BUDHA DAL PUBLIC SCHOOL FATTALA FIRST TERM EXAMINATION (16 September 2024) Class – XII Paper- Applied Mathematics

M.M. 80

Time: 3hrs.

General Instructions:

- 1. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
- 3. Section B has 5 Very Short Answer type questions of 2 marks each.
- 4. Section C has 6 Short Answer type questions of 3 marks each.
- 5. Section D has 4 Long Answer type questions of 5 marks each.
- 6. Section E has 3 case based studies of 4 marks each.

Section - A

- 1. If $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then $A^2 6A =$
 - a) 3I b) -5I c) 5I d) -3I
- 2. In a 100m race A can beat B by 25m and B can beat C by 4m. By how much can A beat C in the same race?
 - a) 32m b) 28m c) 24m d) 20m
- 3. Evaluate (62 + 53) mod 7
 - a) 3 b) 5 c) 7 d) 9
- 4. It is 7:00 PM currently. The time after 1500 hours in (AM or PM) will be

a) 10 AM b) 7:00 PM c) 7:00 AM d) 10 PM

- 5. In what ratio must water be mixed with milk to gain $16\frac{2}{3}\%$ on selling the mixture at cost price?
 - a) 1:6 b) 6:1 c) 3:2 d) 2:3
- 6. A man rows 15km upstream and 25km downstream in 5 hours each time. The speed of current is
 - a) 1km/hr b) 2km/hr c) 3km/hr d) 4km/hr
- 7. If x, y and b are real numbers, x < y, b < 0 then

a) $\frac{x}{b} < \frac{y}{b}$ b) $\frac{x}{b} \le \frac{y}{b}$ c) $\frac{x}{b} > \frac{y}{b}$ d) $\frac{x}{b} \ge \frac{y}{b}$

- 8. A pipe can fill the tank with water in 3 hours and another pipe can empty the full tank in 4 hours. If both are opened together then find how much time will they take to fill the tank?
 a) 15 hours
 b) 12 hours
 c) 20 hours
 d) 17 hours
- 9. If for matrix A, $A^3 = I$, then $A^{-1} =$
 - a) A b) A^2 c) A^3 d) I

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10. If $\begin{vmatrix} 3x & 4 \\ 5 & x \end{vmatrix} = \begin{vmatrix} 4 & -3 \\ 5 & -2 \end{vmatrix}$, then x is a) 3 only b) -3 only c) 3 or -3 d) 6 or -6 11. If $A = \begin{bmatrix} -3 & x \\ y & 5 \end{bmatrix}$ and A = A', then a) x = 5, y = -3 b) x = -3, y = 5 c) x = y d) None of these 12. If C(x) and R(x) are respectively Cost function and Revenue function, then Profit function P(x) is given by a) P(x) = R(x) b) P(x) = C(x) + R(x) c) P(x) = R(x) - C(x) d) $P(x) = R(x) \cdot C(x)$

13. If $f(x) = 2x^3 - 21x^2 + 36x - 30$, then

- a) f(x) has min. at x = 1
- b) f(x) has maximum at x = 6
- c) f(x) has maximum at x = 1
- d) f(x) has no maxima or minima

14. If
$$x = t^2$$
, $y = t^3$, then $\frac{d^2y}{dx^2}$ is

- a) $\frac{3}{2}$ b) $\frac{3}{2}t$ c) $\frac{3}{2t}$ d) $\frac{3}{4t}$
- 15. A box contains 100 bulbs of which 10 are defective. The probability that out of a sample of 5 bulbs drawn one by one with replacement none is defective is.
 - a) $\left(\frac{1}{2}\right)^5$ b) $\frac{9}{10}$ c) $\left(\frac{9}{10}\right)^5$ d) $\left(\frac{1}{10}\right)^5$
- 16. For the given values 23, 32, 40, 47, 58, 33, 42, the 5- yearly moving averages are
 - a) 38, 40, 42 b) 40, 42, 44 c) 40, 42, 46 d) 42, 44, 46

17. If X is a Poisson variable such that P(X = k) = P(X = k + 1) then variance of X is

a) k - 1 b) k c) k + 1 d) k + 2

18. Seasonal variations are

a) short term b) long term c) sudden d) none of these

Assertion - Reason Based Questions

The following questions consists of two statements – Assertion (A) and Reason (R). Answer the question selecting appropriate option given below:

a) Both A and R are true and R is correct explanation for R.

- b) Both A and R are true but R is not correct explanation for R.
- c) A is true but R is false.
- d) A is false but R is true.
- 19. Assertion (A) : adj(adj A) = AReason (R) : |adj A| = |A|
- 20. In a binomial distribution n = 200 and p = 0.04. Taking Poisson distribution as an approximation to the binomial distribution Assertion (A) : Mean of Poisson distribution = 8Reason (R) : $P(X = 4) = \frac{512}{3e^8}$

Section - B

21. Construct a $2 \times 3 matrix:(i + j)^2$

22. Solve $37 - (3x + 5) \ge 9x - 8(x - 3)$

- 23. In a game, A can give 20 points to B, A can give 32 points to C and B can give 15 points to C. How many points make the game?
- 24. Find remainder when $783 \times 657 \times 594 \times 432 \times 346 \times 251$ is divided by 5.
- 25. Using matrix method, solve $\begin{aligned} 5x 7y &= 2\\ 7x 5y &= 3 \end{aligned}$

Section - C

- 26. If $A = \begin{bmatrix} x & 2 \\ 2 & x \end{bmatrix}$ and $|A^4| = 625$, find real value(s) of x
- 27. Cost of a pen and notebook are Rs. 12 and Rs. 27 respectively. On a given day shopkeeper P sells 5 pens and 7 notebooks, whereas shopkeeper Q sells 6 pens and 4 notebooks. Find the money received by both the booksellers using matrix algebra.
- 28. Find the points of local maxima and minima of the function $f(x) = 3x^4 4x^3 + 5$ in [-1, 2]. Also find absolute maximum and minimum values.
- 29. The demand for a certain of product is represented by the function $P = 200 + 20x x^2$ (in Rs.) where *x* is the number of units demanded and P is the price per unit.
 - a) Find marginal revenue
 - b) Obtain marginal revenue when 10 units are sold and interpret it.
- 30. A car hire firm has two cars, which it his out day by day. The number of demands for cars on each day is distributed as Poisson distribution with mean 1.5. Calculate the probabilities of days on which neither car is used and the probabilities of days on which some demand is refused. (use $e^{-1.5} = 0.2231$)
- 31. The following table shows the annual rainfall (in mm) recorded for Cherrapunji, Meghalya.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Rainfall	1.2	1.9	2	1.4	2.1	1.3	1.8	1.1	1.3

Determine trend of rainfall by 3 – years moving average.

32. Fit a straight line trend by the method of least squares

Year	2004			- oqua	res and ta	abulate th	e trend va	lues from the
Sales (in Rs. 000)	2004	2005 26	2006 44	2007 42	2008	2009	2010	and none the

- 33. Four bad oranges are accidently mixed with 16 good oranges. Find the probability distribution of number of bad oranges in a draw of two oranges. Also find mean, variance
- 34. Show that a right circular cylinder which is open at top, and has a given surface area will
- have greatest volume if its height is equal to radius of base. 35. Solve 6x + y - 3z - 5 = 0, x + 3y - 2z - 5 = 0 and 2x + y + 4z - 8 = 0 by Cramer's Rule.

Section - E (Case Studies)

36. A pipe is connected to a tank or cistern. It is used to fill or empty the cistern. The amount of work done by a pipe is a part of the tank filled or emptied in unit time.

Three pipes A, B and C are connected to a tank. A and B fill the tank in 6 hours and 8 hours respectively when operated independently. Pipe C empty the full tank in 12 hours when

Based on above information, answer the following questions

- a) It both pipes A and B are opened together, then find the time in which tank can be filled.
- b) If pipes A and C are opened together, then find the time in which tank can be filled.
- c) If pipes B and C are opened together, then find the time in which tank can be filled.

37. The probability distribution of a random variable X is given as under:

 $P(X = x) = \begin{cases} kx^2, & \text{for } x = 1, 2, 3\\ 2kx & \text{for } x = 4, 5, 6 \\ 0 & \text{othere wise} \end{cases}$ where k is a constant

Based on above information, answer the following questions

- a) Find kb) Find P(X < 4)c) Find E(X)
- 38. The relation between the height of the plant (y in cm) with respect to exposure to sunlight is governed by the following equation $y = 4x - \frac{1}{2}x^2$ where x is the number of days exposed to sunlight.

Based on above information, answer the following questions

- a) Find the rate of growth of the plant with respect to number of days exposed to sunlight.
- b) What will be the height of the plant after 2 days?
- c) What is the number of days it will take for the plant to grow to the maximum height? What is the maximum height of the plant?