

# Standard 11<sup>th</sup>

## MATHEMATICS AND STATISTICS (Commerce)

### LIST OF PRACTICALS

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## 1. Sets and Relations

- Q. 1** If the universal set is  $U = \{x/x \in N, 1 \leq x \leq 15\}$  and  $A = \{1, 2, 5, 9, 13\}$ ,  $B = \{2, 3, 5, 6, 9\}$ , write (i)  $A \cup B$  (ii)  $A \cap B$  (iii)  $A'$  (iv)  $B'$  (v)  $A' \cap B'$  (vi)  $A' \cup B'$  (vii)  $(A \cup B)'$  (viii)  $(A \cap B)'$ . Which of the above sets are equal ?
- Q. 2** Express the set  $\{(x, y) | x^2 + y^2 = 25, x, y \in W\}$  as a set of ordered pairs.
- Q. 3** Given  $A = \{1, 2, 3, 4\}$ ,  $B = \{4, 5, 6\}$ ,  $C = \{5, 6\}$ , find (i)  $A \times (B \cap C)$  (ii)  $(A \times B) \cap (A \times C)$  (iii)  $A \times (B \cup C)$  (iv)  $(A \times B) \cup (A \times C)$
- Q. 4** Give an example of a relation which is
- One-one and onto
  - Many-one and onto
  - One-one and into
  - Many-one and into

## 2. Partition Values

- Q. 1** Calculate  $D_5$ ,  $Q_1$ ,  $P_{45}$  for the distribution of monthly rent paid by 500 families in a locality.

Monthly rent in Rs.	0-5000	5000-10000	10000-15000	15000-20000
No. of Families	5	14	40	91

Monthly rent in Rs.	20000-25000	25000-30000	30000-35000	35000-40000	40000-45000
No. of Families	150	87	60	38	15

- Q. 2** Graphically find the value of Median,  $D_3$  and  $P_{35}$  for the given data.

IQ of Student	60-69	70-79	80-89	90-99	100-109	110-119	120-129
No. of Student	21	37	51	49	21	13	4

- Q. 3** Daily wages for a group of 100 workers are given below. If  $D_3 = 110$ , calculate the missing frequencies. Also calculate  $Q_3$ .

Daily wages in Rs.	0 - 50	50 - 100	100 - 150	150 - 200	200 - 250
No. of persons	7	?	25	30	?

- Q. 4** Given below is the distribution of a sample of students appearing at a C.A. examination. Help C.A. board to decide cut off marks for qualifying the examination when 3% student pass the examination.

Marks	0-100	100-200	200-300	300-400	400-500	500-600
No. of Student	130	150	190	220	280	130

## 3. Functions

- Q. 1** A function  $f: R \rightarrow R$  is defined by

$$f(x) = \frac{3x}{5} + 2 \text{ for } x \in R. \text{ Show}$$

that  $f$  is one-one and onto.

Find a)  $f^{-1}(5)$  b)  $f^{-1}(y)$ .

- Q.2** Find  $g \circ f$  and  $f \circ g$ , where

$$i) f(x) = x - 2,$$

$$g(x) = x^2 + 3x + 1$$

ii)  $f(x) = \frac{1}{x}$  ,  $g(x) = \frac{x-2}{x+2}$

**Q.3**  $f : \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = [x]$  = the greatest integer not greater than  $x$ .  
Find i)  $f(3.5)$  ii)  $f(-2.7)$   
iii)  $f(3)$  iv)  $f(-5)$ .  
Is  $f$  one-one? Why? Find the range of  $f$ . Is  $f$  onto? Why?

**Q.4**  $f : \mathbb{R} \rightarrow \mathbb{R}$  is defined by  
 $f(x) = x$  if  $x \geq 0$   
 $= -x$  if  $x < 0$

Draw rough sketch of  $f$ .

#### 4. Measures of Dispersion

**Q. 1** The number of goals scored per match by two players A and B in a season for all the matches played are as shown below. Which player is more consistent? Why?

Player A	5	5	3	4	7	9	3	0	2	2
Player B	8	7	4	4	5	6	4	3	2	1

**Q. 2** The mean and variance of 12 items are 22 and 9 respectively. Later on it was found that an item 32 was wrongly taken as 23. Compute the correct mean and variance.

**Q. 3** Mean and variance of the following continuous series are 31 and 254 respectively. The distribution after taking step deviation is as follows.

$u_i$	-3	-2	-1	0	1	2	3
$f_i$	10	15	25	25	10	10	5

Determine actual class intervals.

**Q. 4** Price of a particular commodity in 5 years in two cities is as follows. Determine which city shows more stability in price.

Price in City A	10	22	19	23	26
Price in City B	10	20	18	12	15

#### 5. Complex Numbers

**Q. 1** Given  $z_1 = 2 + 3i$ ,  $z_2 = 1 - i$ . Verify the following:

i)  $|z_1 z_2| = |z_1| \cdot |z_2|$   
ii)  $|z_1 z_2|^2 = |z_1|^2 + |z_2|^2 + 2\text{Re}$

$(z_1 \bar{z}_2)$

**Q.2** Given  $\alpha = \frac{-1 + i\sqrt{3}}{2}$ ,

$\beta = \frac{-1 - i\sqrt{3}}{2}$ . Find i)  $\alpha + \beta$

ii)  $\alpha\beta$  iii)  $\frac{1}{\alpha} + \frac{1}{\beta}$  iv)  $\alpha^3 + \beta^3$

**Q.3** If  $\omega$  is a complex cube root of unity then prove that  $(1 - \omega + \omega^2)^6 + (1 - \omega + \omega^2)^6 = 128$ .

**Q.4** Find three cube roots of 8. Show that their sum is zero.

**Q.5** Find the square root of  $7 - 24i$

## 6. Skewness

**Q. 1** Find  $Sk_p$  and  $Sk_b$  for the following data and interpret the result.

18, 27, 10, 25, 31, 13, 28

**Q. 2** Use suitable coefficient of skewness and comment on it for the distribution.

Miles Travelled	Below 10	10-15	15-20	20-25	Above 25
Number of Villages	142	218	90	52	18

**Q. 3** For a frequency distribution the mean is 200 the coefficient of variation is 8% and  $Sk_p = 0.3$ . Find the mode and median of the distribution.

**Q. 4** Calculate Karl Person's coefficient of skewness for the following data and interpret the result.

Marks above	0	10	20	30	40	50	60	70	80
No. of Students	120	115	108	98	85	60	18	5	0

## 7. Bivariate Frequency Distribution

**Q. 1** Construct bivariate frequency table for income (x) and expenditure (y) of 25 families given below.

(250, 200), (300, 280), (325, 800), (400, 300), (450, 280), (325, 310), (450, 325), (275, 200), (355, 245), (425, 375), (475, 400) (410, 300), (280, 225), (300, 250), (425, 400), (365, 300), (270, 200),

(310, 210), (375, 200), (345, 310), (290, 210), (270, 215), (300, 210), (425, 375), (470, 380). Also find i) marginal frequency distributions of x and y ii) conditional frequency distribution of x when y is between 200-300 iii) conditional frequency distribution of y when x is between 400-500.

**Q. 2** Following table gives the ages of husbands and ages of wives. Find a) marginal frequency distribution of age of husband. b) the conditional frequency distribution of age of husband when age of wives lie between 25-35. c) How many couples have age of husband above 40 years and age of wives below 45 years.

Age of Wives in Years	Age of husband (in years)			
	20-30	30-40	40-50	50-60
15-25	5	9	3	-
25-35	-	10	25	2
35-45	-	1	12	2
45-55	-	-	4	16
55-65	-	-	-	4

**Q. 3** A sample of boys and girls was asked to choose their favourite sport with the following result. Find the value of  $\chi^2$  statistic.

	Foot Balls	Cricket	Hockey	Basket Ball
Boys	86	60	44	10
Girls	40	30	25	5

## 9. Correlation

**Q. 4** In a certain sample of 1000 families, 450 families consume tea. Out of 600 Hindu families, 286 families consume tea. Calculate  $\chi^2$  statistic.

### 8. Sequence And Series

**Q. 1** Find the sum of first hundred odd natural numbers.

**Q.2** The sum of first n terms of a sequence is  $5(3^n - 1)$ . Show that the sequence is G.P.

**Q.3** Find the sum to infinity of the following geometric progressions:

i)  $0.9 + 0.09 + 0.009 + \dots$

ii)  $1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \dots$

**Q.4** Evaluate the sum:

$$1 \times \frac{1}{2} + 2 \times \frac{1}{2^2} + 3 \times \frac{1}{2^3} + 4 \times \frac{1}{2^4} + \dots$$

**Q.5** Harsh invested ₹. 50,000/- in a bank for 10 years at the rate of 10% per annum at compound interest. What will be the amount he will get after 10 years? What will be the difference in amount, if interest compounded monthly? (Given that  $(1.1)^{10} = 2.5937$ ,  $\frac{1}{12} = 0.083$ )

**Q. 1** Compute the correlation coefficient between X and Y for the following data

X	20	30	25	65	70	80	95
Y	9	10	7	11	30	40	45

**Q. 2** From the following data compute the coefficient of correlation between X and Y.

	X-series	Y-series
No. of items	15	15
A. M.	25	18
Variance	136	138

Sum of the product of deviation of X and Y from their respective means = 122.

**Q. 3** Calculating correlation coefficient between x and y from 25 pairs of observations, the following result is obtained  $\Sigma x = 125$ ,  $\Sigma x^2 = 650$ ,  $\Sigma y = 100$ ,  $\Sigma y^2 = 460$ ,  $\Sigma xy = 508$ . It was later discovered that the two pairs of observation (6, 14) and (8, 6) are wrongly taken. The correct observations were (8, 12) and (6, 8). Compute the correct correlation coefficient.

**Q. 4** If the correlation coefficient between x and y is 0.8, find the correlation coefficient between

1)  $\frac{x}{2}$  and y

2) 2x and y

3) x and 3y

4) x-5 and y-3

5) x+7 and y+9

6)  $\frac{x-5}{7}$  and  $\frac{y-3}{8}$

### 10. Locus and Straight Line

**Q. 1** Show that the equation of the line passing through  $A(x_1, y_1)$  and parallel to the line  $ax + by + c = 0$  is  $a(x - x_1) + b(y - y_1) = 0$ .

**Q.2** Show that the equation of the line whose slope is  $m$  and which makes intercept  $d$  on the X - axis is  $y = m(x - d)$ .

**Q.3** In  $\Delta ABC$  with vertices  $A(2, 3)$ ,  $B(4, -1)$  and  $C(1, 2)$ , find the length of the altitude drawn from the vertex A.

**Q.4** If lines  $y = 3x + 1$  and  $2y = x + 3$  are equally inclined to the line  $y = mx + 4$  then find the value of  $m$ .

### 11. Applications of Determinants

**Q. 1** Evaluate the following determinants.

i)  $A = \begin{vmatrix} 3 & 2 \\ 19 & 13 \end{vmatrix}$

ii)  $B = \begin{vmatrix} 30 & 12 \\ 20 & 8 \end{vmatrix}$

iii)  $P = \begin{vmatrix} 1 & 1 & 2 \\ 2 & 2 & 3 \\ 3 & 2 & 6 \end{vmatrix}$

iv)  $A = \begin{vmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{vmatrix}$

**Q.2** Solve the following systems of equations. Using crammers rule.

$$x + y - z = 2$$

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

$$2x - y - 3z = -1$$

**Q.3** The sum of three numbers is 2. If twice the second number is added to the sum of first and third number, we get 1. On adding second and third numbers to five times the first number we get 6. Find the three numbers by using Cramer's rule.

**Q.4** By using determinant find the area of  $\Delta ABC$ , whose vertices are given by  $A = (4, 5)$ ,  $B = (0, 7)$ ,  $C = (-1, 1)$

**Q.5** Using determinants, show that the following points are collinear  $A(3, 7)$ ,  $B(4, -3)$ ,  $C(5, -13)$ .

### 12. Permutations and Combinations

**Q. 1 (a)** Find  $r$  if  ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$

**(b)** If  ${}^nP_r = 6652800$  and  ${}^nC_r = 165$  then find  ${}^{n+3}C_{r+4}$

**Q. 2** How many quadratic equations can be formed with the coefficients 0, 5, 7, 9 ?

**Q. 3** How many ways can 5 students be selected out of 11 students if

a) 2 particular students are included.

b) 2 particular students are not included.

**Q. 4** 7 pairs of husband wives mixed double tennis team is selected. How many ways team can be selected such that husband and wives do not play together?

**Q. 5** In how many different ways can the letter of the word 'SALLOON' be arranged if,  
i) two O's must not be together  
ii) consonant and vowels occupy alternate places.

### 13. Limits

**Q. 1** Evaluate the following limits.

i)  $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x - 2}$     ii)  $\lim_{x \rightarrow 5} \frac{x^4 - 625}{x - 5}$

iii)  $\lim_{x \rightarrow 4} \frac{x^3 - 64}{x - 4}$     iv)  $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x^2 - 9}$

**Q.2** Evaluate the following.

i)  $\lim_{x \rightarrow 1} \left[ \frac{1}{x-1} + \frac{2}{1-x^2} \right]$

ii)  $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$

iii)  $\lim_{x \rightarrow 0} \left( 1 + \frac{3x}{4} \right)^{1/x}$

iv)  $\lim_{x \rightarrow 0} \left( \frac{2+x}{2-x} \right)^{1/x}$

**Q.3** Evaluate the following.

i)  $\lim_{x \rightarrow 0} \frac{a^x - b^x}{\log(1+x)}$

ii)  $\lim_{x \rightarrow 0} \frac{10^x - 5^x - 2^x + 1}{x^2}$

iii)  $\lim_{x \rightarrow 0} \frac{e^x + e^{-x} - 2}{x^2}$

iv)  $\lim_{x \rightarrow 0} \frac{e^{3x} - e^{2x} - e^x + 1}{x^2}$

**Q.4** Evaluate  $\lim_{x \rightarrow 0} \left( \frac{2+3x}{2-x} \right)^{1/x}$

**Q.5** Evaluate  $\lim_{x \rightarrow 0} \frac{(14^x - 7^x - 2^x + 1)}{x \cdot \log(1+x)}$

### 14. Continuity

**Q. 1** Examine the continuity of the function  $f(x)$  at  $x = 0$ .

i)  $f(x) = \frac{3^x - 2^x}{x}$ , for  $x \neq 0$   
 $= \log \frac{3}{2}$ , for  $x = 0$ .

ii)  $f(x) = \frac{6^x - 3^x - 2^x + 1}{x^2}$ , for  $x \neq 0$   
 $= \log 5$ , for  $x = 0$ .

iii)  $f(x) = \left( 1 + \frac{2}{3}x \right)^{1/x}$ , for  $x \neq 0$   
 $= e^{\frac{2}{3}}$ , for  $x = 0$ .

iv)  $f(x) = \frac{\log(1+4x)}{4}$ , for  $x \neq 0$   
 $= 4$ , for  $x = 0$ .

**Q.2** Define  $f(2)$  so that  $f(x)$  will be continuous at  $x = 2$ , where

$$f(x) = \frac{x^4 - 16}{x - 2}, \text{ for } x \neq 2.$$

**Q.3** If  $f(x) = (1 + kx)^{\frac{1}{x}}$ , for  $x \neq 0$

$$= e^{\frac{3}{2}}, \text{ for } x = 0$$

is continuous at  $x = 0$ , find  $k$ .

**Q.4** Test the continuity of  $f(x)$  at  $x = 3$  where

$$f(x) = \frac{x^2 - 9}{x - 3}, \text{ for } 0 \leq x < 3$$

$$= 2x, \text{ for } 3 \leq x < 6.$$

**Q.5** Find  $a$  and  $b$  if  $f(x)$  is continuous at  $x = 0$  where

$$f(x) = x^2 + a, \text{ for } x \geq 0$$

$$= 2\sqrt{x^2 + 1} + b, \text{ for } x < 0,$$

also it is given that  $f(1) = 2$ .

## 15. Probability

**Q. 1** In a survey conducted by a music club it was observed that, 45% people out of 1000 liked Indian classical music, while 50% liked western music and 15% liked neither Indian classical music nor western music. A person is selected at random. What is the probability that the person selected likes

- at least one of the music
- exactly one of the music

**Q. 2** Computer Brands A and B

are to be sold. A salesman has 50% and 40% chances of finding customers for brands A and B respectively. Given that salesman can sell at least one of the computer, what is the probability that computer of brand A has been sold?

**Q. 3** In a bag there are red and blue colour balls only. A person draws a ball from a bag randomly if probability of drawing red ball is  $\frac{x}{4}$

and that of blue ball is  $\frac{1}{x}$ .

Determine the number of balls of each colour.

**Q. 4** Two dice are thrown together. What is the probability that sum of the number on two dice is 5 or number on the second die is greater than first die.

**Q. 5** Two cards are drawn from a pack of 52 playing cards. Find the probability that both are king or both are queen.

## 16. Linear Inequalities

**Q. 1** Solve the inequality and represent it on number line.

a)  $2|4 - 5x| \geq 9$

b)  $\frac{x+5}{x-3} < 0$

**Q. 2** Sketch the graph of the following inequality in plane.



- a)  $5x + 4y \leq 40$
- b)  $2x - y \leq -2$
- c)  $y \leq -2x$

**Q. 3** Find the graphical solution of system of linear inequations.  
 $3x + 2y \leq 1800,$   
 $2x + 7y \leq 1400,$   
 $0 \leq x \leq 350, 0 \leq y \leq 150$

**Q. 4** Divija wants to invest at most Rs. 15000 in saving certificate and fixed deposits. She wants to invest at least Rs. 3000 in savings certificate and at least Rs. 5000 in fixed deposits. Represent this information using system of linear inequations and show feasible region graphically.

**Q. 5** Diet for a sick person must contain at least 4000 units of vitamin. Each unit of food  $F_1$  contains 200 units of vitamin. Where as each unit of food  $F_2$  contains 100 units of vitamins. Write an inequation to fulfill sick persons requirements. Represent the solution set graphically.

### 17. Defferentiation

- Q. 1** Differentiate the following functions with respect to  $x$ .
- i)  $\frac{x^2}{2} + \frac{x^3}{3} + \frac{x^5}{5}$
  - ii)  $\sqrt{x} - \frac{1}{\sqrt{x}} + \frac{1}{x}$
  - iii)  $x^2 + 2^x + e^x + 2^2$
  - iv)  $x\sqrt{x} - e^x + \log x$

**Q.2** Differentiate the following w.r.t.x.  
 i)  $x.e^x$       ii)  $x^2.\log x$   
 iii)  $e^x.\log x$       iv)  $\sqrt{x}.\log x$

**Q.3** Differentiate the following w.r.t.x  
 i)  $\frac{e^x}{e^x - 1}$       ii)  $\frac{x}{(1 + \log x)}$

### 18. Applications of Derivatives to Economics

**Q. 1** The demand  $D$  for a price  $P$  is given as  $D = \frac{27}{P}$ , find the rate of change of demand when price is 3.

**Q. 2** If for a commodity; the price-demand relation is given as  $D = \frac{P + 5}{P - 1}$ . Find the marginal demand when price is 2.

**Q. 3** The demand function of a commodity is given as  $P = 20 + D - D^2$ . Find the rate at which price is changing when demand is 3.

**Q. 4** If the total cost function is given by;  $C = 5x^3 + 2x^2 + 7$ ; find the average cost and the marginal cost when  $x = 4$ .

**Q. 5** If for a commodity the demand  $D = \frac{24P}{P - 2}$  and supply  $S = P^2$ . Find the equilibrium price, (the

nonzero price for which the demand equals the supply). Find marginal demand and marginal supply at that price.

- Q. 6** The demand function of a commodity is given by  $P = 32 + 3D - D^2$ . Find the rate at which the price is changing, when the demand is 2. Also find the rate at which the total revenue  $R$  is changing at that time.
- Q. 7** The price  $P$  and the demand  $x$  of pens has relation  $x = 20\sqrt{P} - 4$ . Find the marginal revenue function when  $P = 9$ .

### 19. Commercial Mathematics : Percentage, Profit and Loss

- Q. 1** The price of fuel increased by 10%. What should be the percentage change in the consumption of fuel so that the expense does not increase?
- Q. 2** If Shraddha's income is 25% more than Payal's income then Payal's income is less than Shraddha's income by what percent ?
- Q. 3** Score of a student was wrongly recorded as 378 instead of 387. What was the percentage of decrease recorded in his score?

**Q. 4** Rohit buys an article for ₹. 400. He marks it for sale at 60% more than the cost price. He offers 25% discount on marked price to his customer. Calculate the actual percentage of profit on cost made by Rohit.

**Q. 5** By selling a book at ₹. 450 a bookseller makes loss of 25%. Find the cost price of the book.

### 20. GST, Shares and Dividend

- Q. 1** Darshana AUTO COMPONENTS sell Automobile spare parts. The firm purchased spare parts worth ₹. 8000 from wholeseller and sold them to customers for ₹. 10000. Rate of GST is 18%. Find  
i) Input Tax and Output Tax  
ii) Amount of bill the company paid at the time of purchase  
iii) CGST and SGST.
- Q. 2** Madhavi bought 6% ₹. 100 Preference shares at ₹. 120 each. Sonali bought 8% ₹. 20 Preference shares at ₹. 30 each. Whose investment was better considering Rate of Return on amount invested?
- Q. 3** Shantanu invested ₹. 67200 in ₹. 100 Shares which are quoted at ₹. 120. Calculate the income if 12% dividend

is declared on the shares.

- Q. 4** Mr. Pratik bought 50 shares of face value ₹. 100 each. After one year he received ₹. 400 as dividend against them. Find the rate of dividend on shares.
- Q. 5** A company declares interim dividend of 6% on its shares. Kirti has 500 shares of face value ₹. 25 each. Find Kirti's annual income from these shares.