## MODEL QUESTION PAPER 2027

# MATHEMATICS AND STATISTICS (COMMERCE)

Std. XII (H.S.C.) · Maharashtra State Board

**Time: 3 Hours** **Max. Marks: 80**

**General instructions:**

(1) All questions are compulsory.
(2) The numbers to the right indicate full marks.
(3) Use of a logarithmic table is allowed; use of a calculator is not allowed.
(4) For each MCQ, only the first attempt will be evaluated.
(5) Start each section on a new page.

## SECTION - I

**Q. 1. (A) Select and write the correct answer (each 1 mark):** **6**

(i) Attempt any TWO (4 marks each): Evaluate: integral from 2 to 5 of sqrt(x)/(sqrt(x) + sqrt(7 - x)) dx

(ii) The difference between face value and present worth is called _____. (a) Banker's discount (b) True discount (c) Banker's gain (d) Cash value

(iii) integral $x^2$ (3)^($x^3$) dx = _____ (a) (3)^($x^3$)/(3 log 3) + c (b) (3)^($x^3$) + c (c) (log 3)(3)^($x^3$) + c (d) $x^2$ (3)^($x^3$) + c

(iv) The order and degree of $(d^{2y}/dx^2)^2 + (dy/dx)^2 = a^x$ are respectively ____ (a) 1, 1 (b) 1, 2 (c) 2, 1 (d) 2, 2

(v) Fill in the blank: The integrating factor of the differential equation dy/dx - y = x is _____.

(vi) In regression analysis $b_{yx} . b_{xy}$ = _____. (a) V(x) (b) $sigma_x$ (c) $(sigma_y)^2$ (d) $r^2$

**Q. 1. (B) & (C) Answer the following (each 1 mark):** **6**

(i) State whether true or false: Order and degree of a differential equation are always positive integers.

(ii) Fill in the blank: If P01(L) = 225, P01(P) = 144 then P01(F) = _____.

(iii) Area of the region bounded by the curve $y = x^2$, the X-axis and the lines x = 1 and x = 3 is _____. (a) 3/26 sq. units (b) 3 sq. units (c) 26 sq. units (d) 26/3 sq. units

(iv) Fill in the blank: integral $e^x$ (1/x - $1/x^2$) dx = _____.

(v) Fill in the blank: If the average revenue is 45 and elasticity of demand is 3 then marginal revenue is ____.

(vi) Fill in the blank: The dual of (p ^ ~q) v t is _____.

**Q. 2. (A) Attempt any TWO of the following (each 3 marks):** **6**

(i) Attempt any TWO (4 marks each): Minimize: z = 4x + 2y Subject to: 3x + y >= 27, x + y >= 21, x + 2y >= 30, x >= 0, y >= 0. Solve the above L.P.P. by graphical method.

(ii) Attempt any TWO (3 marks each): Obtain the 4-yearly centered moving averages for the following data: Years 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982; Production 1 0 1 2 3 2 3 6 5 1 4 10

(iii) Attempt any TWO (3 marks each): Determine whether the following statement pattern is tautology, contradiction or contingency. [p ^ (~p v q)]

**Q. 2. (B) Attempt any TWO of the following (each 4 marks):** **8**

(i) Attempt any TWO (3 marks each): Find the inverse of matrix [1 2 3; 1 1 5; 2 4 7] by adjoint method.

(ii) Attempt any ONE (4 marks each): Find the area of the region bounded by the curve $x^2$ = 16y and the line y = 4.

(iii) Attempt any TWO (4 marks each): A random variable X has the following probability distribution: x 1 2 3 4 5 6 7; P[X = x] k 2k 2k 3k $k^2$ $2k^2$ $7k^{2+k}$. Determine (a) k (b) P(X < 3) (c) P(X > 6) (d) P(0 < X < 1)

**Q. 3. (A) Attempt any TWO of the following (each 3 marks):** **6**

(i) Attempt any TWO (3 marks each): Write the converse, inverse and contrapositive of the following statement. 'If a man is rich, then he is happy.'

(ii) Attempt any TWO (3 marks each): Following table shows the number of traffic fatalities (in a state) resulting from drunken driving from years 1975 to 1983: Years 1975 1976 1977 1978 1979 1980 1981 1982 1983; No. of deaths 0 6 3 8 2 9 4 5 10. Fit a trend line by least square method.

(iii) Attempt any TWO (3 marks each): Find dy/dx if $y = (\log x)^x + x^5$

**Q. 3. (B) & (C) Attempt any TWO of the following (each 4 marks):** **8**

(i) Attempt any TWO (3 marks each): For the following bivariate data obtain equation of regression line Y on X: X 1 2 3 4 5; Y 5 7 9 11 13

(ii) Attempt any ONE (4 marks each): Solve the following equation by method of reduction: x - y + z = 4, 2x + y - 3z = 0, x + y + z = 2

(iii) Attempt any TWO (3 marks each): A pair of dice is thrown 3 times. If getting a doublet is considered a success, find the probability of two successes.

(iv) Attempt any TWO (4 marks each): Evaluate: integral from 1 to 3 of log x dx

## SECTION - II

**Q. 4. (A) Select and write the correct answer (each 1 mark):** **6**

(i) integral (1 - x)^(-3) dx = _____. (a) (1/2)(1 - x)^(-2) + c (b) (1/2)(1 + x)^(-2) + c (c) (1/2)(1 - x)^(-2) + x/2 + c (d) (1/2)(1 - x)^(-2) - x/2 + c

(ii) Price Index Number by Simple Aggregate Method is given by (a) sum(p1/p0) x 100 (b) sum(p0/p1) x 100 (c) (sum p1/sum p0) x 100 (d) (sum p0/sum p1) x 100

(iii) If $x = 2at^2$, $y = 4at$ then dy/dx = ____. (a) $-1/(2at^2)$ (b) $1/(2at^3)$ (c) 1/t (d) $1/(4at^3)$

(iv) Paasche's Price Index Number is given by ____. (a) (sum p0 q0/sum p1 q0) x 100 (b) (sum p0 q1/sum p1 q1) x 100 (c) (sum p1 q0/sum p0 q0) x 100 (d) (sum p1 q1/sum p0 q1) x 100

(v) If y = e^(log x) then dy/dx is (a) e^(log x)/x (b) 1/2 (c) 1 (d) both (a) and (c)

(vi) If integral from 0 to a of $3x^2$ dx = 8 then a = _____. (a) 2 (b) 0 (c) 8/3 (d) 1

**Q. 4. (B) & (C) Answer the following (each 1 mark):** **6**

(i) State whether true or false: The integrating factor (I.F.) of dy/dx + y = e^(-x) is $e^x$

(ii) State whether true or false: integral 1/(2x + 3) dx = log|2x + 3| + c

(iii) If 0 < eta < 1, then the demand is (a) elastic (b) unitary elastic (c) relatively elastic (d) relatively inelastic

(iv) Fill in the blank: Graphical solution set of the inequations x >= 0, y >= 0 lies in _____ quadrant.

(v) State whether true or false: For integral $((x - 1)/(x + 1)^3)\, e^x\, dx = e^x \cdot f(x) + c$, where $f(x) = (x + 1)^2$

(vi) State whether true or false: The optimum value of the objective function of L.P.P. occurs at the centre of the feasible region.

**Q. 5. (A) Attempt any TWO of the following (each 3 marks):** **6**

(i) Attempt any TWO (3 marks each): If $e^x + e^y = e^{(x + y)}$ then show that dy/dx = -e^(y - x).

(ii) Attempt any ONE (4 marks each): Solve the following differential equation $(x^2 - y^2)\, dx + 2xy\, dy = 0$

(iii) Attempt any TWO (3 marks each): Given the following information about the production (X) and demand (Y) of a commodity, obtain the regression line of X on Y. Production (X): Mean 85, S.D. 5; Demand (Y): Mean 90, S.D. 6. Coefficient of correlation between X and Y is 0.6. Also estimate the production when demand is 100.

**Q. 5. (B) Attempt any TWO of the following (each 4 marks):** **8**

(i) Attempt any TWO (3 marks each): Find the sequence that minimizes the total elapsed time to complete the following jobs. Each job is processed in order AB. Also find the idle time for machine B. Jobs (processing times in minutes) I II III IV V VI VII; Machine A 12 6 5 11 5 7 6; Machine B 7 8 9 4 7 8 3

(ii) Attempt any ONE (4 marks each): A die is thrown 4 times. If 'getting an odd number' is a success, find the probability of (a) 2 successes (b) at least 3 successes (c) at the most 2 successes.

(iii) Attempt any ONE (4 marks each): In a certain culture of bacteria, the rate of increase is proportional to the number present. If it is found that the number doubles in 4 hours, find the number of times the bacteria increased in 12 hours by using the concept of application of differential equations.

**Q. 6. (A) Attempt any TWO of the following (each 3 marks):** **6**

(i) Attempt any TWO (3 marks each): A shop is valued at Rs 3,60,000 and is insured for 75% of its value. If the rate of premium is 0.9%, find the premium paid by the owner of the shop. Also find the agent's commission if the agent gets commission at 15% of the premium.

(ii) Attempt any TWO (3 marks each): Find y if the cost of living index is 200 for the following data: Group Food Clothing Fuel-and-Lighting House-Rent Miscellaneous; I 180 120 160 300 200; W 4 5 3 y 2

(iii) Attempt any TWO (3 marks each): Following data shows the number of bags of cereals sold in years 1977 to 1984. Years 1977 1978 1979 1980 1981 1982 1983 1984; No. of bags (in ten thousands) 1 0 3 8 10 4 5 8. Fit a trend line to the above data by graphical method.

**Q. 6. (B) & (C) Attempt any TWO of the following (each 4 marks):** **8**

(i) Attempt any TWO (4 marks each): Find MPC, MPS, APC and APS, if the expenditure Ec of a person with income I is given as Ec = (0.0003) $I^2$ + (0.075) I when I = 1000.

(ii) Attempt any TWO (4 marks each): Solve the following equations by the method of inversion: 2x - y + z = 1, x + 2y + 3z = 8, 3x + y - 4z = 1

(iii) Attempt any TWO (4 marks each): Four new machines M1, M2, M3 and M4 are to be installed in a machine shop. There are five vacant places A, B, C, D and E available. Because of limited space, machine M2 cannot be placed at C and M3 cannot be placed at A. The cost matrix is: M1: A=4 B=6 C=10 D=5 E=6; M2: A=7 B=4 C=- D=5 E=4; M3: A=- B=6 C=9 D=6 E=2; M4: A=9 B=3 C=7 D=2 E=3. Find the optimal assignment schedule.

(iv) Attempt any TWO (4 marks each): A bill was drawn on 14th April for Rs 7,000 and was discounted on 6th July at 5% p.a. The banker paid Rs 6,930 for the bills. Find the period of the bill.

This is a model / practice paper built by AglaSem from an analysis of past MSBSHSE board papers. It follows the current board pattern for practice purpose only.