

ONE TWO ACADEMY MAY MONTH EXAM
STD 12 B MATHEMATICS - I

Total:- 45 marks

Time:- 60 minutes

Choose the correct answer

5 x 1 = 5

1. A is a singular matrix of order $n \times n$ then find the incorrect statement
 - (a) A is not invertible.
 - (b) $A(\text{adj}A) = O$.
 - (c) adjoint of A does not exist.
 - (d) The rank of A is less than n.
2. If A is $m \times n$ matrix ($m > n$) then the rank of the matrix can never be
 - (a) m
 - (b) n
 - (c) 1
 - (d) $m - n$
3. Find the rank of
$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$
.
 - (a) 1
 - (b) 2
 - (c) 0
 - (d) 5
4. For a system of homogenous linear equations, the type of solution formed is
 - (a) always consistent
 - (b) only unique $\{x = y = z = 0\}$
 - (c) inconsistent
 - (d) None of the above
5. If the systems of equations $x + ay = 0$; $az + y = 0$; and $ax + z = 0$ has infinite solutions, then the value of a is
 - (a) -1
 - (b) 1
 - (c) 0
 - (d) no real values

Answer any four of the following:-

4 x 2 = 8

Note: Question 11 is compulsory.

6. If A is a non-singular matrix of odd order, prove that $|\text{adj} A|$ is positive.

7. If $\text{adj}(A) = \begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix}$, find A^{-1} .

8. The prices of three commodities A, B and C are ₹ x, y and z per units respectively. A person P purchases 4 units of B and sells two units of A and 5 units of C. Person Q purchases 2 units of C and sells 3 units of A and one unit of B. Person R purchases one unit of A and sells 3 unit of B and one unit of C. In the process, P, Q and R earn ₹ 15,000, ₹ 1,000 and ₹ 4,000 respectively. Form a system of linear equations to find the prices per unit of A, B and C.

9. In a competitive examination, one mark is awarded for every correct answer while a $\frac{1}{4}$ mark is deducted for every wrong answer. A student answered 100 questions and got 80 marks. How many questions did he answer correctly?

10. Show that the system of equations has a trivial solution:

$$2x + 3y - z = 0,$$

$$x - y - 2z = 0,$$

$$3x + y + 3z = 0.$$

11. If $\text{adj } A = \begin{bmatrix} 2 & 3 \\ 4 & -1 \end{bmatrix}$ and $\text{adj } B = \begin{bmatrix} 1 & -2 \\ -3 & 1 \end{bmatrix}$ then find $\text{adj}(AB)$.

Answer any four of the following:-

4 x 3 = 12

Note: Question 17 is compulsory.

12. Find the matrix A for which $A \begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 14 & 7 \\ 7 & 7 \end{bmatrix}$.

13. Find the rank of the matrix $\begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & -1 & 3 & 4 \\ 5 & -1 & 7 & 11 \end{bmatrix}$ using the row-reduction method.

14. A man is appointed in a job with a monthly salary of certain amount and a fixed amount of annual increment. If his salary was ₹ 19,800 per month at the end of the first month after 3 years of service and ₹ 23,400 per month at the end of the first month after 9 years of service, find his starting salary and his annual increment. (Use the matrix inversion method to solve the problem.)

15. Test for consistency and solve: $2x - y + z = 2$, $6x - 3y + 3z = 6$, $4x - 2y + 2z = 4$.

16. Find adjoint of $\frac{1}{3} \begin{bmatrix} 2 & 2 & 1 \\ -2 & 1 & 2 \\ 1 & -2 & 2 \end{bmatrix}$.

17. Solve the following system of equations using the Gauss elimination method:

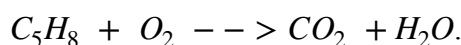
$$2x + 5y = -2,$$

$$x + 2y = -3.$$

Answer any four of the following:-

4 x 5 = 20

17. Balance the following chemical reaction using the Gauss elimination method:



18. Find the value of k for which the equations $kx - 2y + z = 1$, $x - 2ky + z = -2$, $x - 2y + kz = 1$ have

(i) No solution.

(ii) Unique solution.

(iii) Many solutions.

19. If $p(x) = ax^2 + bx + c$ is divided by $x+3$, $x-5$ and $x-1$, the remainders are 21, 61 and 9 respectively. Find $p(0)$ using Cramer's rule.

20. If $A = \begin{bmatrix} -5 & 1 & 3 \\ 7 & 1 & -5 \\ 1 & -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$, find the AB and BA and hence solve the system of

equations $x + y + 2z = 1$, $3x + 2y + z = 7$, $2x + y + 3z = 2$.

21. A family of 3 people went out for dinner in a restaurant. The cost of two dosai, three idlies and two vadais is ₹ 150. The cost of the two dosai, two idlies and four vadais is ₹ 200. The cost of five dosai, four idlies and two vadais is ₹ 250. The family has ₹ 350 in hand and they ate 3 dosai and six idlies and six vadais. Will they be able to manage to pay the bill within the amount they had?

22. State and prove the reversal law of inverses and the law of double inverse.

23. If $F(\alpha) = \begin{bmatrix} \cos \alpha & 0 & \sin \alpha \\ 0 & 1 & 0 \\ -\sin \alpha & 0 & \cos \alpha \end{bmatrix}$, show that $[F(\alpha)]^{-1} = F(-\alpha)$.

All the Best