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Test Booklet Code
**A**

# CUET (UG) 2024

## Questions, Answer Key & Solutions

**Subject: Mathematics | Code: 319 E | Medium: English | Test Date: 16-MAY-2024**

**(Do not open this Test Booklet until you are asked to do so)**

| Time Allowed: 60 minutes | Maximum Marks: 200 | Total Questions : 15+35=50 | Number of Questions to be answered : 15+25=40 |
|---|---|---|---|
| Kindly read the Instructions given on this Page and Back Page carefully before attempting this Question Paper | | | |

***Important Instructions for the Candidates:***

1. This Question Paper contains **two sections** i.e. **Section A** and **Section B** (**B1** and **B2**).
   **Section A** has **15 questions** covering both i.e. **Mathematics** and **Applied Mathematics** which is **compulsory** for all candidates.
   **Section B1** has **35 questions (Q. No. 16 to 50)** from **Mathematics** out of which **25 questions** need to be attempted.
   **Section B2** has **35 questions (Q. No. 51 to 85)** purely from **Applied Mathematics** out of which **25 questions** need to be attempted.
   If a candidate answers more than **25 questions** from **Section B1/B2**, the first **25** answered questions will be considered for evaluation.
2. When you are given the OMR Answer Sheet, fill in your particulars on it carefully with **blue/black** ball point pen only.
3. Use only Blue/Black Ball Point Pen for marking responses. Kindly select Mathematics (Q. No. 16 to 50) **OR** Applied Mathematics (Q. No. 51 to 85) very carefully for marking responses on the OMR Answer Sheet.
4. The CODE for this Test Booklet is **A**. Make sure that the CODE printed on the OMR Answer Sheet is the same as that on this Test Booklet. Also ensure that your Test Booklet No. and OMR Answer Sheet No. are exactly the same. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the OMR Answer Sheet. No claim in this regard will be entertained after five minutes from the start of the examination.
5. Before attempting the question paper kindly check that this Test Booklet has total **16** pages and OMR Answer Sheet consists of one sheet. At the start of the examination within first five minutes, candidates are advised to ensure that all pages of Test Booklet and OMR Answer Sheet are properly printed and they are not damaged in any manner.]
6. Each question has four answer options. Out of these four options choose the **MOST APPROPRIATE OPTION** and darken/blacken the corresponding circle on the OMR Answer Sheet with a Blue/Black Ball Point Pen.
7. Five (5) marks will be given for each correct answer. One (1) mark will be deducted for each incorrect answer. If more than one circle is found darkened/blacked for a question, then it will be considered as an incorrect answer. Unanswered questions will be given no mark.

**Name of the Candidate (in Capital Letters):**______________________________

**Application Number (in figures):**______________________________

**Roll Number (in figures):)**______________________________

**Centre of Examination (in Capital Letters):**______________ **Invigilator's Signature:** ______________

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***Read carefully the following instructions:***

8. No candidate will be allowed to leave the **OMR** Answer Sheet blank. If any OMR Answer Sheet is found blank, it shall be crossed by the Invigilator with his/her signature, mentioning "Cancelled" on it.

9. Do not tear or fold any page of the Test Booklet and OMR Sheet.

10. Candidates are advised to ensure that they fill the correct particulars on the OMR Answer Sheet, i.e., Application No., Roll No., Test Booklet No., Name, Mother's Name, Father's Name and Signature.

11. Rough work is to be done in the space provided for this purpose in the Test Booklet only.

12. The answers will 'be evaluated through electronic scanning process. Incomplete or incorrect entries may render the OMR Answer Sheet invalid.

13. Candidates are advised not to fold or make any stray marks on the OMR Answer Sheet. Use of Eraser, Nail, Blade, White Fluid/Whitener, etc., to smudge, scratch or damage in any manner the OMR Answer Sheet during examination is strictly prohibited. Candidature and OMR Answer Sheet of candidates using Eraser, Nail, Blade or White Fluid/Whitener to smudge, scratch or damage in any manner shall be cancelled.

14. There-will be one copy of OMR Answer Sheet i.e., the Original Copy. After the examination is over, the candidate shall hand over the OMR Answer Sheet to the Invigilator. The candidate can take away the Test Booklet after the examination is over. If the candidates does not hand over the OMR Answer Sheet to the Invigilator and goes away with the OMR Answer Sheet, his/her candidature shall be cancelled and criminal proceedings shall also be initiated against him/her.

15. Candidates are advised strictly not to carry handkerchief, any mobile phone, any type of watch, belt or wear ornaments like ring, chain, ear-ring, etc., electronic or communication device, pen, pencil, eraser, sharpener and correction fluid to the Examination Centre. If candidate is found possessing any such item, he/she will not be allowed to enter the examination centre. Possession of a mobile phone or any other aiding material as mentioned above by the candidate in the examination room will be treated as a serious violation and it may lead to cancellation of the candidature and debarring him/her from future examinations.

16. If a 'candidate violates any instructions or shows any indiscipline or misbehaviour, appropriate action will be taken including cancellation of candidature and debarring from future examinations.

17. Use of electronic/manual calculator is **not** allowed.

# MATHEMATICS

## SECTION - A (MATHEMATICS)

**1.** The corner points of the feasible region determined by

$x + y \le 8$, $2x+y \ge 8$, $x \ge 0$, $y \ge 0$

are A(0, 8), B(4, 0) and C(8, 0). If the objective function Z = ax + by has its maximum value on the line segment AB, then the relation between a and b is:

(1) 8a+4=b (2) a=2b (3) b = 2a (4) 8b+4=a

**Ans.** **(2)**

**Sol.** Z = ax + by

A (0, 8), B (4,0), C (8,0)

$\because$ Maximum value segment AB

at point A (0,8) $Z_{max} = 8b$

at point B (4,0) $Z_{max} = 4a$

$\therefore$ 4a = 8b

a = 2b

**2.** If $t = e^{2x}$ and $y = \log \log_e t^2$, then $\frac{d^2y}{dx^2}$ is :

(1) 0 (2) 4t (3) $\frac{4e^{2t}}{t}$ (4) $\frac{e^{2t}(4t-1)}{t^2}$

**Ans.** **(1)**

**Sol.** $t = e^{2x}$ and $y = \log_e t^2$

log t = 2x and $y = 2\log_e t$

differentiate w.r.to t

$\frac{1}{t} = \frac{2dx}{dt}$ and $\frac{dy}{dt} = \frac{2 \times 1}{t}$

$\frac{dx}{dt} = \frac{1}{2t}$

$\therefore \frac{dy}{dx} = 4$

Again differentiation $\frac{d^2y}{dx^2} = 0$

**3.** An objective function Z = ax + by is maximum at points (8, 2) and (4, 6). If a ≥ 0 and b≥ 0 and ab = 25, then the maximum value of the function is equal to:

(1) 60 (2) 50 (3) 40 (4) 80

**Ans.** **(2)**

**Sol.** Z = ax + by

Maximum value at points (8,2) and (4,6)

∴ 8a + 2b = 4a + 6b

4a = 4b

a = b

given ab = 25

∴ a = 5 and b = 5

Max. value

⇒ 8×5 + 2×5

⇒ 50

**4.** The area of the region bounded by the lines x + 2y=12, x=2, x=6 and x-axis is :

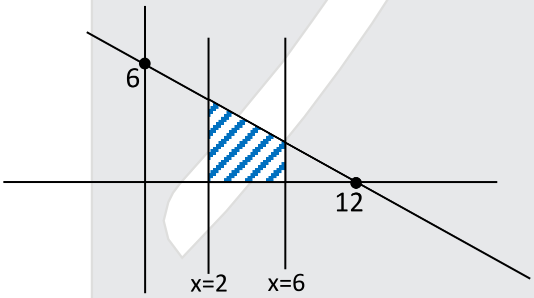
(1) 34 sq units (2) 20 sq units (3) 24 sq units (4) 16 sq units

**Ans.** **(4)**

**Sol.** x + 2y = 12 ; x = 2, x = 6

and x-axis

Area




$$\Rightarrow \int_2^6 y\,dx$$

$$\Rightarrow \int_2^6 \left(\frac{12-x}{2}\right)dx$$

$$\Rightarrow \frac{1}{2}\left[12x-\frac{x^2}{2}\right]_2^6$$

⇒ 16 sq. unit

**5.** A die is rolled thrice. What is the probability of getting a number greater than 4 in the first and the second throw of dice and a number less than 4 in the third throw?

(1) $\frac{1}{3}$ (2) $\frac{1}{6}$ (3) $\frac{1}{9}$ (4) $\frac{1}{18}$

**Ans.** **(4)**

**Sol.** A die is rolled thrice

Total outcome = 6×6×6
= 216

Favourable outcome

| | | |
|---|---|---|
| (5, 5, 1) | (5, 5, 2) | (5, 5, 3) |
| (6, 6, 1) | (6, 6, 2) | (6, 6, 3) |
| (5, 6, 1) | (5, 6, 2) | (5, 6, 3) |
| (6, 5, 1) | (6, 5, 2) | (6, 5, 3) |

∴ Total fav. outcome = 12

∴ Probability = $\frac{12}{216} = \frac{1}{18}$

**6.** $\int \frac{\pi}{x^{n+1} - x} dx =$

(1) $\frac{\pi}{n}\log_e\left|\frac{x^n - 1}{x^n}\right| + C$ (2) $\log_e\left|\frac{x^n + 1}{x^n - 1}\right| + C$ (3) $\frac{\pi}{n}\log_e\left|\frac{x^n + 1}{x^n}\right| + C$ (4) $\pi\log_e\left|\frac{x^n}{x^n - 1}\right| + C$

**Ans.** **(1)**

**Sol.** $\Rightarrow \int \frac{\pi}{x^{n+1} - x} dx$ $\Rightarrow \pi\int \frac{1}{x^n \cdot x - x} dx$

$\Rightarrow \pi\int \frac{1}{x(x^n - 1)} dx$

Multiply Nr and Dr { By $x^{n-1}$ }

$\Rightarrow \pi\int \frac{x^{n+1}}{x^n(x^n - 1)} dx$

Let $x^n = t$

$n\,x^{n-1}\,dx = dt$

∴ $\Rightarrow \frac{\pi}{n}\int \frac{1}{t(t-1)} dt$

$\Rightarrow \frac{\pi}{n}\left[\int -\frac{1}{t}dt + \int \frac{1}{t-1}dt\right]$

$\Rightarrow \frac{\pi}{n}[-\log t + \log(t-1)]$

$\Rightarrow \frac{\pi}{n}\left[\log\left(\frac{t-1}{t}\right)\right]$

$\Rightarrow \frac{\pi}{n}\log\left(\frac{x^n - 1}{x^n}\right) + C$

**7.** The value of $\int_0^1 \frac{a-bx^2}{(a+bx^2)^2}dx$ is :

(1) $\frac{a-b}{a+b}$ (2) $\frac{1}{a-b}$ (3) $\frac{a+b}{2}$ (4) $\frac{1}{a+b}$

**Ans.** **(4)**

**Sol.** $\int_0^1 \frac{a-bx^2}{(a+bx^2)^2}dx$

Put $x = \sqrt{\frac{a}{b}}\tan\theta \Rightarrow \tan\theta = x\sqrt{\frac{b}{a}}$

$dx = \sqrt{\frac{a}{b}}\sec^2\theta\, d\theta$ | $\theta = \tan^{-1}\left(x\sqrt{\frac{b}{a}}\right)$; limit $x=0;\ \theta=0$; $x=1;\ \theta=\tan^{-1}\sqrt{\frac{b}{a}}$

$$\int_0^{\tan^{-1}\sqrt{\frac{b}{a}}} \frac{a-b\times\frac{a}{b}\tan^2\theta}{\left(a+b\times\frac{a}{b}\tan^2\theta\right)^2}\times\sqrt{\frac{a}{b}}\sec^2\theta\, d\theta$$

$$\Rightarrow \int_0^{\tan^{-1}\sqrt{\frac{b}{a}}} \frac{a(1-\tan^2\theta)}{a^2(1+\tan^2\theta)^2}\times\sqrt{\frac{a}{b}}\sec^2\theta\, d\theta$$

$$\Rightarrow \frac{1}{a}\times\sqrt{\frac{a}{b}}\int_0^{\tan^{-1}\sqrt{\frac{b}{a}}}\cos 2\theta\, d\theta$$

$$\Rightarrow \frac{1}{a}\sqrt{\frac{a}{b}}\left[\frac{\sin 2\theta}{2}\right]_0^{\tan^{-1}\sqrt{\frac{b}{a}}} \Rightarrow \frac{1}{a+b}$$

**8.** The second order derivative of which of the following is $5^x$?

(1) $5^x\log_e 5$ (2) $5^x(\log_e 5)^2$ (3) $\frac{5^x}{\log_e 5}$ (4) $\frac{5^x}{(\log_e 5)^2}$

**Ans.** **(4)**

**Sol.** $\int 5^x dx$

$\int \frac{5^x}{\ln 5}dx$ Again Integrate

$$\frac{1}{\ln 5}\times\frac{5^x}{\ln 5} = \frac{5^x}{(\ln 5)^2}$$

**9.** The degree of the differential equation $\left(1-\left(\frac{dx}{dx}\right)^2\right)^{\frac{3}{2}} = k\frac{d^2y}{dx^2}$ is :

(1) 1 (2) 2 (3) 3 (4) $\frac{3}{2}$

**Ans.** **(2)**

**Sol.** **degree of** $\left(1-\left(\frac{dy}{dx}\right)^2\right)^{3/2} = k\frac{d^2y}{dx^2}$

squaring both side….

$$\left[1-\left(\frac{dy}{dx}\right)^2\right]^3 = k^2\left(\frac{d^2y}{dx^2}\right)^2$$

$\therefore$ degree = 2

**10.** If A and B are symmetric matrices of the same order, then AB - BA is a :

(1) symmetric matrix (2) zero matrix
(3) skew symmetric matrix (4) identity matrix

**Ans.** **(3)**

**Sol.** Given A = A'
B = B'

(AB – BA)' = (AB)' – (BA)'
= B'A' – A'B'
= BA – AB
= – (AB – BA)

$\therefore$ it is skew symmetric matrix

**11.** If A is a square matrix of order 4 and |A|= 4, then |2A| will be:

(1) 8 (2) 64 (3) 16 (4) 4

**Ans.** **(2)**

**Sol.** |A| = 4 then
$|2A| = 2^4\,|A| = 16 \times 4 = 64$

**12.** If $[A]_{3\times2}\,[B]_{x\times y} = [A]_{3\times1}$ , then :

(1) x=1, y = 3 (2) x=2, y = 1 (3) x=3, y = 3 (4) x=3, y = 1

**Ans.** **(2)**

**Sol.** $[A]_{3\times2}\,[B]_{x\times y} = [C]_{3\times1}$

Product of matrices is defined when (A) no. of column = no. of row (B)

$\therefore$ x = 2

and $[C]_{3\times1} = [C]_{x\times y}$

y = 1

$\therefore$ x = 2 ; y = 1

**13.** If a function $f(x) = x^2 + bx + 1$ is increasing in the interval [1, 2], then the least value of b is:

(1) 5 (2) 0 (3) –2 (4) –4

**Ans.** **(3)**

**Sol.** $f(x) = x^2 + bx + 1$

$f'(x) = 2x + b$

it is increasing in [1, 2]

$f'(x) \geq 0$

$2x + b \geq 0$

$b \geq -2x$

at point $x = 1 \Rightarrow b \geq -2$ ; at point $x = 2 \Rightarrow b \geq -4$

$\therefore$ least value of b is – 2

**14.** Two dice are thrown simultaneously. If X denotes the number of fours, then the expectation of X will be

(1) $\frac{5}{9}$ (2) $\frac{1}{3}$ (3) $\frac{4}{7}$ (4) $\frac{3}{8}$

**Ans.** **(2)**

**Sol.** Two dice thrown

then total out come = 36

x denotes no. of fours.

x can take value 0, 1, 2

Now

| x | 0 | 1 | 2 |
|---|---|---|---|
| P(x) | $\frac{25}{36}$ | $\frac{10}{36}$ | $\frac{1}{36}$ |

$\therefore$ Expectation E(x) $\Rightarrow$ $0 \times \frac{25}{36} + 1 \times \frac{10}{36} + 2 \times \frac{1}{36}$ $\Rightarrow$ $\frac{12}{36} = \frac{1}{3}$

**15.** For the function $f(x) = 2x^3 - 9x^2 + 12x - 5$, $x \in [0, 3]$, match List-I with List-II:

| **List-I** | **List-II** |
|---|---|
| (A) Absolute maximum value | (I) 3 |
| (B) Absolute minimum value | (II) 0 |
| (C) Point of maxima | (III) –5 |
| (D) Point of minima | (IV) 4 |

Choose the correct answer from the options given below :

(1) (A)-(IV), (B) - (II), (C) - (I), (D) - (III)
(2) (A) - (II), (B) - (III), (C) - (I), (D) - (IV)
(3) (A) (IV), (B) - (III), (C) - (II), (D) - (I)
(4) (A) (IV), (B) - (III), (C) - (I), (D) - (II)

**Ans.** **(4)**

**Sol.** $f(x) = 2x^3 - 9x^2 + 12x - 5$ ; $x \in [0,3]$

put x = 0 ; f(0) = – 5 $\leftarrow$ Minimum

put x = 3 ; f(3) = 4 $\leftarrow$ Minimum

Now (A) – IV ; (B) – III ; (C) – I ; (D) – II

## SECTION - B1 (MATHEMATICS)

**16.** The rate of change (in $cm^2/s$) of the total surface area of a hemisphere with respect to radius r at $r = \sqrt[3]{1.331}$ cm is :

(1) $66\pi$ (2) $6.6\pi$ (3) $3.3\pi$ (4) $4.4\pi$

**Ans.** **(2)**

**Sol.** Area of Hemi sphere = $3\pi r^2$

$\therefore A = 3\pi r^2$

$\frac{dA}{dr} = 6\pi r$

$r = (1.331)^{1/3}$

$r = \frac{11}{10}$

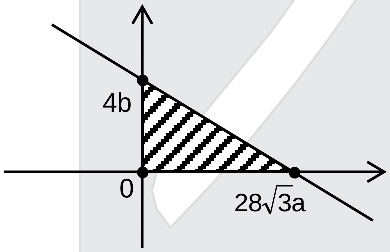
$\therefore \frac{dA}{dr} \Rightarrow 6\pi \times \frac{11}{10} = \frac{66\pi}{10} = 6.6\,\pi$

**17.** The area of the region bounded by the line $\frac{x}{7\sqrt{3}a} + \frac{y}{b} = 4$, x=0 and y=0 is

(1) $56\sqrt{3}ab$ (2) 56a (3)ab/2 (4)3ab

**Ans.** **(1)**

**Sol.** line $\frac{x}{7\sqrt{3}a} + \frac{y}{b} = 4$




$\therefore$ Area

$\Rightarrow \frac{1}{2} \times 4b \times 28\sqrt{3}a \quad \Rightarrow 56\sqrt{3}ab$

**18.** If A is a square matrix and I is an identity matrix such that $A^2=A$, then $A(I-2A)^3 + 2A^3$ is equal to

(1) I+A (2) I+2A (3) I–A (4) A

**Ans.** **(4)**

**Sol.** Given $A^2 = A$

$A(I-2A)^3 + 2A^3$

$\Rightarrow A[I - 8A - 6A + 12A] + 2A^3$

$\Rightarrow A[I - 2A] + 2A$

$\Rightarrow A - 2A^2 + 2A$

$\Rightarrow A - 2A + 2A = A$

**19.** The value of the integral $\int_{\log_e 2}^{\log_e 3} \frac{e^{2x}-1}{e^{2x}+1} dx$ is

(1) $\log_e 3$ (2) $\log_e 4 - \log_e 3$ (3) $\log_e 9 - \log_e 4$ (4) $\log_e 3 - \log_e 2$

**Ans.** **(2)**

**Sol.** $\int_{\log_e 2}^{\log_e 3} \frac{e^{2x}-1}{e^{2x}+1} dx$

[multiply $N^r$ and $D^r$ By $e^{-x}$]

$\Rightarrow \int_{\log_e 2}^{\log_e 3} \frac{e^{x}-e^{-x}}{e^{x}+e^{-x}} dx$

$\Rightarrow$ let $e^x + e^{-x} = t$

$(e^x - e^{-x})\, dx = dt$

$\Rightarrow \int \frac{dt}{t} \Rightarrow \ln t$

$\Rightarrow \left[\ln\left(e^x + e^{-x}\right)\right]_{\log_e 2}^{\log_e 3}$

$\Rightarrow \log\left(\frac{10}{3}\right) - In\left(\frac{5}{2}\right)$

$\Rightarrow \ln\left(\frac{4}{3}\right) \Rightarrow \log_e 4 - \log_e 3$

**20.** If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, where $\vec{a}$ and $\vec{b}$ are unit vectors and $|\vec{c}| = 2$,

Then the angle between the vectors $\vec{b}$ and $\vec{c}$ is

(1) 60° (2) 90° (3) 120° (4)180°

**Ans.** **(4)**

**Sol.** $\vec{a} + \vec{b} + \vec{c} = 0$

$\vec{b} + \vec{c} = -\vec{a}$ (squaring both side)

$|\vec{b}|^2 + |\vec{c}|^2 + 2|\vec{a}|\,|\vec{c}| \cos\theta = |\vec{a}|^2$

$\Rightarrow 1 + 4 + 2 \times 2 \cos\theta = 1$

$\Rightarrow \cos\theta = -1$

$\theta = 180°$ **option (4) Ans**

**21.** Let [x] denote the greatest integer function, then match List-I with List-II

| List-I | List-II |
|---|---|
| (A) $\lvert x-1\rvert+\lvert x-2\rvert$ | (I) is differentiable everywhere except at x =0 |
| (B) $x-\lvert x\rvert$ | (II) is continuous everywhere |
| (C) $x-[x]$ | (III) is not differentialbe at x=1 |
| (D) $x\lvert x\rvert$ | (IV) is differentialbe at x=1 |

Choose the correct answer from the options given below:

(1) (A) –(I),(B)-(II), (C)-(III), (D)-(IV)
(2) (A) –(I),(B)-(III), (C)-(II), (D)-(IV)
(3) (A) –(II),(B)-(I), (C)-(III), (D)-(IV)
(4) (A) –(II),(B)-(IV), (C)-(III), (D)-(I)

**Ans.** **(3)**

**Sol.** $|x-1|+|x-2|$ is continuous everywhere

x – |x| is differentiable at every where except at x = 0.

x – [x] is not differentiable at x = 1

x |x| is differentiable at x = 1.

**22.** Match List-I with List-II

| **List-I** | **List-II** |
|---|---|
| (A) Integrating factor of xdy–(y+2x$^2$)dx=0 | (I) $\frac{1}{x}$ |
| (B) Integrating factor of (2x$^2$–3y)dx= xdy | (II) x |
| (C) Integrating factor of (2y+3x$^2$)dx+ xdy=0 | (III) x$^2$ |
| (D) Integrating factor of 2xdy+ (3x$^3$+2y)dx=0 | (IV) x$^3$ |

Choose the correct answer from the options given below:

(1) (A) –(I),(B)-(III), (C)-(IV), (D)-(II)
(2) (A) –(I),(B)-(IV), (C)-(III), (D)-(II)
(3) (A) –(II),(B)-(I), (C)-(III), (D)-(IV)
(4) (A) –(III),(B)-(IV), (C)-(II), (D)-(I)

**Ans.** **(2)**

**Sol.** xdy – (y + 2x$^2$)dx = 0

$$\frac{dy}{dx}-\frac{y}{x}=2x$$

$p = -\frac{1}{x}$ $\quad\therefore$ I.F. = $e^{\int P dx}$ $\quad\Rightarrow\quad$ $e^{\int -\frac{1}{x}dx}$

I.F. $\Rightarrow \frac{1}{x}$

Similarlily

(2x$^2$ – 3y)dx xdy

I.F. = x$^3$

(2y + 3x$^2$) dx xdy = 0

I.F. = x$^2$

And 2xdy + (3x$^3$ + 2y)dx = 0

I.F. = x

**23.** If the function $f : N \to N$ is defined as f(n) = $\begin{cases} n-1 & \text{if n is even} \\ n+1 & \text{if n is odd} \end{cases}$, then

(A) f is injective (B) f is into

(C) f is surjective (D) f is invertible

Chose the correct answer from the options given below:

(1) (B) only (2) (A), (B) and (D) only

(3) (A) and (C) only (4) (A), (C) and (D) only

**Ans.** **(4)**

**Sol.** $f : N \to N$

$$f(n) = \begin{cases} n-1; \text{ n is even} \\ n-1; \text{ n is odd} \end{cases}$$

This function is injective and subjective both and if function is bijective then it is also invertible.

**24.** $\int_0^{\frac{\pi}{2}} \frac{1-\cot x}{\operatorname{cosec} x+\cos x}dx$

(1) 0 (2) $\frac{\pi}{4}$ (3) $\infty$ (4) $\frac{\pi}{12}$

**Sol.**

$$\int_0^{\pi/2} \frac{1-\cot x}{\operatorname{cosec} x+\cos x}dx$$

$$\Rightarrow \int_0^{\pi/2} \frac{1-\frac{\cos x}{\sin x}}{\frac{1}{\sin x}+\cos x}dx$$

$$I = \int_0^{\pi/2} \frac{\sin x-\cos x}{1+\sin x\cos x}dx \quad \text{...(1) Using property}$$

$$I = \int_0^{\pi/2} \frac{\cos x-\sin x}{1+\sin x\cos x}dx \quad \text{...(2)}$$

Adding both equation (1) and (2)

$$2I = \int_0^{\pi/2} \frac{0}{1+\sin x\cos x}dx$$

I = 0 **Option (1)**

**25.** If the random variable X has the following distribution :

| X | 0 | 1 | 2 | otherwise |
|---|---|---|---|---|
| P(X) | k | 2k | 3k | 0 |

Match **List-I** with **List-II** :

| **List-I** | | **List-II** | |
|---|---|---|---|
| (A) | k | (I) | $\frac{5}{6}$ |
| (B) | P(X < 2) | (II) | $\frac{4}{3}$ |
| (C) | E(X) | (III) | $\frac{1}{2}$ |
| (D) | $P(1 \le X \le 2)$ | (IV) | $\frac{1}{6}$ |

Choose the correct answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
(2) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

**Ans.** **(2)**

**Sol.** Here k + 2k + 3k + 0 = 1

$K = \frac{1}{6}$

$P(x < 2) = k + 2k = \frac{1}{6} + \frac{2}{6} = \frac{1}{2}$

$(x) = \frac{4}{3}$

and $P(1 \le x \le 2) \Rightarrow \frac{5}{6}$ Option (2)

**26.** For a square matrix $A_{nxn}$

(A) $|\text{adj. } A| = |A|^{n-1}$
(B) $|A| = |\text{Adj. } A|^{n-1}$
(C) $A(\text{adj } A) = |A|$
(D) $|A^{-1}| = \frac{1}{|A|}$

Choose the correct answer from the options given below :

(1) (B) and (D) only
(2) (A) and (D) only
(3) (A) (C) and (D) only
(4) (B) (C) and (D) only

**Ans.** **(2)**

**Sol.** According to standard properties of adjoint of matrix (A), (C) and (D) only option (3) correct.

**27.** The matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is a :

(A) scalar matrix
(B) diagonal matrix
(C) skew-symmetric matix
(D) symmetric matrix

Choose the correct answer from the options given below :

(1) (A) (B) and (D) only
(2) (A) (B) and (C) only
(3) (A), (B), (C) and (D)
(4) (B) (C) and (D) only

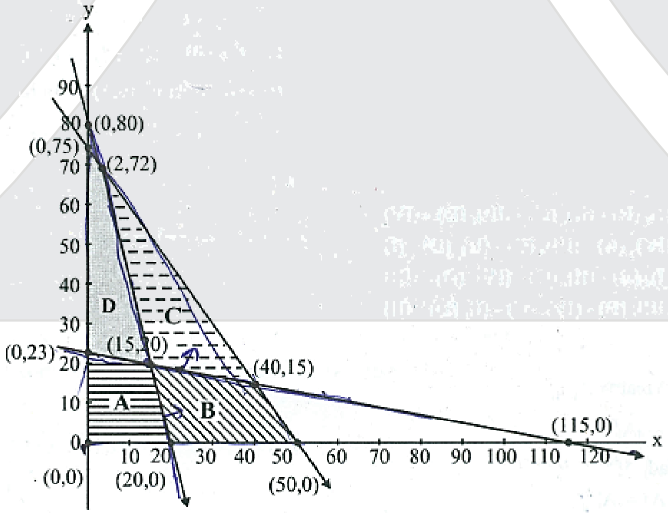
**Ans.** **(1)**

**Sol.** $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

this is scalar matrix, diagonal matrix and symmetrix matrix.

$\therefore$ option (1) (A) (B) and (D) are correct.

**28.** The feasible region represented by the constraints $4x + y \geq 80$, $x + 5y \geq 115$, $3x + 2y \leq 150$, $x, y \geq 0$ an LPP is




(1) Region A
(2) Region B
(3) Region C
(4) Region D

**Ans.** **(3)**

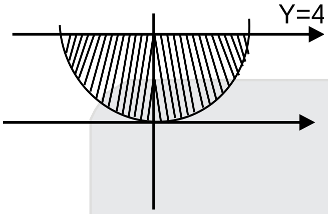
**Sol.** According to graph the common feasible region is C part option (3).

**29.** The area of the region enclosed between the curves $4x^2 = y$ and $y = 4$ is :

(1) 16 sq. units (2) $\frac{32}{3}$ sq. units (3) $\frac{8}{3}$ sq. units (4) $\frac{16}{3}$ sq. units

**Ans.** **(4)**

**Sol.** Required area




$$\Rightarrow 2\int_0^4 x\,dy$$

$$\Rightarrow \frac{2}{2}\int_0^4 \sqrt{y}\,dy$$

$$\Rightarrow \frac{2}{3}\left[(y)^{\frac{3}{2}}\right]_0^4 \Rightarrow \frac{16}{3}\text{ sq unit}$$

**Option – 4**

**30.** $\int e^x\left(\frac{2x+1}{2\sqrt{x}}\right)dx =$

(1) $\frac{1}{2\sqrt{x}}e^x + C$ (2) $-e^x\sqrt{x} + C$ (3) $-\frac{1}{2\sqrt{x}}e^x + C$ (4) $e^x\sqrt{x} + C$

**Ans.** **(4)**

**Sol.**

$$\int e^x\left(\frac{2x+1}{2\sqrt{x}}\right)dx$$

$$\Rightarrow \int e^x\left(\sqrt{x} + \frac{1}{2\sqrt{x}}\right)dx$$

Standard result $\left\{\int e^x[f(x) + f'(x)]dx\right\}$

$\Rightarrow e^x\sqrt{x} + c$ $\Rightarrow e^x f(x) + c$

**Option - 4**

**31.** If f(x), defined by f(x) = $\begin{cases} kx+1 & \text{if } x \le \pi \\ \cos x & \text{if } x > \pi \end{cases}$ is continuous at x = $\pi$, then the value of k is:

(1) 0 (2) $\pi$ (3) $\frac{\pi}{2}$ (4) $-\frac{\pi}{2}$

**Ans.** **(4)**

**Sol.** It is continuos at x = $\pi$

$\therefore$ LHS = RHS

$\Rightarrow$ $\pi k + 1 = \text{Cos}(\pi)$

$\Rightarrow$ $\pi k + 1 = -1$

$\Rightarrow$ $\pi k = -2$

$$k = \frac{-2}{\pi}$$

**Option - 4**

**32.** If P = $\begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$ and Q = $[2 \quad -4 \quad 1]$ are two matrices, then (PQ)' will be

(1) $\begin{bmatrix} 4 & 5 & 7 \\ -3 & -3 & 0 \\ 0 & -3 & -2 \end{bmatrix}$ (2) $\begin{bmatrix} -2 & 4 & 2 \\ 4 & -8 & -4 \\ -1 & 2 & 1 \end{bmatrix}$ (3) $\begin{bmatrix} 5 & 5 & 2 \\ 7 & 6 & 7 \\ -9 & -7 & 0 \end{bmatrix}$ (4) $\begin{bmatrix} -2 & 4 & 8 \\ 7 & 5 & 7 \\ -8 & -2 & 6 \end{bmatrix}$

**Ans.** **(2)**

**Sol.** $\begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix} \begin{bmatrix} 2 & -4 & 1 \end{bmatrix}$

$$PQ \Rightarrow \begin{bmatrix} -2 & 4 & -1 \\ 4 & -8 & 2 \\ 2 & -4 & 1 \end{bmatrix}$$

$$(PQ)' = \begin{bmatrix} -2 & 4 & 2 \\ 4 & -8 & -4 \\ -1 & 2 & 1 \end{bmatrix}$$

**Option - 2**

**33.** $\Delta = \begin{vmatrix} 1 & \cos x & 1 \\ -\cos x & 1 & \cos x \\ -1 & -\cos x & 1 \end{vmatrix}$

(A) $\Delta = 2(1–\cos^2 x)$
(B) $\Delta = 2(2–\sin^2 x)$
(C) Minimum value of $\Delta$ is 2
(D) Maximum value of $\Delta$ is 4

Choose the correct answer from the options given below:
(1) (A), (C) and (D) only
(2) (A), (B) and (C) only
(3) (A), (B), (C) and (D)
(4) (B), (C) and (D) only

**Ans.** **(4)**

**Sol.** $\Delta = \begin{bmatrix} 1 & Cosx & 1 \\ -Cosx & 1 & Cosx \\ -1 & -Cosx & 1 \end{bmatrix}$

$\Delta = 2 + 2Cos^2 x$ ; $\Delta = 2[2 - Sin^2 x]$

$\therefore$ min value of $\Delta$ is 2 and max value of $\Delta$ is 4

**Option – 4**

**34.** f(x) = sin x + $\frac{1}{2}$ cos 2x in $\left[0, \frac{\pi}{2}\right]$

(A) f'(x) = cos x – sin 2x

(B) The critical points of the function are x = $\frac{\pi}{6}$ and x = $\frac{\pi}{2}$

(C) The minimum value of the functions is 2

(D) The maximum value of the function is $\frac{3}{4}$

Choose the correct answer from the option given below:
(1) (A), (B) and (D) only
(2) (A), (B) and (C) only
(3) (A), (B), (C) and (D)
(4) (B), (C) and (D) only

**Ans.** **(1)**

**Sol.** $f(x) = Sinx + \frac{1}{2}Cos2x$

$f'(x) = Cosx - Sin2x$

For critical point.

$f'(x) = 0$

$Cosx - 2SinxCosx = 0$

$Cosx[1 - 2Sinx] = 0$

$Cosx = 0 \quad or \quad Sinx = \frac{1}{2}$

$x = \frac{\pi}{2} \quad or \quad x = \frac{\pi}{6}$

**35.** The direction cosines of the line which is perpendicular to the lines with direction ration 1, –2, –2 and 0, 2, 1 are:

(1) $\frac{2}{3},-\frac{1}{3},\frac{2}{3}$ (2) $-\frac{2}{3},-\frac{1}{3},\frac{2}{3}$ (3) $\frac{2}{3},-\frac{1}{3}-\frac{2}{3}$ (4) $\frac{2}{3},\frac{1}{3},\frac{2}{3}$

**Ans.** **(1)**

**Sol.** let $\ell$, m, n be the direction cosines of lines

$\therefore$ $\ell - 2m - 2n = 0$

$\ell + 2m + n = 0$

on solving equation, we get

$$\frac{\ell}{2} = \frac{m}{-1} = \frac{n}{2}$$

direction ration of lines are proportional to 2, –1, 2

$\therefore$ direction cosines are $\frac{2}{3},\frac{-1}{3},\frac{2}{3}$

**36.** Let X denote the number of hours you play during a randomly selected day. The probability that X can take values x has the following form, where c is some constant.

$$p(X = x) = \begin{cases} 0.1 & , \text{ if } x = 0 \\ cx & , \text{ if } x = 1 \text{ or } x = 2 \\ c(5-x) & , \text{ if } x = 3 \text{ or } x = 4 \\ 0 & , \text{ otherwise} \end{cases}$$

Match List-I with List-II :

| List-I | List-II |
|---|---|
| (A) c | (I) 0.75 |
| (B) $P(X \le 2)$ | (II) 0.3 |
| (C) P(X = 2) | (III) 0.55 |
| (D) $P(X \ge 2)$ | (IV) 0.15 |

Choose the correct answer from the options given below :

(1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
(2) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

**Ans.** **(2)**

**Sol.** $\Rightarrow$ $\sum_{0}^{4} P(x) = 1$

$\Rightarrow$ P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3) + P(x = 4) = 1

$\Rightarrow$ 0.1 + c + 2c + 2c + c = 1

$\Rightarrow$ 6c = 0.9

$$c = \frac{0.9}{6} = 0.15$$

**37.** If sin y = x sin (a + y), then $\frac{dy}{dx}$ is :

(1) $\frac{\sin^2 a}{\sin(a+y)}$ (2) $\frac{\sin(a+y)}{\sin^2 a}$ (3) $\frac{\sin(a+y)}{\sin a}$ (4) $\frac{\sin^2(a+y)}{\sin a}$

**Ans.** **(4)**

**Sol.** sin y = x sin (a + y)

differentiate wrt x ....

$\cos y \frac{dy}{dx} = x\cos(a+y)\frac{dy}{dx} + \sin(a+y).1$

$\frac{dy}{dx} = \frac{\sin(a+y)}{\cos y - x\cos(a+y)}$ now put

$\therefore x = \frac{\sin y}{\sin(a+y)}$

$\therefore \frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a} \left\{ \begin{array}{l} u\sin g \\ \sin(A-B) \end{array} \right. = \sin A\cos B - \cos A\sin B$

**38.** The unit vector perpendicular to each of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$, where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+3\hat{k}$, is :

(1) $\frac{1}{\sqrt{6}}\hat{i}+\frac{2}{\sqrt{6}}\hat{j}+\frac{1}{\sqrt{6}}\hat{k}$ (2) $-\frac{1}{\sqrt{6}}\hat{i}+\frac{1}{\sqrt{6}}\hat{j}-\frac{1}{\sqrt{6}}\hat{k}$

(3) $-\frac{1}{\sqrt{6}}\hat{i}+\frac{2}{\sqrt{6}}\hat{j}+\frac{2}{\sqrt{6}}\hat{k}$ (4) $-\frac{1}{\sqrt{6}}\hat{i}+\frac{2}{\sqrt{6}}\hat{j}-\frac{1}{\sqrt{6}}\hat{k}$

**Ans.** **(4)**

**Sol.** $\because$ $\vec{a}+\vec{b} = 2\hat{i}+3\hat{j}+4\hat{k}$

$\vec{a}-\vec{b} = -\hat{j}-2\hat{k}$

$$(\vec{a}+\vec{b})\times(\vec{a}-\vec{b}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 4 \\ 0 & -1 & -2 \end{vmatrix}$$

$\Rightarrow -2\hat{i}+4\hat{j}-2\hat{k}$

$\therefore$ Unit perpendicular vector

$\Rightarrow \frac{-2\hat{i}+4\hat{j}-2\hat{k}}{\sqrt{24}}$

**39.** The distance between the lines $\vec{r} = \hat{i} - 2\hat{j} + 3\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$ and $\vec{r} = 3\hat{i} - 2\hat{j} + 1\hat{k} + \mu(4\hat{i} + 6\hat{j} + 12\hat{k})$ is :

(1) $\frac{\sqrt{28}}{7}$ (2) $\frac{\sqrt{99}}{7}$ (3) $\frac{\sqrt{328}}{7}$ (4) $\frac{\sqrt{421}}{7}$

**Ans.** **(3)**

**Sol.** $\vec{r} = \hat{i} - 2\hat{j} + 3\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$

$\vec{r} = 3\hat{i} - 2\hat{j} + \hat{k} + \mu(4\hat{i} + 6\hat{j} + 12\hat{k})$

Both are parallel lines.

$\therefore$ distance d = $\left|\frac{\vec{b} \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|}\right|$

$\Rightarrow \vec{a}_2 - \vec{a}_1 = 2\hat{i} - 2\hat{k}$

$\therefore \vec{b} \times (\vec{a}_2 - \vec{a}_1) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 6 \\ 2 & 0 & -2 \end{vmatrix}$

$= -\ 6\hat{i} + 16\hat{j} - 6\hat{k}$

$\Rightarrow \sqrt{36 + 256 + 36}$

$\Rightarrow \sqrt{36 + 256 + 36}$

$\therefore$ distance $\Rightarrow \frac{\sqrt{328}}{7}$ **option (3)**

**40.** If f(x) = $2\left(\tan^{-1}(e^x) - \frac{\pi}{4}\right)$, then f(x) is :

(1) even and is strictly increasing in $(0,\infty)$
(2) even and is strictly decreasing in $(0,\infty)$
(3) odd and is strictly increasing in $(-\infty,\infty)$
(4) odd and is strictly decreasing in $(-\infty,\infty)$

**Ans.** **(3)**

**Sol.** f(x) = $2\left[\tan^{-1}(e^x) - \frac{\pi}{4}\right]$

f′x = $2\left[\frac{1}{1+e^{2x}}.e^x - 0\right]$

f′(x) = $\frac{2e^x}{1+e^{2x}} > 0 \ \{\because\ e^x.0$

$\therefore$ It is strictly increasing and this is odd function.

**41.** For the differential equation $(x \log_e x)dy = (\log_e x - y)dx$

(A) Degree of the given differential equation is 1.

(B) It is a homogeneous differential equation.

(C) Solution is $2y \log_e x + A = = (\log_e x)^2$, where A is an arbitrary constant

(D) Solution is $2y \log_e x + A = \log_e (\log_e x)$, where A is an arbitrary constant

Choose the correct answer from the options given below :

(1) (A) and (C) only
(2) (A), (B) and (C) only
(3) (A), (B) and (D) only
(4) (A) and (D) onlys

**Ans.** **(1)**

**Sol.** $(x \log x)dy = (\log_e x - y)dx$

$$\frac{dy}{dx} = \frac{\log x - y}{x \log x} \Rightarrow \frac{dy}{dx} = \frac{1}{x} - \frac{y}{x\log x} \Rightarrow \frac{dy}{dx} + \frac{y}{x\log x} = \frac{1}{x}$$

$$P = \frac{1}{x\log x}; \frac{1}{x}$$

$$\text{I.F.} = e^{\int P dx} = e^{\int \frac{1}{x\log x}dx} = e^{\ell n}(\log x) = \log x$$

$\therefore$ Solution $\quad y \times \text{I.F.} = \int \text{I.F.} \times Q\, dx + C$

$$\Rightarrow \quad y \times \log x = \int \log x . \frac{1}{x} dx \text{ (using ILATE)}$$

$$\Rightarrow \quad y \log x = \frac{1}{2}(\log x)^2 + C \quad \Rightarrow \quad 2y \log x = (\log x)^2$$

**42.** There are two bags, Bag-1 contains 4 white and 6 black balls and Bag-2 contains 5 white and 5 black balls A die is rolled, if it shows a number divisible by 3, a ball is drawn from Bag-I, else a ball is drawn from Bag-2, If the ball drawn is not black in colour, the probability that it was not drawn from Bag-2 is :

(1) $\frac{4}{9}$ (2) $\frac{3}{8}$ (3) $\frac{2}{7}$ (4) $\frac{4}{19}$

**Ans.** **(2)**

**Sol.** let $E_1$ be the event that a ball is drawn from first bag.

let $E_2$ be the event that a ball is drawn from second bag.

$\therefore \quad P(E_1) = \frac{2}{6} = \frac{1}{3} \quad ; \quad P(E_2) = \frac{2}{3}$

Let A = Ball is drawn black ball

$$P(A) = \frac{1}{3} \times \frac{6}{10} + \frac{2}{3} \times \frac{5}{10} = \frac{16}{30}$$

$\therefore$ Probability of ball is drawn second bag

$$P\left(\frac{E_2}{A}\right) = \frac{\frac{2}{3} \times \frac{5}{20}}{\frac{16}{30}} \Rightarrow \frac{10}{16}$$

$\therefore$ Ball is not drawn from Bag 2.

$$\Rightarrow \quad 1 - \frac{10}{16} \Rightarrow \frac{6}{16} = \frac{3}{8}$$

**43.** Which of the following ***cannot*** be the direction ratios of the straight line $\frac{x-3}{2}=\frac{2-y}{3}=\frac{z+4}{-1}$?

(1) 2, –3, –1 (2) –2, 3, 1 (3) 2, 3, –1 (4) 6, –9, –3

**Ans.** **(3)**

**Sol.** $\frac{x-3}{2}=\frac{2-y}{3}=\frac{z+4}{-1}$

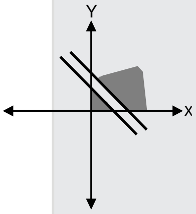
$\frac{x-3}{2}=\frac{y-2}{-3}=\frac{z+4}{-1}$

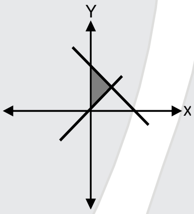
Here direction Ratio $\Rightarrow$ 2, –3, –1

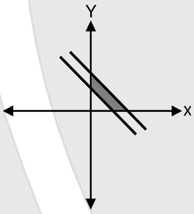
then 2, 3, –1 can not be direction Ratio.

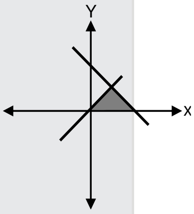
**44.** Which one of the following represents the correct feasible region determined by the following constraints of an LPP?

$x + y \geq 10$, $2x + 2y \leq 25$, $x \geq 0$, $y \geq 0$

(1) 

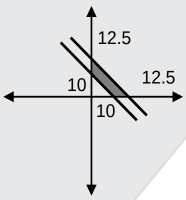

(2) 


(3) 


(4) 


**Ans.** **(3)**

**Sol.** $x + y \geq 10$, $2x + 2y \leq 25$ , $x \geq 0$, $y \geq 0$

$\therefore$ 


Option (3) is correct

**45.** Let R be the relation over the set A of all straight lines in a plane such that $l_1$ R $l_2 \Leftrightarrow l_1$ is parallel to $l_2$. Then R is:

(1) Symmetric (2) An Equivalence relation

(3) Transitive (4) Reflexive

**Ans.** **(2)**

**Sol.** $\ell_1$, R, $\ell_2$ $\Leftrightarrow$ $\ell_1$ is parallel to $\ell_2$ for reflexive.

$(\ell_1, \ell_2)\ \varepsilon R)$

$\ell_1$ is parellel to $\ell_1$

for symmetric :

$(\ell_1, \ell_2)\ \varepsilon R \Rightarrow (\ell_2, \ell_1)\ \varepsilon R$

It is also true.

For transitive :

$(\ell_1, \ell_2)\varepsilon R\ \&\ (\ell_2, \ell_3)\varepsilon R \Rightarrow (\ell_1, \ell_3)\ \varepsilon R$

It is also true.

$\therefore$ It is an equivalance relation.

**46.** The probability of not getting 53 Tuesdays in a leap year is:

(1) 2/7 (2) 1/7 (3) 0 (4) 5/7

**Ans.** **(4)**

**Sol.** Total days in leap year $\Rightarrow$ 366 days.

$\Rightarrow$ 52 weeks + 2 days

Probability of not getting 53 Tuesday.

in leap year $\Rightarrow \quad 1-\frac{2}{7} \Rightarrow \frac{5}{7}$

**47.** The angle between two lines whose direction ratios are propotional to 1, 1, –2 and $(\sqrt{3}-1), \left(-\sqrt{3}-1\right), -4$ is :

(1) $\frac{\pi}{3}$ (2) $\pi$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{2}$

**Ans.** **(1)**

**Sol.** $\cos\theta = \dfrac{a_1a_2+b_1b_2+c_1c_2}{\sqrt{a_1^2+b_1^2+c_1^2}\sqrt{a_2^2+b_2^2+c_2^2}}$

$\cos\theta = \dfrac{\left(\sqrt{3}-1\right)\cdot 1+\left(-\sqrt{3}-1\right)\cdot 1+8}{\sqrt{6}\sqrt{24}}$

$\cos\theta = \frac{1}{2}$

$\theta = \frac{\pi}{3}$

**48.** If $(\vec{a}-\vec{b})\bullet(\vec{a}+\vec{b})=27$ and $|\vec{a}|=2|\vec{b}|$, then $|\vec{b}|$ is :

(1) 3 (2) 2 (3) 5/6 (4) 6

**Ans.** **(1)**

**Sol.** $\left(\vec{a}-\vec{b}\right).\ \left(\vec{a}+\vec{b}\right) = 27$

$\Rightarrow \quad \left|\vec{a}\right|^2-\left|\vec{b}\right|^2=27$

$\Rightarrow \quad 4\left|\vec{b}\right|^2-\left|\vec{b}\right|^2=27$

$\Rightarrow \quad 3\left|\vec{b}\right|^2=27$

$\Rightarrow \quad \left|\vec{b}\right|^2=9$

$\Rightarrow \quad \left|\vec{b}\right|^2=3$

**49.** If $\tan^{-1}\left(\frac{2}{3^{-x}+1}\right) = \cot^{-1}\left(\frac{3}{3^{x}+1}\right)$, then which one of the following is 'true?

(1) There is no real value of x satisfying the above equation.
(2) There is one positive and one negative real value of x satisfying the above equations.
(3) There are two real positive values ofx satisfying the above equation.
(4) There are two real negative values of x satisfying the above equation.

**Ans.** **(1)**

**Sol.** $\tan^{-1}\left(\frac{2}{3^{-x}+1}\right) = \cot^{-1}\left(\frac{3}{3^{x}+1}\right)$

$\cot^{-1}\left(\frac{3^{-x}+1}{2}\right) = \cot^{-1}\left(\frac{3}{3^{x}+1}\right)$

$\therefore \quad \frac{3^{-x}+1}{2} = \frac{3}{3^{x}+1}$

$\frac{1+3^{x}}{2.3^{x}} = \frac{3}{3^{x}+1}$

$3^x + 1 + 3^{2x} + 3^x = 6.3^x$

$2.3^x + 1 + 3^{2x} = 6.3^x$

$\therefore$ there is no read value of x satisfying the above equation.

**50.** If A, B and C are three singular matrices given by A = $\begin{bmatrix} 1 & 4 \\ 3 & 2a \end{bmatrix}$, B = $\begin{bmatrix} 3b & 5 \\ a & 2 \end{bmatrix}$ and

C = $\begin{bmatrix} a+b+c & c+1 \\ a+c & c \end{bmatrix}$, then the value of abc is :

(1) 15 (2) 30 (3) 45 (4) 90

**Ans.** **(3)**

**Sol.** A = $\begin{pmatrix} 1 & 4 \\ 3 & 2a \end{pmatrix}$; B = $\begin{pmatrix} 3b & 5 \\ a & 2 \end{pmatrix}$

C = $\begin{pmatrix} a+b+c & c+1 \\ a+c & c \end{pmatrix}$

Matrices are singular

$\therefore \quad |A| = 0$

$2a - 12 = 0$

$a = 6$

$|B| = 0$

$6b - 5a = 0$

$b = 5$

$|C| = 0$

$\Rightarrow \quad c(a + b + c) - (c + 1)(a + c) = 0$

$\Rightarrow \quad c(6 + 5 + c) - (c + 1)(6 + c) = 0$

$\Rightarrow \quad 4c - 6 = 0$

$c = \frac{3}{2}$

$\therefore \quad abc$

$\Rightarrow \quad 6 \times 5 \times \frac{3}{2}$