Institute of Actuaries of India

ACET August 2025

Mathematics

Q1. If $f(x) = x^3 - x^2 + 2x, then the equation f(x) = 4$ has:

A. No real roots

B. Exactly 1 real root

C. Exactly 2 real roots

D. Exactly 3 real roots

[1]

Q2. Evaluate the limit:

$$lim_{x \to 0} \frac{tan\left(\frac{x}{5}\right) - tan\left(\frac{x}{10}\right)}{sin\left(\frac{x}{20}\right)}$$

A. -2

B. 2

C. 0

D. Undefined

[1]

Q3. If $\vec{p} = 3\hat{\imath} - 2\hat{\jmath} \wedge \vec{q} = 4\hat{\imath} + 5\hat{\jmath}$, then the scalar product $\vec{p} \cdot \vec{q}$ is:

A. 2

B. 1

C. 0

D. -2

[1]

Q4. Which of the following matrix operations is undefined, given that matrix A has dimensions 3×2, matrix B has dimensions 2×4, and matrix C has dimensions 3×4?

A. $A \cdot B + C$

B. $A^T \cdot C$

C. $C \cdot A$

D. $B^T \cdot A^T$

[3]

Q5. Use the Newton-Raphson method to estimate the root of the equation

$$f(x) = x^3 - 2x - 5 = 0$$

Start with an initial guess of $x_0 = 2$. Calculate x_1 and x_2, rounding your answers to four decimal places.

Option	x_1	x_2
A	2.0009	2.0999
B	2.0999	2.0946
C	2.0009	2.0999
D	2.1000	2.0946

[3]

Q6. Using the Newton-Raphson method, find the first approximation x_1 for the root of the equation

$$f(x) = ln\left(\sqrt{x^2 + sin(x)}\right) - 2 = 0$$

starting with an initial guess of $x_0 = 1$. Round your answer to five decimal places.

A. 3.45679

B. 4.45679

C. -3.45679

D. UNDEFINED

[3]

Q7. What does the modulus of a complex number $z = a + bi$ (denoted as $|z|$) geometrically represent in the complex plane?

A. The angle the complex number forms with the positive real axis.

B. The distance of the complex number from the origin $(0, 0)$.

C. The real part of the complex number.

D. The complex conjugate of the complex number.

[1]

Q8. The value of the integral

$$\int_{-2}^{5} |x-1|\, dx$$

A. 12.5

B. 10

C. 15

D. 7.5

[1]

Q9. If M is a square matrix such that $M^2 = I$ (where I is the identity matrix of the same dimensions), then which of the following statements must be true about M?

A. M may have determinant -1 or 1

B. M is a zero matrix

C. M is a diagonal matrix

D. M has a determinant 0

[1]

Q10. If ω is a non-real cube root of unity, then what is the value of $(1-\omega-\omega^2)^5$?

A. 32

B. i

C. 0

D. -32

[1]

Q11. The principal value of $arcsin\left(\frac{-\sqrt{3}}{2}\right)$ is:

A. $0+\frac{\pi}{3}$

B. $0-\frac{\pi}{3}$

C. $0-\frac{\pi}{6}$

D. $0+\frac{2\pi}{6}$

[1]

Q12. Find the coefficient of x^3 in the binomial expansion of $\left(2x-\frac{1}{x}\right)^7$

A. 572

B. 670

C. 762

D. 672

[2]

Q13. If $z = tan\left(\frac{y}{x}\right)$ evaluate $x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}$

A. 0

B. 1

C. -1
D. Can't be determined

[3]

Q14. The interval in which the $f(x) = x^4 - 4x^3 + 5$ is strictly increasing in x is:

A. $(-\infty, 0)$
B. $(0, 3)$
C. $(3, \infty)$
D. $(-\infty, 3)$

[1]

Q15. The inverse of

$$\begin{pmatrix} 1 & 0 \\ 2 & -1 \end{pmatrix}$$

A. $\begin{pmatrix} -1 & 0 \\ 2 & 1 \end{pmatrix}$
B. $\begin{pmatrix} 1 & 0 \\ -2 & -1 \end{pmatrix}$
C. $\begin{pmatrix} 1 & 0 \\ 2 & -1 \end{pmatrix}$
D. $\begin{pmatrix} 0 & 1 \\ -1 & 2 \end{pmatrix}$

[1]

Q16. Which of the following is True regarding the Cross Vector multiplication?

A. The resultant vector has no direction
B. Vector multiplication is associative
C. Vector multiplication is commutative
D. The magnitude of the Vector multiplication represents area of a parallelogram

[1]

Q17. What is the value of $x^2 + y^2$ if $x + y = 5$and $xy = 6$?

A. 3
B. 10
C. 13
D. 0

[1]

Q18. The number of terms in the expansion of $(1 + x^{10})(1 + x)^8$ is:

A. 19
B. 23
C. 10
D. 18

[1]

Q19. Find the derivative $\frac{dy}{dx}$ of the function $y = \frac{e^x}{cosx}$

A. $\frac{e^x(cosx+sinx)}{cos^2x}$

B. $\frac{e^x(cosx-sinx)}{cos^2x}$

C. $\frac{e^x sinx}{cos^2x}$

D. $\frac{e^x}{cosx+sinx}$

[2]

Q20. Evaluate the definite integral

$$\int_0^{\frac{\pi}{2}} \frac{sinx}{sinx + cosx} dx$$

A. $\pi/2$

B. π/3

C. π/4

D. π/6

[1]

Statistics

Q21. Let A, B, and C be three events in a sample space such that:

- $P(A) = 0.5$
- $P(B) = 0.6$
- $P(C) = 0.4$
- $P(A \cap B) = 0.2$
- $P(A \cap C) = 0.15$
- $P(B \cap C) = 0.1$
- $P(A \cap B \cap C) = 0.05$

Find $P\big((A \cup B) \cap C^c\big)$

A. 5/6

B. 3/4

C. 11/12

D. 7/10

[2]

Q22. A factory has two machines, Machine A and Machine B, producing light bulbs. Machine A produces

60% of the bulbs, and Machine B produces 40%. The defect rate for bulbs from Machine A is 3%, and for Machine B it is 5%. A bulb is chosen at random from the total production, and it is found to be defective. What is the probability that this defective bulb was produced by Machine B?

A. 0.33

B. 0.4

C. 0.45

D. 0.53

[2]

Q23. A gamer is testing a new online game where there are two types of treasure chests that appear at random: rare and common. The game developers claim that one-quarter of the treasure chests are rare, while the remaining three-quarters are common. The gamer decides to test this claim by opening chests one by one and tracking their types.
He assumes that each chest has a 1/4 chance of being rare and a 3/4 chance of being common. He can clearly distinguish between the two types.
If the assumption is correct, what is the probability that the gamer will open at least 2 rare chests before he opens 3 common chests?

A. 0.2222

B. 0.2513

C. 0.2032

D. 0.2617

[3]

Q24. In a survey of 100 people, 60 people like tea, 50 like coffee, and 30 like both tea and coffee. If one person is selected at random, then the probability that the person likes neither tea nor coffee is:

A. 1/10

B. 1/5

C. 2/25

D. 4/25

[1]

Q25. For an exponential distribution, which of the following is the correct relationship among the mean, median, and mode?

A. Mean > Median > Mode

B. Mode > Median > Mean

C. Mean = Median = Mode

D. Mean < Median < Mode

[1]

Q26. Let X, Y, and Z be random variables such that $Var(X) = 4, Var(Y) = 9, Var(Z) = 1, \wedge Cov(X, Y) = 3$. Assume that X and Z are uncorrelated, and Y and Z are uncorrelated. Find $Var(2X + 3Y + Z)$.

A. 58

B. 55

C. 52

D. 134

[2]

Q27. A multiple-choice quiz has 8 questions, each with 4 options and only one correct answer. A student guesses all questions at random. What is the probability that the student gets exactly 3 answers correct?

A. 0.278

B. 0.293

C. 0.312

D. 0.207

[1]

Q28. The random variable X has probability density function:

$$f(x) = \begin{cases} k(3x - x^2), \wedge\ 0 \leq x \leq 3 \\ 0, \wedge\ \text{otherwise} \end{cases}$$

Evaluate the constant k and hence calculate Var(X). What is the value of Var(X)?

A. 27/80

B. 9/20

C. 81/160

D. 21/50

[1]

Q29. The time taken by employees to complete a routine task in a company is normally distributed with a mean of 50 minutes and a standard deviation of 10 minutes. What is the probability that a randomly selected employee completes the task in between 40 and 65 minutes? Use the following values from the standard normal distribution:
$\Phi(1.5) = 0.9332,\ \Phi(1) = 0.8413$

A. 0.6826

B. 0.7745

C. 0.8186

D. 0.9332

[2]

Q30. Let $X \sim Uniform[a, b]$, where $a < b$, and let $Y = cX$, where c is a non-zero constant. A student is attempting to derive $Var(Y)$ using properties of variance for transformed variables. Which of the following correctly represents $Var(Y)$ in terms of a, b, and c

A. $\frac{c^2(b-a)^2}{12}$

B. $\frac{c(b-a)^2}{12}$

C. $\frac{(b-a+c)^2}{12}$

D. $\frac{c^2(b^2-a^2)}{12}$

[1]

Q31. In a simple linear regression model $Y = a + bX + \varepsilon$, the least squares estimator b is:

A. The average of X

B. $\frac{\Sigma(X_i-\overline{X})(Y_i-\overline{Y})}{\Sigma(X_i-\overline{X})^2}$

C. $\frac{\Sigma X_i}{\Sigma Y_i}$

D. Always equal to 1 if correlation is perfect

[1]

Q32. Let $X_1, X_2, \ldots, X_n$ be i.i.d. with mean μ and variance σ^2. Consider the sample variance

$S^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2$

Which of the following is true about $E[S^2]$?

A. $\frac{n-1}{n}\sigma^2$

B. σ^2

C. $\frac{n+1}{n}\sigma^2$

D. $\frac{1}{n}\sigma^2$

[1]

Q33. The marginal distributions of X and Y are given in the following table:

y \x	1	3	Total
1	q	0.4 − q	0.4
2	0.2	0.4	0.6

The value of q for which the correlation between X and Y is 0.25 is:

A. 0.18

B. 0.22

C. 0.5

D. None of the above

[2]

Q34. A joint pdf is defined by

$$f(x,y) = kxy^2 + \frac{1}{5}, 0 \le x \le 2, 0 \le y \le 1.$$

Which of the following statements is correct?

A. X and Y are independent.

B. $Cov(X,Y) = 0$.

C. Marginal of X is uniform on $[0,2]$.

D. None of the above.

[2]

Q35. In a simple linear regression with intercept, which of the following is always true?

A. The regression line passes through the origin.

B. The residuals are uncorrelated with the fitted values.

C. The sum of residuals is aways negative.

D. The slope is always less than 1.

[1]

Q36. You are estimating a population mean using sample mean $\overline{X}$, where $X_1, \ldots, X_n \sim N(\mu, \sigma^2)$. What happens to the standard error if sample size is multiplied by 4?

A. It doubles

B. It is halved

C. It becomes one-fourth

D. It remains the same

[1]

Q37. A manager needs to select a 4-member team from a group of 6 accountants and 4 analysts. At least one analyst must be included in the team. How many such teams can be formed?

A. 185

B. 195

C. 205

D. 215

[1]

Q38. Given joint pdf $f(x,y) = \frac{2}{0} < y < x < 1$ find marginal pdf of X.

A. $f_X(x) = 2x, x \in [0,1]$

B. $f_X(x) = 2(1-x)$

C. $f_X(x) = 2(1+x)$

D. $f_X(x) = x$

[2]

Q39. Let $f(x) = 6x(1-x), 0 < x < 1$. Find the median of the distribution.

A. 0.5

B. $1 - \frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{2}}$

D. Cannot be determined

[2]

Q40. In a city's central station, trains arrive from two independent railway lines. Line 1 follows a Poisson process with a rate of 4 trains per hour, and Line 2 follows a Poisson process with a rate of 6 trains per hour. All arrivals are independent. What is the probability that exactly 7 trains arrive at the station in a 1-hour period?

A. $\frac{(10)^7 e^{-10}}{7!}$

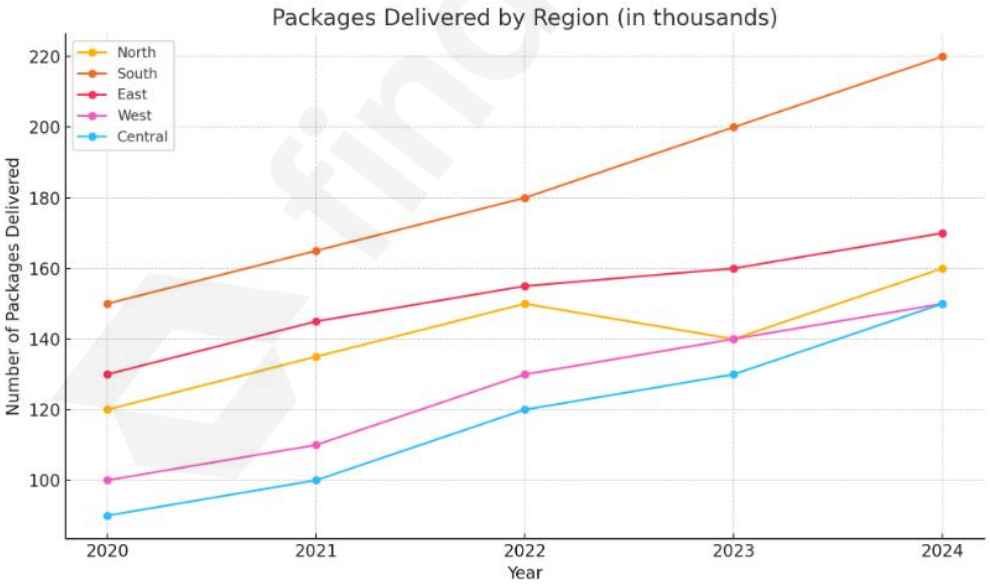
B. $\frac{(6)^7 e^{-10}}{7!}$

C. $\frac{(4)^7 e^{-6}}{7!}$

D. $\frac{(10)^7 e^{-6}}{7!}$

[1]

Data Interpretation



A logistics company tracks the number of packages delivered by its five regional hubs over five years.

The data below shows the number (in thousands) of packages delivered by each hub.

Year	North	South	East	West	Central
2020	120	150	130	100	90
2021	135	165	145	110	100
2022	150	180	155	130	120
2023	140	200	160	140	130
2024	160	220	170	150	150

Q41. In which year did the Central hub experience the highest percentage increase in deliveries over the previous year?

A. 2021
B. 2022
C. 2023
D. 2024

[1]

Q42. What is the average annual growth rate (in %) of total packages delivered across all hubs from 2020 to 2024?

A. 8.7%

B. 9.56%

C. 10.1%

D. 10.5%

[2]

Q43. If each delivery generates a profit of ₹15,000 per 1,000 packages, what was the **total profit from the South and East hubs combined** in 2022?

A. ₹5.03 million

B. ₹4.95 million

C. ₹5.05 million

D. ₹4.65 million

[1]

Q44. Which region showed the most consistent year-over-year growth in terms of the lowest standard deviation of deliveries?

A. North

B. South

C. Central

D. West

[2]

Q45. Assume the West hub can only operate at a maximum of 150,000 packages per year. In which year(s) did the West hub reach or exceed 90% of its operational capacity?

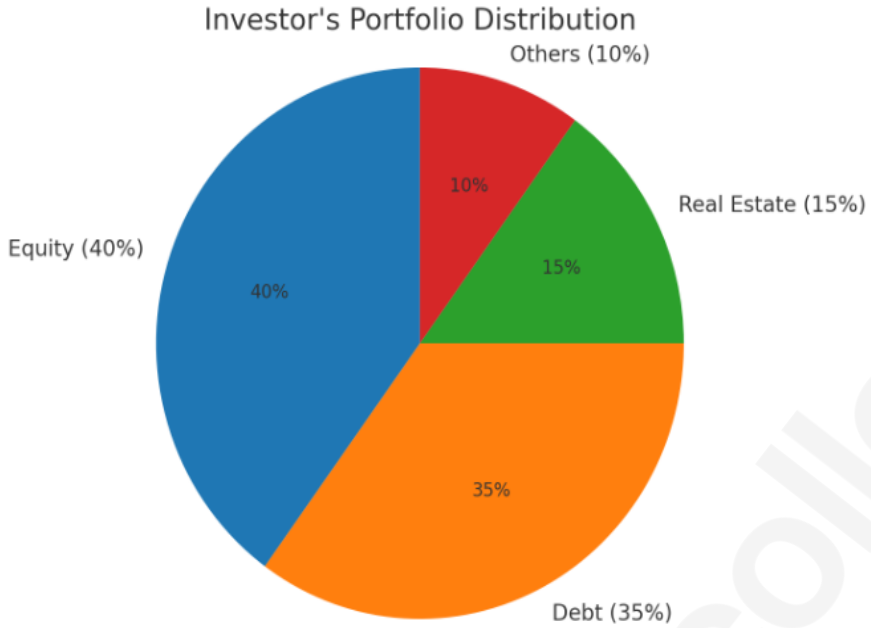
A. 2022, 2023, 2024

B. 2023 and 2024

C. 2022 only

D. 2024 only

[1]



An investor's portfolio is divided across four asset classes as follows: Equity (40%), Debt (35%), Real Estate (15%), and Others (10%).

Q46. If the total investment is ₹50 lakhs, how much is invested in Real Estate?

A. ₹6,50,000

B. ₹7,00,000

C. ₹7,50,000

D. ₹8,00,000

[1]

Q47. What is the difference in investment amount between Equity and Debt?

A. ₹1,50,000

B. ₹2,50,000

C. ₹3,00,000

D. ₹3,50,000

[1]

Q48. Equity is expected to grow by 10% next year. What will be the new amount invested in Equity?

A. ₹21,00,000

B. ₹21,50,000

C. ₹22,00,000

D. ₹22,50,000

[1]

Q49. If the investor wants Debt and Others combined to represent no more than 40% of the portfolio, by what percentage must the Debt investment be reduced (assuming Others remain constant)?

A. 12.5%

B. 13.5%

C. 14.29%

D. 15%

[2]

Q50. What percentage of the portfolio is not invested in Equity and Debt combined?

A. 15%

B. 20%

C. 30%

D. 25%

[1]

Q51. Assuming all else remained equal and only Equity increased by 10% next year, calculate the percentage of portfolio that Real estate comprises of

A. 14.42%

B. 15%

C. 20%

D. 25%

[2]

English

Q52. Choose the word that best completes the sentence:
The manager was praised for her _____ handling of the crisis, preventing any serious damage.

A. Careless

B. Meticulous

C. Reckless

D. Negligent

[1]

Q53. Choose the word closest in meaning to **"vigilant."**

A. Careless

B. Attentive

C. Indifferent

D. Timid

[1]

Q54. Choose the word that is the opposite of **"transient."**

A. Temporary

B. Permanent

C. Fleeting

D. Momentary

[1]

Q55. Find the part of the sentence with a grammatical error:
Neither the employees nor the manager are willing to accept the new schedule.

A. Neither the employees

B. Nor the manager

C. Are willing

D. To accept the new schedule

[2]

Q56. He succeeded _____ convincing the board to approve his project.

A. At

B. In

C. On

D. For

[1]

Q57. What does the phrase "break the ice" mean?

A. To shatter a conversation in an awkward situation

B. To shatter frozen water

C. To create a conflict

D. To freeze up emotionally

[2]

Q58. Choose the correct order of the following parts to form a meaningful sentence:

(1) the committee approved the proposal
(2) which had been under review
(3) after a series of heated discussions

(4) for several weeks

A. 1,2,3,4

B. 1,3,4,2

C. 4,3,1,2

D. 3,1,2,4

[2]

Q59. Choose the correct word:
A person who writes poems is called a _____.

A. Novelist

B. Poet

C. Playwright

D. Narrator

[1]

Q60.The CEO's decision was considered _____ since it brought a fresh perspective to the company's culture.

A. Conventional

B. Innovative

C. Obsolete

D. Insignificant

[1]

Q61. Choose the sentence that best expresses the meaning of the original sentence:
"Despite the heavy rain, the event continued as planned."

A. The event was canceled because of the heavy rain.

B. The event was postponed due to heavy rain.

C. The event took place despite the heavy rain.

D. The event did not happen because of the rain.

[2]

Q62. Change the sentence into indirect speech:
She said, "I will finish the task tomorrow."

A. She said she will finish the task tomorrow.

B. She said she would finish the task tomorrow.

C. She said she would finish the task the next day.

D. She said she will finish the task the next day.

[1]

Q63. Rahul introduces Priya saying, "She is the daughter of my grandfather's only child." How is Priya related to Rahul?

A. Cousin

B. Sister

C. Aunt

D. Niece

[2]

Q64. If September 15, 2029, is a Saturday, what day of the week will December 31, 2029, be?

A. Monday

B. Tuesday

C. Thursday

D. Sunday

[2]

Q65. The pattern of figures is as follows: black triangle, white square, black pentagon, white hexagon, black heptagon, ... What color and shape come next?

A. White octagon

B. Black hexagon

C. White nonagon

D. Black octagon

[1]

Q66. Five colleagues – R, S, T, U, V – are sitting in a straight line, all facing north.

S does not sit at any end.
U sits second to the left of V.
R sits to the immediate right of T.
V is not at an end.
Who is in the middle?

A. R

B. V

C. T

D. U

[1]

Q67. Statements:

1. Some engineers are musicians.
2. All musicians are dancers.
3. No dancer is a scientist.

Choose the correct option:

A. Some engineers are definitely not scientists.

B. All musicians are not engineers.

C. Some dancers are engineers.

D. All of the above

[1]

Q68. If ACTION is coded as BDUJPO and REACT as SFBDU, how is TEACH coded?

A. UFBDI

B. SDBDI

C. UFDBI

D. SDBDJ

[1]

Q69. Find the next number in the sequence: 10, 18, 33, 55, 84, . . .

A. 187

B. 205

C. 195

D. 120

[1]

Q70. Six people—Nina, Omar, Priya, Raj, Surya, Tia—sit around a circular table, facing the center.

Priya sits to the right of Tia.
Raj is not adjacent to Priya or Surya.
Nina is between Omar and Surya.
Who sits to the immediate right of Surya?

A. Priya

B. Omar

C. Tia

D. Nina

[1]

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