation in Python)

- Write a menu-driven Python program to implement a **Stack** (LIFO - Last In, First Out) using a list with the following operations:
    1. Push() (Add an element)
    2. Pop() (Remove an element)

3. Peek() / Display() (Show top element or entire stack)l
4. IsEmpty() (Check if the stack is empty)

- *Application Problem*: Write a function in Python that pushes the names of books starting with the letter'A'or'a'from a list onto a stack, and then pops and displays them.

Part 3: Computer Networks (Theory&Case Study)

Answer the following comprehensive networking questions:

- Differentiate between **Circuit Switching** and **Packet Switching**, and **STP vs. UTP** cables.
- Explain network devices: *Hub, Switch, Router, Gateway, Repeater, and NIC*.
- **Case Study Problem**:
  A company with 4 buildings (Building A, Building B, Building C, and Server Room) wants to set up a local area network.
    - Suggest the **cable layout** (topology and media) for connecting the buildings.
    - Suggest the optimal location for the **Server** and **Switch/Hub**.
    - Name the device to connect this network to the **Internet**.

Part 4 : Python Programming&Functions (40 Marks Weightage)

- **User-Defined Functions:** Write a Python program to accept a list of numbers and create a function that separates and returns two new lists— one containing only even numbers and the other containing only odd numbe**rs.**
- **String & List Manipulation:** Write a program to read a string from the user and count the number of uppercase letters, lowercase letters, digits, and special characters.

Part 5 : Practical File&Project Milestone

- **Practical File Work:** Complete at least 15 Python programs, 5 MySQL query sets, and 3 Python-MySQL connectivity programs in your lab manual/practical file.
- **Project Work:** Finalize your Class 12 Project Topic (e.g., *Library Management System*, *Hospital Management System*, or *Quiz Application*), document the abstract, and write the baseline code structure.

PM SHRI KENDRIYA VIDYALAYA, TIKAMGARH
PROJECT WORK 2026-27

CLASS XII **Subject- English**

Dear Students

Make the following project based on the lesson 'On the face of It'. The project should be a result of meticulous research and analysis. Be honest and refrain from any plagiarism.

Project Work

Topic- On the Face of It- Social Inclusion of Specially Challenged People

1) Introduction
2) Data:
    - Percentage of physically disabled people and probable causes resulting in the same
    - Percentage of mentally disabled people and probable causes resulting in the same
    - Children born with disability compared to it acquired later
3) Differently abled children should study in special school meant for them? Write your views in favour or against in about 200 words.
4) You come to know that a new student is joining your school soon who is visually impaired. Your class teacher has assigned you the responsibility of making your classroom a convenient and conducive place for him to learn. You have also been given a sum of Rs 3000 to buy things essential for him/her. How will you work on this task and also utilize the money for the purpose? Elaborate in about 200 words.
5) A few differently abled students are visiting your school next week. They have hearing and speaking disability. Make a layout/map of your school so that they can see the entire school independently without anyone's assistance. Make sure to include all important places like labs, library, assembly ground, playground, etc. The map should be clear and colourful. Add small notes to help them. (for eg; Library- check our the new encyclopedia on Space.)
6) Be ready to speak on any subtopic of your choice during the final assessment of speaking skills.

Remember!

Do your assignment on ruled sheet in a good handwriting. Follow the format shared in the group. Make a cover page with the school name, session, subject, your name and class. Do not use plastic file. **Illustrate your work with pictures and drawings.**

P.M. SHRI KENDRIYA VIDYALAYA TIKAMGARH

AUTUMN BREAK HOLIDAY HOMEWORK

CLASS XII – YOGA (841)

Name: _____

Class & Section: _____ **Roll No.:** _____

GENERAL INSTRUCTIONS

1. Complete all ten topics neatly in your Yoga notebook or on A4-size sheets.
2. Write each topic in your own handwriting using clear headings and subheadings.
3. Paste a relevant photograph or labelled picture for every topic.
4. Write a suitable caption below each photograph/picture.
5. For Yogasanas, include the procedure, benefits and precautions wherever applicable.
6. Maintain proper margins and arrange the pages in the correct order.
7. Use reliable information and write in your own words.
8. Practise Yoga safely and within your comfort level. Stop if you feel pain, dizziness or discomfort.
9. Submit the completed homework on the first working day after the Autumn Break.
10. Revise the topics for classroom discussion after the break.

TOPICS

1. Aahara and Yogic Diet

Written work: Explain the meaning of a yogic diet and describe the qualities of a balanced, nutritious diet.

Picture work: Paste a picture of a balanced vegetarian meal or healthy food plate.

[Paste photograph / picture here]

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2. Hatha Yoga and Health

Written work: Explain how Hatha Yoga practices can support physical and mental well-being.

Picture work: Paste photographs of suitable Hatha Yoga practices.

[Paste photograph / picture here]

---

3. Bahiranga and Antaranga Yoga

Written work: Explain Bahiranga Yoga and Antaranga Yoga and list the limbs included in each group.

Picture work: Paste a labelled chart of the limbs of Ashtanga Yoga.

[Paste photograph / picture here]

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4. Mental Health and Well-being according to Patanjali

Written work: Explain how the principles of Patanjali Yoga can support mental calmness and well-being.

Picture work: Paste a picture showing meditation or a calm Yoga practice.

5. Healthy Lifestyle according to the Bhagavad Gita

Written work: Explain the importance of balance in food, activity, rest and daily routine.

Picture work: Paste a picture showing a healthy daily routine.

[Paste photograph / picture here]

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6. Stress and its Consequences

Written work: Define stress and describe its physical, emotional and behavioural consequences.

Picture work: Paste a relevant educational picture illustrating stress or relaxation.

[Paste photograph / picture here]

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7. Stress Management through Yoga

Written work: Explain how asana, pranayama, meditation and relaxation may help manage stress.

Picture work: Paste photographs of pranayama and meditation.

[Paste photograph / picture here]

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8. Prevention of Common Diseases through Yoga

Written work: Explain the role of regular physical activity, Yoga, hygiene and healthy habits in disease prevention.

Picture work: Paste pictures of suitable Yoga practices and healthy habits.

[Paste photograph / picture here]

---

9. First Aid and CPR

Written work: Define first aid. Explain when it is needed and write the full form of CPR. Mention that CPR should be performed by a trained person or according to emergency guidance.

Picture work: Paste a labelled first-aid-kit picture or an educational CPR diagram.

[Paste photograph / picture here]

---

10. Personality Development through Yoga

Written work: Explain how Yoga may help develop self-discipline, concentration, confidence and emotional balance.

Picture work: Paste a picture showing a student practising Yoga or meditation.

[Paste photograph / picture here]
