Model Questions   Class 12   Subject: B. Mathematics

Group A [1x11=11]

Rewrite the correct option in your answer sheet

1. If $A = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$ then adjoint of matrix A is

    a) $\begin{bmatrix} 5 & 2 \\ -3 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 1 & -3 \\ 2 & 5 \end{bmatrix}$ c) $\begin{bmatrix} 1 & -3 \\ 2 & 5 \end{bmatrix}$ d) $\begin{bmatrix} 5 & -3 \\ 2 & 1 \end{bmatrix}$

2. Determinant of $\begin{vmatrix} 2 & 3 & -2 \\ -1 & 2 & -1 \end{vmatrix}$ is equal to

    a) 0   b) 1   c) 2   d) 3

3. If $4x - 3y = 6$ and $6x - 5y = 12$ then value of (x, y) is

    a) $(3, 6)$ b) $(-3, 6)$ c) $(3, -6)$ d) $(-3, -6)$

4. If $y = x^2 - 6x$ then $\frac{d^2y}{dx^2}$ is equal to

    a) -6 b) 0   c) 2   d) $2x - 6$

5. What is the area bounded by the curve $3x^2 = y - 6$ and two ordinate $x = 0, x = 1$

    a) 6   b) 7   c) 8   d) 9

6. S_n of geometric series is

    b) $\frac{lr-a}{r-1}$ b) $a\frac{r^n-1}{r-1}$ c) $\frac{a-ar^n}{1-r}$ d) all of above

7. At what rate of % p.a. compound intersect will Rs. 960 amount to Rs. 1500 in 8 years?

    a) 5.47   b) 5.74   c) 7.54   d) 4.75

8. In an annuity, if the periodic payment begins only after a certain period of time, then the annuity is known as

    a) deferred annuity   b) perpetual annuity
    c) immediate annuity   d) annuity due

9. In simplex method, the feasible basic solution must satisfy the

    a) non negative constraint   b) negative constraint
    c) basic constraint   d) common constraint

10. For a group of 50 items; $\sum X^2 = 600$, $\sum X = 150$ and $M_o = 1.75$; Pearsonian coefficient of skewness is

    a) 0.7   b) 0.71   c) 0.72   d) 0.73

11. What is the probability that a couple's second child is a boy given that their first child is a girl?

    a) 1   b) $\frac{1}{2}$ c) $\frac{1}{3}$ d) $\frac{1}{4}$

Group B [5x8=40]

12. Solve the following system by Gauss elimination method.

    $$3x + 3y + 4z = 9, 2x + y + 5z = 5, 6x + 3y - 2z = 15$$

13. The inter industry transaction table presented below was formed far an economy of the two industries P and Q for a certain year.

Products	User		Final	Total
	P	Q		
P	250	160	90	500
Q	200	120	80	400

a) Find the input coefficient matrix.
b) Find the total output to be produced by the industries P and Q when the final demands are 152 of P and 114 units of Q.

14. The demand equation for a certain commodity is $P = 20 - Q$ and the total cost function $C = Q^2 + 8Q + 2$, determine the total profit, revenue and cost under profit maximization.

15. a) Depreciation on machinery is written off at 5% every year. If its value at the end of 12 years is Rs. 12,500. What was the original cost of the machinery?
    b) Divide Rs. 2,708 between Ram and Mohan so that Ram's share at end 5 years be equal to Mohan's share at the end of 7 years compound interest being calculated at 8% p.a.

16. A and D the input-output coefficient matrix and the demand vector respectively are given $A = \begin{bmatrix} 0.1 & 0.4 \\ 0.2 & 02 \end{bmatrix}$ and $D = \begin{bmatrix} 560 \\ 320 \end{bmatrix}$. Find the total output.

17. Solve the following linear programming problem by simplex method to maximize $z = 2x + y$ subject to $x + 2y \leq 10$, $x + y \leq 6, x, y \geq 0$.

18. A factory has some automatic and some mechanical machines. Some of these machines are new and some old.

Machine	Automatic	Mechanical	Total
New	40	30	70
Old	20	10	30
Total	60	40	100

A machine is selected. Find the probability that
a) The machine is new given that it is automatic
b) The machine is old given that is mechanical

19. A binomial distribution has 5 independent trials. If the probability of 1 and 2 successes are $\frac{1}{4}$ and $\frac{1}{3}$ respectively, find p and q. Also find $P(r = 3)$.

Group C [8X3=24]

20. a) The demand function is $P = 20 - 3x$ and the supply function is $P = 4 + x$. Find the consumer surplus and producer surplus at the market equilibrium price.

    b) If the marginal revenue function is $\frac{dR}{dx} = \frac{6}{(x+2)^2} - 2$, show that the demand law is $P(x) = \frac{3}{x+2} - 2$.

21. a) Find the compound interest on Rs. 6,400 for 4 years, the rate of percent for the first year is 8% pa and for the second year is 6% pa. and for last two years 5% pa.
    b) In how many years will an annuity of Rs. 400 amount to Rs. 4,064 at 3% pa compound interest.

22. The following table shows the relation between price and demand of certain item

Price (X)	10	12	20	22	24	26
Demand (Y)	16	15	14	12	11	10

a) Calculate the correlation coefficient by Karl Pearson's Method
b) How can you find the correlation coefficient by using regression coefficients?
c) Find the equation of line of regression of X on Y. Estimate the value of X when $Y = 30$.

Group A [1x11=11]
Rewrite the correct option in your answer sheet

1. If $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then AB=?

   a) $\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$
   b) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$
   c) $\begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$
   d) $\begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}$

2. $\begin{vmatrix} x-1 & -5 \\ -3 & x+1 \end{vmatrix} = 0$ then the value of x is

   a) ± 2
   b) ± 4
   c) ± 3
   d) ± 1

3. Adjoint of $\begin{bmatrix} 5 & -7 \\ -3 & 2 \end{bmatrix}$ is

   a) $\begin{bmatrix} 2 & 7 \\ -3 & 5 \end{bmatrix}$
   b) $\begin{bmatrix} 2 & -7 \\ -3 & 5 \end{bmatrix}$
   c) $\begin{bmatrix} 2 & 7 \\ 3 & 5 \end{bmatrix}$
   d) $\begin{bmatrix} -2 & 7 \\ -3 & -5 \end{bmatrix}$

4. The elasticity of demand of the demand function $p = \frac{1}{x}$ is

   a) -1
   b) $-\frac{1}{2}$
   c) $-\frac{1}{3}$
   d) 0

5. $\frac{d}{dx}(x + c) =$

   a) 1
   b) x
   c) 0
   d) x^n

6. Which of the following is homogenous differential equation?

   a) $x(x + y)dy = y(x - y)dx$
   b) $\cos^2 x \frac{dy}{dx} + y = 1$

   c) $\frac{dy}{dx} + \frac{y}{x} = y^2$
   d) $\tan x\, dy + y\, dx = \sec x\, dx$

7. Every LPP is associated with another LPP by

   a) slack
   b) surplus
   c) primal
   d) dual

8. The skewness of data distribution is left skewed if

   a) Mean < Median < Mode
   b) Mean > Median >Mode
   c) Mean = Median = Mode
   d) None of above

9. Which of the following is correct for two events to be independent?

   a) $P(A\backslash B) = P(B)$
   b) $P(A\backslash B) = P(A)$
   c) $P(B\backslash A) = P(A)$
   d) None of above

10. The effect of independent variable (X) on the dependent variable (Y) is best explained by:

   a) Correlation analysis
   b) Measure of central tendency
   c) Regression analysis
   d) None of these option is correct

11. The system of equation cannot be solved by Crammer's rule if

   a) $D = 0$
   b) $D_1 = 0$
   c) $D_2 = 0$
   d) $D_3 = 0$

Group B[5x8=40]

12. Prove that $\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix} = (b^2 - ac)(ax^2 + 2bxy + cy^2)$.

13. a) Consider a matrix $A = \begin{bmatrix} 4 & 1 & 3 \\ 2 & 0 & 1 \\ 1 & 2 & 0 \end{bmatrix}$. Find the adjoint of A.

    b) The input-output coefficient matrix A and the demand vector D respectively are given below

$A = \begin{pmatrix} 0.1 & 0.4 \\ 0.2 & 0.2 \end{pmatrix}$ and $D = \begin{pmatrix} 5 & 6 & 0 \\ 3 & 2 & 0 \end{pmatrix}$. Find the total output

14. a) Solve $\frac{dy}{dx} + 2y = 40$

    a) Evaluate: $\int_0^2 \left(x - \frac{3}{4}\right)(2x^2 - 3x + 3)dx$

15. Solve the following system of equation by row equivalent method.
$$9x - 5y = 3, x + z = 1, z + 2y = 2$$

16. Solve: $xy\frac{dy}{dx} = x^2 + y^2$

17. Solve the following LPP using simplex method.
    Maximize $P = 30x + 20y$ subject to : $2x + y \leq 24, x + 2y \leq 15, x, y \geq 0$

18. From the following information, calculate Karl Pearson's coefficient of skewness
    $\sum x = 452, \sum x^2 = 24270$, Mode = 43.7 and number of observation = 10

19. The marks secured economics and statistics are as follows

Marks in Eco	25	28	35	32	31	36	29	38	34	32
Marks in statistics	43	46	49	41	36	32	31	30	33	39

Calculate two regression equations and coefficient of correlation between the marks in economics and statistics.

Group C[8x3=24]

20. A company has two plants to manufacture cars. Plant I manufactures 80% of the cars are rated standard quality or better and the plant II only 65 out of 100 cars are rated standard quality of better

    a) What is the probability that car selected at random came from plant I, if it is known that car is of standard quality?

    b) What is the probability that car came from plant II it is known that the car is of standard quality.

21. a) Find the amount of an immediate annuity of Rs. 1,400 a year payable half yearly for 12 years at 8% p.a.

    b) The product of 3 numbers in GP is 729 and sum of their square is 819. Determine the numbers

22. a) A company produces Q units of output at a total cost of
$$C = \frac{1}{4}Q^2 + 3Q + 100.$$

    Verify that the minimum average cost is equal to the marginal cost at the level minimizing the average cost.

    b) Define. i) Monotonic function
        ii) Skew symmetric matrix
        iii) Pivot elements [in Gaussian Elimination Method]

Group A[11x1=11]

Rewrite the correct option in your answer sheet.

1. What is the order of the matrix $\begin{bmatrix} 1 & 3 & 4 \\ 4 & 6 & 5 \end{bmatrix}$?
   a) 2×3 b) 3×2 c) 4×2 d) 2×4

2. Which of the following equation is not linear?
   a) $3x + 4y = 5$ b) $7x - 5y = 9$ c) $8x - 5y = 0$ d) $3x^2 + 4x = 11$

3. The demand is elastic is
   a) $-\infty < E_q(P) < -1$ b) $E_q = -1$ c)$E_q = 0$ d) $E_q = 1^\infty$

4. If A is input-output coefficient matrix, then $I - A$ is called
   a) Robert Leontief   b) Johon Leotief
   c) Wassily Leontief   d) Nobel Leontief

5. The point of intersection of the function $f(x) = 2x^3 + 6x$ is :
   a) 1   b) 0   c) -1 d) no point of inflection

6. The value of $\int_1^3 dx$
   a) 1   b) 2   c) -2 d) 0

7. If $y(0) = 3$ and $y = Ce^x$ is the general solution, then the particular solution is
   a) $y = 2e^x$ b) $y = 4e^x$ c) $y = e^x$ d) $y = 3e^x$

8. The 6th term in the series is $1 + 3 + 9 + 27 + \cdots$ is
   a) 84   b) 143   c) 243   d) 99

9. The distribution is symmetrical if
   a) $S_k = 1$ b) $S_k = 0$ c) $S_k = -1$ d) $S_k = \infty$

10. Which of the following is true for Karl Pearson's coefficient of skewness?
    a) $-1 < S_k < 1$ b) $-1 \leq S_k \leq 1$ c) $-3 < S_k < 3$ d) $-3 \leq S_k \leq 1$

11. The total number of sample space while two tosses of coin is
    a) 2   b) 3   c) 1   d) 4

Group B[8x5=40]

12. State the Hawkins-Simon condition for the viability of a system. The data below are about an economy of two industries P and Q. The values are in lakhs of rupees.

Producer	User		Final demand	Total output
	P	Q		
P	250	160	90	500
Q	200	120	80	400

Find the technology matrix and test whether the system is viable as per the Hawkins – Simon Condition

13. Solve the system $3x + y + 2z = -1, 2x + 3y + z = 5, x + 2y - z = 8$ by using inverse matrix method.

14. Suppose that the demand equation for a certain commodity is $Q = 60 - 0.1P$. Is demand elastic or inelastic at $P = 200$? Prove that $e_d = \frac{AR}{AR-MR}$ where AR is average revenue and MR is marginal revenue. Verify this relation for demand law $P = a - bQ$.

15. The demand equation for a certain commodity is $P = 20 - Q$ and the total cost function $C = Q^2 + 8Q + 2$, determine the total profit, revenue and cost under profit maximization.

16. In a competitive market where $Q_d = 560 - 6P$ and $Q_s = -45 + 28.7P$ the initial price P_o is Rs. 50. Derive a function for the time path of P and use it to predict price in time period 5 given that price adjusts in proportion to excess demand at the rate
$$\frac{dP}{dt} = 0.01(Q_d - Q_s)$$
How many periods would you have to wait for the price to drop by Rs. 20?

17. Maximize $P = 4x + 5$ subject $2x + 5y \leq 25, 6x + 5y \leq 45, x, y \geq 0$ by the simplex method.

18. State Bayes' Theorem. A basketball team is to play two games in a tournament. The probability of winning the first game is 0.10. If the first game is won, the probability of winning the second game is 0.15. If the first game is lost, the probability of winning the second game is 0.25. What is the probability the first game was won if the second game is lost?

19. Coefficient of correlation between X and Y for 20 items is 0.3 mean of X is 15 and that of Y is 20., standard deviations are 4 and 5 respectively. At the time of calculation on item 17 was wrongly copied instead of 27 in case of X-series and 35 instead of 30 in case of Y-series. Find the correct coefficient of correlation.

Group C[3x8=24]

20. a) Find the area bounded by the x-axis and the curve $f(x) = x(x - 1)(x + 1)$
    b) The marginal cost function of manufacturing x shoes is $6 + 10x - 6x^2$. The total cost function of producing of a pair of shoes is Rs. 12, find the total and average cost function.
    c) Find the consumer's surplus and the producer's surplus under market equilibrium if the demand function is $P_d = 20 - 3Q - Q^2$ and the supply function is $P_s = Q - 1$.

21. a) In a GP the first term is 5, the last term 1215 and the sum is 1820, find the common ratio
    b) The difference between the simple interest and compound interest on a certain sum for two years at 4% pa. is Rs 32. Find the sum invested.