TOPICWISE : ENGINEERING MATHEMATICS-1 (GATE - 2019) - REPORTS

Q. 1

Which of the following represents the solution to the system of equation?

$$\begin{bmatrix} 3 & 7.5 \\ -6 & 4.5 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ -90 \end{bmatrix}$$

Solution Video | Have any Doubt ?

A
12, −4

Your answer is **Correct**

Solution :
(a)

$$\begin{bmatrix} 3 & 7.5 \\ -6 & 4.5 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ -90 \end{bmatrix}$$

$$\left[\begin{array}{cc|c} 3 & 7.5 & 6 \\ -6 & 4.5 & -90 \end{array}\right]$$

$R_2 + 2R_1$

$$\left[\begin{array}{cc|c} 3 & 7.5 & 6 \\ 0 & 19.5 & -78 \end{array}\right]$$

$$\begin{aligned} 19.5y &= -78 \\ \text{or} \qquad y &= -4 \\ 3x + 7.5y &= 6 \\ 3x + 7.5(-4) &= 6 \\ 3x &= 36 \\ \Rightarrow \qquad x &= 12 \\ \therefore \qquad \begin{bmatrix} x \\ y \end{bmatrix} &= \begin{bmatrix} 12 \\ -4 \end{bmatrix} \end{aligned}$$

B
−12, −4

C
−12, 4

D
12, 4

QUESTION ANALYTICS

Q. 2

The normal distribution $N(\mu, \sigma^2)$ with mean $\mu \in R$ and variance $\sigma^2 > 0$ has probability distribution function:

$$N(x \mid \mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{1}{2\sigma^2}(x-\mu)^2\right) \text{ for } x \in R$$

The difference of median and mean is ______.

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A
μ

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C
$-\mu$

D
0

Correct Option

Solution :
(d)
Mean, median and mode are all same (μ) for normal distribution.

QUESTION ANALYTICS

Q. 3

A bag contains 15 defective items and 35 non defective items. If three items are selected at random without replacement, what will be the probability that all three items are defective?

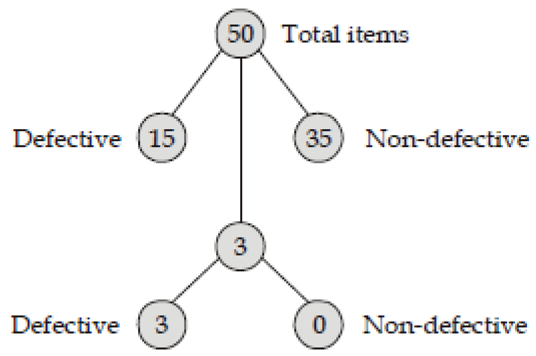
Solution Video | Have any Doubt ?

A
$\frac{1}{40}$

B
$\frac{13}{560}$

Correct Option

Solution :
(b)



$$\text{Required probability} = \frac{{}^{15}C_3 \times {}^{35}C_0}{{}^{50}C_3}$$
$$= \frac{15 \times 14 \times 13}{50 \times 49 \times 48} = \frac{13}{560}$$

C
$\frac{15}{34}$

Your answer is **Wrong**

D
$\frac{12}{499}$

QUESTION ANALYTICS

Q. 4

A

$\begin{bmatrix} -1 \\ 1 \end{bmatrix}$

B

$\begin{bmatrix} 3 \\ 1 \end{bmatrix}$

C

$\begin{bmatrix} 1 \\ 1 \end{bmatrix}$

Your answer is **Correct**

Solution :
(c)

The characteristic equation $|A - \lambda I| = 0$

$$\text{i.e.} \quad \begin{vmatrix} 4-\lambda & 6 \\ 2 & 8-\lambda \end{vmatrix} = 0$$

$$\begin{aligned}
\text{or} \quad (4-\lambda)(8-\lambda) - 12 &= 0 \\
\text{or} \quad 32 - 8\lambda - 4\lambda + \lambda^2 - 12 &= 0 \\
\Rightarrow \quad \lambda^2 - 12\lambda + 20 &= 0 \\
\Rightarrow \quad \lambda^2 - 10\lambda - 2\lambda + 20 &= 0 \\
\Rightarrow \quad (\lambda - 10)(\lambda - 2) &= 0 \\
\Rightarrow \quad \lambda &= 10, 2
\end{aligned}$$

Corresponding to $\lambda = 10$, we have

$$[A - \lambda I]x = \begin{bmatrix} -6 & 6 \\ 2 & -2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}$$

$$\begin{aligned}
\text{Which gives,} \quad -6x + 6y &= 0 \\
\Rightarrow \quad x &= y \\
2x - 2y &= 0 \\
\Rightarrow \quad x &= y
\end{aligned}$$

i.e. eigen vector $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$

Corresponding to $\lambda = 2$, we have

$$[A - \lambda I]x = \begin{bmatrix} 2 & 6 \\ 2 & 6 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}$$

Which gives, $2x + 6y = 0$ i.e. eigen vector $\begin{bmatrix} -3 \\ 1 \end{bmatrix}$

D

$\begin{bmatrix} 1 \\ 3 \end{bmatrix}$

QUESTION ANALYTICS

Q. 5

Check whether the given system of equation has

$x + y + z = 8$

$2x + 3y + 5z = 8$

$4x + 5z = 2$

Solution Video | Have any Doubt ?

A

Infinite solution

C
Unique solution

Your answer is **Correct**

Solution :
(c)

$$\begin{bmatrix} 1 & 1 & 1 & 8 \\ 2 & 3 & 5 & 8 \\ 4 & 0 & 5 & 2 \end{bmatrix} = M(A|B)$$

$$\begin{aligned} \text{Rank (A)} &= 3 \\ \text{Rank (A|B)} &= 3 \\ \text{Number of variables} &= 3 \end{aligned}$$

So unique solution as

$$\rho(A|B) = \rho(A) = \text{Number of variables}$$

D
Question incomplete

QUESTION ANALYTICS

Q. 6

The determinant of a 2 × 2 matrix is 30. If one eigen value of the matrix is 5, then other eigen value is _______.

Solution Video | Have any Doubt ?

6

Your answer is **Correct**6

Solution :
6

The product of eigen values is always equal to the determinant value of the matrix.

$$\begin{aligned} \lambda_1 &= 5,\ \lambda_2 = \text{Unknown} \\ |A| &= 30 \\ \lambda_1 \times \lambda_2 &= 30 \\ 5 \times (\lambda_2) &= 30 \\ \Rightarrow \qquad \lambda_2 &= 6 \end{aligned}$$

QUESTION ANALYTICS

Q. 7

The value of x for which equation satisfied is _______. [Upto 1 decimal place]

$$e^x e^2 = \frac{e^4}{e^{x+1}}$$

Solution Video | Have any Doubt ?

0.5

Your answer is **Correct**0.5

Solution :
0.5

Using the product and quotient properties of exponents we can rewrite the equation as

$$\begin{aligned} e^{x+2} &= e^{4-(x+1)} \\ &= e^{4-x-1} \\ &= e^{3-x} \end{aligned}$$

Since the exponential function e^x is one-to-one, we know the exponents are equal:

$$x + 2 = 3 - x$$

QUESTION ANALYTICS

Q. 8

Four vendors were asked to supply GPS instruments to the Indian Army. The respective probabilities of their meeting the strict technical specifications are 0.6, 0.7, 0.8 and 0.9. Each vendor supplies one instrument. The probability that out of the total four instruments supplied by the vendors, at least one will meet the design specification is_______. (Upto 3 decimal places)

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0.997 (0.996 - 0.999)

Your answer is **Correct**0.9976

Solution :
0.997 (0.996 - 0.999)

Probability of atleast one meeting the specification

$$= 1-(\bar{A}\cap\bar{B}\cap\bar{C}\cap\bar{D})$$
$$= 1 - (0.4 \times 0.3 \times 0.2 \times 0.1)$$
$$= 1 - (0.0024)$$
$$= 0.9976$$

QUESTION ANALYTICS

Q. 9

A coin is tossed 5 times. The probability of getting exactly 3 heads is _______. (Upto 2 decimal place)

Solution Video | Have any Doubt ?

0.31 (0.30 - 0.33)

Correct Option

Solution :
0.31 (0.30 - 0.33)

Using binomial distribution formula $P = {}^nC_x\, P^x\, S^{(h-x)}$

$$P(x = 3) = {}^5C_3(0.5)^3\ (0.5)^{(5-3)}$$
$$= \frac{5!}{3! \times 2!}(0.5)^3(0.5)^2$$
$$= 0.3125 \approx 0.31$$

Your Answer is 0.0032

QUESTION ANALYTICS

Q. 10

Consider X be a random variable with E(X) = 10 and Var(X) = 25. What is the positive value of a and b such that Y = aX – b has expectation 0 and variance 1?

Solution Video | Have any Doubt ?

A
$a = 1, b = 2$

B
$a = 0.2, b = 2$

Your answer is **Correct**

Solution :
(b)

We know that, $E(X) = 10$

$$\Rightarrow \quad a(10) - b = 0$$
$$10a - b = 0 \quad \ldots(i)$$

Given, $\text{Var}(Y) = 1$
$$\text{Var}(aX - b) = a^2\,\text{Var}(X) = 1$$
$$\Rightarrow \quad 25a^2 = 1$$
i.e $\quad a = \pm\frac{1}{5}$
$$a = \frac{1}{5} \text{ (taking positive values only)}$$

By putting value of 'a' in equation (i)

We get $\quad b = 2$

C

$a = 0.2$, $b = 1$

D

$a = 0.2$, $b = 0.5$

QUESTION ANALYTICS

Q. 11

For a given matrix $M = \begin{bmatrix} 12+9i & -i \\ i & 12-9i \end{bmatrix}$ where $i = \sqrt{-1}$, the inverse of matrix M is

Solution Video | Have any Doubt ?

A

$$\frac{1}{225}\begin{bmatrix} 12+9i & -i \\ i & 12-9i \end{bmatrix}$$

B

$$\frac{1}{225}\begin{bmatrix} i & 12-9i \\ 12+9i & -i \end{bmatrix}$$

C

$$\frac{1}{224}\begin{bmatrix} 12-9i & i \\ -i & 12+9i \end{bmatrix}$$

Your answer is **Correct**

Solution :
(c)

Given matrix is $M = \begin{bmatrix} 12+9i & -i \\ i & 12-9i \end{bmatrix}$

$$\text{Determinant of } M = \begin{vmatrix} 12+9i & -i \\ i & 12-9i \end{vmatrix} = (12+9i)(12-9i) + i^2$$
$$= (12^2 - 9^2 i^2) + i^2$$
$$= 225 - 1 = 224$$
$$\therefore \quad \text{Inverse of } M = M^{-1} = \frac{1}{|M|}(adj M)$$
$$= \frac{1}{224}\begin{bmatrix} 12-9i & i \\ -i & 12+9i \end{bmatrix}$$

D

$$\frac{1}{224}\begin{bmatrix} 12+9i & -i \\ i & 12-9i \end{bmatrix}$$

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Q. 12

What is the standard deviation of a uniformly distributed variable between 0 and $\frac{1}{2}$?

Have any Doubt ?

A

$\frac{1}{2\sqrt{12}}$

Your answer is **Correct**

Solution :
(a)
For rectangular distribution

$$\text{Variance} = \frac{(b-a)^2}{12}$$

Here, $a = 0, b = \frac{1}{2}$

$$\therefore \quad \text{Variance} = \frac{\left(0-\frac{1}{2}\right)^2}{12} = \frac{\frac{1}{4}}{12} = \frac{1}{4\times 12}$$

$$\text{Then standard deviation} = \sqrt{\text{Variance}}$$

$$= \sqrt{\frac{1}{4\times 12}} = \frac{1}{2\sqrt{12}}$$

B

$\frac{1}{\sqrt{12}}$

C

$\frac{2}{\sqrt{12}}$

D

$\frac{1}{\sqrt{6}}$

QUESTION ANALYTICS

Q. 13

Multiplication of matrices A and B is C. Matrices A and C are

$$A = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and } C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

What is the matrix B?

Solution Video Have any Doubt ?

A

$$\begin{bmatrix} \cos\theta & \cos\theta & 0 \\ -\cos\theta & \sin\theta & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

B

Solution :
(b)

According to question $A \times B = C$

Matrix C is a unit matrix. So matrix B will be inverse of A

$$A^{-1} = \frac{\text{Adj (A)}}{|A|}$$

$$|A| = 1 \times 1 = 1$$

$$\text{Adj (A)} = (\text{Cofactor (A)})^T$$

Solve to get, $\text{Adj (A)} = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Now substitute the values of $|A|$ and Adj (A) to get,

$$B = A^{-1} = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

C

$$\begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

D

$$\begin{bmatrix} \sin\theta & -\cos\theta & 0 \\ \cos\theta & \sin\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

QUESTION ANALYTICS

Q. 14

Consider ‘A’ is a set containing n elements. A subset ‘P’ of ‘A’ is chosen at random. The set ‘A’ is reconstructed by replacing the elements of ‘A’. A subset ‘Q’ of ‘A’ is again chosen at random. What is the probability that ‘P’ and ‘Q’ have no common element?

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A

$(0.75)^n$

Correct Option

Solution :
(a)

Let, $\text{‘A’} = \{a_1, a_2, a_3 \ldots\ldots a_n\}$

There is an element a_1 of ‘A’ and two subsets ‘P’ and ‘Q’, then four possibilities

$$\left.\begin{array}{l} \text{(a) } a_1 \in P \text{ and } a_1 \in Q \\ \text{(b) } a_1 \in P \text{ and } a_1 \notin Q \\ \text{(c) } a_1 \notin P \text{ and } a_1 \in Q \\ \text{(d) } a_1 \notin P \text{ and } a_1 \notin Q \end{array}\right\} \text{4 choices}$$

Total number of ways selecting ‘P’ and ‘Q’ = 2^n

$\Rightarrow \quad 2^n \times 2^n = 4^n$ ways

$\Rightarrow \quad n(S) = 4^n$

Number of favorable elements = 3^n

$$P(E) = \frac{n(E)}{n(S)} = \frac{3^n}{4^n}$$

$$= (0.75)^n$$

$(0.85)^n$

C
$(0.95)^n$

D
None of these

QUESTION ANALYTICS

Q. 15

The eigen vectors of the matrix $\begin{bmatrix} 4 & 1 \\ 0 & 7 \end{bmatrix}$ are written in the form $\begin{bmatrix} 1 \\ p \end{bmatrix}$ and $\begin{bmatrix} 1 \\ q \end{bmatrix}$. What is p + q?

Solution Video | Have any Doubt ?

3

Correct Option

Solution :
3

$$\begin{bmatrix} (4-\lambda) & 1 \\ 0 & (7-\lambda) \end{bmatrix} = 0$$
$$\Rightarrow \quad (4-\lambda)(7-\lambda) = 0$$
$$\therefore \quad \lambda = 4, 7$$
Putting the value of $\lambda = 4$
$$\Rightarrow \quad \begin{bmatrix} 0 & 1 \\ 0 & 3 \end{bmatrix}\begin{bmatrix} 1 \\ p \end{bmatrix} = 0$$
$$\Rightarrow \quad p = 0$$
Putting the value of $\lambda = 7$
$$\Rightarrow \quad \begin{bmatrix} -3 & 1 \\ 0 & 0 \end{bmatrix}\begin{bmatrix} 1 \\ q \end{bmatrix} = 0$$
$$\Rightarrow \quad q = 3$$
$$\therefore \quad p + q = 3$$

QUESTION ANALYTICS

Q. 16

Perform the following operations on the matrix $\begin{bmatrix} 1 & \frac{4}{3} & 15 \\ \frac{7}{3} & 3 & 35 \\ \frac{13}{3} & \frac{2}{3} & 65 \end{bmatrix}$

1. Add the third row to the second row.
2. Subtrace the third column from the first column.
The determined of the resultant matrix is ________.

FAQ | Have any Doubt ?

0

Your answer is **Correct**0

Solution :
0

Since operations 1 and 2 are elementary operations of the type of $R_i \pm kR_j$ and $C_i \pm kC_j$ respect
the determinant will be unchanged from the original determinant.
So the required determinant

$$= \begin{vmatrix} \cdots \\ \frac{13}{3} & \frac{2}{3} & 65 \end{vmatrix} \rightarrow \begin{vmatrix} \cdots \\ \frac{13}{3} & \frac{2}{3} & 0 \end{vmatrix}$$

QUESTION ANALYTICS

Q. 17

The number of satellites launched worldwide in a month follows Poisson distribution with mean as 6.8. The probability of launch of less than 3 satellites during a randomly selected month is_______. (Upto 2 decimal places)

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0.03

Correct Option

Solution :
0.03

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$P(x<3) = P(0) + P(1) + P(2)$$

$$= \frac{\lambda^0 e^{-\lambda}}{0!} + \frac{\lambda^1 e^{-\lambda}}{1!} + \frac{\lambda^2 e^{-\lambda}}{2!}$$

$$= \frac{1}{e^{\lambda}} + \frac{\lambda}{e^{\lambda}} + \frac{\lambda^2}{2e^{\lambda}}$$

As $\lambda(\text{mean}) = 6.8$

$$\therefore \quad P(x<3) = \frac{1 + 6.8 + \left(\frac{6.8^2}{2}\right)}{e^{6.8}} = \frac{30.92}{897.85} = 0.0344$$

Your Answer is .0344

QUESTION ANALYTICS