Maharashtra State Board

HSC 2017 - 2018 July

12th Board Exam

Mathematics and Statistics

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BOARD QUESTION PAPER : July 2018

Notes:

i. All questions are compulsory.
ii. Figures to the right indicate full marks.
iii. Graph paper is necessary for L.P.P.
iv. Use of logarithmic table is allowed.
v. Answers to the question in Section – I and Section – II should be written in two separate answer books.
vi. Question from Section – I attempted in the answer book of Section – II and vice-versa will not be assessed / not be given any credit.
vii. Answer to every question must be written on a new page.

Section – I

Q.1. Attempt any SIX of the following: **[12]**

i. p: It is a day time, q : It is warm
Give the verbal statements for the following symbolic statements :
a. $p \wedge \sim q$ b. $p \rightarrow q$ (2)

ii. Express the truth of each of the following statements using Venn diagrams:
a. No circles are polygons
b. Some quadratic equations have equal roots. (2)

iii. Find the values of x and y if
$$2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix}+\begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix}=\begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$$ (2)

iv. Find $\frac{dy}{dx}$; if $x = \sin^3\theta$, $y = \cos^3\theta$ (2)

v. Find $\frac{dy}{dx}$; if $y = \cos^{-1}\left(2x\sqrt{1-x^2}\right)$ (2)

vi. Evaluate: $\int x \cdot \log x \, dx$ (2)

vii. The cost C of producing x articles is given as $C = x^3 - 16x^2 + 47x$. For what values of x, the average cost is decreasing? (2)

viii. Evaluate: $\int_0^{\frac{\pi}{4}} \frac{1}{1+x^2} dx$ (2)

Q.2. (A) Attempt any TWO of the following: **(6)[14]**

i. Solve the following equations by reduction method:
$x + y + z = 6$, $3x - y + 3z = 10$, $5x + y - 4z = 3$ (3)

ii. Evaluate : $\int \frac{2x+1}{(x+1)(x-2)} dx$ (3)

iii. Evaluate : $\int_0^1 x(1-x)^{\frac{3}{2}} dx$ (3)

(B) Attempt any TWO of the following: **(8)**

i. Using the rules of negation, write the negation of the following :

a. $p \wedge (q \rightarrow r)$ (b) $\sim p \vee \sim q$ (4)

ii. If the function f is continuous at $x = 2$ and $x = 4$ then find the values of a and b.

Where $f(x) = x^2 + ax + b, \; x < 2$

$= 3x + 2, \quad 2 \leq x \leq 4$

$= 2ax + 5b, \quad 4 \leq x$ (4)

iii. A manufacturing company produces x items at the total cost of ₹ $(180 + 4x)$. The demand function of this product is $P = (240 - x)$. Find x for which profit is increasing. (4)

Q.3. (A) Attempt any TWO of the following: **(6)[14]**

i. If $A = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 7 & 1 \\ 2 & 5 \end{bmatrix}$, verify that $|AB| = |A|.|B|$ (3)

ii. Evaluate : $\int \frac{1}{x.[(\log x)^2 + 4]} dx$ (3)

iii. Find the volume of solid generated by rotating the area bounded by $x^2 + y^2 = 36$ and the lines $x = 0, x = 3$ about X – axis. (3)

(B) Attempt any TWO of the following: **(8)**

i. If f is continuous at $x = 0$, then find $f(0)$. Where $f(x) = \frac{(3^{\sin x} - 1)^2}{x.\log(x + 1)}, x \neq 0$ (4)

ii. If $x^7 . y^9 = (x + y)^{16}$, then show that $\frac{dy}{dx} = \frac{y}{x}$ (4)

iii. In a firm the cost function for output x is given as $C = \frac{x^3}{3} - 20x^2 + 70x$. Find the output for which marginal cost (C_m) is minimum. (4)

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Section – II

Q.4. Attempt any SIX of the following: **[12]**

i. The price of a T.V. set is ₹ 17,000. An agent charges at 3% and earns ₹ 25,500. Find the number of T.V. sets sold by him (2)

ii. Find the Age-Specific death rate (Age –SDR) for the following data:

Age groups (in years)	Population (in '000)	Number of deaths
0 – 10	11	275
10 – 20	12	180
20 – 60	9	81
60 and above	2	32

(2)

iii. The regression equation of y on x is given by $3x + 2y - 26 = 0$. Find b_{yx}. (2)

iv. Verify whether the following function can be regarded as p.m.f. of the random variable X:

$$P(x) = \begin{cases} \frac{x-1}{3}, & x = 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$ (2)

v. If X has a binomial distribution with $n = 20$, $p = \frac{1}{10}$, find E(X) and V(X). (2)

vi. Bring out the inconsistency, if any: $b_{YX} + b_{XY} = 1{\cdot}30$ and $r = 0{\cdot}75$ (2)

vii. A train travelled between two stations. The distance and time were recorded as below:

Distance (km)	80	120	160	200	240
Time (hr)	2	3	4	5	6

Draw scatter diagram and identify the type of correlation. (2)

viii. If $r = 0.5$, $\sigma_x = 1$ and $\sigma_y = 4$, then find Cov. (X, Y). (2)

Q.5. (A) Attempt any TWO of the following: **(6)[14]**

i. Calculate $e_0^\circ, e_1^\circ, e_2^\circ$ from the following.

Age x	0	1	2
l_x	1000	880	876
T_x	-	-	3323

(3)

ii. Calculate the CDR for Districts A and B compare them :

Age group (in years)	District A		District B	
	No. of persons (in '000)	No. of deaths	No. of persons (in '000)	No. of deaths
0 – 15	1	20	2	50
15 -60	3	30	7	70
60 and above	2	40	1	25

(3)

iii. The equation of the line of regression of Y on X is $3x + 2y = 26$ and X on Y is $6x + y = 31$. Find Var. (X) if Var. (Y) = 36. (3)

(B) Attempt any TWO of the following: **(8)**

i. Calculate Spearman's Rank Correlation Coefficient between the following marks given by 'two' judges (A and B) to 'eight' contestants in the elocution competition: (4)

Contestants	1	2	3	4	5	6	7	8
Marks by A	81	72	60	33	29	11	56	42
Marks by B	75	56	42	15	30	20	60	80

ii. Solve the following assignment problem to minimize the cost :

Persons	Jobs		
	I	II	III
A	7	3	5
B	2	7	4
C	6	5	3
D	3	4	7

(4)

iii. Find the sequence of the following five jobs to be processed on three machines M_1, M_2, M_3 that will minimize the total elapsed time to complete the tasks. Each job is to be processed in the order $M_1 - M_2 - M_3$:

Jobs	1	2	3	4	5
Machine M_1	5	11	5	7	6
Machine M_2	1	4	2	5	3
Machine M_3	1	5	2	3	4

(4)

Q.6. (A) Attempt any TWO of the following: **(6)[14]**

i. Minimize : $Z = 2x + y$

Subject to : $x + y \leq 5$

$x + 2y \leq 8$

$4x + 3y \geq 12$

$x \geq 0, y \geq 0$

Solve graphically. (3)

ii. Find the graphical solution for the following system of linear equations:

$3x + 4y \geq 12, 4x + 7y \leq 28, y \geq 1, x \geq 0, y \geq 0$.

Hence find the co-ordinates of corner points of the common region. (3)

iii. A wholesaler allows 25% trade discount and 5% cash discount. Find the list price of an article, if it was sold for the net amount of ₹ 1,140. (3)

(B) Attempt any TWO of the following: **(8)**

i. Find the accumulated value after 3 years of an immediate annuity of ₹ 2,000 p.a. with interest compounded at 10% p.a. [Given $(1.1)^3 = 1.331$] (4)

ii. If the difference between true discount and banker's discount on a sum due 4 months hence is ₹ 20, find true discount, banker's discount and amount of the bill, the rate of simple interest charged being 5% p.a. (4)

iii. If a random variable X follows Poisson distribution such that $P(X = 1) = P(X = 2)$, then find $(X \geq 1)$. [Use $e^{-2} = 0.1353$] (4)