Q&A

WORK BOOK CUM QUESTION BANK WITH ANSWERS

BUSINESS MATHEMATICS AND STATISTICS

CLASS - XII

COMMERCE

SCHEDULED CASTES & SCHEDULED TRIBES
RESEARCH & TRAINING INSTITUTE (SCSTRTI)
ST & SC DEVELOPMENT DEPARTMENT
BHUBANESWAR

Work Book
cum
Question Bank with Answers

BUSINESS MATHEMATICS AND STATISTICS

CLASS-XII

COMMERCE

Compiled by :

Dr. Banamali Panda, M.Com, Ph.D.
Retd. Associate Professor in Commerce
Khalikote Cluster University

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RESEARCH & TRAINING INSTITUTE (SCSTRTI)
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BHUBANESWAR

2020

FOREWORD

An innovative education program has been initiated by ST & SC Development Department, Govt. of Odisha for the students appearing in +2 Science and Commerce examination pursuing studies in the ST & SC Development Department Schools (EMRS & HSS) to ensure quality education at +2 level.

In this regard it is to mention that an Academic Performance Monitoring Cell (APMC)has been set up in SCSTRTI to monitor the Training and Capacity Building of Teachers of SSD Higher Secondary Schools and Ekalabya Model Residential Schools (EMRS) to enhance quality education for better performance of the students appearing +2 Science and Commerce examination.This effort by APMC will certainly help the students to equip themselves for appropriate answering the question in the examination in an efficient manner.

In order to materialize the effort, thebest ofsubject experts of the state have been roped into formulate self-contained and self-explanatory "Work book cumQuestions Bankwith Answers" as per the syllabi of CHSE,Odisha.They have tried to make the material as far as activity based and solution based as possible.This novel effort is first of its kind at +2 level in Odisha.

I would like to extend my thanks to Prof.(Dr.) A.B. Ota, Advisor-Cum-Director and Special Secretary, SCSTRTI and the team of Subject experts for their sincere effort for bringingout the study materials in quick time.

Hope, these study materials will be extremely useful for the students appearing the +2 examination in Science and Commerce of our SSD Schools.

Ranjana Chopra
Principal Secretary
ST & SC Development Department
Govt. of Odisha

PREFACE

The ST and SC Development Department, Government of Odisha, has initiated an innovative effort by setting up an Academic Performance Monitoring Cell (APMC) in Scheduled Castes and Scheduled Tribes Research and Training Institute (SCSTRTI) to monitor the Training and Capacity Building of teachers of SSD Higher Secondary Schools and Ekalavya Model Residential Schools (EMRS) and to ensure quality education of students studying at +2 level under the administrative control of the ST & SC Development Department. This innovative programme is intended to ensure quality education in the Higher Secondary Level of the schools of the ST & SC Development Department.

Since the introduction of +2 Science and +2 Commerce stream by the Council of Higher Secondary Education, Odisha, there was a great demand to cater to the needs of the students appearing the +2 Examination. But no organisation or institute has taken the initiative to fulfil the needs of the students appearing the +2 examination. Realizing the necessities and requirements of students to perform better and secure better marks in the examination and proper pattern of answering the question in a scientific way, the APMC under the banner of SCSTRTI has taken the initiative for the first time in Odisha to prepare Questions Banks in Physics, Chemistry, Botany, Zoology, Mathematics, IT, English & Odia of the Science Stream and all the disciplines of the Commerce stream in line with the Syllabus of the Council of Higher Secondary Education (CHSE).

These questions banks are first of this kind in Odisha, as per syllabi of CHSE and are self contained and self explanatory. The subject expert, who are the best in their respective subjects in the state have been roped in for the exercise. They have given their precious time to make the question banks as activity based and solution based as possible.

I take this opportunity to thank all the subject experts of different subjects for rendering help and assistance to prepare the question banks within a record time. I hope, this material will be extremely useful for the students preparing for the +2 examination in different subjects of Science & Commerce streams.

Prof. (Dr.) A.B. Ota
Advisor cum Director & Special Secretary
SCSTRTI, Govt. of Odisha

BUSINESS MATHEMATICS AND STATISTICS (2nd Year) Syllabus

Objectives :

- To provide students an understanding of the Concept, features, objectives, importance & functions of Management;
- To help the students in learning the principles & Techniques of Management;
- To develop Students with an understanding of Financial Markets with its types & functions;
- To acquaint students with concept, objectives and functions of marketing management;
- To enable students to act more effectively and responsibly as consumers, employers, employees and citizens after learning the concept and features of consumer protection act;

Course Inputs :

Unit-I Business Mathematics:

Determinants - Upto third order, Minors, Co-factors, properties and Cramer's rule

Matrices: Meaning, Definition, Types, Algebra of matrices, Solving Linear Equation Problems through Matrics.

Set Theory: Meaning, Definition, Types and Operations (Union & Intersection)

Functions: Meaning and Relations of Functions, Types of Functions and Classification of Functions (excluding Trigonometric Functions)

Unit -II Calculus :

Calculus - I Limit & Continuity - Meaning, Definition, Methods of Finding Limits, Differentiation

Calculus - II Integration up to substitution

Unit-III Measure of Central Tendency :

Meaning, Objectives, Types of Averages (Mathematical & Positional Averages)

Mathematical Averages : AM, GM, HM (Simple & Weighted)

Positional Averages : Median, Mode, Quartile, Deciles and Percentiles

Relationship of AM, GM, HM, Median, Mode

Unit - IV Measure of Dispersion :

Meaning, Objectives, Characteristics of dispersion, Measures of Dispersion, (Absolute and Relative)

Positional Dispersion : Range, Inter Quartile Range, Quartile Deviation.

Mathematical Dispersion : Mean Deviation, Standard Deviation & Co-efficient of variation.

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QUESTION PATTERN OF

Theory	:	80 marks
Project Work	:	20 marks
Total	**:**	**100 marks**

Group - A (Objective type - Compulsory)

1. Multiple choice Questions (12 bits from all units) — 1 mark each x 12 = 12 marks

2. One word answer / very short answer / Correct the sentence / fill up the blanks (12 bits from all units) — 1 mark each x 12 = 12 marks

Group B (Short type Answer)

3. Answer within 30 words (out of 13 bits, one has to answer 10 bits) — 2 marks each x 10 = 20 marks

4. Answer within 50 words (out of Six bits, one has to answer Four bits) — 3 marks each x 4 = 12 marks

Group C (Long Answer type)

5. to 9.

Out of Five Questions from all units, one has to answer 3 questions. — 8 marks each x 3 = 24 marks

TOTAL — **80 marks**

CHSE QUESTION PAPERS WITH ANSWERS

2019 to 2018

2019 (A)

Time : 2 hours ***Full Marks : 80***

The figures in the right-hand margin indicate marks.

Carefully follow the instructions given in each Group and questions.

Group - A

1. From the alternatives given under each bit, write serially the correct answer along with its serial number against each bit : [1x12=12]

(a) If $\begin{pmatrix} x-y & z \\ 2x-y & w \end{pmatrix} = \begin{pmatrix} -1 & 4 \\ 0 & 5 \end{pmatrix}$, then the respective values of x, y, z, w are

(i) 1, 2, 3, 4 (ii) 1, 2, 4, 5
(iii) 1, 2, 3, 5 (iv) 1, 1, 4, 5

(b) The number of elements, a determinant of order two contains, is

(i) 2 (ii) 4
(iii) 6 (iv) 9

(c) Number of subsets, a set of 4 elements can have, is

(i) 8 (ii) 16
(iii) 32 (iv) 64

(d) If $f(x) = 3x + 7$, then $f(2)$ is equal to

(i) 12 (ii) 13
(iii) 14 (iv) 15

(e) $\lim\limits_{x \to 2} \dfrac{x^2 - 4}{x - 2}$ is equal to

(i) 4 (ii) 2
(iii) 0 (iv) ∞

(f) The derivative of $\sqrt{x}$ with respect to x, is

(i) $\frac{1}{2}\sqrt{x}$ (ii) $\frac{1}{2}x^{3/2}$
(iii) $\frac{1}{2}x\sqrt{x}$ (iv) $\frac{1}{2\sqrt{x}}$

(g) $\int 2x.dx$ is equal to

(i) x^2 (ii) 2
(iii) $\frac{1}{x^2}$ (iv) $\frac{2}{x^2}$

(h) Arithmetic mean of Rs.10, Rs.25 and Rs.37 is

(i) Rs. 24 (ii) Rs. 36
(iii) Rs. 24 (iv) Rs. 36

(i) Median of 72, 78, 81, 88, 92, 83 and 100 is

(i) 88 (ii) 78
(iii) 81 (iv) 83

(j) The values that divide a given data into four equal parts are called

(i) Deciles
(ii) Quartiles
(iii) Percentiles
(iv) Mathematical averages

(k) The difference between the greatest and smallest values of a distribution is called

(i) Range
(ii) Quartile Deviation
(iii) Mean Deviation
(iv) Standard Deviation

(l) An absolute measure of dispersion is

(i) Range
(ii) Coefficient of quartile deviation
(iii) Coefficient of mean deviation
(iv) Coefficient of variation

2. Answer the following questions as per instructions given in each bit : [1x12=12]

(a) Express each of the following in one word/ term each :

(i) A type of matrix whose number of rows and number of columns are equal.

(ii) A rule with the help of which, linear equations are solved using determinants.

(iii) A set which does not contain any element.

(b) Answer each of the following questions in one sentence :

(iv) Evaluate : $\lim_{x\to 2}\frac{x^2+4}{x+2}$

(v) Differentiate $3r^2+4r+7$ with respect to r.

(vi) Integrate $3x^2+1$ with respect to x.

(c) Rectify the underlined portions of the following sentences :

(vii) Median is a <u>mathematical</u> average.

(viii) <u>Standard</u> deviation is half of the difference between the third and first quartiles.

(ix) Standard deviation is <u>one</u> if all the values of a variable are equal.

(d) Fill in the blanks :

(x) Semi-interquartile range is also known as _____ deviation.

(xi) The median of 198, 205, 179, 146, 210, 186 and 190 is _____.

(xii) Coefficient of _____ = $\frac{\text{Standard Deviation}}{\text{Mean}}\times 100$

Group - B

3. Answer any ten of the following questions within 30 words each : [2x10=20]

(a) Find the interquaritile range and quartile deviation from the three quartiles 36, 54 and 72.

(b) If the coefficient of variation and standard deviation of 10 observations are 40% and 2 respectively, find their arithmetic mean.

(c) Find the product of

$$(2\ \ 3\ -1)\ x\begin{pmatrix}1 & 0 & 2\\ 3 & -2 & 4\\ 2 & 1 & 0\end{pmatrix}$$

(d) If A = {1, 3, 5, 7, 9}, B = {1, 7, 8} and C = {3, 5, 8, 10, 12}, then find $(A\cap B)\cap(B\cup C)$.

(e) Find the Harmonic Mean of 2, 4, 5, 10.

(f) Find the differential coefficient of $x.\log_e^x$.

(g) Evaluate : $\int(8x^3+33x^2-6x-7)dx$.

(h) If the sum and arithmetic mean of several observations are 133 and 19 respectively, then find the number of observations.

(i) Find the mode from the following values :

10, 12, 14, 15, 17, 15, 17, 18, 20, 22, 17, 15, 14, 12, 15

(j) State any two merits of standard deviation.

(k) What is meant by order of a matrix ?

(l) Show that $\begin{pmatrix}1 & 1 & 1\\ 1 & -1 & 1\\ 2 & 1 & -1\end{pmatrix}$ is a non-singular matrix.

(m) Show that $f(x)=7x^6+3x^4-2x^2+4$ is an even function.

4. Answer any four of the following questions within 50 words each : [3x4=12]

(a) Test the continuity of the following function at x = 1 :

$$f(x) = \begin{cases} \dfrac{x^2 - 4x + 3}{x - 1} & , x \neq 1 \\ -2 & , x = 1 \end{cases}$$

(b) If $A = \begin{pmatrix} 2 & 1 \\ 5 & 2 \end{pmatrix}$, $B = \begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix}$, find 3A + 2B.

(c) From the following particulars of Firm A and Firm B, find out the firm that pays larger amount as monthly wages :

No. of wage-earners	550	650
Average monthly wages (in rupees)	5,000	4,500

(d) Explain weighted arithmetic mean.

(e) From the following data find the mean deviation from its median :

10, 15, 18, 20, 30

(f) If $y = (2x^3 - 1)^4$, find $\dfrac{dy}{dx}$.

Group - C

Answer any three of the following questions : [8x3=24]

5. Using matrix method solve the following system of equations :

$$2x + 5y = 1$$

$$3x + 2y = 7$$

6. Evaluate : $\lim\limits_{x \to 2} \left[\dfrac{1}{x - 2} - \dfrac{2(2x - 3)}{x^3 - 3x^2 + 2x} \right]$

7. From the following data calculate the arithmetic mean :

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of Students	1	4	7	24	72	108	32	2

8. From the following data calculate the quartile deviation :

Marks	0-15	15-30	30-45	45-60	60-75	75-90	90-105
No. of Students	8	26	30	45	20	17	4

9. (i) Show the relationship between airthmetic mean, geometric mean and harmonic mean with example.

(ii) Explain the meaning of dispersion.

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ANSWERS 2019 (A)

Group - A

1. (a) (ii) 1, 2, 4, 5

(b) (ii) 4

(c) (ii) 16

(d) (ii) 13

(e) (i) 4

(f) (iv) $\frac{1}{2\sqrt{x}}$

(g) (i) x^2

(h) (i) Rs. 24

(i) (iv) 83

(j) (ii) Quartiles

(k) (i) Range

(l) (i) Range

2. (a) (i) Square Matrix

(ii) Crammer's Rule

(iii) Null / Empty Set

(b) (iv) 2

(v) 6r + 4

(vi) $x^3 + x + c$

(c) (vii) Median is a positional average

(viii) Quartile deviation is half of the difference between the 3rd and 1st quartile.

(ix) Standard deviation is zero of all the values are equal

(d) (x) Quartile

(xi) 190

(xii) Variation

Group - B

3. (a) Inter quartile range = $Q_3 - Q_1 = 72 - 36 = 36$

Quartile deviation = $\frac{Q_3 - Q_1}{2} = \frac{72 - 36}{2} = 18$

(b) C.V. = $\frac{\sigma}{x} x 100$ Given C.V. = 40 $\sigma = 2$

$\bar{x} = \frac{2 \times 100}{40} = 5$.

(c) $(2 \;\; 3 \;\; -1)\begin{pmatrix} 1 & 0 & 2 \\ 3 & -2 & 4 \\ 2 & 1 & 0 \end{pmatrix}$

$$= \begin{matrix} (2x1)+(3x3)+(-1x2) & (2x0)+(3x2)+(-1x1) & (2x2)+(3x4)+(-1x0) \\ 2+9-2 & 0-6-1 & 4+12+0 \\ (9 & -7 & 16) \end{matrix}$$

1 x 3.

(d) $A \cup B = \{1, 3, 5, 7, 8, 9\}$

$B \cup C = \{1, 3, 5, 7, 8, 10, 12\}$

$(A \cup B) \cap (B \cup C) = \{1, 3, 5, 7, 8\}$

(e) $H.M. = \dfrac{N}{\sum \frac{1}{x}}$

$= \dfrac{4}{\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{10}} = \dfrac{4}{\frac{10+5+4+2}{20}}$

$= \dfrac{4}{\frac{21}{20}} = \dfrac{4 \times 20}{21} = \dfrac{80}{21} = 3.81$

(f) $y = x.\text{Log}_e{}^x$

$\dfrac{dy}{dx} = \dfrac{d}{dx}(x.\text{Log}_e{}^x)$

$= \text{Log}_e{}^x \dfrac{d}{dx}x + x\dfrac{d}{dx}\text{Log}_e{}^x$

$= \text{Log}_e{}^x . x^2 + x\dfrac{1}{x}$

$= \text{Log}_e{}^x . x^2 + 1$

(g) $\int (8x^3 + 33x^2 - 6x - 7)dx$

$= \int 8x^3 dx + \int 33x^2 dx + \int 6x\,dx - \int 7\,dx$

$= 8\int x^3 dx + 33\int x^2 dx + 6\int x\,dx - 7\int 1 dx$

$= 8\dfrac{x^4}{4} + 33\dfrac{x^3}{3} + 6\dfrac{x^2}{2} - 7x + c$

$= 2x^4 + 11x^3 + 3x^2 - 7x^2 + c \cdot$

(h) A.M. = 19 $\sum X = 133$

$\therefore N = \dfrac{133}{19} = 7$

(i)

X		frequency
10	1	1
12	11	2
14	11	2
15	111	4
17	111	3
18	1	1
20	1	1
22	1	1

As 15 has the highest frequency it is the mode of the distribution.

(j) (i) Standard deviation is rigidly defined.

(ii) It takes into consideration all the values in the observation.

(k) The order of a matrix is determined by the number of columns and rows of the matrix. By convention rows are noted first and then the columns. Thus a matrix having 3 rows and 2 column is called 3 x 2 matrix.

(l) $\begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 2 & 1 & -1 \end{pmatrix}$

The determinant of the matrix is

$= 1(-1.-1-1.1) - 1(1.-1-1.2) + 1(1.1--1.2)$

$= 1(1-1) - 1(-1-2) + 1(1+2)$

$= 1.0 - 2 + 3 = 1$

Thus it is a non singular matrix.

(m) $f(x) = 7x^6 + 3x^4 - 2x^2 + 4$

$f(-x) = 7(-x)^6 + 3(-x)^4 - 2(-x)^2 + 4$

$= 7x^6 + 3x^4 - 2x + 4$

f(x)=f(-x) Hence f(x) is an even function.

4. (a) $\lim\limits_{x \to 1} f(x) \dfrac{x^2 - 4x + 3}{x - 1}$

$\lim\limits_{x \to 1} f(x) \dfrac{x^2 - 3x - x + 3}{x - 1}$

$\lim\limits_{x \to 1} f(x) \dfrac{x(x-3) - (x-3)}{x - 1}$

$\lim\limits_{x \to 1} f(x) \dfrac{(x-1)(x-3)}{x - 1}$

$\lim\limits_{x \to 1} f(x)\, x - 3 = 1 - 3 = -2$

As $\lim\limits_{x \to 1} f(x) \dfrac{x^2 - 4x + 3}{x - 1} = f(-2) = -2$

the function is continuous at x = 1.

(b) $A = \begin{pmatrix} 2 & 1 \\ 5 & 2 \end{pmatrix}$ $B = \begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix}$

$3A = \begin{pmatrix} 6 & 3 \\ 15 & 6 \end{pmatrix}$ $2B = \begin{pmatrix} 2 & -6 \\ 4 & 8 \end{pmatrix}$

$3A + 2B = \begin{pmatrix} 6+2 & 3+-6 \\ 15+4 & 6+8 \end{pmatrix}$

$= \begin{pmatrix} 8 & -3 \\ 19 & 14 \end{pmatrix}$

(c)

	Form A	Form B
No. of Wage earners	550	650
Avg. Wage	5000	4500
Total Wage	5000x550	4500x650
Payment	=27,50,000	=29,25,000

Firm B pays larger amount as monthly wages.

(d) Weighted A.M. assigns different weights to different values in the variable. Keeping in view their importance and calculated as following :

Weighted A.M.

$$= \frac{W_1X_1 + W_2X_2 + W_3X_3 .... W_nX_n}{W_1 + W_w + W_3 .... + W_n}$$

$$= \frac{\sum XW}{\sum W}$$

Where W stands for weights and X stands for respective values of the variable.

(e)

X	$\lvert X - Med \rvert$
10	8
15	3
18	0
20	2
30	12
	$\sum \lvert X - Med \rvert = 25$

The Median of the series is $\frac{NH}{2}$ th item,

$\frac{5+1}{2} = 3rd$ item i.e. 18

$$M.D. = \frac{\sum |X - Med|}{N}$$

$$= \frac{25}{5} = 5$$

(f) $y = (2x^3 - 1)^4$

$$\frac{dy}{dx} = \frac{d}{dx}(2x^3 - 1)^4$$

If $(2x^3 - 1) = u$

Then $y = u^4$

$$\frac{du}{dx} = \frac{d}{dx}(2x^3 - 1) = 6x^2$$

$$\frac{dy}{du} = \frac{d}{du}u^4 = 4(2x^3 - 1)$$

The composite function

$$\frac{dy}{dx} = \frac{dy}{du} x \frac{du}{dx}$$

$$= 4(2x^3 - 1) x 6x^2 = 24x^2(2x^3 - 1)$$

Group - C

5. $2x + 5y = 1$

$3x + 2y = 7$

Presenting the equations in 3 different matrices we will have

$$\begin{pmatrix} 2 & 5 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 7 \end{pmatrix}$$

$$A = \begin{pmatrix} 2 & 5 \\ 3 & 2 \end{pmatrix} \quad x = \begin{pmatrix} x \\ y \end{pmatrix} \text{and } B = \begin{pmatrix} 1 \\ 7 \end{pmatrix}$$

By technique of inverse we have $X = A^{-1} B$

$$A^{-1} = \frac{\text{Adj } A}{|A|} \quad |A| = 4 - 15 = -11 \neq 0$$

Co-factor Matrix of A.

$C_{11} = 2 \quad C_{12} = -3 \quad C_{21} = -5 \quad C_{22} = 2$

Co-factor Matrix

$$\begin{pmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{pmatrix} = \begin{pmatrix} 2 & -3 \\ -5 & 2 \end{pmatrix}$$

$\bar{A}$ adjoint = Transpose of the Co-factor Matrix

$$= \begin{pmatrix} 2 & -5 \\ -3 & 2 \end{pmatrix}$$

$$A^{-1} = -\frac{1}{11}\begin{pmatrix} 2 & -5 \\ -3 & 2 \end{pmatrix} = \begin{pmatrix} \frac{-2}{11} & \frac{5}{11} \\ \frac{3}{11} & \frac{-2}{11} \end{pmatrix}$$

$$X = A^{-1}B = \begin{pmatrix} \frac{-2}{11} & \frac{5}{11} \\ \frac{3}{11} & \frac{-2}{11} \end{pmatrix}\begin{pmatrix} 1 \\ 7 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{-2}{11} & \frac{35}{11} \\ \frac{3}{11} & \frac{14}{11} \end{pmatrix} = \begin{pmatrix} \frac{33}{11} \\ \frac{-11}{11} \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

$\therefore x = 3 \quad y = -1$

6. $$\lim_{x\to 2}\left[\frac{1}{x-2} - \frac{2(2x-3)}{x^3-3x^2+2x}\right]$$

$$= \lim_{x\to 2}\left[\frac{1}{x-2} - \frac{2(2x-3)}{x^3-2x^2-x^2+2x}\right]$$

$$= \lim_{x\to 2}\left[\frac{1}{x-2} - \frac{2(2x-3)}{x^2(x-2)-x(x-2)}\right]$$

$$= \lim_{x\to 2}\left[\frac{1}{x-2} - \frac{2(2x-3)}{x(x-1)(x-2)}\right]$$

$$= \lim_{x\to 2}\frac{x(x-1)-2(2x-3)}{x(x-1)(x-2)}$$

$$= \lim_{x\to 2}\frac{x^2-x-4x+6}{x(x-1)(x-2)}$$

$$= \lim_{x\to 2}\frac{x^2-5x+6}{x(x-1)(x-2)}$$

$$= \lim_{x\to 2}\frac{x(x-3)-2(x-3)}{x(x-1)(x-2)}$$

$$= \lim_{x\to 2}\frac{(x-2)(x-3)}{x(x-1)(x-2)}$$

$$= \lim_{x\to 2}\frac{x-3}{x(x-1)}$$

$$\therefore \frac{2-3}{4-2} = \frac{-1}{2} = -\frac{1}{2}$$

7.

X	M	d	d^1	f	fd_1
0 – 10	5	–40	–4	1	–4
10 – 20	15	–30	–3	4	–12
20 – 30	25	–20	–2	7	–14
30 – 40	35	–10	–1	24	–24
40 – 50	45	0	0	72	0
50 – 60	55	10	1	108	108
60 – 70	65	20	2	32	64
70 – 80	75	30	3	2	6
				$\sum fd_1$	124

A = 45

$\sum f = N = 250$

i = 10

$$\bar{X} = A + \frac{\sum fd_1}{\sum f} \text{ x } i$$

$$= 45 + \frac{124}{250} \text{ x } 10$$

$$= 45 + \frac{124}{25}$$

8.

x	f	cf
0 – 15	8	8
15 – 30	26	34
30 – 45	30	64
45 – 60	45	109
60 – 75	20	129
75 – 90	17	146
90 – 105	4	150

Q_1 = The value of $\frac{N}{4}$ th item.

= The value of $\frac{15D}{4} = 37.5$ th item.

$\therefore Q_1$ = lies in the class 30-45

$$Q_1 = L + \frac{\frac{N}{4} - Cf.}{f} x\, i$$

L = 30, N/4 = 37.5 c.f. = 34, f = 30 i = 15

$$Q_1 = 30 + \frac{37.5 - 34}{30} x 15$$

$$= 30 + \frac{3.5}{2} = 30 + 1.75 = 31.75$$

Q_3 = The value $\frac{3N}{4}$ th item.

= The value of $\frac{3 x 150}{4}$ th item.

= 112.5th iem.

$\therefore$ Q_3 lies in 60-75 the class 60-75

$$Q_3 = L + \frac{\frac{3N}{4} - Cf}{f} x i$$

$$L = 60 \ \frac{3N}{4} = 112.5 \ Cf = 109 \ i = 15, \ f = 20$$

$$Q_3 = 60 + \frac{112.5 - 109}{20} x 15$$

$$= 60 + \frac{3.5}{20} x 15$$

$$= 60 + \frac{10.5}{4} = 60 + 2.625 = 62.63$$

$$Q.D. = \frac{Q_3 - Q_1}{2} = \frac{62.63 - 31.75}{2}$$

$$= \frac{30.88}{2} = 15.44$$

9.(i) (a) For any two positive numbers

$$G.M. = \sqrt{A.M. \ x \ H.M.}$$

Let two numbers are 16 and 4 then their

$$A.M. = \frac{16 + 4}{2} = 10$$

$$H.M. = \frac{2}{\frac{1}{16} + \frac{1}{4}} = \frac{2}{\frac{5}{16}} = \frac{32}{5} = 6.4$$

$$G.M. = \sqrt[2]{16 x 4} = \sqrt{64} = 8.$$

Now it can be shown that

$$G.M. = \sqrt{A.M. x H.M.}$$

$$= \sqrt{10 x 6.4} = 8$$

(b) When all values in a series are same then A.M. = G.M. = H.M..

Let us take a series of 4 values where all are same i.e. 5, 5, 5, 5.

Then A.M. will be $= \frac{5 + 5 + 5 + 5}{4} = 5.$

The G.M. is $= \sqrt[4]{5x5x5x5} = 5$

The H.M. is $= \frac{4}{\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5}} = 4 x \frac{5}{4} = 5$

Thus A.M. = G.M. = H.M. = 5.

(c) When all values in a series differ then A.M. > G.M. > H.M.

Let us take two number 27 and 3.

The A.M. will be $= \frac{27 + 3}{2} = \frac{30}{2} = 15$

The G.M. will be $= \sqrt[2]{27 x 3} = 9$

The H.M. will be $= \frac{2}{\frac{1}{27} + \frac{1}{3}} = \frac{2}{\frac{1+9}{27}} = \frac{2}{10}$

$$= \frac{2 x 27}{10} = 5.4.$$

Thus A.M. = 15

G.M. = 9

H.M. = 5.4

$\therefore$ A.M. > G.M. > H.M.

(ii) Dispersion refers to variability. It is the scatter or spread of data from some central value. According to Spiegel. The degree to which numerical data tend to spread about an average value is called the variation or dispersion of the data. The different measures of dispersion such as Range, Quartile deviation. Mean deviation, Standard deviation aim at studying this degree of variation in a distribution. Disperssion, along with central value makes the analysis more meaningful.

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2018 (A)

Time : 2 hours ***Full Marks : 80***

The figures in the right-hand margin indicate marks.

Carefully follow the instructions given in each Group and questions.

Group - A

1. From the alternatives given under each bit, write serially the correct answer along with its serial number against each bit : [1x12=12]

a) Set of all even numbers between 10 and 14, is:
i) {10, 11, 12, 13, 14} ii) {11, 13}
iii) {10, 12,14} iv) {12, 14}

b) Number of quartiles which a frequency distribution has, is:
i) 1 ii) 2
iii) 3 iv) 4

c) The derivative of a constant, K is:
i) K ii) $\frac{1}{K}$
iii) 1 iv) 0

d) The Median of 21, 24, 39,30 and 48 is:
i) 21 ii) 24
iii) 39 iv) 30

e) The nth root of product of n observations is called:
i) Harmonic Mean
ii) Geometric Mean
iii) Arithmetic Mean
iv) Mode

f) A measure of dispersion which is not a relative measure:
i) Quartile Deviation
ii) Coefficient of Mean Deviation
iii) Coefficient of standard Deviation
iv) Coefficient of Variation

g) Sum of absolute deviations is minimum when measured from:
i) Extreme values ii) Mean
iii) Median iv) Mode

h) $\lim_{x \to a} \frac{x^3 - a^3}{x^2 - a^2}$ is equal to :
i) $\frac{3}{2}$ ii) $\frac{3a}{2}$
iii) $\frac{2}{3a}$ iv) $\frac{a}{3}$

i) In $\int f(x)dx$, $f(x)$ is called:
i) Integral
ii) Integrand
iii) Constant of Integration
iv) Integration

j) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ is not a:
i) Identity Matrix ii) Square Matrix
iii) Diagonal Matrix iv) Zero Matrix

k) $\begin{vmatrix} 3 & 2 \\ -1 & 4 \end{vmatrix}$ is equal to :
i) -10 ii) 10
iii) 12 iv) 14

l) The arithmetic mean of first 5 natural numbers is:
i) 3 ii) 4
iii) 5 iv) 6

2. Answer the following questions as per instructions in each bit: [1x12=12]

a) Rectify the <u>underlined portion</u> of the following sentences:

i) <u>Chain Rule</u> is applied to solve equations using determinants.

ii) In a continuous function:
$\lim_{x \to a^-} f(x) = \underline{f(x)} = \lim_{x \to a^+} f(x)$

iii) Harmonic Mean of 10 and 15 , is <u>13</u>.

b) Fill in the blanks:

iv) The process of differentiation and integration are _____ to each other.

v) Semi-interquartile range is also known as _____.

vi) Adjoint of the matrix $\begin{pmatrix} 2 & -1 \\ -4 & -3 \end{pmatrix}$ is _____.

c) Express each of the following in one word/term :

vii) A set, which contains all subsets of a given set.

viii) The alternative name of differential coefficient.

ix) Values that divide a frequency distribution into ten equal parts.

d) Answer each of the following questions in one sentences :

x) What is coefficient of variation ?

xi) What is positional average ?

xii) Differentiate x^4 with respect to x^2.

Group-B

3. Answer any ten of the following questions within 30 words each : [2x10=20]

(a) Show that the following function is discontinuous at x = 2:

$$f(x) = \begin{cases} 4 \text{ when } & x > 2 \\ 1 \text{ when } & x \le 0 \end{cases}$$

(b) Find the differential coefficient of $\frac{1}{(2x+7)^5}$.

(c) Find the integral of the function $\left(x - \frac{1}{x}\right)^2$.

(d) The sum of 50 observations is 500. Find their arithmetic mean.

(e) Find the Geometric Mean of 27, 125 and 343.

(f) Define Harmonic Mean.

(g) Find the first and third quartiles of the following data :

Marks	10	20	30	40	50	60
Number of Students	3	6	8	15	5	2

(h) Explain Range and Coefficient of Range.

(i) If mean and standard deviation of runs scored by A and B are 50 and 15 respectively then, find its coefficient of variation.

(j) The coefficient of variation of a distribution is 60% and its mean is 20. Find its standard deviation.

(k) Find the adjoint of the matrix $A = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$.

(l) Evaluate : $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$.

(m) Give one numerical example each of constant function and identity function.

4. Answer any four of the following questions within 50 words each :

(a) Compute the median from the following data :

2, 4, 8, 10, 12, 20, 25, 15, 30, 32 and 40

(b) State any three demerits of mean deviation.

(c) If A = {1, 3, 5, 7, 9}, B = {2, 4, 6, 8, 10} and C = (3, 4, 7, 8, 11, 12}.

Show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

(d) Identify the following functions as odd or even function :

(i) $f(x) = x^2 + 5$

(ii) $f(x) = x^3 - x$

(iii) $f(x) = 19x^4 - 7x^2 + 1$

(e) Evaluate :

$$\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$$

(f) Find the derivative of $\frac{x^2+9}{x+2}$ with respect to x.

Group-C

Answer any three of the following questions :[8x3=24]

5.

Age (in years)	Number of persons (in thousands)
Below 10	2
Below 20	5
Below 30	9
Below 40	12
Below 50	14
Below 60	15
Below 70	15.5
70 and above	15.6

6. From the following data, Calculate the standard deviation and the coefficient of variation :

Marks	4	6	8	10	12	14	16
Number of Students	2	3	6	8	5	3	2

7. Explain the merits and demerits of arithmetic mean.

8. Solve the following equations by using Cramer's Rule :

$x + 2y + 3z = 6$

$2x + y + z = 4$

$x + y + 2z = 4$

9. (a) Evaluate :

$$\int 3x^2(x^3 + 9)dx$$

(b) If $\frac{d[f(x)]}{dx} = 3x^2 - 2x$ and f(2)=0 find f(x).

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ANSWERS 2018 (A)

Group - A

1. a) iii) {10, 12,14}
   b) iii) 3
   c) iv) 0
   d) iv) 30
   e) ii) Geometric Mean
   f) i) Quartile Deviation
   g) iii) Median
   h) ii) $\frac{3a}{2}$
   i) i) Integral
   j) iv) Zero Matrix
   k) iv) 14
   l) i) 3

2. a) i) Crammers Rule
   ii) f(a)
   iii) 6
   b) iv) Reverse / Opposite
   v) Quartile Deviation
   vi) $\begin{pmatrix} -4 & 1 \\ 3 & 2 \end{pmatrix}$
   c) vii) Power Set
   viii) Derivative
   ix) Describe
   d) x) Co-efficient of variation is a relative measure of dispersion and found out by using the following formula

$$\frac{S.D.}{Mean} \times 100$$

   xi) Average whose value is foundout simply by location or by locating its position in the distribution is called positional average.

   xii) $y = x^4$

$$\frac{dy}{dx} = \frac{d}{dx}x^4 = \frac{d}{dx}(x^2)^2 = 2x^2$$

Group - B

3. a) $f(x) = \begin{cases} 4 \text{ When } x > 2 \\ 1 \text{ When } x \le 0 \end{cases}$

$\lim_{x \to 2^+} f(x) = 4$

$\lim_{x \to 2^-} f(x)$ is undefined

RHL ≠ LHL

Hence the function is discontinuous.

b) $y = \frac{1}{(2x+7)^5}$

$\frac{dy}{dx} = \frac{d}{dx} \frac{1}{(2x+7)^5}$

$= \frac{d}{dx} (2x+7)^{-5}$

Let $t = (2x+7)$

$y = (2x+7)^{-5} = t^{-5}$

By Chain rule

$\frac{dy}{dx} = \frac{dy}{dt} x \frac{dt}{dx}$

$= \frac{dt^{-5}}{dt} x \frac{d(2x+7)}{dx}$

$= -5t^{-5-1} \left(\frac{d}{dx} 2x + \frac{d}{dx} 7 \right)$

$= -5t^{-6}(2+0)$

$= -5 \frac{1}{t^{-6}} .2$

$= -10 \frac{1}{(2x+7)^6}$

c) $\int \left(x - \frac{1}{x} \right)^2 dx$

$= \int \left(x^2 - 2x . \frac{1}{x} + \frac{1}{x^2} \right) dx$

$= \int x^2 dx - \int 2dx + \int \frac{1}{x^2} dx + C$

$= \frac{x^3}{3} - 2x + \frac{x^{-1}}{-1} + C$

$= \frac{x^3}{3} - 2x - \frac{1}{x} + C$

d) Given $\sum X = 500$

$N = 50$

$\bar{X} = \frac{\sum X}{N} = \frac{500}{50} = 10$

e) G.M. of 27, 125 and 343 is

$\sqrt[3]{27 \text{ x } 125 \text{ x } 343}$

$= \sqrt[3]{3 \text{ x } 3 \text{ x } 3 \text{ x } 5 \text{ x } 5 \text{ x } 5 \text{ x } 7 \text{ x } 7 \text{ x } 7}$

$= 3 \text{ x } 5 \text{ x } 7$

$= 105$

f) Harmonic Mean is the raciprocal of the A.M. of the raciprocal of the values of the variable. Thus symbolically

H.M. = Raciprocal of $\frac{\sum \frac{1}{x}}{N} = \frac{N}{\sum \frac{1}{X}}$

g)

X	f	C.f.
10	3	3
20	6	9
30	8	17
40	15	32
50	5	37
60	2	39

$Q_1 = \frac{N+1}{4}$ th item

$= \frac{39+1}{4} = \frac{40}{4} = 10$ th item

$\therefore Q_1 = 30$

$Q_3 = 3 \frac{(N+1)}{4} = \frac{3(39+1)}{4} = 30$ th item

$\therefore Q_3 = 40$.

h) Range is the difference between the largest value and smallest value in a series. It is an absolute measure of dispersion. Range is symbolically written as L-S.

Where L - Largest Value

S - Smallest Value

Co-efficient of range is a relative measure and symbolically written as $\frac{L-S}{L+S}$.

i) Co-efficient of variation is $\frac{\sigma}{\bar{X}} x 100$

Given $\sigma = 15, \bar{X}50$

The C.V. $= \frac{15}{50} x 100 = 30\%$

j) C.V. $= \frac{\sigma}{\bar{X}} x 100$

$\therefore \sigma = \frac{\text{C.V. x } \bar{X}}{100} \quad \therefore \frac{60 \text{ x } 20}{100} = 12$

k) $A = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$

$C_{11} = (-1)^{1+1}.4 = 4$

$C_{12} = (-1)^{1+2}.1 = -1$

$C_{21} = (-1)^{2+1}.3 = -3$

$C_{22} = (-1)^{2+2}.2 = 2$

Cofactor Matrix of $A = \begin{pmatrix} 4 & -1 \\ -3 & 2 \end{pmatrix}$

Adjoint of $A = \begin{pmatrix} 4 & -3 \\ -1 & 2 \end{pmatrix}$

l) $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$

$= 2\begin{vmatrix} 0 & 4 \\ 5 & -7 \end{vmatrix} - (-3)\begin{vmatrix} 6 & 4 \\ 1 & -7 \end{vmatrix} + 5\begin{vmatrix} 6 & 0 \\ 1 & 5 \end{vmatrix}$

= 2(0 - 20) - (- 3)(- 42 - 4) + 5(30 - 0)

= (2 x -20) - (- 3)(- 46) + (5 x 30)

= - 40 - 138 + 150

= - 178 + 150

= - 28.

m) Constant function f(x)=C. Where C is a constant.

f(x) = 5

Identity function f(x) = x

$\therefore f(5) = 5$

4. (a) For finding median the data must be arranged in ascending or descending order. thus after arrangement we get.

2, 4, 8, 10, 12, 15, 20, 25, 30, 32, 40

Total No. of items 11.

Median is $\frac{N+1}{2}$ th item i.e. $\frac{11+1}{2} = 6$ th item, 6th item is 15. Hence median is 15.

(b) The demerits of mean deviation are

(i) It ignores the '+' and '-' signs which is illogical

(ii) It is not capable of further algebraic treatment

(iii) It is difficult to calculate when Mean, Median or Mode is a fraction.

(c) $A = \{1, 3, 5, 7, 9\}$

$B = \{2, 4, 6, 8, 10\}$

$C = \{3, 4, 7, 8, 11, 12\}$

$B \cup C = \{2,3,4,6,7,8,10,11,12\}$

$A \cap B = \{\varnothing\}$

$A \cap C = \{3,7\}$

$(A \cap B) \cup (A \cap C) = \{3,7\}$

$A \cap (B \cup C) = \{3,7\}$

$\therefore A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

(d) (i) $f(x) = x^2 + 5$

$= (-x)^2 + 5 = x^2 + 5$

Even Function.

(ii) $f(x) = x^3 - x = (-x)^3 - (-x)$

$= -x^3 + x = -(x^3 - x)$

$f(x) \neq f(-x)$

$\therefore$ Odd function.

(iii) $f(x) = 19x^4 - 7x^2 + 1$

$= 19(-x)^4 - 7(-x)^2 + 1$

$= 19x^4 - 7x + 1$

$f(x) = f(-x)$

$\therefore$ Even function.

(e) $\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$

Multiplying by $\sqrt{1+x} + \sqrt{1-x}$ we will get

$$\lim_{x \to 0} \frac{(\sqrt{1+x} - \sqrt{1-x})(\sqrt{1+x} + \sqrt{1-x})}{x(\sqrt{1+x} + \sqrt{1-x})}$$

$$= \lim_{x \to 0} \frac{(\sqrt{1+x})^2 - (\sqrt{1-x})^2}{x(\sqrt{1+x} + \sqrt{1-x})}$$

$$= \lim_{x \to 0} \frac{1+x-1+x}{x(\sqrt{1+x} + \sqrt{1-x})}$$

$$= \lim_{x \to 0} \frac{2x}{x(\sqrt{1+x} + \sqrt{1-x})}$$

$$= \lim_{x \to 0} \frac{2}{\sqrt{1+x} + \sqrt{1-x})}$$

$$= \frac{2}{\sqrt{1+0} + \sqrt{1-0}} = \frac{2}{1+1} = 1$$

(f) $y = \frac{x^2 + 9}{x + 2}$

$$\frac{dy}{dx} = \frac{d}{dx}\frac{x^2+9}{x+2}$$

$$= \frac{(x+2)\frac{d}{dx}(x^2+9) - (x^2+9)\frac{d}{dx}(x+2)}{(x+2)^2}$$

$$= \frac{(x+2)(2x+0) - (x^2+9)(1+0)}{(x+2)^2}$$

$$= \frac{(x+2)2x - x^2 - 9}{(x+2)^2}$$

$$= \frac{2x^2 + 4x - x^2 - 9}{(x+2)^2}$$

$$= \frac{x^2 + 4x - 9}{(x+2)^2}$$

Group - C

5.

X	f	C.f.
0 – 10	2	2
10 – 20	3	5
20 – 30	4	9
30 – 40	3	12
40 – 50	2	14
50 – 60	1	15
70 – 60	0.5	15.5
70 – 80	0.1	15.6

Median = $\frac{N}{2}$ th item

$= \frac{15.6}{2} = 7.8$ th item.

Thus median class is 20-30.

Median $= L_1 + \frac{L_2 - L_1}{f_1}(M - C)$

Given $L_1 = 20 \quad L_2 = 30$

$f_1 = 4 \quad m = N/2 = 7.8$

C = 5.

$$\text{Median} = 20 + \frac{30-20}{4}(7.8-5)$$

$$= 20 + \frac{10}{4} \times 2.8 = 20 + \frac{20}{4} = 27$$

$\therefore$ Median age is 27 years.

6.

X	f	X – A		fd_1	d^2	fd^2
4	2	–6	–3	–6	9	18
6	3	–4	–2	–6	4	12
8	6	–2	–1	–6	1	6
10	8	0	0	0	0	0
12	5	+2	1	5	1	5
14	3	4	2	6	4	12
16	2	6	3	6	9	18
	$\sum f = 29$			$\sum fd_1 = -1$		$\sum fd^2 = 91$

Assumed Mean (A) = 10

$$\bar{X} = A + \frac{\sum fd_1}{\sum f} \times i$$

$$= 10 + \frac{-1}{29} \times 2$$

$$= 10 - \frac{2}{29}$$

$$= 10 - 07 = 9 - 93$$

$$\sigma = \sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2} \times 2$$

$$= \sqrt{\frac{71}{29} - \left(\frac{-1}{29}\right)^2} \times 2$$

$$= \sqrt{2.448 - 0.001 \times 2}$$

$$= 1.56 \times 2 = 3.12.$$

$$\text{C.V.} = \frac{\sigma}{\bar{X}} \times 100$$

$$= \frac{3.12}{9.93} \times 100 = 31.42.$$

7. The merits and demerits of A.M. can be stated as follows :

Mertis :

(i) It is easy to calculate

(ii) It is simple to understand

(iii) It is rigrdly defined

(iv) It is based on all the observations

(v) It is capable of further mathematical treatment

(vi) It is least affected by sampling flucutations.

(vii) It is considered the best average for comparing two or more series.

Demerits

(i) When all values are not known it is not possible to calculate A.M.

(ii) It is affected by presence of extreme values in the series.

(iii) It is not possible to find out mean graphically.

(iv) It may not be represented in the actual data and as such is theoritical in nature.

(v) It has not use in case of qualitative data like, honesty, beauty, affection, emotion etc.

8. $x + 2y + 3z = 6$

$2x + y + z = 4$

$x + y + 2z = 4$

$$D = \begin{vmatrix} 1 & 2 & 3 \\ 2 & 1 & 1 \\ 1 & 1 & 2 \end{vmatrix}$$

$$= 1\begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} - 2\begin{vmatrix} 2 & 1 \\ 1 & 2 \end{vmatrix} + 3\begin{vmatrix} 2 & 1 \\ 1 & 1 \end{vmatrix}$$

= 1(2 - 1) -2 (4 - 1) + 3 (2 - 1)

= 1.1 - 2.3 + 3.1

= 1 - 6 + 3 = - 2

$$D_1 \begin{vmatrix} 6 & 2 & 3 \\ 4 & 1 & 1 \\ 4 & 1 & 2 \end{vmatrix}$$

$$= 6\begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} - 2\begin{vmatrix} 4 & 1 \\ 4 & 2 \end{vmatrix} + 3\begin{vmatrix} 4 & 1 \\ 4 & 1 \end{vmatrix}$$

= 6 (2 - 1) - 2 (8 - 4) + 3 (4 - 4)

= 6-8+0=-2

$$D_2 \begin{vmatrix} 1 & 6 & 3 \\ 2 & 4 & 1 \\ 1 & 4 & 2 \end{vmatrix}$$

$$= 1\begin{vmatrix} 4 & 1 \\ 4 & 2 \end{vmatrix} - 6\begin{vmatrix} 2 & 1 \\ 1 & 2 \end{vmatrix} + 3\begin{vmatrix} 2 & 4 \\ 1 & 4 \end{vmatrix}$$

= 1(8 - 4) - 6 (4 - 1) + 3 (8 - 4)

= 4 - 18 + 12 = -2

$$D_3 \begin{vmatrix} 1 & 2 & 6 \\ 2 & 1 & 4 \\ 1 & 1 & 4 \end{vmatrix}$$

$$= 1\begin{vmatrix} 1 & 4 \\ 1 & 4 \end{vmatrix} - 2\begin{vmatrix} 2 & 4 \\ 1 & 4 \end{vmatrix} + 6\begin{vmatrix} 2 & 1 \\ 1 & 1 \end{vmatrix}$$

= 1(4 - 4) - 2 (8 - 4)+ 6 (2 - 1)

= 0 - 8 + 6 = -2

$$X = \frac{D_1}{D} = \frac{-2}{-2} = 1$$

$$Y = \frac{D_2}{D} = \frac{-2}{-2} = 1$$

$$Z = \frac{D_3}{D} = \frac{-2}{-2} = 1.$$

9. (a) $\int 3x^2(x^3 + 9)dx$

$= \int (3x^5 + 27x^2)dx$

$= \int 3x^5dx + \int 27x^2dx$

$= \int 3x^5dx + \int 27x^2dx + C$

$= 3\int x^5dx + 27\int x^2dx + C$

$= 3\frac{x^6}{6} + 27\frac{x^3}{3} + C$

$= \frac{x^6}{2} + 9x^3 + C$

(b) $\frac{d}{dx}f(x) = 3x^2 - 2x$

$f(x) = \int (3x^2 - 2x)dx$

$= 3\int x^2dx - 2\int xdx + C$

$= 3\frac{x^3}{3} - 2\frac{x^2}{2} + C$

$= x^3 - x^2$

When f(2) then $f(2) = 2^3 - 2^2 + C$

$= 8 - 4 = 4$

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GROUP - A

OBJECTIVE TYPE QUESTIONS

1. From the alternatives given under each bit, choose and write serially the correct answer alongwith its serial number against each bit.

Matrices

1. A matrix with single column and any number of rows is known as :
   (a) Unit Matrix (b) Row Matrix
   (c) Column Matrix (d) Singular Matrix

2. If the determinant of a matrix is zero, the matrix is called :
   (a) Column matrix (b) Row matrix
   (c) Singular matrix (d) Unit matrix

3. A, 2 x 2 matrix whose elements are given by $a_{ij} = i + j$ is.
   (a) $\begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ (b) $\begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$
   (c) $\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$ (d) $\begin{pmatrix} 4 & 2 \\ 2 & 1 \end{pmatrix}$

4. $\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$ is a
   (a) Identity matrix (b) Row matrix
   (c) Singular matrix (d) Unit matrix

5. $(2\ 3\ 5) \times \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} = ?$
   (a) 13 (b) 15
   (c) 23 (d) 18

6. If two matrices are in same order they are called :
   (a) Equal matrices
   (b) Equivalent matrices
   (c) Square matrices
   (d) sub matrices

7. Non singular matrix is a square matrix the value of whose determinant is
   (a) Zero (b) One
   (c) Not Zero (d) Negative

8. If matrix 'A' is symmetric as well as skew symmetric then 'A' is a
   (a) Diaginal matrics (b) Zero matrix
   (c) Identity matrix (d) Unit matrix

9. If A is a symmetric matrix then :
   (a) $A^1 = -A$ (b) $A = A^{-1}$
   (c) $A^1 = A^{-1}$ (d) $A = A^1$

10. If $\begin{pmatrix} x-3 & 5 \\ 3 & x-2 \end{pmatrix}$ is $\begin{pmatrix} 8 & 5 \\ 3 & 9 \end{pmatrix}$ then x=?
    (a) 10 (b) 11
    (c) 8 (d) -1

11. A row matrix has only
    (a) One element
    (b) One row and two columns
    (c) One row with one or more columns
    (d) One column with on any rows

12. The inverse of $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$ is :
    (a) $\begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} -1 & 1 \\ 0 & 1 \end{pmatrix}$
    (c) $\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$ (d) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

13. The matrix obtained by interchanging the rows and columns of a matrix is called.
    (a) Transpose matrix
    (b) Adjoint matrix
    (c) Inverse matrix
    (d) Symmetric matrix

14. If the transpose of a matrix is the matrix itself, then the matrix is called.
    (a) Adjoint matrix
    (b) Symmetic matrix
    (c) Inverse matrix
    (d) Skew symmetric matrix

15. The Cofactor of 3 in $\begin{vmatrix} 1 & 3 & 1 \\ 2 & 4 & 1 \\ 2 & 4 & 2 \end{vmatrix}$ is

(a) 2 (b) -2
(c) 4 (c) -4

16. The inverse of matrix $\begin{vmatrix} 1 & 2 \\ 2 & 4 \end{vmatrix}$ can not be found out as it is a :

(a) Singular matrix
(b) Indentity matrix
(c) Non singular matrix
(d) Square matrix

Determinant

17. If two rows/columns of a determinant are identical then the value of the determinant is :

(a) 1 (b) 0
(c) ∞ (d) Negative

18. The minor of the element 1 in the determinant $\begin{vmatrix} 2 & 3 & 4 \\ 4 & 5 & 6 \\ 1 & 2 & 3 \end{vmatrix}$ is :

(a) -3 (b) 3
(c) 18 (d) 20

19. The value of $\begin{vmatrix} 4 & 3 \\ 2 & 4 \end{vmatrix}$ is :

(a) 16 (b) -10
(c) -8 (d) 10

20. The cofactor of M_{12} is :

(a) $(-1)^3 M_{12}$ (b) $(1)^3 M_{12}$
(c) $(-1)^2 M_{12}$ (d) M_{12}

21. If $\begin{vmatrix} x & 4 \\ 2 & 2 \end{vmatrix} = 0$ then the value of x is :

(a) 2 (b) 8
(c) 4 (d) 16

22. The value $\begin{vmatrix} 6 & 4 \\ 12 & 8 \end{vmatrix}$ is equal to :

(a) $3\begin{vmatrix} 2 & 4 \\ 4 & 8 \end{vmatrix}$ (b) $2\begin{vmatrix} 3 & 2 \\ 6 & 2 \end{vmatrix}$

(c) $6\begin{vmatrix} 1 & \frac{2}{3} \\ 2 & \frac{4}{3} \end{vmatrix}$ (d) $4\begin{vmatrix} 6 & 1 \\ 3 & 2 \end{vmatrix}$

23. The cofactor of '2' in $\begin{vmatrix} 4 & 2 \\ 3 & 4 \end{vmatrix}$ is :

(a) -3 (b) -4
(c) 2 (d) 4

24. Crammer's rule solve a system of linear aquations using.

(a) Matrices (b) Differentiation
(c) Integration (d) Determinant

25. If all the elements of a column/row of a determinant is '0' there the value of the determinant is :

(a) One (b) Zero
(c) Minus One (d) Two

Set Theoy

26. If $A \cap B = B$ then

(a) $A \subseteq B$
(b) $B \subseteq A$
(c) A and B are disjoint sets.
(d) $A = \varnothing$

27. When $A \cap B = \varnothing$:

(a) $A \subseteq B$
(b) $B \subseteq A$
(c) A and B are disjoint sets
(iv) A = B

28. If A = {A} then A is 0 :

(a) Null set (b) Single ton set
(c) Infinite set (d) Power set

29. If $A \subseteq B$ and $B \subseteq A$ then A and B are :

(a) Equivalent sets
(b) Equal sets
(c) Disjoint sets
(d) Complementary sets

30. If $A \subseteq B$ and $B \not\subset A$ then A is called :
(a) Proper subset of B
(b) Subset of B
(c) Complement of B
(d) Univresal set of B

31. Number of subsets a set of 5 elements can have is :
(a) 5 (b) 10
(c) 25 (d) 20

32. Number of proper subset a set of 4 elements can have is :
(a) 4 (b) 16
(c) 15 (d) 32

Function

33. The function $f(x) = \frac{10}{x-2}$ is undefined when the values of x is
(a) 2 (b) 4
(c) 7 (d) 5

34. $y = 10^x$ is a
(a) Linear function
(b) Constant function
(c) Trigonmetric function
(d) Exporentral function

35. The inverse of the function $y = 2x - 3$ is :
(a) $x = \frac{3-y}{2}$ (b) $x = \frac{y+3}{2}$
(c) $x = \frac{y-3}{2}$ (d) $x = \frac{2-y}{3}$

36. If $f(x) = 3x + 7$, then $f(2)$ is equal to :
(a) 12 (b) 13
(c) 14 (d) 15

37. If $A = \{1,2,3\}$ $B\{4, 5\}$ and $f(1,4), (2,4), (3,5)$ then $f \to B$ is a
(a) One-One into function
(b) One-One onto function
(c) Many-One into function
(d) Many-One onto function

38. If f(x)=5 then it is a/an
(a) Into function (b) Onto function
(c) Constant function (d) Inverse function

39. $y^2 = x^2 + 2xy + y$ is a/an
(a) Implicity function
(b) Constant function
(c) Explicity function
(d) Linear function

40. Which one of the following is an even function
(a) $f(x) = 3x^2 + 2x^4$
(b) $f(x) = \frac{1}{x}$
(c) $f(x) = 4x^5 + 2x^3 + 2x$
(d) $f(x) = e^{3x} - e^{-3x}$

Limit & Continuity

41. $\lim_{x \to a} \frac{x^3 - a^3}{x - a}$ is equal to
(a) $\frac{3}{2}$ (b) $\frac{3a}{2}$
(c) $\frac{2}{3a}$ (d) $3a^2$

42. $\lim_{x \to 4} \frac{xz^2 - 16}{x - 4}$ is equal to
(a) 4 (b) 8
(c) -8 (d) 16

43. $\lim_{x \to \infty} \frac{ax^2 + bx + c}{cx^2 + d}$ is equal to
(a) $\frac{b}{c}$ (b) $\frac{c}{d}$
(c) $\frac{a}{c}$ (d) $\frac{a}{d}$

44. x tends to zero from the right means
(a) x is positive and inifinitely small
(b) x is negative and inifinitely small
(c) x is equal to zero
(d) x is equal to one

45. $\lim_{x \to a} \frac{x^n - a^n}{x - a}$ is equal to
(a) an^{-1} (b) na^{n-1}
(c) na^n (d) an

46. If a function is defined by

$$f(x)=\begin{cases}5x-4 & 0<x\le 1\\ 4x^3-3 & 1<\le 2\end{cases}$$

(a) It is continuous at x = 1
(b) it is continuous at x = 3
(c) It is continuous at x = 4
(d) It is continous at x = 2

47. $\lim\limits_{x-2}\dfrac{x^3+8}{x+2}$ is equal to

(a) 0 (b) 4
(c) 12 (d) 8

48. $\lim\limits_{x\to 0}\dfrac{e-1^{1/x}}{x}$ is equal to

(a) 1 (b) 3
(c) 0 (d) x

Differentiation

49. As per the chain rule $\dfrac{dy}{dx}$ is equal to

(a) $\dfrac{dy}{du}x\dfrac{dy}{dx}$ (b) $\dfrac{dx}{du}x\dfrac{dx}{dy}$

(c) $\dfrac{dy}{du}\bullet\dfrac{du}{dx}$ (d) $\dfrac{du}{dy}x\dfrac{dx}{du}$

50. The differential co-efficient of a constant 'C' is

(a) C (b) $\dfrac{1}{C}$

(c) C^2 (d) 0

51. The second order derivative of x^2 w.r.t. x is

(a) 2x (b) x

(c) $\dfrac{1}{x}$ (d) 2

52. Derivative of $7x^2$ w.r.t. x is

(a) x^2 (b) 14x
(c) 7x (d) $14x^2$

53. $\dfrac{d}{dx}\text{Log}_e{}^x$ is equal to

(a) x (b) 2x
(c) 1/x (d) e

54. The derivative of $\sqrt{x}$ w.r.t. x is

(a) $\dfrac{1}{2}\sqrt{x}$ (b) $\dfrac{1}{2}\bullet x^{\frac{3}{2}}$

(c) $\dfrac{1}{2}x\sqrt{x}$ (d) $\dfrac{1}{2\sqrt{x}}$

55. $\dfrac{d}{dx}\left(\dfrac{1}{x}\right)$ is equal to :

(a) x^2 (b) $-x^2$

(c) $\dfrac{1}{x^2}$ (d) $-\dfrac{1}{x^2}$

56. If $f(x)=\left(x+\dfrac{1}{x}\right)^2$ then f^1 is equal to :

(a) 0 (b) 1
(c) 2 (d) -1

57. If u and v are two differentiable function of x then $\dfrac{d}{dx}(u+v)$ is equal to :

(a) $\dfrac{du}{dx}-\dfrac{dv}{dx}$ (b) $\dfrac{du}{dx}+\dfrac{dv}{dx}$

(c) $\dfrac{du}{dx}x\dfrac{dx}{dv}$ (d) $\dfrac{du}{dx}-\dfrac{dv}{dx}$

58. When $y=\sqrt[3]{x}$ $\dfrac{dy}{dx}$ is equal to :

(a) $x^{\frac{2}{3}}$ (b) $\dfrac{1}{3}x^{-\frac{2}{3}}$

(c) $3x^{\frac{2}{3}}$ (d) $\dfrac{2}{x}x^3$

59. The second order differential co-efficient of the function $y=x^4$ is equal to

(a) $7x^6$ (b) $210x^4$
(c) $42x^5$ (d) $840x^3$

Integration

60. $\int nx^{n-1}\,dx$ is equal to

(a) x^{n-1} (b) x^n
(c) x^n+C (d) C

61. $\int 5x^3\,dx$ is equal to

(a) $\dfrac{5}{4}x^3$ (b) $\dfrac{5}{4}x^4+C$
(c) $5x^4+C$ (d) $5x^4$

62. Integration is the reverse process of
(a) Function (b) Determinant
(c) Differentation (d) Logarithm

63. $\int \text{Log}\, x\, dx$ is equal to :
(a) $\frac{1}{x} + C$ (b) $x(\text{Log}\, x + 1)$
(c) $(\text{Log}\, x)^2 + C$ (d) $\frac{1}{2}(\text{Log}\, x)^2 + C$

64. $\int 9^{x-2} dx$ is equal to :
(a) 9x + C (b) 18x + C
(c) $-9x^{-1} + C$ (d) $9x^2 + C$

65. $\int 5^x dx = ?$
(a) Log e^5+C (b) 5^x+C
(c) $\frac{5^x}{\text{Log}\, e^5} + C$ (d) $\frac{5^{2x}}{\text{Log}\, e^5}$

66. $\int e^{5x}\, dx = ?$
(a) e^{5x} (b) $\frac{e^{5x}}{5} + C$
(c) $5e^x + C$ (d) $e^{5x} + C$

67. $\int \frac{1}{x^2 - 16} dx =$
(a) $\frac{1}{8}\text{Log}\left(\frac{x-4}{x+4}\right) + C$
(b) $\frac{x-4}{x+4} + C$
(c) Log $(x^2 - 16)$
(d) $\text{Log}\left(\frac{x-4}{x+4}\right)$

68. $\int (3x^2 + 4x^3 + 5x^4 + 6) dx = ?$
(a) $6x^3 + 12x^4 + 20x^5 + C$
(b) $x^5 + x^4 + x^3 + C$
(c) $\frac{x^3}{3} + \frac{x^4}{4} + \frac{x^5}{3} + C$
(d) Zero

69. Constant of integration appears in
(a) Indefinite integrals
(b) Definite integrals
(c) All types of integrals
(d) Derivatives

70. $\int (3x - 7)^5 dx$ is
(a) $\left(\frac{3x-7}{6}\right)^6 + C$ (b) $\frac{(3x-7)^6}{18} + C$
(c) $\frac{(3x-7)^5}{15} + C$ (d) $\frac{(3x-7)^6}{3} + C$

71. $\int x^n dx =$
(a) $x^n + C$ (b) $\frac{x^n + 1}{n}$
(c) $\frac{x^n + 1}{n+1} + C$ (d) $\frac{x^n + 1}{n-1} + C$

Measures of Central Tendency

72. The sum of deviations taken from Arithmetic Mean is always equal to
(a) One (b) Zero
(c) Median (d) Assumed Mean

73. Harmonic Mean gives greater weightage to
(a) Larger items (b) Smaller items
(c) Middle items (d) Average values

74. When all the values in a series differ in size the relationship between A.M. G.M. and H.M. is
(a) AM > GM > HM (b) GM > AM > HM
(c) HM > GM > AM (d) AM > HM > GM

75. If Arithmetic Mean of two numbers is 8 and Harmonic mean is 2 then their Geometric mean will be :
(a) 5 (b) 3
(c) 4 (d) 16

76. If Mean of 7, 8, 10, x, 9 is 8, the value of x is :
(a) 8 (b) 10
(c) 6 (d) 12

77. The Arithmetic Mean of first 20 natural numbers is
(a) 110 (b) 210
(c) 310 (d) 420

78. The Geometic Mean of 3, 6, 24 and 48 is
(a) 9 (b) 10
(c) 12 (d) 22

79. If the algebric sum of deviations of 10 numbers taken from 8 is 25 then the Arithmetic Mean of the distribution is :
(a) 10 (b) 10.5
(c) 11 (d) 11.5

80. The Median of 2, 6, 5, 8, 10 is
(a) 5 (b) 6
(c) 6.5 (d) 8

81. In a symmetric distribution the 1st and 3rd quartiles are equidistant from :
(a) Mean (b) Median
(c) Mode (d) G.M.

82. Quartiles divide a series into :
(a) Three equal parts
(b) Four equal parts
(c) Eight equal parts
(d) Ten equal parts

83. The 2nd Quartile of a distribution is equal to:
(a) Mean (b) Mode
(c) Median (d) Range

84. In a moderately symmetric distribution Mode is equal to
(a) 3 mean - 2 Median
(b) 3 Median - 2 Mean
(c) 2 Median - 3 Mean
(d) 2 Mean - 3 Median

85. Sum of deviations of the values of variables ignoring '+' and '-' signs is minimum when taken from.
(a) Mean (b) Median
(c) Mode (d) Weighted A.M.

86. G.M. of two numbes is 16. If one is 4, the other number is :
(a) 32 (b) 64
(c) 16 (d) 4

87. If G.M. of 4 numbers is 5; then their product is
(a) 125 (b) 625
(c) 525 (d) 600

88. The value of the median is equal to :
(a) P_{10} (b) Q_3
(c) D_8 (d) Q_2

89. One of the following is not a measure of central tendency. That is :
(a) Mean (b) Mode
(c) Mean Deviation (d) Median

90. Harmonic Mean of 5, 10 and 30 is
(a) 3 (b) 9
(c) $\frac{10}{30}$ (d) 15

91. The nth root of product of n observations is called
(a) Harmonic Mean (b) Weighted A.M.
(c) Arithmetic Mean (d) Geometric Mean

92. The Median of 8, 6, 12, 16 is :
(a) 8 (b) 12
(c) 10 (d) 6

93. The cummulative frequency curve is also known as :
(a) Lorenzo curve (b) Histogram
(c) Ogive (d) Pictogram

Measures of Dispersion

94. An absolute measure of dispersion is expressed in
(a) Ratio (b) Percentage
(c) Decimal (d) Unit of orignal data

95. A measure of dispersion which is not a relative measure
(a) Quartile Deviation
(b) Coefficient of Mean Deviation
(c) Co-efficient of Standard Deviation
(d) Co-efficient of Variation

96. The difference between the greatest and smallest values of a distribution is called
(a) Range (b) Quartile Deviation
(c) Mean Deviation (d) Standard Deviation

97. The most preferred measure of central tendency used for calculation of Mean Deviation is :
(a) Mean (b) Median
(c) Mode (d) Geometric Mean

98. Measure of dispersion, that is based on all the observations of a series.
(a) Range
(b) Inter Quartile Range
(c) Mean Deviation
(d) Quantile Deviation

99. If each observation of a series is reduced by 5 then the standard deviation of the new observations is
(a) Reduced by 5 (b) Increased by 5
(c) Not changed (d) Divided by 5

100. If each observation of a series is devided by 5 then the standard deviation of the new series is
(a) Divided by 5 (b) Multiplied by 5
(c) Not charged (d) Decreased by 5

101. Standard Deviation of the natural numbers 1 to 5 is
(a) 2 (b) 3
(c) $\sqrt{2}$ (d) 2^{-2}

102. Co-efficient of variation is equal to :
(a) $\frac{\sigma}{x}$ (b) σ^2
(c) $\frac{\sigma}{x} x 100$ (d) $\frac{\sigma}{\text{Median}}$

103. Standard Deviation in otherwise known as:
(a) Variation
(b) Variance
(c) Root Mean Square Deviation
(d) Coefficient of Variation

104. Which of the following measure of dispresion is based on the middle 50% of items.
(a) Mean Deviation
(b) Quartile Deviation
(c) Standard Deviation
(d) Range

105. In a symmetric distribution the relationship among Q.D., M.D. and S.D. is
(a) QD < MD < SD (b) MD < QD < SD
(c) SD < MD < QD (d) QD = MD = SD

106. for the observations 5, 3, 9, 8, 12, 20, 25 the range is
(a) 20 (b) 22
(c) 17 (d) 25

107. In a symmetric distribution the relationship between Mean Deviation and standard deviation is :
(a) 3 MD = 2 SD (b) 2 MD = 3 SD
(c) 5 MD = 4 SD (d) 5 SD = 4 MD

108. The concept of Standard Deviation was developed by
(a) Coxton and Cowden
(b) Karl Pearson
(c) Lord Bowly
(d) Clark

109. Mean Deviation is not suitable in case of
(a) Inclusive series
(b) Exclusive series
(c) Open ended series
(d) Close inded series.

110. The most practical measure of dispersion used for the purpose of forecasting business cycle is
(a) Standard Deviation
(b) Range
(c) Quartile Range
(d) Mean Deviation

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GROUP - A
ANSWERS

1. From the alternatives given under each bit. Choose and write serailly the correct answer alongwith its serial number against each bit.

Matrices

1. (c) Column Matrix
2. (c) Singular matrix
3. (b) $\begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$
4. (a) Identity matrix
5. (c) 23
6. (b) Equivalent matrices
7. (c) Not Zero
8. (b) Zero matrix
9. (d) $A = A^1$
10. (b) 11
11. (c) One row with one or more columns
12. (c) $\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$
13. (a) Transpose matrix
14. (b) Symmetic matrix
15. (b) -2
16. (a) Singular matrix

Determinant

17. (b) 0
18. (b) 3
19. (d) 10
20. (a) $(-1)^3 M_{12}$
21. (c) 4
22. (a) $3\begin{vmatrix} 2 & 4 \\ 4 & 8 \end{vmatrix}$
23. (a) -3
24. (d) Determinant
25. (b) Zero

Set Theoy

26. (b) $B \subseteq A$
27. (c) A and B are disjoint sets
28. (b) Single ton set
29. (b) Equal sets
30. (a) Proper subset of B
31. (c) 25
32. (c) 15

Function

33. (a) 2
34. (d) Exponential function
35. (b) $x = \frac{y+3}{2}$
36. (b) 13
37. (d) Many-One onto function
38. (c) Constant function
39. (a) Implicity function
40. (a) $f(x) = 3x^2 + 2x^4$

Limit & Continuity

41. (d) $3a^2$
42. (b) 8
43. (c) $\frac{a}{c}$
44. (a) x is positive and inifinitely small
45. (b) na^{n-1}
46. (a) It is continuous at x = 1
47. (c) 12
48. (a) 1

Differentiation

49. (c) $\frac{dy}{du} \bullet \frac{du}{dx}$
50. (d) 0
51. (a) 2x
52. (b) 14x
53. (c) 1/x
54. (d) $\frac{1}{2\sqrt{x}}$
55. (d) $-\frac{1}{x^2}$
56. (a) 0
57. (b) $\frac{du}{dx} + \frac{dv}{dx}$
58. (b) $\frac{1}{3}x^{-\frac{2}{3}}$
59. (c) $42x^5$

Integration

60. (c) $x^n + C$
61. (b) $\frac{5}{4}x^4 + C$
62. (c) Differentation
63. (a) $\frac{1}{x} + C$
64. $-9x^{-1} + C$
65. (c) $\frac{5^x}{\text{Log}\, e^5} + C$
66. (b) $\frac{e^{5x}}{5} + C$
67. (a) $\frac{1}{8}\text{Log}\left(\frac{x-4}{x+4}\right) + C$
68. (c) $\frac{x^3}{3} + \frac{x^4}{4} + \frac{x^5}{3} + C$
69. (a) Indefinite integrals
70. (b) $\frac{(3x-7)^6}{18} + C$
71. (c) $\frac{x^{n+1}}{n+1} + C$

Measures of Central Tendency

72. (b) Zero
73. (b) Smaller items
74. (a) AM > GM > HM
75. (c) 4
76. (c) 6
77. (b) 210
78. (c) 12
79. (b) 10.5
80. (b) 6
81. (b) Median
82. (b) Four equal parts
83. (c) Median
84. (b) 3 Median - 2 Mean
85. (b) Median
86. (b) 64
87. (b) 625
88. (d) Q_2
89. (c) Mean Deviation
90. (b) 9
91. (d) Geometric Mean
92. (c) 10
93. (c) Ogive

Measures of Dispersion

94. (d) Unit of orignal data
95. (a) Quartile Deviation
96. (a) Range
97. (b) Median
98. (c) Mean Deviation
99. (c) Not changed
100. (a) Divided by 5
101. (c) $\sqrt{2}$
102. (c) $\frac{\sigma}{x} x 100$
103. (c) Root Mean Square Deviation
104. (b) Quartile Deviation
105. (a) QD < MD < SD
106. (b) 22
107. (c) 5 MD = 4 SD
108. (b) Karl Pearon
109. (c) Open ended series
110. (d) Mean Deviation

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QUESTIONS

2. Answer the following Questions in one sentence each.

Matrices

1. What do you mean by a transpose matrix ?
2. What do you mean by a singular matrix ?
3. When two matrices are equal ?
4. When two matrices are equivalent ?
5. What is meant by a non-singular matrix ?
6. What is a symmetric matrix ?
7. What is a diagonal matrix ?

Determinant

8. How the order of a determinant is determined?
9. How the minor of an element of a determinant is determined ?
10. Why Crammer's rule is used ?
11. What do you mean by inconsistent system of equation ?

Set Theoy

12. What is a finite set ?
13. What is a proper sub-set ?
14. What is an universal set ?

Function

15. What is an identity function ?
16. What is a composite function ?
17. What do you mean by range of a function?
18. Find the domain and range of the function $Y = x^2+2$.

Limit & Continuity

19. When a function is said to be continuous ?
20. Evaluate $\lim_{x\to 1} \frac{x^3-1}{x-1}$
21. Write one condition when the limit of a function does not exist.

Differentiation

22. What is the summation rule of differentiation?
23. Find the differential co-efficient of 10^x w.r.t. x.
24. Find the differential co-efficient of the function $y = \sqrt[3]{x}$.
25. Write the rule for finding the derivative of the product of two functions.

Integration

26. Find the integral of the function $y = \frac{1}{x^4}$ w.r.t. x.
27. What do you mean by integration ?
28. Evaluate : $y = x^{n+1}$.

Measures of Central Tendency

29. What is an average ?
30. What do you mean by raciprocal of a number?
31. What is class interval ?
32. Define Harmonic Mean.
33. What is the difference between Mean and Median.
34. Define Geometric Mean.
35. What is weighted arithmetic mean ?
36. Write one mathematical property of arithmetic mean.
37. What do you mean by a continuous variable?

Measures of Dispersion

38. What is Range ?
39. What is a relative measure of dispersion ?
40. What do you mean by measure of dispersion?
41. What is Quartile deviation ?
42. What is co-efficient of variation ?
43. Define standard deviation.
44. Give the formula for calculation of co-efficient of variation.
45. Find out the co-efficient of mean deviation of a distribution whose median is ₹30 and mean deviation from the median is ₹15.

***

ANSWERS

2. Answer the following Questions in one sentence each.

Matrices

1. When the row of a matrix are changed into columns or vice-versa, the resultant matrix is called the transpose matrix.
2. A square matrix the determinant of which is 0, is called a singular matrix.
3. A matrix is said to be equal to another matrix if all its elements are equal to the corresponding elements of the said matrix.
4. A matrix is aid to be equivalent to another matrix if the number of rows and columns are equal to those of the other matrix.
5. A square matrix the determinant of which is not zero is called a non-singular matrix.
6. A square matrix in which the elements of rows are the respective elements of the corresponding columns called a symmetric matrix. The transpose of such matrix is the matrix itself.
7. A square matrix in which all the principal diagonal elements are non-zeros and all other elments are zeros is called a diagonal matrix.

Determinant

8. The orders of a determinant is determined by its number of rows and columns.
9. Minor of an element of a determinant is obtained by deleting the row and the column for the given determinant to which the element belongs to.
10. Crammer's Rule is used to solve simultaneous linear equations with the help of determinants.
11. When there is no solution to a system of equations it is called inconsistent i.e. D=0.

Set Theoy

12. A set is said to be a finite set if its number of elements are countable.
13. If each and every element of Set A is the element of Set B and there exists at least one element of Set B that does not belong to Set A then A in said to be the proper subset of B.
14. A set which contains the elements of all sets under consideration is called universal set.

Function

15. A function $f.R \to R$ is called an identity function if f(x) = x for all $x \in r$. In this function the image of the element is the element itself.
16. If y = g(u) and u = g(x) then y = gf(x) is a composite or function of a function.
17. The set of values of the dependent variable is called range of the function.
18. $y = x^2 + 2$.

    Domain (1, 2, 3, 4 ...) Ranges (3, 6, 11, 18 ...)

Limit & Continuity

19. A function is said to be continuous at a point x = a if $\lim_{x\to a^-} f(x)$, $\lim_{x\to a^+} f(x)$ and f(a) have finite and definite values and are equal.
20. $$\lim_{x\to a}\frac{x^3-1}{x-1} = \lim_{x\to a}\frac{x^3-(1)^3}{x-1}$$
    $$= 3a^2\left\{\lim_{x\to a}\frac{x^n-a^n}{x-a} = n a^{n-1}\right\}$$
21. $\lim_{x\to a^-} f(x)$ does not exist or

    $\lim_{x\to a^+} f(x)$ does not exist or

    $\lim_{x\to a^-} f(x) \neq \lim_{x\to a^+} f(x)$

Differentiation

22. The derivative of the sum of two differtiable functions is the sum of their derivative i.e. if u and v are two differentiable functions of x then
    $$\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{du}{dx}.$$
23. $$\frac{d}{dx}(10^x) = 10^x \text{Log}_e 10 \left[\frac{d}{dx} = a^x \text{Log}_e a\right]$$
24. $$y = \sqrt[3]{x} \quad \frac{d}{dx}\sqrt[3]{x} = \frac{d}{dx}(x)^{\frac{1}{3}} = \frac{1}{3}x^{\frac{1}{3}-1} = \frac{1}{3}x^{-\frac{-2}{3}}$$

25. The derivative of the product of two function is equal to the product of the second function and the derivative of the 1st function plus the product of the 1st functon and derivative of the second function.

$$\therefore \frac{d}{dx}(uv) = v\frac{d}{dx}(u) + u\frac{d}{dx}(v)$$

Integration

26. $y = \frac{1}{x^4} = x^{-4}$

$$I = \int x^{-4}dx = \frac{x^{-4+1}}{-4+1} + C = -\frac{x^{-3}}{3} + C$$

$$= -\frac{1}{3}x^{-3} + C = -\frac{1}{3x^3} + C.$$

27. Integration is the reverse process of differentiation.

28. $Z = \int x^{n+1}dx = \frac{x^{n+1+1}}{n+1+1} + C$

$$= \frac{x^{n+2}}{n+2} + C.$$

Measures of Central Tendency

29. An average is a single value within the range of the data that is used to represent all the values in a series.

30. The reciprocal of number is the value of one divided by that number.

31. The difference between the upper limit and lower limit of a class is called class interval.

32. H.M. is the raciprocal of the A.M. of the raciprocal of the values of the variables. Symbolically

$$H.M. = \frac{N}{\sum\frac{1}{x}}.$$

33. The main difference between Mean and Median is Mean is a mathematical avrage whereas Median is a positional average.

34. Geometric mean is the n^{th} root of the product of all x values. symbolically.

$$G.M. = \sqrt[n]{x_1.x_2.x_3.....x_n}.$$

35. An arithmetic average that assigns different weights to different values in the series is called an weighted A.M.

36. The algebric sum of deviations taken from mean is Zero. Symbolically $\sum(x - \bar{x}) = 0$

(Any one of the eight properties can be written).

37. A variable that is capable of manifesting in every conceivable fractional value within a range of possibilities is called a continuous variable.

Measures of Dispersion

38. Range is the difference between the largest and smallest value in a distribution.

39. A relative measure of dispersion is the ratio of obsolute dispersion to an appropriate average.

40. The degree to which numerical data tend to spread about an average value is called dispersion of the data.

41. Half of the difference between 1st Quartile and 3rd Quartile is called Quartile deviation or semi-inter quartile range. Thus

$$QD = \frac{Q_3 - Q_1}{2}.$$

42. Co-efficient of variation or $C.V. = \frac{\sigma}{\bar{x}}x100$ or co-efficient of S.D. multiplied by 100.

43. Standard deviation is the square root of the A.M. of the square of deviations of the given observations from their A.M.

Symbolically $\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{N}}$.

44. co-efficient of variation $= \frac{\sigma}{\bar{x}}x100$.

Where σ = Standard Deviation

$\bar{x}$ = Arithmetic mean

45. Co-efficient of Mean deviation

$$= \frac{\text{Deviation from Median}}{\text{Median}} = \frac{₹15}{₹30} = \frac{1}{2}.$$

***

QUESTIONS

2. Correct the underlined portion of the following sentences.

Matrix

1. If A and B are two matrices then A x B is <u>equal</u> to B x A.
2. A matrix which is obtained by changing the rows into colmns and columns into rows is called an <u>adjoint</u> matrix.
3. Two matrices are said to be <u>equal</u> if both have same number of rows and columns.
4. If the transpose of a matrix is equal to the matrix itself then the matrix is called <u>adjoint</u> matrix.
5. When the number of rows and columns of a matrix are equal if is called a <u>rectangular</u> matrix.

Determinant

6. If every element of a 3rd order determinant $|A|$ is multipliedby 3 then the value of the new determinant is equal to $\underline{3|A|}$.
7. The determinant which is obtained by changing rows into columns and columns into rows is called <u>inverse</u> of the determinant.
8. A determinant has always <u>unequal</u> number of rows and columns.
9. The co-factor of any element of a determinant is equal to $(I)^{i+j} x M$.

Set Theoy

10. When the number of elements of two sets are same thy are called <u>equal</u> sets.
11. A set within elements will have $\underline{3^n}$ number of subsets.
12. A set having only one 'zero' as its element is called an <u>empty</u> set.

Function

13. The function $f(-x) = -f(x)$ is a <u>constant</u> function.
14. The range of the function is a subset of the <u>domain.</u>
15. The function $f(x) = 5^x$ is called a <u>logarithmic</u> function.

Limit & Continuity

16. In a continuous function $\lim_{x \to a^+} f(x) = \lim_{x \to a^-} = \underline{f(x)}$.
17. $\lim_{x \to a} k.\, f(x) = \underline{x}.\lim_{x \to a} f(x)$
18. $\lim_{x \to 0} \dfrac{e^x - 1}{x} = \underline{\infty}$.

Differentiation

19. The differential co-efficient of a constant is always equal to <u>one</u>.
20. Deivative of x^n where n is any integer is $\underline{n-1\,.\,x^{n-1}}$.
21. Derivative of $\log e^x$ is equal to <u>x</u>.

Integration

22. Integration is the reverse process of <u>continuity.</u>
23. $\int x^3 dx = \underline{\dfrac{x^3}{d}} + C$
24. $\int \dfrac{x}{5} dx = \underline{10} + C$

Measures of Central Tendency

25. Geometric Mean is a <u>positional</u> avreage.
26. The sum of dviations of the items from actual mean is always <u>lowest</u>.
27. Median is a <u>mathematicial</u> average.
28. Second Quartile and <u>Mean</u> of a series are equal.
29. <u>Quartiles</u> divide the series into 10 equal parts.
30. The Mean of first 'n' natural numbers can be obtained by the formula $\underline{\dfrac{n(n-1)}{2}}$.

31. When Mean, Median and Mode of a distribution are equal, if is called an Assymetric distribution.
32. The Geometric Mean of 3, 9 & 27 is 13.
33. The Geometric Mean of a series is always more than its Arithmetic mean.

Measures of Dispersion

34. The lower the co-efficient of variation the Lesser would be the consistency of data.
35. Standard deviation gives comparatively Lesser importance to extreme values in the series.
36. Standard deviation is a/an relative measure of dispersion.
37. In a symmetric distribution M.D. is 2/3rd of the S.D.
38. Standard deviation is indpendent to change in origin.
39. The appropriate measure of dispersion of a frequency distribution with open ended classes is standard deviation.
40. Standard deviation is one of all the values of the variable are equal.
41. Smi inter quartile range is also known as average deviation.
42. Inter quartile range takes into consideration only two extreme values present in the series.
43. When Mean, Median and Mode of a distribution are un-equal it is called a Symmetric distribution.

ANSWERS

2. Correct the underlined portion of the following sentences.

Matrix

1. Not equal
2. Transpose
3. Equivalent
4. Symmetric
5. Square

Determinant

6. $9|A|$
7. Transpose
8. Equal
9. $(-1)^{i+j} M_{ij10}$

Set Theoy

10. Equivalent
11. 2^n
12. Single ton

Function

13. Odd
14. Co-domain
15. Exponential

Limit & Continuity

16. f(a)
17. k
18. $\text{Log}_e a$

Differentiation

19. Zero
20. $n x^{n-1}$
21. $\frac{1}{x}$

Integration

22. Differentition
23. $\frac{x^4}{4}$
24. $\frac{x^2}{10}$

Measures of Central Tendency

25. Mathematical
26. Zero
27. Positional
28. Median
29. Deciles
30. $\frac{n(n+1)}{2}$
31. symmetric
32. 9
33. Less

Measures of Dispersion

34. More/Greator Higher
35. More
36. Absolute
37. Q.D.
38. Scale
39. M.D.
40. Zero
41. Quartile
42. Range
43. Assymetric

***

QUESTIONS

2. Answer the following in one word/term each.

Matrix

1. A square matrix in which all the leading diagonal elements are is one and other elements are Zeros.
2. When the transpose of a matrix produces the matrix itself.
3. A matrix that consists of Zeros only.
4. A diagonal matrix in which all the leading diagonal elements are equal.
5. A matrix with a single colmn and any number of rows is known as.

Determinant

6. The numbers of rows and number of columns of a determinant are always :
7. If two rows/colmns of a determinant are identical then the value of the determinant is :
8. If all the elements of a row/column of a determinant are Zero then the value of the determinant would be.

Set Theoy

9. A set, which is sch that all the sets under consieration are its subset.
10. The set of sets is called as :
11. A set containing no element is know as :
12. Th cardinal number of a set is denoted by :
13. If A$\underline{C}$B and B$\underline{C}$A ten A and B are called.

Function

14. When f(-x)=f(x) the function is known as :
15. When the range of a function is equal to its co-domain the function is called as :
16. When all the elements of the domain are associated with one element 'C' which is a constant for function is a :

Limit & Continuity

17. The limit of a constant is equal to
18. Th left hand limit of f(x) as x tends to a is symbolically written as :

Differentiation

19. A function y, where y can not b expressed in terms of x only is known as :
20. the limit of th ratio of increment in dependent variable corresponding to a small increment in the indpendent variable is known as :
21. The diferential co-efficient is otherwise known as :
22. The rule $\frac{dy}{dx} = \frac{dy}{du} x \frac{du}{dy}$, in calculation of differential co-efficient is known as :

Integration

23. The process by which an integral is found
24. A value by which two functions with same derivative differ
25. In $\int f(x)\, dx$, $f(x)$ is known as

Measures of Control Tendency

26. A measure of central tendency is otherewise known as :
27. The difference between the upper limit and lower limit of a class is known as :
28. A single value that represents a series of values.
29. The number of times a value is repeated in a series.
30. A value that divides a series into some equal parts.
31. A partition value that divides the series into the ten equal parts.

32. Value that most frequently occurs in a series.
33. A distribution having two modal values.
34. A distribution having many modes.
35. A continuous classification that does not include the upper limit of the class interval.
36. A continuous classification that includes the upper limit of the class interval in the same class.
37. the average that is foundout by taking n th root of the product of 'n' number of variables.
38. A distribution whose Mean, Median and Mode are equal.
39. Method used to locate the value of Median/ Mode from a class interval.
40. A series whose Mean, Median and Mode are not equal.

Measures of Dispersion

41. Quartile Deviation is also known as :
42. The other name of mean Deviation is :
43. The squar of standard deviation (a^2) is known as :
44. A measure of dispersion, that is expressed in ratio or percentage is known as :
45. A measure of dispersion, that is expressed in terms of actual unit of the data is :

***

ANSWERS

2. Answer the following in one word/term each.

Matrix

1. Unit or Identity Matrix
2. Symmetric Matrix
3. Null Matrix
4. Scalar Matrix
5. Column Matrix

Determinant

6. Equal/Same
7. Zero
8. Zero

Set Theoy

9. Universal Set
10. Power Set
11. Null Set
12. $|A|$ or n(A)
13. Equal Sets

Function

14. Even Function
15. On to function
16. Constant function

Limit & Continuity

17. 0
18. $\lim_{x \to a^-} f(x)$

Differentiation

19. Implicit function
20. Differential co-efficient
21. Derivative
22. Chain rule

Integration

23. Integration
24. Constant of integration
25. Integral

Measures of Control Tendency

26. Average/Central Value
27. Class interval
28. Central Values/Average
29. Frequency
30. Partition Value
31. Decile
32. Mode
33. Bimodal
34. Multimodal
35. Exclusive
36. Inclusive
37. Geometric Mean
38. Symmetric/Normal
39. Interpolation
40. Assymetric Series

Measures of Dispersion

41. Semi Inter Quartile Range
42. Average Deviation
43. Variance
44. Relative Measure
45. Absolute Measure

***

QUESTIONS

2. Fill in the blanks.

Matrix

1. A square matrix 'A' is said to be symmetric if A^{I} =_____.
2. The transpose of the Matrix $\begin{pmatrix} -a & b \\ c & d \end{pmatrix}$ is _____.
3. The matrix that is assocaited with determinant is a _____ matrix.
4. a square matrix whose determinant is Zero is called a _____ matrix.
5. If A is an m X n matrix and B is an n X p matrix, BA can be found when P =_____.
6. If A is a symmetric matrix then A=_____.
7. A diagonal matrix in which all the diagonal elements are 1 is called _____ matrix.

Determinant

8. The value of a determinant remains _____ if its rows and columns are interchanged.
9. Sarrus diagram can be applied to determinant of _____ order only.
10. A determinant of order 3 contain _____ number of elements.
11. If any two rows and columns of a determinant are interchanged the vale of the determinant does not change but the _____ changes.
12. The value of a determinant becomes Zero, if any two rows/columns of the same are ___.

Set Theoy

13. If A = {1, 2, 3, 4, 5}, B = {3, 4, 6, 8, 10} then $A \cap B$ = _____.
14. $A \cup \varnothing$ = _____.

Function

15. In Y = 5x + 2 the independent variable is _____.
16. The set of independent variable in a function are called _____.
17. Image refers to the value of _____variable.
18. Range is a _____ of codomain.
19. the domain of the function f(2,4) (3,9) (4,16) is _____.
20. If f(-x)=-f(x) then f(x) is a/an _____function.

Limit & Continuity

21. A function is said to be continuous at x=a if and only if _____ defined at x=a.
22. The product of two continuous function is a _____ function.
23. $\lim_{x \to a} \frac{x^n - a^n}{x - a}$ =_____.
24. The limit of a function exists when $\lim_{x \to a^+} f(x)$ is _____ to $\lim_{x \to a^-} f(x)$.

Differentiation

25. The second derivative of x^4 is _____.
26. The differential co-efficient of a^x where x and a are more than '0' is _____.
27. $\frac{d}{dx}uv = V\frac{d}{dx}u +$ _____.
28. The derivative of the sum of two differentiable functions is the _____ of their derivatives.

Integration

29. $\int \frac{1}{x} dx$ = _____ + C
30. The expression $\int f(x)dx$ is generally read as the _____ of f(x) with respect to x.
31. Integration of the derivation of a function is the _____ itself.

Measures of Control Tendency

32. In a symmetric distribution Mean, Median and Mode are _____.
33. Harmonic Mean gives _____ weightage to smaller values.

34. Harmonic Mean can not be computed when any of the values in the series is _____.
35. The raciprocal of the _____ of a number is the number itself.
36. Deciles divide a series into _____ equal parts.
37. Median is a _____ average.
38. A series having many modal values is called a _____ series.
39. In a positively skewed distribution Mode is _____ than mean.
40. Median and _____ Quartile of a series are equal.
41. In a moderately assymetric distribution if the value of Mean and Median are 15 and 12 the value of the Mode is _____.

Measures of Dispersion

42. Standard Deviation is a/an _____ measure of dispersion.
43. Sum of the square of deviations taken from _____ is minimum.
44. Standad Deviation is ____ to change in origin.
45. Standard Deviation is ____ upon change in scale.
46. When mean of a distribution is 15, variance is 25, the co-efficience of variation is _____.
47. _____ is the simplest measure of dispersion.
48. Semi inter quartile range is also known as _____.
49. In a symmetric series Mean Deviation is equal to _____ of Standard Deviation.
50. In a symmetric distribution the value of Range is _____ times of the Mean Deviation.

ANSWERS

2. Fill in the blanks.

Matrix

1. A
2. $\begin{matrix} -a & c \\ b & d \end{matrix}$
3. Square
4. Syngular
5. 5
6. A^{I}
7. unity / Identity

Determinant

8. Unchanged
9. 3rd
10. 9
11. Sign
12. Identical

Set Theoy

13. {3, 4}
14. A

Function

15. x
16. Domain
17. Dependent
18. Subset
19. (2, 3, 4)
20. Even

Limit & Continuity

21. f(x)
22. Continuous
23. na^{n-1}
24. Equal

Differentiation

25. $12x^2$
26. $a^x Log_e^a$
27. $u\frac{d}{dx}V$
28. Sum

Integration

29. Log x
30. Integral
31. Function

***

Measures of Control Tendency

32. Equal
33. More
34. Zero
35. Raciprocal
36. Ten
37. Positional
38. Multimodal
39. More
40. 2nd
41. 6

Measures of Dispersion

42. Absolute
43. Arithmetic Mean
44. Independent
45. Dependent
46. 33%
47. Range
48. Quartile Deviation
49. 4/5 th
50. 6

GROUP - B

SHORT TYPE QUESTIONS

3. Answer the following questions within 30 words

Matrix

1. What is an adjoint of a matrix ? Explain with example.
2. When two matrices can be multiplied ?
3. What is a transpose matrix ?
4. Explain the candition necessary for matrix addition.
5. Evaluate

$$\begin{pmatrix} 3 & 2 & 7 \\ 4 & 2 & -1 \end{pmatrix} + \begin{pmatrix} 10 & 7 & -5 \\ 4 & 3 & 6 \end{pmatrix} - \begin{pmatrix} -2 & 0 & 8 \\ 1 & 3 & 4 \end{pmatrix}$$

6. What is skew symmetric matrix ? Give one example of such matrix.
7. If $A = \begin{pmatrix} 1 & 0 \\ 2 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 1 & 1 \\ 2 & 0 & 4 \end{pmatrix}$ find AB.
8. Write the co-factor of the element in the 2nd row and third column of the following matrix.

$$\begin{pmatrix} 2 & 3 & -4 \\ 5 & 0 & -6 \\ 3 & 2 & 1 \end{pmatrix}$$

9. Show that $\begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 2 & 1 & -1 \end{pmatrix}$ is a non singular matrix.
10. Explain orthogonal matrix wih example.

Determinant

11. Evaluate $\begin{vmatrix} 1 & 4 & 5 \\ 3 & 6 & 9 \\ 2 & 9 & 7 \end{vmatrix}$
12. Evaluate $\begin{vmatrix} x-y & y-z & z-x \\ y-z & z-x & x-y \\ z-x & x-y & y-z \end{vmatrix}$
13. What do you mean by a 3rd order determinant. Explain with example.
14. Evaluate $\begin{vmatrix} 1 & 4 & 5 \\ 3 & 6 & 9 \\ 2 & 9 & 7 \end{vmatrix}$ by using Sarrus diagram.
15. Evaluate $\begin{vmatrix} 2x+2 & x+2 \\ x+1 & 2x+1 \end{vmatrix}$
16. If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ find the value of x.
17. Evaluate $\begin{vmatrix} 4 & 0 & 0 \\ 2 & 5 & 0 \\ 10 & 0 & 9 \end{vmatrix}$.
18. What is minor of an element in a determinant ?
19. Write the following determinant as sum of two determinants.

$$\begin{vmatrix} x_1 + a_1 & x_2 & x_3 \\ y_1 + a_2 & y_2 & y_3 \\ z_1 + a_3 & z_2 & z_3 \end{vmatrix}$$

20. Evaluate $\begin{vmatrix} a & b \\ c & d \end{vmatrix} - \begin{vmatrix} d & b \\ c & a \end{vmatrix}$.

Set Theory

21. What is a power set? Write all the subsets of the Set A when $A = \{p, q, r\}$.
22. Differentiate between equal and equivalent sets.
23. What is a proper subset ? Explain with example.
24. Write the De-Morgan's Law.
25. What do you mean by Union of sets is associative.

26. What do you mean by disjoint sets ? Give one example.
27. Explain Universal set with example.
28. If A={1,3,5,7,9} B={1,7,8} C={3,5,8,10,12) then find $(A \cup B) \cap (B \cup C)$.
29. What do you mean by complement of a set?
30. What do you mean by symmetric difference of two sets ?
31. A={2,4,6,8,10} B={1,2,3,4,5,6,7} C={2,6,7,10,11} then show that $A \cap (B \cap C) = (A \cap B) \cap C$.
32. If n(A)=25, n(B)=30 and $n(A \cap B) = 10$. Find $n(A \cup B)$.
33. If n(A)=20, n(B)=12, $n(A \cap B) = 20$. Find $n(A \cap B)$.
34. If A={a, b, c} B={a, e, i, o, u). Prove that $A - B \neq B - A$.
35. If A={1, 2, 3, 4} B={2, 4, 10, 12}. Find out $(A \cap B)^{|}$.

Function

36. Given A={1,2,3,4} B={a,b,c,d} Construct a function $\int : A \to B$ which is one-one onto function.
37. If dom . $f = \{1,2,3,4\}$ and $f(x) = 2x - 1$. Find the codomain of the function.
38. Given $f(x) = x^2 + 1$. Find the domain and Range.
39. What is domain and range?
40. Define function.
41. What is many one onto function ? Give an example.
42. Explain inverse of a function.
43. Find the inverse of $f(x) = \frac{x+1}{x-1}, x \neq 1$.
44. What is a linear function and Quadraie function?
45. Distinguish between explicit and implicit function.

Limit & continuity

46. Evalate $\lim_{x \to 2} \frac{x^3 - 2^3}{x - 2}$.
47. When the limit of a function does not exit?
48. Name any two methods of evaluating limit.
49. Evaluate $\lim_{x \to 3} \frac{x^2 + x - 12}{x - 3}$.
50. Find out the Left hand limit of the f(x) $\lim_{x \to 3} x^2 - 3x$.
51. What do you mean by a continuous function?
52. What do you mean by limit ?
53. Evaluate $\lim_{x \to 1} \frac{x^3 - 1}{x - 1}$.
54. Evaluate $\lim_{x \to 3} \frac{x^2 - 5x + 6}{x^2 - 9}$.
55. Evaluate $\lim_{x \to 1} \frac{x^2 - 3x + 2}{x^2 - 1}$.
56. Evaluate $\lim_{x \to a} \frac{x^5 - a^5}{x^2 - a^2}$.
57. Evaluate $\lim_{x \to 0} \frac{(1+x)^n - 1}{x}$.
58. Evaluate $\lim_{x \to 0} \frac{x^3 + 3x}{3x}$.
59. Evaluate $\lim_{x \to 0} \frac{(x-2)^2 - 4}{x}$.
60. Evaluate $\lim_{x \to 0} \frac{3^x - 1}{x}$.
61. Evaluate $\lim_{x \to 0} \frac{e^x - 1}{x}$.
62. Evaluate $\lim_{x \to 3} \frac{x^3 - 27}{x - 3}$.

63. What do you mean by x teds to a from the left ?

64. What do you mean by x tends to a from the right hand ?

65. Evaluate $\lim_{x\to 1}(x^4 - 2x^3 + 3x^2 + 10x - 3)$.

66. Write the name of the functions which are always continuous.

67. Show that $f(x) = 2x + 3$ is continuous at x=1.

Differentiation

68. Differentiate the following function by method of 1st principle $y = x^2$.

69. Differentiate $y = \frac{1}{x^4}$.

70. Differentiate $y = \sqrt[3]{x}$.

71. Differentiate $y = 5^x$.

72. Write the summation rule of differentiation.

73. Differentaite $y = 5x + x^3$.

74. Differentaite $y = x^2 - 2x$.

75. Differentaite $y = x + \frac{1}{x}$.

76. Differentiate $y = x^3 e^x$.

77. Write the product rle of differentiation.

78. Differentiate $y = 4^x.x^4$.

79. Differentiate $y = 5\text{Log}_e{}^x$.

80. differentaite $y = (3x + 2)^4$.

81. differentiate $y = e^{x+2} + 3x + d$.

82. Write the chain rule used to find the derivative of a composite function.

83. Find $\frac{dy}{dx}$ when $y = 3x^3 + 4x^2 + 5x - 3$.

84. Find $\frac{dy}{dx}$ if $y = 5x + x^3$.

85. Find $\frac{dy}{dx}$ when $y = \sqrt{1 + x^2}$.

Integration

86. What is indefinite integration ?

87. Evaluate $\int 5x^3\, dx$.

88. Evaluate $\int x^{1/2}\, dx$.

89. Determine the integral of the following w.r.t. x $8 - 9x - x^5$.

90. Evaluate $\int 5^x\, dx$.

91. Evaluate $\int 5^{2x}\, dx$.

92. Evaluate : $\int \frac{7x^2}{25} dx$.

93. Evaluate $\int \frac{x^4 + 1}{x^2} dx$.

94. Write the 3 important methods of finding integral.

95. Evaluate $\int (x^2 - 2)^2$.

96. Evaluate $\int e^{1/2} dx$.

97. Evaluate $\int 5x3^x$.

98. Evaluate $\int 3x^6\, dx$.

99. Evaluate $\int \frac{5}{x^3} dx$.

100. Evaluate $\int (x + 1)^3\, dx$.

Measures of Central Tendency

101. Write any two mathematical properties of A.M.

102. Define G.M.

103. Write any two advantages of A.M.

104. Write any wo demerits of G.M.

105. Write the relationship between A.M., G.M. and H.M.

106. Write the uses of H.M.

107. What is weighted A.M. ?

108. Write any two disadvantages of A.M.

109. What do you mean by positional average ?

110. Write any two merits of G.M.

111. Calculate the H.M. of 10, 20, 25, 50.

112. Find the Combined Mean of the following :

	I	II	II
$\bar{X}$	12	15	18
N	20	40	30

113. Find the A.M. of 1st 10 odd numbers.

114. The average IQ of 20 boys and 30 girls of a class is 80. The average IQ of the girls are 82. What is the average IQ of boys ?

115. The G.M. and H.M. of two numbers are respectively 8 and 4. Find out the A.M.

116. Find the missing frequency. When mean is 2.9.

x	1	2	3	4	5
f	2	1	4	?	1

117. Write any three characterstic of a good average.

118. Write the formula for finding A.M. of a continuous Series using short-cut method.

119. Find out the H.M. of $\frac{1}{2}, \frac{1}{5}, \frac{1}{10}$ and $\frac{1}{20}$.

120. What do you mean by a measure of central tendency ?

121. find the A.M. of 1st 50 natural numbers.

122. A man traveled from one place to another at the rate of 20km/hour and returned at 30 km/ hours. Find the average speed.

123. Find out the G.M. of 4, 8, 16.

124. Differentiate between mathematical average and positional average.

125. The population of a city increases over the years 2017 to 2019 by 2% and 8%. What is the annual average increase.

126. what do you mean by Median ?

127. Write any two uses of Median.

128. Write any two merits of Median.

129. Write any two demerits of Median.

130. What do you mean by quartile ?

131. What do you mean by percentile ?

132. Write the formula for finding median from the median class in a continuous distribution.

133. What is Mode ?

134. Write th methods used for determining Mode.

135. Write the formula for finding mode from the modal class in case of a continuous series.

136. Write any two merits of Mode.

137. Write any two demerits of Mode.

138. Write the specific ses of Mode.

139. Write the empirical relationship between Mean, Median and Mode.

140. The arithmetic Mean of marks secured by 100 students in mathematics is 50. It was found that the mark of one student whose actual score was 48 has been wrongly taken as 84. Find th correct mean.

141. In a moderately assymmetric distribution the Mode is 50 and Mean is 35 then find out the value of median.

142. What points should be taken into consideration while calculating mode, when class intervals are unequal.

143. State the factors that are to be considered to judge the appropraitness of an average.

144. Write any two differences between Mean and Median.

145. Write any two differences between mean and Mode.

Measues of Dispersion

146. Why study of dispersion is necessary ?

147. Write any three features of an ideal measure of dispersion.

148. What is an absolute measure of dispersion ?

149. What is a relative measure of dispersion ?

150. State the merits of range.

151. Write any three demerits of range.

152. What is inter quartile range ?

153. What are positional dispersion ?

154. Write any two advantages of quartile deviation.

155. Calclate the Inter Quartile range from the following data

Marks	10	20	30	40	50	60
No. of Students	3	6	8	15	5	2

156. Find out the co-efficient of range from the following data

45, 40, 42, 47, 50, 52, 55

157. Find out the QD from the following data

Wages (₹)	200	325	612	740	818	920
No. of Workers	3	5	8	6	7	2

158. Write any three advantages of mean deviation.

159. Write any three limitations of mean deviation.

160. Write the formula for finding out mean deviation in case of a continuous series.

161. Write any advantages of standard deviation.

162. Write any two limitations of standard deviation.

163. Write the formula for calculation of S.D. of a discrete series using assumed mean.

164. Find out the S.D. of 1st 50 natural numbers.

165. What do you mean by standard deviation is dependent upon change of scale ?

166. What do you mean by standard deviation is independent of change in origin ?

167. State the relationship between Q.D. S.D. and M.D.

168. In a moderately assymmetric series the standard deviation is 45. Find out the Quartile deviation and M.D.

169. If $\bar{x}$ and δ of runs scroed by A are 50 and 15 and B are 60 and 20, find out who is more consistent ?

170. State any difference between S.D. and M.D.

171. Calculate S.D. from the following values of x

4, 6, 8, 10, 12.

172. find the S.D. if $\bar{x} = 6$, $\sum x = 60$ and $\sum x^2 = 100$.

173. Write the formula for finding out combined S.D. of two series.

174. From the following data find out which share is more stable in value.

Share	Average Price	S.D.
A	18	5.4
B	22	4.5

175. Find out the individual frequency of each class from the following table.

Marks below	20	40	60	80	100
No. of Students	8	20	50	70	80

176. Define standard deviation.

177. Why standard deviation is called the best of all measures of dispersion ?

178. The $\bar{x}$ and δ of a symmetric distribution is 50 and 3. Find out the highest and lowest value of the distribution.

179. In a symmetric distribution the 1st quartile is 142 and the semi inter quartile range is 18. Find out the median.

180. The value of 1st quartile of a series is 1/3rd of the 3rd quartile. If 1st quartile 5. Find out quartile deviation.

GROUP - B

ANSWERS

1. By the adjoint of a matrix we mean the transpose of the matrix of its cofactors. For the purpose of finding the adjoint the given matrix must be a square matrix. For example

If Matrix $A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$

Cofactor Matrix $A = \begin{pmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{pmatrix}$

Adjoint of Matrix $A = \begin{pmatrix} C_{11} & C_{21} \\ C_{12} & C_{22} \end{pmatrix}$

Transpose of the Cofactor matrix of A.

2. For the purpose of multiplication of two matrices the numbers of columns in the multiplicant matrix must be equal to the number of rows in the multiplier matrix.

3. A matrix which is obtained by changing the rows into their respective columns and the columns into their respective rows is called a transposed matrix. For example if matrix

$A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$

Then A transpose $A^{I} = \begin{pmatrix} a_{11} & a_{21} \\ a_{12} & a_{22} \end{pmatrix}$.

4. The matrices to be added to each other must be equivalent i.e. each of the matrices must have equal number of rows and equal number of columns.

5. $\begin{pmatrix} 3+10-(-2) & 2+7-0 & 7+(-5)-8 \\ 4+4-1 & 2+3-3 & -1+6-4 \end{pmatrix}$

$= \begin{pmatrix} 15 & 9 & -6 \\ 7 & 2 & 1 \end{pmatrix}$

6. A square matrix in which all the leading diagonal elements are zeroes and the elements in the upper triangular are respectively equal to the elements in the lower triangular with opposite signs is called a skew symmetric or alternative matrix.

Example $A = \begin{pmatrix} 0 & 1 & 2 \\ -1 & 0 & 3 \\ -2 & -3 & 0 \end{pmatrix}$

Where $A^{I} = -A$.

7. $\begin{pmatrix} 1 & 0 \\ 2 & 3 \end{pmatrix}\begin{pmatrix} 3 & 1 & 1 \\ 2 & 0 & 4 \end{pmatrix}$

$\begin{pmatrix} 1x3+0x2 & 1x1+2x0 & 1x1+2x1 \\ 2x3+3x2 & 2x1+3x0 & 2x1+3x4 \end{pmatrix}$

$= \begin{pmatrix} 3 & 1 & 3 \\ 12 & 2 & 14 \end{pmatrix}$

8. The element in 2nd row and 3rd col. is -6.

the Minor of -6 is $\begin{vmatrix} 5 & 0 \\ 3 & 2 \end{vmatrix} = 10$

The Cofactor is $(-1)^{2+3}.10 = -10$.

9. $\begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 2 & 1 & -1 \end{pmatrix}$ $|D|$ of the matrix is

$1\begin{vmatrix} -1 & 1 \\ 1 & -1 \end{vmatrix} - 1\begin{vmatrix} 1 & 1 \\ 2 & -1 \end{vmatrix} + 1\begin{vmatrix} 1 & -1 \\ 2 & 1 \end{vmatrix}$

-1 . 0 - 1 (-3) + (1+3)

= 3 +3 = 6.

$\therefore$ The matrix is a non singular matrix.

10. A square matrix which when multiplied by its transpose, amounts to an identity matrix is called an orthogonal matrix. Thus it if A . A^{I}=1 then A is an orthogonal matrix.

11. $\begin{vmatrix}1 & 4 & 5\\ 3 & 6 & 9\\ 2 & 9 & 7\end{vmatrix} = 1\begin{vmatrix}6 & 9\\ 9 & 7\end{vmatrix} - 4\begin{vmatrix}3 & 9\\ 2 & 7\end{vmatrix} + 5\begin{vmatrix}3 & 6\\ 2 & 9\end{vmatrix}$

= 1(42 - 81) - 4 (21 - 18) + 5 (27 - 12)

= - 39 - 12 + 75

= 24

12. $\begin{vmatrix}x-y & y-z & z-x\\ y-z & z-x & x-y\\ y-x & x-y & y-z\end{vmatrix}$

If we will add the elements of the first row with the corresponding elements of the 2nd and 3rd row, we will get.

$$\begin{vmatrix}0 & 0 & 0\\ y-z & z-x & x-y\\ z-x & x-y & y-z\end{vmatrix}$$

As all the elements of a row is zero. The value of the determinent is '0'.

13. A determinant having 3 rows and 3 columns is called a third order determinant. It has 9 elements and can be presented as follows :

$$|D| = \begin{vmatrix}a_{11} & a_{12} & a_{13}\\ a_{21} & a_{22} & a_{23}\\ a_{31} & a_{32} & a_{33}\end{vmatrix}$$

14. 1 4 5 1 4
3 6 9 3 6
2 9 7 2 9

= (1 x 6 x 7) + (4 x 9 x 2) + (5 x 3 x 9) -
(2 x 6 x 5) - (9 x 9 x 1) - (7 x 3 x 4)

= (42 + 72 + 135) = (160 + 81 + 84)

= 249 - 225 = 24.

15. $\begin{vmatrix}2x+2 & x+2\\ x+1 & 2x+1\end{vmatrix} = \begin{vmatrix}3x+3 & 3x+3\\ x+1 & 2x+1\end{vmatrix}$

$$(3x+3)\begin{vmatrix}1 & 1\\ x+1 & 2x+1\end{vmatrix}$$

$$= (3x+3)\{2x+1-x-1\} = (3x+3)x$$

$$= 3x(x+1).$$

16. $\begin{vmatrix}3 & x\\ x & 1\end{vmatrix} = \begin{vmatrix}3 & 2\\ 4 & 1\end{vmatrix}$

$$3 - x^2 = 3 - 8$$

$$-x^2 = -8$$

$$\therefore x = \sqrt{8} = 2\sqrt{2}$$

17. The minor of an element of a determinant is in the sub-square determinant of the given determinant, along which the particular element does not exist. It is obtained by deleting the row and column in whcih the particular element lies.

For example if $|A|$ is $\begin{vmatrix}a_{11} & a_{12} & a_{13}\\ a_{21} & a_{22} & a_{23}\\ a_{31} & a_{32} & a_{33}\end{vmatrix}$ the minor

of a_{11} donated by

$$M_{11} = \begin{vmatrix}a_{22} & a_{23}\\ a_{32} & a_{33}\end{vmatrix}.$$

19. $\begin{vmatrix}x_1 & x_2 & x_3\\ y_1 & y_2 & y_3\\ z_1 & z_2 & z_3\end{vmatrix} + \begin{vmatrix}a_1 & x_2 & x_3\\ a_2 & y_2 & y_3\\ a_3 & z_2 & z_3\end{vmatrix}$

20. ad - cb - ad + cb

= 0

21. The collection or family of all subsets of a set is called the power set. If A is a set then the power set of A or P(A)={S ! S $\underline{C}$ A}

When A = {p, q, r}

All its subsets are

{p}, {q}, {r}, {p,q}, {p,r}, {q,r} {p,q,r} $\varnothing$

22. Two sets A & B are said to be equal if all elements of 'A' belong to 'B' and all elements of B beong to A. Equal sets are known as identical sets. They are said to be equivalent sets of they have same numbers of elements. Symolically n(A)=n(B).

23. Let A and B are two sets. If each and every element of Set A is the element of set B and there exist at least one element of set B that does not belong to A then the set A is called the proper subset of B.

If A = {1, 2, 3} B = {1, 2, 3, 4} then $A \subset B$ and $B \supset A$.

24. $(A \cup B)^{l} = A^{l} \cap B^{l}$ (i)

$(A \cap B)^{l} = A^{l} \cup B^{l}$ (ii)

25. The union of sets is associative means.

$(A \cup B) \cup C = A \cup (B \cup C)$

26. The sets are said to be disjoint or mutually exclusive if they do not have any common element.

Example Set A = {p, q, r} and Set = {x, y, z} are disjoint sets. They have no common elements. Symbotically $A \cap B = \varnothing$.

27. A set which contains all the sets under consideration as its subset is called the universal set which is denoted by U or E.

Example : The set of english alphabets can be called as the universal set of

A = {a, e, i, o, u} and B = {p, q, r, s}.

28. $(A \cup B) = \{1,3,5,7,8,9\}$

$(B \cup C) = \{1,3,5,7,8,10,12\}$

$(A \cup B) \cap (B \cup C) = \{1,3,5,7,8\}$

29. Complement of a set A is the set which contains all elements of the universal set those are not in A and is denoted by A^{l}. Symbolically A^{l} = U-A.

Example If U = {1,2,3,4,5,6,7}

A = {4,5,6,7}

A^{l} = {1,2,3}

30. Th symmetric difference of two sets A and B is equal to $(A - B) \cup (B - A)$ and is denoted by $A \Delta B$.

Example If A = {1,2,3,45}, B = {4,5,6,7}

A - B = {1,2,3}, B-A = {6,7}

$A \Delta B = \{1,2,3\} \cup \{6,7\} = \{1,2,3,6,7\}$

31. $B \cap C = \{2,6,7\}$ $A \cap B = \{2,4,6\}$

$A \cap (B \cap C) = \{2,4,6,8,10\} \cap \{2,6,7\}$

$= \{2,6\}$

$(A \cap B) \cap C = \{2,4,6\} \cap \{2,6,7,10,11\}$

$= \{2,6\}$

$\therefore A \cap (B \cap C) = (A \cap B) \cap C$.

32. $n(A) + n(B) - n(A \cap B) = n(A \cup B)$

25 + 30 - 10 = 45.

33. $n(A \cap B) = n(A) + n(B) - n(A \cup B)$

= 20 + 12 - 20 = 12.

34. A = {a, b, c} B = (a, e, i, o, u}

A - B = {b, c} B - A = {e, i, o, u}

$A - B \neq B - A$.

35. $A = \{1,2,3,4\}$ $B = \{2,4,10,12\}$

$(A \cap B) = \{2,4\}$

$(A \cap B)^{l} = \{1,3,10,12\}$.

36. $F : A \to B$ $\{(1,a)(2,b)(3,c)(4,d)\}$

is a one one onto function.

37. If codomain of the function is 1, 3, 5, 7.

f(x) = 2x -1

f(1) = 1

f(2) = 3

f(3) = 5

f(4) = 7

38. $f(x) = x^2 + 1$

When x = 1 y = 2 $\therefore$ D = {1,2,3,4}

x = 2 y = 5 R = {2,5,10,17}

x = 3 y = 10

x = 4 y = 17

39. The set of all values of independent variable x is called the domain of a function and the set of values of the dependent variable is called the range of the function.

40. A function from A to B is a set of ordered pair of elements in which every element of A is assocaited with exactly one element of B

If $f : A \to B$.

$f = \{(a,b): a \in A$ and $b \in B$ and has unique assignment with b}.

41. A function $f : x \to y$ is called a many one onto function of there is at least two elements in x which have the same image in y and each element in y is the image of atleast one element of x.

Example :

x = {Sita, Kausalya, Kaikei, Sumitra, Tara}

y = {Ram, Dasarath, Bali}

$f : x \to y$ = {(Ram, Sita)(Dasarath, Kausalya) (Dasarath, Kaikei) (Dasarath, Sumitra)(Bali, Tara)}

42. The function which is obtained by interchanging the ordered f^1 pairs of a one one into function is called as the inverse function and denoted by f^1.

For example A = {3,4,5} B={a,b,c}

f $A \to B$ f = {(3,a)(4,b)(5,c)}

f^1={(a,3)(b,4)(c,5)}

43. $f(x) = \dfrac{x+1}{x-1}$ $x \neq 1$

$y = \dfrac{x+1}{x-1}$

y(x - 1) = x + 1

yx - y = x + 1

yx - x = y + 1

x(y - 1)=y + 1

$x = \dfrac{y+1}{y-1}$

$\therefore f^{-1} = x\dfrac{y+1}{y-1}.$

44. Linear function is a function of type f(x)=ax+b. Where a and b are real numbers and $a \neq 0$. The highest power of the independent variable is 1. Quadratie function is of the type $f(x) = ax^2 + bx + c$ of. Where a.b.c are real numbers and the highest power of the independent variable is 2.

45. When the function is defined in terms of x only it is called explicit function. Here the L.H.S. contains y and the R.H.S. contains x. When the function is not directly expressed in terms of x then it is called an implicit function. Here the L.H.S. and R.H.S. or both contain x and y.

46. $\underset{x\to 2}{Lim}\dfrac{x^3-2^3}{x-2} = 3.2^2 \left[\therefore \underset{x\to a}{Lim}\dfrac{x^n-a^n}{x-a} = na^{n-1}\right]$

= 3 x 4 = 12

47. The limit of a function does not exist under the following conditions.

(i) $\underset{x\to a^-}{Lim} f(x)$ i.e. left hand limit does not exit.

(ii) $\underset{x\to a^+}{Lim} f(x)$ i.e. right hand limit oes not exit.

(iii) $\underset{x\to a^-}{Lim} f(x) \neq \underset{x\to a^+}{Lim} f(x)$ or LHL $\neq$ RHL.

48. Substitution method
Factorisation method
Rationalisation method
Dividing by highest power of x method
Method of using some standard results.

49. $\underset{x\to 3}{Lim}\dfrac{x^2+x-12}{x-3}$

$= \underset{x\to 3}{Lim}\dfrac{x^2+4x-3x-12}{x-3}$

$= \underset{x\to 3}{Lim}\dfrac{x(x+4)-3(x+4)}{x-3}$

$= \underset{x\to 3}{Lim}\dfrac{(x+4)(x-3)}{x-3}$

$= \underset{x\to 3}{Lim}\ x+4 = 3+4 = 7$

50. $\lim_{x\to 3^-} x^2 - 3x$

$\lim_{h\to 0}(3-h)^2 + 3(3-h)$

$\lim_{h\to 0}(3-0)^2 + 3(3-0)$

$\lim_{h\to 0} 3^2 + 3\,x\,3$

= 9 + 9 = 18

51. A function is said to be continuous in an interval if in its graph there is no break in that interval. If however there is break at a point in the graph then the function is not continuous at that point.

52. L is said to be the limit of the function f(x) as x approaches a, if the difference between L and f(x) can be made as smal as possible by taking x sufficiently closer to a and is denoted symbolically $\lim_{x\to a} f(x) = L$.

53. $\lim_{x\to 1} \frac{x^3-1}{x-1}$

$= \lim_{x\to 1} \frac{(x)^3-(1)^3}{x-1} = 3(1)^{3-1} = 3$

$\left(\therefore \lim_{x\to a} \frac{x^n-a^n}{x-a} = na^{n-1}\right)$

54. $\lim_{x\to 3} \frac{x^2-5x+6}{x^2-9}$

$= \lim_{x\to 3} \frac{x^2-3x-2x+6}{x^2-(3)^2}$

$= \lim_{x\to 3} \frac{x(x-3)-2(x-3)}{(x+3)(x-3)}$

$= \lim_{x\to 3} \frac{(x-3)(x-2)}{(x+3)(x-3)}$

$= \lim_{x\to 3} \frac{x-2}{(x+3)} = \frac{3-2}{3+3} = \frac{1}{6}$

55. $\lim_{x\to 1} \frac{x^2-3x+2}{x^2-1}$

$= \lim_{x\to 1} \frac{x^2-2-2x+2}{x^2-(1)^2}$

$= \lim_{x\to 1} \frac{x(x-1)-2(x-1)}{(x+1)(x-1)}$

$= \lim_{x\to 1} \frac{(x-1)(x-2)}{(x+1)(x-1)}$

$= \lim_{x\to 1} \frac{(x-2)}{(x+1)} = \frac{1-2}{1+1} = -\frac{1}{2}$

56. $\lim_{x\to a} \frac{x^5-a^5}{x^2-a^2} = \frac{\lim_{x\to a} \frac{x^5-a^5}{x-a}}{\lim_{x\to a} \frac{x^2-a^2}{x-a}}$

$= \frac{5a^4}{2a}\left(\therefore \lim_{x\to a} \frac{a^n-a^n}{x-a} = na^{n-1}\right) = \frac{5}{2}a^3$.

57. $\lim_{x\to 0} \frac{(1+x)^2-1}{x} = 2\left(\therefore \lim_{x\to 0} \frac{(1+x)^n-1}{x} = n\right)$

58. $\lim_{x\to 0} \frac{x^3+3x}{3x}$

$\lim_{x\to 0} \frac{\frac{x^3}{x}+\frac{3x}{x}}{\frac{3x}{x}} = \frac{x^2+3}{3} = \frac{0+3}{3} = \frac{3}{3} = 1$

59. $\lim_{x\to 0} \frac{(x-2)^2-4}{x} = \frac{(x-2)^2-2^2}{x}$

$= \frac{(x-2+2)(x-2-2)}{x}$

$= \frac{x(x-4)}{x} = x-4 = 0-4 = -4$.

60. $\lim_{x\to 0} \frac{3^x-1}{x}$

$= \text{Log}_e 3\left(\therefore \lim_{x\to 0} \frac{a^x-1}{x} = \text{Log}_e a\right)$

61. $\underset{x+0}{Lim}\frac{e^{2x}-1}{x}=\underset{x+0}{Lim}\frac{2(e^{2x}-1)}{2x}$

$=2\underset{x+0}{Lim}\frac{e^{2x}-1}{2x}$

$=2.1\left(\therefore \underset{x\to 0}{Lim}\frac{e^{x}-1}{x}=1\right)$

=2.

62. $\underset{x\to 3}{Lim}\frac{x^3-27}{x-3}$

$=\frac{x^3-3^3}{x-3}\ \therefore\left(\underset{x\to a}{Lim}\frac{x^n-a^n}{x-a}=na^{n-1}\right)$

$=3.3^{3-1}=3.9=27\cdot$

63. x tends to a from the left is symbolically written as $x\to a^-$ which means the value of x successively increases and ultimately approaches very nearer to a.

64. If the value of x successively decreases and ultimately is very nearer to 'a' then it is called x tends to a from the right hand side and symbolically written as $x\to a^+$ and read as x tends to a plus.

65. $\underset{x\to 1}{limit}\ (x^4-2x^3+3x^2+10x-3)$

= 1^4 - 2.1^3 + 3.1^2 + 10.1 - 3

= 1 - 2 + 3 + 10 - 3

= 14 - 5

= 9.

66. Constant function

Identity function

Polinomial function

Rational function

67. $\underset{x\to 1^-}{Lim}\ f(x)=\underset{x\to 1^-}{Lim}-2x+3=2+3=5$

$\underset{x\to 1^+}{Lim}\ 2x+3=2+3=5$

LHL = RHL

Hence the function is continuous.

Differentiation

68. $f(x+h)=(x+h)^2$

$\frac{dy}{dx}\underset{h\to 0}{Lim}\frac{(x+h)-f(x)}{h}=\underset{h\to 0}{Lim}\frac{(x+h)^2-x^2}{h}$

$=\underset{h\to 0}{Lim}\frac{x^2+2xh+h^2-x^2}{h}$

$=\underset{h\to 0}{Lim}\frac{2xh+h^2}{h}=\underset{h\to 0}{Lim}\frac{h(2x+h)}{h}$

$=2x+h=2+0=2$

69. $\frac{dy}{dx}=\frac{d}{dx}\left(\frac{1}{x^4}\right)=\frac{d}{dx}(x^{-4})=-4x^{-4-1}=-4x^{-5}.$

70. $\frac{dy}{dx}=\frac{d}{dx}\sqrt[3]{x}$

$\frac{d}{dx}=(x^{1/3})=\frac{1}{3}x^{1/3-1}=\frac{1}{3}x^{-2/3}.$

71. $\frac{d}{dx}=5^x=5^x Log_e{}^5\left(\because\frac{d}{dx}a^x=a^x Log_e{}^a\right)$

72. The derivative of the sum of two differentiable functions is the sum of their derivatives. If u and v are two differentiable functions of x then

$\frac{d}{dx}(u+v)=\frac{du}{dx}+\frac{dv}{dx}.$

73. $\frac{d}{dx}(5x+x^3)=\frac{d}{dx}5x+\frac{d}{dx}x^3$

$=5\frac{d}{dx}x+3x^2$

$=5.1+3x^2$

$=5+3x^2\cdot$

74. $\frac{d}{dx}(x^2-2x)=\frac{d}{dx}x^2-\frac{d}{dx}2x$

$=2x-2\frac{d}{dx}x$

$=2x-2.1$

$=2x-2=2(x-1)$

75. $\frac{d}{dx}\left(x+\frac{1}{x}\right)=\frac{d}{dx}(x)+\frac{d}{dx}\left(\frac{1}{x}\right)$

$=1+\frac{d}{dx}x^{-1}$

$=1+-1x^{-1-1}$

$=1+x^{-2}$

$=1+\frac{1}{x^2}$.

76. $\frac{d}{dx}x^3e^x=e^x\frac{d}{dx}x^3+x^3\frac{d}{dx}e^x$

$=e^x3x^2+x^3e^x=e^x(3x^2+x^3)$.

77. The derivative of the product of two functions is equal to the product of the second function and derivative of the first function plus th product of the 1st function and derivative of the second function. thus if u and v are two differentiable function is x then

$\frac{d}{dx}(uv)=v\frac{d}{dx}u+u\frac{d}{dx}v.$

78. $\frac{d}{dx}4^x.x^4=x^4\frac{d}{dx}4^x+4^x\frac{d}{dx}x^4$

$=x^4.4x\text{Log}_e{}^4+4^x.4x^3$

$=4x^3(x^2\text{Log}_e{}^4+4^x)$.

79. $\frac{d}{dx}5\text{Log}_e{}^x$

$=5.\frac{d}{dx}\text{Log}_e{}^x=5\frac{1}{x}$.

80. $4=(3x+2)^4$

Let $u=(3x+2)$

$\frac{du}{dx}=\frac{d}{dx}(3x+2)=3+0=3$

$\frac{dy}{du}=\frac{d}{du}u^4=4(3x+2)^3$

$\frac{dy}{dx}=\frac{dy}{du}x\frac{du}{dx}=4(3x+2)^3x3=12(3x+2)^3$.

81. $\frac{dy}{dx}e^{x^2+3x+9}=\frac{d}{dx}e^{x^2+3x+9}$

$=e^{x^2+3x+9}\frac{d}{dx}(x^2+3x+9)$

$=e^{x^2+3x+9}(2x+3+0)$

$=e^{x^2+3x+9}(2x+3)$.

82. If y is a function of u and u is a function of x or y=f(u) u=f(x) then

$\frac{dy}{dx}=\frac{dy}{du}x\frac{du}{dx}$.

83. $\frac{dy}{dx}(3x^3+4x^2+5x-3)$

$=\frac{d}{dx}(3x^3+4x^2+5x-3)$

$=\frac{d}{dx}(3x^3)+\frac{d}{dx}(4x^2)+\frac{d}{dx}(5x)-\frac{d}{dx}(3)$

$=9x^2+8x+5-0$

$=9x^2+8x+5$.

84. $\frac{d}{dx}(5x+x^3)$

$=\frac{d}{dx}(5x)+\frac{d}{dx}x^3$

$=5\frac{d}{dx}(x)+3x^2$

$=5.1+3x^2$

$=5+3x^2$.

85. $\frac{d}{dx}\sqrt{1+x^2}$

$=\frac{d}{dx}(1+x^2)^{1/2}$

$=\frac{1}{2}(1+x^2)^{-1/2}$

$=\frac{1}{2}\frac{1}{\sqrt{1+x^2}}$

86. The expression g(x)+c which represents all the antiderivatives of f(x) but not any definite derivative is called the indefinite integral of f(x). this is written as $\int f(x)$ and read as indefinite integral of f(x) w.r.t. x.

87. $\int 5x^3dx = 5\frac{x^{3+1}}{3+1} + C$

$= 5\frac{x^4}{4} + C = \frac{5}{4}x^4 + C$

88. $\int x^{1/2}dx = \frac{x^{1/2+1}}{1/2+1} + C$

$= \frac{x^{3/2}}{\frac{3}{2}} + C = \frac{2}{3}x^{3/2} + C$.

89. $\int 8 - 9x - x^5dx = \int 8dx - \int 9xdx - \int x^5dx$

$= 8x - \frac{9x^2}{2} - \frac{x^6}{6} + C$.

90. $\int 5^x dx = \frac{5^x}{\text{Log}_e 5} + C$

91. $\int 5^{2x}dx = \frac{5^{2x}}{2\text{Log}_e 5} + C$

92. $\int \frac{7x^2}{25}dx = \frac{7}{25}\int x^2dx$

$= \frac{7}{25}\frac{x^{2+1}}{2+1} + C$

$= \frac{7}{25}x^3 + C$

93. $\int \frac{x^4+1}{x^2}dx$

$= \int \frac{x^4}{x^2}dx + \int \frac{1}{x^2}dx$

$= \int x^2dx + \int x^{-2}dx$

$= \frac{x^3}{3} + \frac{x^{-2+1}}{-2+1} + C$

$= \frac{x^3}{3} - \frac{1}{x} + C$

94. The 3 important methods of finding integral are

(i) Integration by substitution

(ii) Integration by parts

(iii) Integration by partial fraction

95. $\int (x^2-2)^2dx$

$= \int (x^4 - 4x^2 + 4)dx$

$= \int x^4dx - \int 4x^2dx + \int 4dx$

$= \frac{x^5}{4} - 4\int x^2dx + \int 4dx$

$= \frac{x^5}{4} - 4\frac{x^3}{3} + 4x + C$

96. $\int e^{1/2x}dx = \int \frac{e^{\frac{x}{2}}}{\frac{1}{2}} + C$

$= 2e^{\frac{x}{2}} + C$.

97. $\int 5x3^x dx = 5\int 3^x dx$

$= 5\frac{3^x}{\text{Log}_e 3} + C$.

98. $\int 3x^6dx = 3\int x^6dx$

$= 3\frac{x^7}{7} + C$

$= \frac{3}{7}x^7 + C$.

99. $\int \frac{5}{x^3}dx \quad = 5\int x^{-3}$

$= 5\frac{x^{-3+1}}{-2} + C$

$= 5\frac{x^{-2}}{2} + C$

$= -5\frac{1}{2x^2} + C$

$= -\frac{5}{2x^2} + C$

100. $\int (x+1)^3 dx$

$= \int \frac{(x+1)^{3+1}}{4} dx + C$

$= \frac{(x+1)^4}{4} + C$

Measures of Central Tendency

101. The mathematical properties of A.M.

(i) The algebraic sum of deviations from Mean is Zero.

(ii) The sum of square of deviations taken form mean is lowest. symbolically $\sum (x - \bar{x})^2 = \text{Lowest.}$

102. Geometric Mean is the n^{th} root of the product of N items.

Symbolically $G.M. = \sqrt[n]{x_1 . x_2 . x_3 ... x_n}$

103. (i) It is easy to understand.

(ii) Its calculation is based on all the values of the observation.

104. (i) It is difficult to understand and calculate.

(ii) It can not be found out when a value is either zero or negative.

105. In a series A.M. > G.M. > H.M. If all the alues of series are equal AM = GM = HM. For any two positive numbers $G.M. = \sqrt{A.M. \times H.M.}$.

106. Harmonic Mean is useful in averaging speed, prices where relationship between two types of units are being capable of being expressed as raciprocals.

107. When different weights are assigned to different values in a series according to their importance for the purpose of better representation, and their A.M. is found out that is called weighted A.M.

Symbolically $\text{Weighted A.M.} = \frac{\sum WX}{\sum W}$.

108. It is not possible to calculate A.M. if all the values are not known. Presence of extreme values in the series affect the Mean.

109. Positional averages are values which are not derived, they are existing values, picked out only by identifying their position or location in a series.

110. It is based on all the values of the observation. It is very much seful in construction of index number.

111. H.M. $= \frac{N}{\sum \frac{1}{x}}$

$= \frac{4}{\frac{1}{10} + \frac{1}{20} + \frac{1}{25} + \frac{1}{50}} = \frac{4}{\frac{10+5+4+2}{100}}$

$= \frac{400}{21} = 19.04$

112. Combined Mean

$= \frac{\bar{X}, N_1 + \bar{X}_2 N_2 + \bar{X}_3 N_3}{N_1 + N_2 + N_3}$

$= \frac{(12x20) + (15x40) + (18x30)}{20 + 40 + 30}$

$= \frac{240 + 600 + 540}{90}$

$= \frac{1380}{90} = 15.33$

113. First 10 odd numbers are

1,3,5,7,9,11,13,15,17,19

$\text{The A.M.} = \frac{1+3+5+7+9+11+13+15+17+19}{10}$

$= \frac{100}{10} = 10$.

114. The total students in the class is 20+30=50

Sum of IQ of the class is = 80 x 50 = 4000

Total IQ of Girls = 82 x 30 = 2460

Total IQ of Boys = 4000 - 2460 = 1540

Avg. IQ of Boys = $\frac{1540}{20} = 77$.

115. $G.M. = \sqrt{A.M. \times H.M.}$

$\therefore A.M. = \frac{G.M.^2}{H.M.} = \frac{8^2}{4} = 16$.

116. $A.M. = \frac{\sum fx}{N}$

$$\frac{(1x2)+(2x1)+(3x4)+(4xx)+(5x1)}{2+1+4+x+1} = 2.9$$

$$= \frac{2+2+12+4x+5}{8+x} = 2.9$$

$$= \frac{21+4x}{8x} = 2.9$$

$$21+4x = 2.9(8+x)$$

$$21+4x = 23.2+2.9x$$

$$4x - 2.9x = 23.2 - 21$$

$$1.1x = 2.2 \therefore x = 2.$$

117. (i) It should be easy to understand.

(ii) It should take into consideration all the values in the variable.

(iii) It must be rigidly defined.

118. $\bar{X} = A + \frac{\sum fd}{\sum f}$

Where A = Assumed Mean

$\sum f = N$ or total number of observations

fd = Product of the frequency with respect deviations from Assumed mean.

119. $H.M = \frac{N}{\sum \frac{1}{x}}$

$$= \frac{4}{\frac{2}{1}+\frac{5}{1}+\frac{10}{1}+\frac{20}{1}} = \frac{4}{37} = 0.11$$

120. Measures of central tendency refers to a group of statistical methods those are being used to find out the central value or the average value or the indicators of a frequency distribution.

121. The A.M. of 1st 50 natural numbers is

$\frac{50 \times 51}{2 \times 50} = 25.5$.

122. The required average speed is

$$\frac{2}{\frac{1}{20}+\frac{1}{30}} = \frac{2}{\frac{3+2}{60}} = \frac{2 \times 60}{5} = 24 \text{ km/hour}.$$

123. The G.M. of 4, 8, 16 is $= \sqrt[3]{4 \times 8 \times 16} = 8$.

124. The mathematical avreage is a derived value found out by taking into consideration all the values in the distribution whereas the positional average is a locataional value identified by its position in the distribution.

125. The annual average increase will be the G.M. of 2% and 8% i.e.

$\sqrt[2]{2 \times 8} = \sqrt{16} = 4$.

126. Median is a positional measure of central value which lies in the middle of the distribution. It divides the distribution into two equal halves, one half comprises all values greater and the other all values smaller than the Median.

127. Median is useful when :

(i) All the observations are not available.

(ii) Where numerical measuresments are not possible like skill, honesty, intelligence etc.

128. (i) It is easy to unerstand and simple to calculate.

(ii) Its determination does not require all the items of the observations.

129. (i) It is not based on all the observations.

(ii) It is not capable of further mathematical treatment like A.M., G.M. or H.M.

130. Quartile is a partition value that divides an arranged (ascending / discending order) series into 4 equal parts. There are 3 quartile values i.e. Q_1, Q_2 and Q_3. The Q_1 is called the lower quartile whereas the Q_3 is called the upper quartile.

131. Percentiles are partition values that devide the series into 100 equal parts. There are 99 percentiles which are denoted by $P_1.P_2.P_3...P_{99}$. The 50th percentile is the same as the alue of the median as it stands in the middle of a distribution.

132. Median $= L_1 + \frac{L_2 - L_1}{f_1}(m - c)$

Where L_1 = Lower limit of the median class

L_2 = Upper limit of the median class

f_1 = Frequency of the median class.

m = N/2

c = Cummulative frequency of the class proceeding the Median Class.

133. Mode is a positional average like Median. It is the most frequently occuring value in a frequency distribution. Thus, it is the value with the highest frequency.

134. Methods used for determining mode are

(i) Method of inspection

(ii) Metod of grouping and analysis

(iii) Method of graph

(iv) Method of empirical relation

135. $Z = L_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2}(L_2 - L_1)$

Where,

Z = Mode

L_1 = Lower limit of the modal class

L_2 = Upper limit of the modal class

f_1 = Frequency of the modal class

f_0 = Frequency of the class Preceeding modal class

f_2 = Frequency of the class succeeding modal class

136. (i) It is easy to understand.

(ii) It is not affected by presence of extreme values in the series. Its determination is based on the frequency not on values of the variable.

137. (i) It is not rigidly defined

(ii) It is not capable of further mathematical treatment.

138. Unlike other averages mode is capable of studying qualitiative data as its determination is based on frequencies not on the values of the variable. It helps in studying trend in fashion, and deciding quantities of stock and production of different goods.

139. In a moderately asymmetrical distribution. The mean, median and mode maintain a mathematical relationship as follows.

Mode = 3 Median - 2 Mean.

140. $N = 100 \quad \bar{X} = 50$

$\bar{X} = \frac{\sum X}{N} \quad \therefore \sum X = 50 \times 100 = 5000$

Corrected $\sum X = 5000 - 84 + 48 = 4964$

Corrected Mean $= \frac{4964}{100} = 49.64$.

141. Mode = 3 Median - 2 Mean.

$\therefore$ Median $= \frac{\text{Mode} + 2\text{Mean}}{3}$

$= \frac{50 + 35x2}{3} = \frac{50 + 70}{3} = 40$

142. When class intervals are unequal they should be made equal before computing the mode. The related frequencies shall be adjusted on the assumption that they are equally distributed throughout the class.

143. Following factors are important to judge the appropriateness of an average.

(i) Level of measurement of data

(ii) Shape of the distribution

(iii) Stability of the measure

144. The differences between Mean and Median are

(i) Mean is a mathematical average whereas median is a positional average.

(ii) Mean is bassed on all the values of the observation but median is the value that lies in the middle of the distribution.

145. Mean takes into consideration all the items of the observation whereas for calculation mode all items are not required.

Mean is capable of further mathematical treatment whereas mode is not.

Measures of Dispersion

146. The study of dispersion determines the reliability of an average, the nature and cause of variation and helps in comparision of two or more series of data and therefore necessary for better analysis and interpretation of data.

147. (i) It should be simple to understand

(ii) Based on all observations

(iii) Not affected by extreme values in the observation

148. A measure of dispersion which is expressed in the same statistical unit in which the original data are given called obsolute measure of dispersion. Thus it is expressed in terms of rupees, kilograms, metres, litres etc.

149. A relative measures is the ratio of an absolute measure of dispersion to one appropriate average. It is free from any unit of measurement and known as co-efficient of variation.

150. Merits of range are :

(i) It is simple to understand and easy to calculate.

(ii) For finding the alue of range it is not necessary to calculate any average.

151. (i) It is not based on all the values of the observation.

(ii) It is affected by presence of extreme values in the observation.

(iii) It is not possible to calculate range in opne-ended series.

152. Inter quartile range is the difference between third quartile and first quartile of the observation. It is an obsolute measure of dispersion. Symbolically IQR = Q_3-Q_1.

153. Positional dispersions are the measures that describe the spread or scatter among values of variables taking into account the physical position of the variable in a distribution. Range, IQR and quartile deviation are examples of positional measures of dispersion.

154. The advantages of Q.D. are

(i) It is not effected by extreme values

(ii) It can be determined in case of open-ended distribution.

155.

x	10	20	30	40	50	60
f	3	6	8	15	5	2
cf	3	9	17	32	37	39

$Q_3 = \frac{3(N+1)}{4}$ th item

i.e. $\frac{3(39+1)}{4}$ =30th item i.e. 40

$Q_1 = \frac{3(N+1)}{4}$ th item

i.e. $\frac{39+1}{4}$ = 10th item i.e. 30.

156. Highest value in the series = 55 (L)

Smallest value in the series = 40 (S)

Co-efficient of Range is

$\frac{55-40}{55+40} = \frac{15}{95} = 0.158$.

157.

x	200	325	612	740	818	920
f	3	5	8	6	7	2
c.f.	3	8	16	22	29	31

$Q_3 = \frac{3(N+1)}{4} = \frac{3(31+1)}{4} = 24$ th item. i.e. 818

$Q_1 = \frac{(N+1)}{4} = \frac{31+1}{4} = 8$ th item i.e. 325.

$\therefore Q.D. = \frac{Q_3 - Q_1}{2} = \frac{₹818 - ₹325}{2}$

$= \frac{₹493}{2} = 246.5$.

158. (i) It is easy to understand and simple to calculate.
(ii) It is based on all the obsrevations
(iii) It is rigidly defined.

159. (i) It is illogical as it ignores '+' and '-' signs - for finding deviations from the central value.
(ii) it is not capable of further mathematical treatment.
(iii) It is difficult to calculate when the central value is in fraction.

160. Mean Deviation $= \frac{\sum f|d|}{N}$

Where f = frequency

$|d| =$ Deviations taken from central value i.e. either $\bar{X}$. Med or Mode ignoring plus, minus signs from the Mid values.

N = Total Number of observations or $\sum f$.

161. (i) It is based on all the observations.
(ii) It is rigidly defined.
(iii) It is amenable to further algebraic treatment.

162. (i) It is difficult to calculate
(ii) It gives more weightage to extreme items and comparatively less weightage to near mean items.

163. Standard Deviation (S.D)

$$= \sqrt{\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N}\right)^2}$$

Where d = X-A (Variable - Assumed Mean)
f = frequency
N = $\sum f$ or Total number of obsrevations

164. The S.D. of 1st 50 natural numbers

$$\sigma = \sqrt{\frac{n^2-1}{12}} = \sqrt{\frac{50^2-1}{12}} = \sqrt{\frac{2499}{12}} = \sqrt{208.25}$$

= 14.43

165. Standard deviation is dependent upon change of scale means if each item data is multiplied or divided by a constant number then the value of standard deviation will either increase or decrease proporationately with the same constant.

166. Standard deviation is independent of change in origin means if each item is either decreased or increased by a constant numbers then the value of standard deviation will remain unchanged.

167. In a symmetric or moderately asymmetrical distribution.

$$Q.D. = \frac{2}{3} S.D.$$

$$M.D. = \frac{4}{5} S.D. \text{ and}$$

$$Q.D. < M.D. < S.D.$$

168. Q.D. = 2/3rd of S.D. = 2/3 x 45 = 30

M.D. = 4/5 of S.D. = 4/5 x 45 = 60.

169. Co-efficient of variation is $\frac{\bar{X}}{\sigma}$ x 100.

C. V. for $A = \frac{15}{50} x100 = 30\%$

C.V. for $B = \frac{20}{60} x100 = 33.33\%$.

As C.V. in case of A is less. A is more consistent.

170. (i) Standard deviation is calculated from A.M. only whereas M.D. can be found out from A.M. or Median or Mode.
(ii) while calculating S.D. '$\pm$' signs are not ignored, but while calculating M.D. '$\pm$' signs are ignored.

171. Mean $= \frac{\sum x}{N}$

X	$X - \bar{X}$	$(X - \bar{X})^2$
4	–4	16
6	–2	4
8	0	0
10	+2	4
12	+4	16

$$\sum (x - \bar{x})^2 = 40$$

$$\therefore \bar{X} = \frac{4+6+80+10+12}{5} = 8$$

$$\sigma = \sqrt{\frac{\sum (X-\bar{X})^2}{N}}$$

$$= \sqrt{\frac{40}{5}} = \sqrt{8} = 2.83$$

172. $\bar{X} = \frac{\sum X}{N} \therefore 6 = \frac{60}{N} \therefore N = 10$

$$\sigma = \sqrt{\frac{\sum X^2}{N} - (X)^2}$$

$$= \sqrt{\frac{100}{10} - (6)^2} = \sqrt{100-36} = \sqrt{64} = 8.$$

173. Combined Standard Deviation

$$\sigma_{12} = \frac{n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)}{n_1 + n_2}$$

Where n_1 = Size of the 1st series

n_2 = Size of the 2nd series

$\sigma_1 . \sigma_2$ = S.D. of 1st and second series

$d_1 = \bar{X}_1 - \bar{X}_{12}$

$d_2 = \bar{X}_2 - \bar{X}_{12}$

174. For finding out which share is more stable we have to compare the co-efficient of variation.

$$C.V. = \frac{\sigma}{\bar{X}} x100$$

Share A $C.V. = \frac{5.4}{18} x100 = 30$

B $C.V. = \frac{4.5}{22.5} x100 = 20$

Since C. V. for share B is less, it is more stable.

175.

0-20	8
20-40	20-8=12
40-60	50-20=30
60-80	70-50=20
80-100	80-70=10

176. The positive square root of the arithmetic mean of the square of the deviations of the values of distribution from its arithmetic mean is called the standard deviation of the distribution.

Symbolically $\sigma = \sqrt{\frac{\sum (X-\bar{X})}{N}}$.

177. Standard deviation is called the best measure of dispersion because it satisfy allmost all the criterias of an ideal measure. It is rigidly defined, takes into consider all the values in the variable and has further mathematical and statistical requirements.

178. In a symmetric distribution $\bar{X} \pm 3\sigma$ deviation covers almost all the items of distribution. hence the lowest value in the distribution will be

$\bar{X} - 3\sigma = 50 - 3 \times 3 = 41$

The highest value in the distribution will be

$\bar{X} + 3\sigma = 50 + 3 \times 3 = 59$

179. In symmetric distribution

$Q_3 - M = M - Q_1$

$$\therefore \text{Median} = \frac{Q_1 + Q_3}{2}$$

Semi inter quartile range=18.

or $\frac{Q_3 - Q_1}{2} = 18$

or $Q_3 - Q_1 = 36$

$\therefore Q_3 = 142 + 36 = 178$

$$\therefore \text{Median} = \frac{178+142}{2} = \frac{320}{2} = 160.$$

180. $Q_1 = \frac{1}{3} Q_3$

Given $Q_1 = 5 \quad Q_3 = 15$

$$Q.D. = \frac{Q_3 - Q_1}{2} = \frac{15-5}{2} = 5.$$

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SHORT TYPE QUESTIONS

4. Answer the following questions within 50 words each.

Matrix

1. What is singular and non-singular matrix? Explain with example.
2. What is equal matrix ? How it is different from equivalent matrix ?
3. If $A=\begin{pmatrix}2 & 1\\ 5 & 1\end{pmatrix}$ and Find $B=\begin{pmatrix}1 & -3\\ 2 & 4\end{pmatrix}$
   Find 2A+4B.
4. Find the adjoint matriex of $\begin{pmatrix}2 & -1\\ -4 & -3\end{pmatrix}$
5. If $\begin{pmatrix}a & 4\\ 2a+3b & 7\end{pmatrix}=\begin{pmatrix}7 & 4\\ 20 & 7\end{pmatrix}$
   Find the value of a and b.
6. What is transpose of a matrix ? Explain with example.
7. Find the product of A and B when
   $A=\begin{pmatrix}1 & 3\\ 2 & 1\end{pmatrix}_{2x2}$ $B=\begin{pmatrix}4\\ -1\end{pmatrix}_{2x1}$

Determinant

8. Find the value of the determinant.
   $|A|=\begin{vmatrix}3 & -2 & 5\\ 4 & 0 & 4\\ 1 & 7 & 6\end{vmatrix}$
   Expanding along the 1st row.
9. Solve the following equations using Crammers rule
   $2x+3y=3$
   $3x-2y=11$
10. Find the Co-factor of each element of the following determinant
    $\begin{vmatrix}2 & 4 & 3\\ 1 & 2 & 3\\ 2 & 3 & 1\end{vmatrix}$
11. If each element in a row or column of a determinal is multiplied by a constant then the value of the determinant get multiplied by the same constant. Show with example.
12. Evaluate the following determinant by expanding along the column.
    $\begin{vmatrix}3 & 7 & 2\\ 3 & 0 & 5\\ 8 & 2 & 1\end{vmatrix}$
13. Find the cofactor of all the elements of 1st row of the following determinant.
    $\begin{vmatrix}1 & 2 & 3\\ 5 & 6 & 7\\ 9 & 10 & 11\end{vmatrix}$
14. Determine the numerical value of the determinant by Sarrus Expansion method.
    $\begin{vmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 7 & 8 & 9\end{vmatrix}$
15. Using appropraite property evaluate the determinant
    $\begin{vmatrix}8 & 4 & 3\\ 6 & 3 & 5\\ 8 & 4 & 2\end{vmatrix}$

Set Theory

16. If set $A=\{x:x^2-4x+3=0\}$ and $B=\{0,1,2,3\}$. Find $A\cup B$.
17. What is Venn diagram? Explain with example.
18. In A={x : x^2+5x+6=0} and B={0,1,2} Find $A\cap B$.
19. Prove that $A\cap B=B\cap A$.
20. Prove that $A\cup B=B\cup A$.
21. Prove that $A-B=B'-A'$
22. Prove that $A\cap(A\cup B)=A$
23. Of a group of 30 students 15 like music 10 like dance and the rest five like both. Find the number of students those who like neither music nor dance.

Function

24. If (x) = $(x)^2$ and g(x) = x + 2 then find fog(2) and gof(2).

25. Test whether the following function is odd or even $y = 2x^4 + 3x^2$.

26. Prove that the following function is an odd function
$y = \frac{1}{4x^3}$.

27. Differentiate between a relation and a function.

28. Find the inverse of the following function
f(x) = 3x + 1

29. Explain exponential function with example

Limit and Continuity

30. Evaluate $\lim_{x\to 0} \frac{\sqrt{3+x} - \sqrt{3-x}}{x}$

31. Evaluate the value of n if $\lim_{x\to 2} - \frac{x^n - 2^n_1}{x-2} = 32$.

32. Test the continuity of the following function at x=0.
$$f(x)\begin{cases} 4 & \text{for} \quad x > 0 \\ 2 & \text{for} \quad x < 0 \end{cases}$$

33. Test the continuity of the following function at x=1
$$f(x)\begin{cases} 3x+1 & \text{for} \quad x \le 1 \\ x^2+3 & \text{for} \quad x > 1 \end{cases}$$

34. Find the right hand limit of the following function.
$$\lim_{x\to 5} f(x) = \begin{cases} 2x+1 & \text{for} \quad x < 5 \\ x^2 & \text{for} \quad x > 5 \end{cases}$$

35. Find the LHL of the following function.
$$\lim_{x\to 4} f(x) = \frac{|x-4|}{x-4}$$

36. Find the value of
$$\lim_{x\to 0} \frac{(1+x)^2 - 1}{x}$$

37. Find the value of
$$\lim_{x\to 3} \frac{x^3 - 27}{x^2 - 9}$$

38. Find the value of
$$\lim_{x\to 0} \frac{x^3 + 3x}{3x}$$

39. Test the continuity of the following function of x=1
$$f(x) = \begin{cases} \frac{x^6 - 1}{x - 1} & \text{for} \quad x \neq 1 \\ 6^x & \text{for} \quad x = 1 \end{cases}$$

Differentiation

40. Find the differential co-efficient of the following function.
$y = x^5 + x^3 + \frac{1}{x}$

41. Differentiate $x^5 + 2x - x^3$.

42. Find the differential of $\frac{(1-x)^2}{x^2}$.

43. Differentiate $y = (2x+3)^2$

44. Differentiate $y = \frac{x^3}{x^3+2}$

45. Find the differential co-efficient of $y = x^3 e^x$.

46. Write the quotent rule of differentiation.

47. Write the product rule of differentiation.

48. Differentiate $\frac{3}{1-5x}$.

49. Find the derivative of $10^x.x^{16}$

Integration

50. Evaluate $\int \frac{7}{\sqrt{x}} dx$

51. Evaluate $\int \left(x + \frac{1}{x}\right)^2$

52. Evaluate $\int \frac{1}{3+2x} dx$

53. Evaluate $\int \frac{1}{2x-3} dx$

54. Evaluate $\int 5^{3x} dx$

55. Evaluate $\int e^{3x} - 7x^{-1}$

56. Evaluate $\int (x+1)^3 dx$

Measures of Central Tendency

57. Explain the empirical relationship between mean median and mode.
58. Write the features of an ideal average.
59. What is Weighted A.M. and how it is calculated ?
60. What are the objectives of a measure of central value.
61. Explain the specific uses of G.M.
62. Write any three properties of A.M.
63. If A.M. and G.M. of two values are 10 and 8 respectively. Find the values.
64. A driver covers a distance of 100 k.m. at 30 k.m. per hour and came back the same distance at 20 k.m. per hour. Find his average speed.
65. Explain the relationship among A.M., G.M. and H.M.
66. The population of a city increased by 5%, 10% and 20% in last 3 years. What is the average percentage increase during the period ?
67. Write the steps you will follow in case of calculating median of a continuous series.
68. Average rainfal of a city from Monday to Saturday was 30 mm. Due to heavy rainfal on Sunday the average rain fall during the period increases to 35 mm. What was the rainfal on Sunday ?
69. Explain the imitations of mode.
70. The A.M. of a group of 75 observations was 27. It was later discovered that one observation was wrongly read as 43 instead of the correct value 53. Find out the correct A.M.
71. During a period of decline in stock market prices a stock sold at ₹50 per share on one day ₹40 on the next day and ₹25 on 3rd day. If the investor bought ₹1000 worth of shares on each day, find the average price per share.
72. What is combined A.M.? How it is calculated?
73. Write any three mathematical properties of G.M.
74. Explain the advantages of Mode.

Measures of Dispersion

75. State the merits of standard deviation.
76. State the merits of Mean deviation.
77. Write the points of difference between M.D. and S.D.
78. Calculate mean deviation form A.M. for the following data :

x	10	20	30
f	4	10	6

79. The 1st quartile is 142 and the semi interquartile rang is 18, find the value of Median assuming the distribution to be symmetrical.
80. The highest value of a series is 120 the co-efficient of range is 0.75. Find the lowest value.
81. Calculate stanard deviation form the following data :
3, 5, 7, 9, 11
82. The numbe of employees, wage per employee and the standard deviation of the wage for two factories are given below :

	Factory A	Factory B
No. of employees	100	150
Average wage per employee	3200	2800
Standard deviation	25	27

In which factory there is greater variance in distribution of wage per employee.

83. Explain the relationship among Q.D. M.D. and S.D.
84. What do you mean by Co-efficient of variation?
85. The mean and standard deviation of a normal distribution are 60 and 5 respectively. Find the inter quartile range and the mean deviation.
86. Explain the main objectives of measuring variation.
87. What is a relative measure of dispersion ? How it is useful ?
88. Write the features of an ideal measure of dispersion
89. From the following data find the mean deviation and co-efficient of M.D. from the median

10, 15, 18, 20, 30

***

ANSWERS

4. Answer the following questions within 50 words each.

Matrix

1. A square matrix the determinant of which is zero is called a singular matrix and when it is not zero then called a non singular matric. Example.

$$A = \begin{pmatrix} 2 & 10 \\ 1 & 5 \end{pmatrix}$$

Determinant of A = (2x5) - (10x1)=10-10 = 0
Thus A is a singular matrix

$$B = \begin{pmatrix} 2 & 10 \\ 1 & 6 \end{pmatrix}$$

$$|B| = (2x6) - (10x1) = 12 - 10 = 2$$

As $|B| \neq 0$ B is a non singular matrix.

2. Two matrices are said to be equal if all the elements of one matrix are equal to the corresponding elements of other matrix.

Example $A = \begin{pmatrix} 3 & 4 \\ 5 & 6 \end{pmatrix}_{2x2}$ and $B = \begin{pmatrix} 3 & 4 \\ 5 & 6 \end{pmatrix}_{2x2}$

then A = B.
The matrix are said to be equivalent if both have same number of rows and same number of columns.

Example $A = \begin{pmatrix} a & b & c \\ d & e & f \end{pmatrix}_{2x2}$ and

$$B = \begin{pmatrix} p & q & r \\ s & t & u \end{pmatrix}_{2x2}$$

A and B are equivalent moterails.

3. $A = \begin{pmatrix} 2 & 1 \\ 5 & 2 \end{pmatrix}$ $2A = 2\begin{pmatrix} 2 & 1 \\ 5 & 2 \end{pmatrix} = \begin{pmatrix} 4 & 2 \\ 10 & 4 \end{pmatrix}$

$B = \begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix}$ $4B = 4\begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix} = \begin{pmatrix} 4 & -12 \\ 8 & 16 \end{pmatrix}$

$$2A+4B = \begin{pmatrix} 4 & 2 \\ 10 & 4 \end{pmatrix} + \begin{pmatrix} 4 & -12 \\ 8 & 16 \end{pmatrix}$$

$$= \begin{pmatrix} 4+4 & 2-12 \\ 10+8 & 4+16 \end{pmatrix} = \begin{pmatrix} 8 & -10 \\ 18 & 20 \end{pmatrix}$$

4. $A = \begin{pmatrix} 2 & -1 \\ 4 & -3 \end{pmatrix}$ $|A| = \begin{vmatrix} 2 & -1 \\ 4 & -3 \end{vmatrix}$

$M_{11} = -3$ $M_{12} = 4$ $M_{21} = -1$ $M_{22} = 2$

$C_{11} = (-1)^{1+1}\ M_{11} = -3$ $C_{12} = (-1)^{1+2}\ M_{12} = -4$

$C_{11} = (-1)^{2+1}\ M_{21} = 1$ $C_{22} = (-1)^{2+2}\ M_{22} = 2$

Cofactor matrix of $A = \begin{pmatrix} -3 & -4 \\ 1 & 2 \end{pmatrix}$

Adjoint of Matrix $A = \begin{pmatrix} -3 & 1 \\ -4 & 2 \end{pmatrix}$

5. $\begin{pmatrix} a & 4 \\ 2a+3b & 7 \end{pmatrix} = \begin{pmatrix} 7 & 4 \\ 20 & 7 \end{pmatrix}$

$\therefore$ a = 7

2a + 3b = 20

b = 20 - 2a = 20 - 2 x 7 = 6.

6. A matrix which is obtained by changing the rows into their respective columns and columns, into rows is called a transpose matrix.

Example $A = \begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix}$

Transpose of A or $A^{I} = \begin{pmatrix} a & d & g \\ b & e & h \\ c & f & i \end{pmatrix}$

7. $\begin{pmatrix} 1 & 3 \\ 2 & 1 \end{pmatrix} x \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

$$\begin{pmatrix} 1 \text{ x } 4 + 3 \text{ x } (-1) \\ 2 \text{ x } 4 + 1 \text{ x } (-1) \end{pmatrix} = \begin{pmatrix} 4-3 \\ 8-1 \end{pmatrix} = \begin{pmatrix} 1 \\ 7 \end{pmatrix}_{2x1}$$

Determinants

8. Value of the determinant expanding along the 1st row

$$|A| = \begin{vmatrix} 3 & -2 & 5 \\ 4 & 0 & 4 \\ 1 & 7 & 6 \end{vmatrix}$$

$$|A| = 3\begin{vmatrix} 0 & 4 \\ 7 & 6 \end{vmatrix} - (2)\begin{vmatrix} 4 & 4 \\ 1 & 6 \end{vmatrix} + 5\begin{vmatrix} 4 & 0 \\ 1 & 7 \end{vmatrix}$$

= 3(0-28) - (-2) (24-4) + 5(28-0)

= 3 x - 28 + 40 + 140

= - 84 + 40 + 140

= 180 - 84 = 96.

9. 2x + 3y = 3

3x - 2y = 11

$$|D| = \begin{vmatrix} 2 & +3 \\ 3 & -2 \end{vmatrix} = -4 - 9 = -13$$

$$D_1 = \begin{vmatrix} 3 & 3 \\ 11 & -2 \end{vmatrix} = -6 - 33 = -39$$

$$D_2 = \begin{vmatrix} 2 & 3 \\ 3 & 11 \end{vmatrix} = 22 - 9 = 13$$

$$x = \frac{D_1}{D} = \frac{-39}{-13} = 3$$

$$y = \frac{D_2}{D} = \frac{13}{-13} = -1$$

10. Cofactor of an element is = $(-1)^{i+j}$. M_{ij}.

Cofactor of $2 = (-1)^{1+1}\begin{vmatrix} 2 & 3 \\ 3 & 1 \end{vmatrix} = -7$

Cofactor of $4 = (-1)^{1+2}\begin{vmatrix} 1 & 3 \\ 2 & 1 \end{vmatrix} = 5$

Cofactor of $3 = (-1)^{1+3}\begin{vmatrix} 1 & 2 \\ 2 & 3 \end{vmatrix} = -1$

Cofactor of $1 = (-1)^{2+1}\begin{vmatrix} 4 & 3 \\ 3 & 1 \end{vmatrix} = 5$

Cofactor of $2 = (-1)^{2+2}\begin{vmatrix} 3 & 1 \\ 2 & 3 \end{vmatrix} = -4$

Cofactor of $3 = (-1)^{2+3}\begin{vmatrix} 1 & 2 \\ 2 & 3 \end{vmatrix} = 1$

Cofactor of $2 = (-1)^{3+1}\begin{vmatrix} 4 & 3 \\ 2 & 3 \end{vmatrix} = 6$

Cofactor of $3 = (-1)^{3+2}\begin{vmatrix} 2 & 3 \\ 1 & 3 \end{vmatrix} = -3$

Cofactor of $1 = (-1)^{3+3}\begin{vmatrix} 1 & 2 \\ 2 & 3 \end{vmatrix} = -1$

11. Let $A = \begin{vmatrix} 2 & 3 \\ 4 & 8 \end{vmatrix}$ $|A| = 16 - 12 = 4$

If the first column is multiplied by 2 then the new determinant will be

$$\begin{vmatrix} 4 & 3 \\ 8 & 8 \end{vmatrix} = 32 - 24 = 8$$

If the 1st row is multiplied by 2.

$$\begin{vmatrix} 4 & 6 \\ 4 & 8 \end{vmatrix} = 32 - 24 = 8 .$$

12. $$\begin{vmatrix} 3 & 7 & 2 \\ 3 & 0 & 5 \\ 8 & 2 & 1 \end{vmatrix}$$

Expanding along the 1st column we will get.

$$|D| = 3\begin{vmatrix} 0 & 5 \\ 2 & 1 \end{vmatrix} - 3\begin{vmatrix} 7 & 2 \\ 2 & 1 \end{vmatrix} + 8\begin{vmatrix} 7 & 2 \\ 0 & 5 \end{vmatrix}$$

= (0 - 10) - 3 (7- 4) + 8 (35 - 0)

= - 10 - 9 + 280

= 261

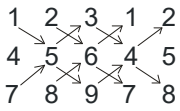
13. $$\begin{vmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 9 & 10 & 11 \end{vmatrix}$$

Cofactor of an element = $(-1)^{i+j} M_{ij}$

Cofactor of $1 = (-1)^{1+1}\begin{vmatrix} 6 & 7 \\ 10 & 11 \end{vmatrix} = -3$

Cofactor of $2 = (-1)^{1+2}\begin{vmatrix} 5 & 7 \\ 7 & 1 \end{vmatrix} = 8$

Cofactor of $3 = (-1)^{1+3}\begin{vmatrix} 5 & 6 \\ 9 & 10 \end{vmatrix} = -4$

14. 

$|D| = (1 \times 5 \times 9) + (2 \times 6 \times 7) + (3 \times 4 \times 8) -$
$(7 \times 5 \times 3) - (8 \times 6 \times 1) - (9 \times 4 \times 2)$
$= 45 + 84 + 96 - 105 - 48 - 72$
$= 225 - 225$
$= 0$

15. $\begin{vmatrix} 8 & 4 & 3 \\ 6 & 3 & 5 \\ 8 & 4 & 2 \end{vmatrix} = \begin{vmatrix} 2x4 & 4 & 3 \\ 2x3 & 3 & 3 \\ 2x4 & 4 & 2 \end{vmatrix} = 2\begin{vmatrix} 4 & 4 & 3 \\ 3 & 3 & 5 \\ 4 & 4 & 2 \end{vmatrix}$

As two columns of the determinant are equal the value of the determinant is 0.

Hence the numerical value is 2 x 0 =0

16. $x^2 - 4x + 3 = 0$

$x^2 - 3x - x + 3 = 0$

$x(x-3) - 1(x-3) = 0$

$(x-1)(x-3) = 0$

$\therefore x - 1 = 0 \qquad \therefore x = 1$

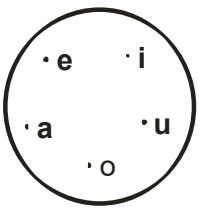
$x - 3 = 0 \qquad x = 3$

Then the elements of set A are 1 and 3
A = {1, 3}, B = {0,1,2}

$A \cup B = \{0,1,2,3\}$

17. Venn diagram is a method of presenting a set in geometrical shape and was developed by English logician John Venn. Under this method sets are represented in form of cricles or elipse or rectangle and its elements are denoted by points or dots inside.

Example : A set of english vowels can be presented as follows :



18. $A = \{x : x^2 + 5x + 6x\}$

We have to find out the elements of A.

$x^2 = 5x + 6 = 0$

$\therefore x^2 + 3x + 2x + 6 = 0$

$x(x+3) + 2(x+3) = 0$

$(x+2)(x+3) = 0$

$\therefore x = -2$ or $x = -3$.

$\therefore A = \{-2, -3\}$

$A \cap B = \{-2\}$

19. LHS

Let $x \in A \cap B$

$\Rightarrow x \in A$ and $x \in B$

$\Rightarrow x \in B$ and $x \in A$

$\Rightarrow x \in A \cap B$

$\therefore A \cap B \subseteq B \cap A$

RHS Let $x \in B \cap A$

$\Rightarrow x \in B$ and $x \in A$

$\Rightarrow x \in A$ and $x \in B$

$\Rightarrow x \in A \cap B$

$\therefore B \cap A \subseteq A \cap B$

$A \cap B = B \cap A$.

20. LHS Let $x \in A \cup B$

$\Rightarrow x \in A$ and $x \in B$

$\Rightarrow x \in B$ and $\in A$

$\Rightarrow x \in B \cup A$

$\therefore A \cup B \subseteq B \cup A$

RHS Let $y \in B \cup A$

$\Rightarrow y \in B$ and $y \in A$

$\Rightarrow y \in A$ and $y \in B$

$\Rightarrow y \in AUB$

$\therefore B \cup A \subseteq A \cup B$

$\therefore A \cup B = B \cup A$

21. LHS Let $x \in (A - B)$

$\Rightarrow x \in A \;\&\; x \notin B$

$\Rightarrow x \in (B^{I} - A^{I})$

R.H.S. Let $y \in (B^{I} - A^{I})$

$\Rightarrow y \in B^{I}$ and $y \notin A^{I}$

$\Rightarrow y \notin B$ and $y \in A$

$\Rightarrow y \in (B - A)$

$\therefore A - B \subseteq B^{I} - A^{I}$

$B^{I} - A^{I} \subseteq A - B$

$\therefore AB = B^{I} - A^{I}$

22. LHS $= A \cap (A \cup B)$

$= (A \cap \varnothing) \cap (A \cup B)$

$= AU(\varnothing \cap B)$

$= AU\varnothing$

$= A$

LHS = RHS

Or

Let A = {a, b, c, d} B = {c, d, e, f}

$A \cap (A \cup B) =$

$= (a\ b\ c\ d) \cap \{(a, b, c, d) \cup (c, d, e, f)\}$

$= (a\ b\ c\ d) \cap \{(a, b, c, d, e, f)\}$

$= (a, b, c, d) = A.$

23. Let the Group be E. A and B be students who like music and dance respectively.

Then n(E) = 30n(A)=15 n(B)=10 $n(A \cap B) = 5$

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

= 15 + 10 - 5 = 20.

Those who don't like neither music nor dance in $n(A \cup B)^{I}$

$n(A \cup B)^{I} = n(E) - n(A \cup B)$

= 30 - 20

= 10

Function

24. Given $f(x) = x^2$ $g(x) = x + 2$

fog (2) $= f(g(2))$

$= f(2 + 2)$

$= f(4)$

$= 4^2 = 16$

gof $= g(f(2))$

$= g(2)^2$

$= g(4)$

$= 4 + 2 = 6$

25. Give $y = 2x^4 + 3x^2$

$f(x) = 2x^4 + 3x^2$

$f(-x) = 2(-x)^4 + 3(-x)^2$

$= 2x^4 + 3x^2$

$\therefore f(-x) = f(x)$

The function is even.

26. $y = \frac{1}{4x^3}$

$f(x) = \frac{1}{4x^3}$

$f(-x) = \frac{1}{4x^{-3}}$

$f(-x) = -\frac{1}{4x^3}$

$\therefore f(-x) = -f(x)$

The function is odd.

27. The difference between a relation and a function are.

(i) In a function all the elements of the domain must be associated, but this need not be the case for a relation.

(ii) In case of function no element of the domain shall have association with different elements of the co-domain but this need not be the case for a relation.

Thus all functions are relation but all relations are not function.

28. $f(x) = 3x + 1$

$y = 3x + 1$

$3x = 1 - y$

$x = \frac{1-y}{3}$

$\therefore f^{-1}(y.x) = \frac{1-y}{3}$

29. It is a function of the type $f(x)=a^x$. Here 'a' is a real positive constant and $a \neq 1$. Thus, any function in which the independent variable occurs as the power or exponent is called an exponential function.

Example of exponential functions are

$f(x) = 5^x$ $f(x) = b^x$ $f(x) = 7^x$ etc.

Limit & Continuity

30. $\lim_{x\to 0} \frac{\sqrt{3+x} - \sqrt{3-x}}{x}$

$= \lim_{x\to 0} \frac{(\sqrt{3+x} - \sqrt{3-x})x(\sqrt{3+x} + \sqrt{3-x}}{x(\sqrt{3+x} + \sqrt{3-x})}$

$= \lim_{x\to 0} \frac{(3+x)-(3-x)}{x(\sqrt{3+x} + \sqrt{3+x})} = \frac{3+x-3+x}{x(\sqrt{3+x} + \sqrt{3-x})}$

$= \lim_{x\to 0} \frac{2x}{x\sqrt{3+x} + \sqrt{3-x}}$

$= \lim_{x\to 0} \frac{2}{\sqrt{3+0} + \sqrt{3-0}}$

$= \frac{2}{\sqrt{3}+\sqrt{3}} = \frac{2}{2\sqrt{3}} = \frac{1}{\sqrt{3}}$

31. $\lim_{x\to 2} \frac{x^n - 2^n}{x-2} = 32$

As per standard result

$\lim_{x\to} \frac{x^n - a^n}{x-a} = na^{n-1}$

$n2^{n-1} = 32$

$n2^n = 64$

$\therefore n = 4$

32. We have to test the continuity of the function at x=0.

$\lim_{x\to 0^+} f(x) = 4$

$\lim_{x\to 0^-} f(x) = 2$

$\therefore \lim_{x\to 0^+} f(x) \neq \lim_{x\to 0^-}$

Hence the given function is discontinuous at x=0.

33. We have to test the continuity of the function out x=1.

$\lim_{x\to 1^+} f(x) = x^2 + 3 = 1^2 + 3 = 4$

$\lim_{x\to 1^-} f(x) = 3x + 1 = 3 + 1 = 4$

$\lim_{x\to 1^+} f(x) = \lim_{x-1^-} f(x)$

$\therefore$ The function is continuous at x=1.

34. We have to find out right hand limit (RHL)

RHL

$\lim_{x\to 5^+} = \lim_{h\to 0^+} f(5+h)^2$

$= \lim_{h\to 0} (5+h)^2$

$= \lim_{h\to 0} (25 + 10h + h)^2$

$= \lim_{h\to 0} (25 + 10.0 + 0^2)$

$= 25$

35. LHL

$\lim_{x\to 4^-} f(x) = \lim_{h\to 0} (4-h) = \lim_{h\to 0} \frac{|4-h-4|}{4-h-4}$

$= \lim_{h\to 0} \frac{|-h|}{-h}$

$= \lim_{h\to 0} \frac{h}{-h}$

$= \lim_{h\to 0} -1 = -1$

36. $\lim_{x\to 0} \frac{(1+x)^2-1}{x}$

$= \lim_{x\to 0} \frac{1^2+2.x.1+x^2-1}{x}$

$= \lim_{x\to 0} \frac{1+2x+x^2-1}{x}$

$= \lim_{x\to 0} \frac{x(x+2)}{x}$

$= \lim_{x\to 0} (x+2)$

$= 0+2=2$

37. Dividing the denominator and numerator by x-3 we will get.

$\lim_{x\to 3} \frac{x^3-27}{x^2-9}$

$= \lim_{x\to 3} \frac{x^3-3^3}{x-3}$

$= \lim_{x\to 3} \frac{\frac{x^3-3^3}{x-3}}{\frac{x^2-3^2}{x-3}} = \frac{3x3^2}{2x3} = \frac{3x9}{2x3} = \frac{9}{2}$

$\left(\therefore \lim_{x\to} \frac{x^n-a^n}{x-a} = na^{n-1}\right)$

38. $\lim_{x\to 0} \frac{x^3+3x}{x}$

$= \lim_{x\to 0} \frac{x(x^2+3)}{3x}$

$= \lim_{x\to 0} \frac{(x^2+3)}{3}$

$= \lim_{x\to 0} \frac{(0^2+3)}{3}$

$= \frac{3}{3} = 1$

39. $\lim_{x\to 1} f(x) \frac{x^6-1}{x-1}$

$= \lim_{x\to 1} \frac{x^6-1^6}{x-1}$

$= 6.1^{6-1}$

$= 6\,x\,1^5 = 6\,.$

$f(1) = 6^1 = 6$

As limit of f(x)=f(1). The function is continuous at x=1.

Differentiation

40. $\frac{dy}{dx} = \frac{d}{dx}\left(x^5+x^3+\frac{1}{x}\right)$

$= \frac{d}{dx}x^5 + \frac{d}{dx}x^3 + \frac{d}{dx}x^{-1}$

$= 4x^4 + 2x^2 + -2x^{-2}$

$= 4x^4 + 2x^2 - \frac{2}{x^2}\,.$

41. $y = x^5 + 2x - x^3$

$\frac{dy}{dx} = \frac{d}{dx}(x^5+2x-x^3)$

$= \frac{d}{dx}(x)^5 + \frac{d}{dx}(2x) - \frac{d}{dx}(x^3)$

$= 5x^4 + 2x^{1-1} - 3x^2$

$= 5x^4 + 2 - 3x^2$

$= 5x^4 - 3x^2 + 2$

42. $y = \frac{(1-x)^2}{x^2}$

$\frac{dy}{dx} = \frac{d}{dx}\left\{\frac{(1-x)^2}{x^2}\right\}$

$= \frac{d}{dx}\left\{\frac{1-2x+x^2}{x^2}\right\}$

$= \frac{d}{dx}\left(\frac{1^{x^2}}{x^2} - \frac{2x}{x^2} + \frac{x^2}{x^2}\right)$

$= \frac{d}{dx}(x^{-2} - 2x^{-1} + 1)$

$$= \frac{d}{dx}(x^{-2}) - 2\frac{d}{dx}(2x)^{-1} + \frac{d}{dx}(1)$$

$$= -2x^{-2-1} - 2(-1.x)^{-2} + 0$$

$$= -2x^3 + 2x^{-2} + 0$$

43. $y = (2x+3)^2$

$$\frac{dy}{dx} = \frac{d}{dx}(4x^2 + 12x + 9)$$

$$= \frac{d}{dx}(4x^2) + \frac{d}{dx}(12x) + \frac{d}{dx}(9)$$

$$= 4.2x^{2-1} + 12.1.x^{1-1} + \frac{d}{dx}(9)$$

$$= 8x + 12 + 0$$

$$= 8x + 12$$

44. $y = \frac{x^3}{x^3+2}$

$$\frac{dy}{dx} = \frac{d}{dx}\left(\frac{x^3}{x^3+2}\right)$$

$$= \frac{(x^3+2)\frac{d}{dx}x^3 - x^3\frac{d}{dx}(x^3+2)}{(x^3+2)^2}$$

$$= \frac{(x^3+2)3x^3 - x^3(3x^2)}{(x^3+2)^2}$$

$$= \frac{3x^5 + 6x^2 - 3x^5}{(x^3+2)^2}$$

$$= \frac{6x^5}{(x^3+2)^2}$$

45. $y = x^3e^x$

$$\frac{dy}{dx} = \frac{d}{dx}(x^3e^x)$$

$$= e^x\frac{d}{dx}(x^3) + x^3\frac{d}{dx}(e^x)$$

$$= e^x 3x^2 + x^3e^x$$

$$= e^x(3x^2 + x^3)$$

46. The quotent rule of differention of any two function is equal to the product of the denominator and derivative of the numerator minus the product of the numerator and the derivative of the denominator, all divided by the square of the denominator.

Thus if u and v are two differentiable functions of x and $v \neq 0$ then

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{d}{dx}u - u\frac{d}{dx}v}{v^2}$$

47. The derivative of the product of two function is equal to the product of the second function and derivative of the 1st function plus product of the 1st function and derivative of the second function.
Thus, if u and v are two differentiable function of x then

$$\frac{d}{dx}uv = v\frac{d}{dx}(u) + u\frac{d}{dx}(v)$$

48. $y = \frac{3}{1-5x}$

$$\frac{dy}{dx} = \frac{d}{dx}\left(\frac{3}{1-5x}\right)$$

$$= \frac{(1-5x)\frac{d}{dx}3 - 3\frac{d}{dx}(1-5x)}{(1-5x)^2}$$

$$= \frac{(1-5x)0 - 3\left(\frac{d}{dx}1 - \frac{d}{dx}5x\right)}{(1-5x)^2}$$

$$= \frac{0 - 3(0-5)}{(1-5x)^2} = \frac{15}{(1-5x)^2}$$

49. $y = 10^x.x^{16}$

$$\frac{dy}{dx} = \frac{d}{dx}10^x x^{16}$$

$$= x^{16}\frac{d}{dx}10^x + 10^x\frac{d}{dx}x^{16}$$

$$= x^{16}10^x Log_e^{10} + 10^x 16x^{15}$$

$$= 10^x x^{15}(xLog_e^{10} + 16)$$

Integration

50. $\int \frac{7}{\sqrt{x}} dx = 7\int x^{-1/2} dx$

$= 7\frac{x^{-1/2+1}}{-1/2+1} + C$

$= 7\frac{x^{+1/2}}{\frac{1}{2}} + C$

$= 14x^{1/2} + C$

51. $\int \left(x + \frac{1}{x}\right)^2 dx = \int \left(x^2 + 2 + \frac{1}{x^2}\right) dx$

$= \int (x^2 + 2 + x^{-2}) dx$

$= \int x^2 dx + \int 2dx + \int x^{-2} dx$

$= \frac{x^3}{3} + 2\int dx + \frac{x^{-2+1}}{-2+1} + C$

$= \frac{x^3}{3} + 2x + \frac{x^{-1}}{-1} + C$

$= \frac{x^3}{3} + 2x - x^{-1} + C$

52. $\int \frac{1}{3+2x} dx$

Let 3+2x=t then $\frac{d}{dx}(3+2x) = \frac{dt}{dx}$

$\frac{dt}{dx} = 2 \therefore dx = \frac{1}{2} dt$

$= \int \frac{1}{t}\frac{1}{2} dt$

$= \frac{1}{2}\int \frac{1}{t} dt$

$= \frac{1}{2} Log(t) + C$

$= \frac{1}{2} Log(3+2x) + C$

53. $\int \frac{1}{2x-3} dx$

Let $2x-3 = t$ $\frac{d}{dx}(2x-3) = \frac{dt}{dx}$

$\frac{dt}{dx} = 2 \quad dx = \frac{dt}{2}$

$= \int \frac{1}{t}\frac{dt}{2}$

$= \frac{1}{2}\int \frac{1}{t} dt$

$= \frac{1}{2} \log|t| + C$

$= \frac{1}{2} \log(2x-3) + C$

54. $\int 5^{3x} dx$

Let 3x be t $\frac{d}{dx} 3x = \frac{dt}{dx} = 3$

or $dx = \frac{1}{3} dt$

$= \int 5^t \ 1/3 \, dt$

$= 1/3 \int 5^t \, dt$

$= 1/3 \int \frac{5^t}{Log_e 5} + C$

$= 1/3 \int \frac{5^{3x}}{Log_e 5} + C$

55. $\int (e^{3x} - 7x^{-1}) dx$

$= \int e^{3x} dx - 7x^{-1} dx$

$= \frac{e^{3x}}{3} - 7\int \frac{1}{x} dx + C$

$= \frac{e^{3x}}{3} - 7 Logx + C$

56. $\int (x+1)^3 dx$

$= \int (x^3 + 3x^2 + 3x + 1)dx$

$= \int x^3 dx + \int 3x^2 dx + 3\int xdx + \int 1dx$

$= \frac{x^4}{4} + 3\int x^2 dx + 3\int xdx + 1\int dx + C$

$= \frac{x^4}{4} + 3\frac{x^3}{3} + \frac{x^2 2}{2} + 1x + C$

$= \frac{x^4}{4} + x^3 + \frac{3x^2}{2} + x + C$

57. In a moderately asymmetric distribution the mean, median and mode maintains a mathematical relationship, which can be stated as follows :

Mode = 3 Median - 2 Mean

$$\text{Thus Median} = \frac{\text{Mode} + 2\text{Mean}}{3}$$

$$\text{Mean} = \frac{3\text{Median} - \text{Mode}}{2}$$

58. A good or an ideal average must satisfy the following characterstics features.

(i) It must be simple to understand and easy to calculate.

(ii) It must take into consideration all the values in the distribution.

(iii) It must be rigidly defined.

(iv) It must not be affected by extreme values in the series.

(v) It must be capable of further mathematical manupulation.

(vi) It must be stable and not affected by sampling fluctuations.

59. While calculating simple A.M. all values in the series are given equal importance or equal weights. However, it is often necessary to assign different weights to different values in the series for better representation. Weighted A.M. satisfy the purpose and is calculated as follow

$$\text{Weighted A.M.} = \frac{W_1X_1 + W_2X_2 + \ldots\ldots W_nX_n}{W_1 + W_2 + \ldots.. W_n}$$

$$= \frac{\sum WX}{\sum W}$$

Where W stands for weights and X stands for the values of the variable.

60. The important objectives of a measure of central tendency are

(i) To present or describe a series in a precise and comprehensive manner.

(ii) To facilitate comparison between different distribution by reducing mass data into one single value.

(iii) To help in calculation of other stastical measures.

61. Geometric mean is considered the most appropriate average under the following circumstances

(i) Computing average of ratios and percentages.

(ii) In construction of index numbers.

(iii) Under circumstances where more weights are given to smaller items.

62. The properties of A.M are

(i) The algebraic sum of deviations from mean is zero.

Symbolically $\sum(X - \bar{X}) = 0$

(ii) The sum of square of deviations taken from the mean is minimum.

$\sum(X - \bar{X})^2 < \sum(X - A)^2$

(iii) If mean and number of items of different series are known then the combined mean can be calculated as follows:

$$\bar{X}_{12} = \frac{\bar{X}_1N_1 + \bar{X}_2N_2 \ldots. + \bar{X}_nN_n}{N_1 + N_2 + \ldots. N_n}$$

63. Let the values are x and y.

$$A.M. = 10 \therefore \frac{x+y}{2} = 10 \therefore x + y = 20$$

$$G.M. = 8 \quad \therefore \sqrt{x.4} = 8 \qquad xy = 20$$

$$(x-y)^2 = (x+y)^2 - 4xy$$

$$= (20)^2 - 4 \times 64$$

$$= 400 - 256$$

$$x - y = \sqrt{144} = 12$$

$$x + y = 20 \quad x - y = 12$$

$$\therefore x = \frac{20+12}{2} = 16 \therefore Y = 20 - 16 = 4$$

64. The most appropriate average here in H.M

$$H.M. = \frac{2}{\frac{1}{30} + \frac{1}{20}}$$

$$= \frac{2}{\frac{2+3}{60}} = \frac{2}{\frac{5}{60}}$$

$$= \frac{2 \times 60}{5} = 24 \text{ km per hr.}$$

65. In any distribution when the value of x differ in size the value of A.M ,G.M and H.M would also differ and will be in the following order

A.M. > G.M. > H.M.

However, if all the values in the distribution remain same i.e $x_1 = x_2 = x_3$ .... and so on then for such distribution A.M. = G.M. = H.M.

66. The most appropriate average here is G.M.

The average percentage increase will be the G.M of 5%, 10% and 20%

$$G.M = \sqrt[3]{5 \times 10 \times 20}$$

$$= \sqrt[3]{100}$$

$$= 10$$

67. Steps for calculation of median in case of continuous series

(i) Arrange the series either in ascending or descending order

(ii) Calculate cumulative frequencies

(iii) Find out median class by using the formula N/2

(iv) Interpolate the value by using the formula

$$\text{Median} = L_1 + \frac{L_2 - L_1}{f_1} \text{ (M-C)}$$

Where L_1= Lower limit, L_2= Upper limit, f_1= Frequency of the median class C = Cumulative frequency of the class preceding the median class and M=N/2.

68. Average rainfall during 1st 6 days was 30 mm. i.e. The total rainfall during the 6 days is 30 mm x 6 = 180 mm.

Average rainfall for the week is 35 mm.

Total rainfall for the week is 35mm x 7=245 mm.

Rainfall during Sunday is

245 mm - 180 mm = 65 mm.

69. The important limitations of Mode are:

(i) It is not rigidly defined.

(ii) It is not based on all the observation.

(iii) It is not capable of further mathematical treatment.

(iv) It is significantly affected by fluctuation in sampling

(v) In case of unequal class interval calculations of Mode is difficult.

70. $\bar{X} = \frac{\sum X}{N}$ or $\sum X = \bar{X}N$

$N = 75, \bar{X} = 27$

$\sum X = 27 \times 75 = 2025$

Correct $\sum X = 2025 + 53 - 43 = 2035$

Correct $\bar{X} = \frac{2035}{75} = 27.13$

71.

Price per share	Amount invested	No. of shares
50	1000	20
40	1000	25
25	1000	40
	3000	85

Average price paid per share $= \frac{3000}{85} =$ ₹35.75

72. Average of the averages of two or more series is called the combined average or grand average. If Means of different samples from a universe or different components of a group along with their sizes are known then their combined mean can be found out by using the following formula:

Combined Mean =

$$\frac{N_1\bar{X}_1 + N_2\bar{X}_2 + N_3\bar{X}_3 .... N_n\bar{X}_n}{N_1 + N_2 + N_3 ... + N_n}$$

Where $N_1.N_2.N_3$ are sizes of the different samples and are $\bar{X}_1, \bar{X}_2$ & $\bar{X}_3$ are their respective means.

73. Mathematical properties of G.M are:

(i) If any value in the series is zero then value of G.M becomes infinity.

(ii) Since G.M is the nth root of the product of the observations, nth power of G.M gives the product of the observations

$\therefore (G.M.)^n = X_1 . X_2 . X_3 ... X_n .$

(iii) The product of the value of the series will remain unchanged when the value of G.M. is substituted for each individual value.

74. The important advantages of Mode are:

(i) It can be located by inspection

(ii) It is not affected by presence of extreme values in the series.

(iii) It can be determined graphically.

(iv) For calculation of Mode in case of open ended classification it is not required to estimate the extreme class limits.

(v) It provides the most representative value from within the series.

Measures of Dispersion

75. The important merits of standard deviation are

(i) It is based on all the observations

(ii) It is rigidly defined

(iii) It has further mathematical uses.

(iv) It is not affected by fluctuation in sampling

(v) It is the best measure of dispersion as the sum of squares of deviations taken from A.M. is the lowest compared to the square of deviations taken from any other average.

76. The merits of mean deviation are:

(i) It is simple to understand and easy to calculate.

(ii) It is based on all the values of the observation.

(iii) It is rigidly defined.

(iv) As compared to standard deviation it is less affected by presence of extreme values.

(v) It is useful in forecasting business cycles.

77. The measure differences between M.D and S.D are:

(i) Mean Deviation is calculated from A.M or Median or Mode but Standard Deviation is calculated from A.M only.

(ii) While calculating M.D plus minus signs are ignored but this is not so for S.D.

(iii) Mean Deviation is not capable of further mathematical treatment but standard Deviation is.

78.

x	f	xf	$\lvert x - \bar{x} \rvert$	fd
10	4	40	11	44
20	10	200	1	10
30	6	180	9	54
	20	$\sum$xf420		108

$$\bar{x} = \frac{\sum xf}{\sum f} = \frac{420}{20} = 21.$$

$$\text{M.D.} = \frac{\sum f|d|}{N} = \frac{108}{20} = 5.4$$

79. Semi inter quartile range $= \frac{Q_3 - Q_1}{2}$

$\therefore 18 = \frac{Q_3 - 142}{2}$

$36 = Q_3 - 142$

$Q_3 = 142 + 36 = 178$

In symmetric distribution
Median - $Q_1 = Q_3$ - Median

Hence Median $= \frac{Q_3 + Q_1}{2}$

$= \frac{142 + 178}{2}$

$= \frac{320}{2} = 160$

80. Co-efficient of Range

$= \frac{L - S}{L + S}$

Given L=120 Co-efficient of rnage is 0.75.

$\therefore 0.75 = \frac{120 - S}{120 + S}$

$0.75(120 + S) = 120 - S$

$90 + 0.75S = 120 - S$

$1.75S = 30$

$S = \frac{30}{1.75} = 17.14$

$\therefore$ The lowest value is 17.14.

81.

X	$X - \bar{X}$	$(X - \bar{X})^2$
3	–4	16
5	–2	4
7	0	0
9	+2	4
11	+4	16
$\sum x = 35$		$\sum (X - X)^2 = 40$

$\bar{X} = \frac{35}{5} = 7$

Standard deviation

$= \sqrt{\frac{\sum (X - \bar{X})^2}{N}}$

$= \sqrt{\frac{40}{5}} = \sqrt{8}$ = 2.8

83. **Factory-A** **Factory-B**

Covariation Covariation

$\frac{\sigma}{x} x100$

$\frac{25}{3200} x100 = 0.781$ C.V. $\frac{27}{2800} x100 = 0.964$

Since co-efficient of variation is greater in case of Factory B there is greater variation in distribution of wages per employee.

83. In a normal distribution there is a fixed relationship among the three measures of dispersion. The Q.D. is smallest, the mear deviation next and the standard deviation is the largest. They maintain a proportional relationship as follows :

$Q.D. = \frac{2}{3}\sigma$ or $\sigma = \frac{3}{2} Q.D.$

$M.D. = \frac{4}{5}\sigma$ or $\sigma = \frac{5}{4} M.D.$

$\therefore$ The ratio of S.D. : M.D. : Q.D. is 15:12:10.

84. Co-efficient of variation (C.V.) is a relative measure of dispersion and found out using the following formula

$$C.V. = \frac{\sigma}{\bar{X}} x100$$

It is used to compare the variability of two or more series. When the C.V. of a series is greater, it is said to be more variable or conversly less consistent less uniform, less stable or less homogenous and vice-versa.

85. Given $\bar{X} = 60 \quad \sigma = 5$

$$\text{M.D.} = \frac{4}{5}\sigma \quad \therefore \text{M.D.} = \frac{4}{5}x5 = 4$$

$$\text{Q.D.} = \frac{2}{3}\sigma \quad \text{Q.D.} = \frac{2}{3}x5 = 3.33$$

$$\text{Inter Quartile Range} = \frac{Q_3 - Q_1}{2}$$

$$\text{Q.D.} = \frac{Q_3 - Q_1}{2} = 3.33$$

Inter Quartile Range = Q_3-Q_1=6.66.

86. The main objectives of measuring variation are :

(i) To determine the reliability of average

(ii) To serve as a basis for control of variability.

(iii) To compare two or more series with regard to their variability.

(iv) To facilitate use of other statistical measures.

87. A relative measure of dispersion is the ratio of a measure of absolute dispersion to an appropriate average. It is also called a co-efficient of disperssion. Co-efficient of Mean deviation, standard deviation range and quartile deviation are relative measures of dispersion. Relative measures are more useful as they facilitate comparision among different sets of data in different units and magnitude.

88. The features of an ideal measure of dispersion are

(i) It should be simple to understand and easy to calculate.

(ii) It should be rigidly defined.

(iii) It should be based on all the items of the distribution.

(iv) It should be amenable to further algebraic treatment.

(v) It should not be affected by extreme values.

(vi) It should have sampling stability.

89. The Median $= \frac{N+1}{2}$th item.

$N = 5 \therefore \frac{5+1}{2} = 3$rd item is the median

3rd item in the series = 18.

X	$\lvert X - \text{Med} \rvert$
10	8
15	3
18	0
20	2
30	12
	$\sum \lvert X - \text{Med} \rvert = 25$

$$\text{Mean Deviation} = \frac{\sum \lvert X - \text{Med} \rvert}{N}$$

$$= \frac{25}{5} = 5$$

$$\text{Co-efficient of M.D.} = \frac{\text{MD}}{\text{Median}} = \frac{5}{18} = 0.28.$$

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GROUP - C

LONG TYPE QUESTIONS

Matrix

1. Find the inverse of the following matrix

$$\begin{pmatrix} 4 & -2 & -1 \\ 1 & 10 & -7 \\ 2 & -4 & 1 \end{pmatrix}$$

2. Solve the following symultaneous equations by using matrix method.

x + y + z = 3

x + 2y + 3z = 4

x + 4y + 9z = 6

3. A person buys 15 kg of rice 5 kg of Dal and 2 kg of sugar. rice cost ₹10 per kg, Dal ₹30 per kg and sugar ₹15 per kg. Presenting the quantities bought in a row matrix and prices by a column matrix determine the total cost of the commodities brought by the person.

4. Find A if $A^2 = \begin{pmatrix} 10 & 6 \\ 6 & 10 \end{pmatrix}$.

5. Solve the following system of equation using matrix method

3x + 2y = 6

5x + 4y = 8

6. If $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{pmatrix}$

Show that AB=I when I is an identity matrix.

7. If $A = \begin{pmatrix} 2 & 1 \\ 5 & 3 \end{pmatrix}$ $A = \begin{pmatrix} 4 & 5 \\ 3 & 4 \end{pmatrix}$

Show that $(AB)^{-1} = A^{-1}B^{-1}$.

Determinant

8. Solve the following system of equations using Crammers rule.

x + y - z = -2

3x + 2y + 3z = 13

2x + 7y + 4z = 31

9. Using properties of determinant prove that

$$\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = (a-b)(b-c)(c-a)$$

10. Using properties of determinant prove that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = ab+bc+ca+abc$$

11. Prove that $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix} = 0$

12. Prove that

$$\begin{vmatrix} 1 & 1 & 1 \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(ab+bc+ca)$$

13. Using appropriate property ascertain the value of

$$|A| = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ b+c & c+a & a+b \end{vmatrix}$$

14. Using Crammer's rule solve the following equations.

7x - 5y = 11

3x + 2y = 13

y + 10z - 5x = 14

Set Theory

15. The population of a town is 6000. Out of which 3400 people read "Samaj' and 2700 people read 'Sambad'. There are 700 people who read both the papers. Find the number of persons who donot read either of two papers.

16. In a marriage party there were 400 invitiees. Out of them 320 took meat 100 took fish and 10 did not take either of the two. Using set algebra determine.
    (i) How many took both meat and fish ?
    (ii) How many took meat only ?
    (iii) How many took fish only ?

17. Prove that $(A \cup B)^{I} = A^{I} \cap B^{I}$.

18. In a group of 100 persons 40 can read English, 50 can read Hindi, 30 can read Odia, 18 persons can read both English and Hindi, 12 can read Hindi and Odia, 10 can read English and Odia while 5 person can read all the three lanugages. Find the number of persons who can not read any of the 3 languages.

19. ABC be any three sets. Then prove that
    $A \times (B \cup C) = (A \times B) \cup (A \times C)$

20. Out of 160 students in a class 60 failed in English. 72 failed in Mathematics and 56 failed in Accountancy. If 52 failed both in English and Matheamtics, 47 failed in both Mathematics and Accountancy and 42 failed in both English and Accountancy and 38 failed in all three subjects how many failed in non of the 3 subjects ?

21. Prove that
    $(A \times B) \cap (C \times D) = (A \cap B) \times (B \cap D)$

Function

22. What is function ? Briefly explain different types o function.

23. Find the inverse of the following functions
    (i) $f(x) = \frac{2x-1}{x-1} \; (x > 1)$
    (ii) $f(x) = \frac{x+1}{x-1}, \; x \neq 1$

24. Find out whether the functions are even/odd function
    (i) $f(x) = \frac{1}{x^3}$
    (ii) $f(x) = 2x^4 + 3x^2$

25. Find the fog and gof of the following function
    (i) $f(x) = x + 1$ and $g(x) = x^2 - 1$
    (ii) $f(x) = x^2$ and $g(x) = x + 2$

26. If $f(x) = \frac{2x+1}{3x-2}$ and $g(x) = \frac{4x+5}{3x-4}$ find fog and gof.

27. If $f(x) = \frac{ax+b}{bx-a}$ Prove that $f(y) = x$.

28. (i) Find out the inverse of
    $f(x) = \sqrt{9 - x^2}, \; -3 \leq x \leq 0$
    (ii) Using diagram explain many one into function.

Limit and Continuity

29. Find the value of
    $\lim_{x \to 0} \frac{6^x - 3^x - 2^x + 1}{x^2}$

30. Evaluate $\lim_{x \to 2} \frac{x\sqrt[2]{x} - 4\sqrt{2}}{x - 2}$

31. Evaluate $\lim_{x \to a} \frac{x^m - a^m}{x^n - a^n}$

32. Evaluate $\lim_{x \to 0} \frac{a^x - b^x}{x}$

33. Show that the function $x^2 + 4x - 2$ is continuous at x = 1.

34. Find if the function $\frac{x^2 - 4}{x - 2}$ is continuous at x = 2.

35. What do you mean by a continuous function? Explain the properties of a continuous function.

36. Show that $f(x) = 3x^2 - 2x + 2$ is continuous at x = 1.

37. Evaluate $\lim_{x \to 0} \frac{\sqrt{4+x} - \sqrt{4-x}}{x}$.

Differentiation

38. Find the differential co-efficient of the following w.r.t. x.

$y = (x^2 + 1)(3x^2 - 2x^3)$

39. Differentiate the following w.r.t. x.

$$\frac{1}{\sqrt{5x^3 - 9x^2 + 7}}$$

40. Differentiate w.r.t. x

$$y = \frac{x^3 - 2x^2 + 3}{x^4 + x^2 - 5}$$

41. Differentiate w.r.t. x

$$\frac{1}{(2x+7)^5}$$

42. Find $\frac{dy}{dx}$ of the following implicit function

$x^3 - x^2 + 3x = 4y$

43. Given $y = at^2$, $x = at$ find $\frac{dy}{dx}$.

44. If $x^2+y^2=9$ then find $\frac{dy}{dx}$.

45. If $y = \frac{e^x - 1}{e^x + 1}$ then show that $\frac{dy}{dx} = \frac{2e^x}{(e^x+1)^2}$.

46. If $y = \sqrt{x + \sqrt{x + \sqrt{x + ...\infty}}}$ then find $\frac{dy}{dx}$.

Integration

47. Evaluate $\int \frac{6x - 8}{3x^2 - 8x + 5} dx$.

48. Evaluate $\int (2x+5)^7 dx$.

49. Evaluate $\int \frac{x^3 - 2x^2 + x - 2}{x - 2} dx$.

50. Evaluate $\int \frac{1}{2x+7} dx$

51. Evaluate $\int \frac{3x+4}{6x+7} dx$.

52. Evaluate $\int \frac{1}{(2x+3)^2 - 5} dx$.

53. Evaluate $\int \frac{1}{x^2 + 4x - 5}$.

54. Evaluate $\int \frac{x^3}{(x^2+1)^3} dx$.

55. Evaluate $\int \frac{x^2 + x + 1}{\sqrt{x}} dx$

Measures of Central Tendency

56. What is a measure of central tendency ? What are its uses ? Explain the features of an ideal measure of central tendency.

57. Explain the relationship between A.M., G.M. and H.M. with example.

58. Write notes on the following

(i) Weighted Arithmetic Mean

(ii) Geometric Mean

59. Explain the following

(i) Empirical relationship between Mean, Median and Mode.

(ii) Harmonic Mean

60. What is an average. Briefly explain different types of averages.

61. Find the missing frequency from the following data

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of Students	5	15	20	?	20	10

The $\bar{x}$ of the distribution is 34.

62. Calculate Mean and Median form the following date

Marks	01 – 0	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of Students	6	14	16	27	22	15

63. Mr. Pal travels 8 k.m. at 4 kmph, 6 kms at 3 kmph and 4 kms at 2 kmph. Find out his average speed per hour.

64. An investor buys ₹2000 worth of share in a company each month. During the 1st 4 months he bought the shares at price of ₹10, ₹12, ₹15 and ₹18 per share. Find out the average price per share.

65. The mean annual salary paid to all employees of a company was ₹5000. The mean annual salary paid to male and female employees were ₹5,200 and ₹4,200 respectively. Determine the percentage of males and females employeed in the company.

66. Compute median from the following data

Marks					
Less than	10	20	30	40	50
No. of Students	3	8	17	20	22

67. The price of a commodity doubles in a period of 4 years. What is the average percentage increase per year.

68. Calculate Mode from the following data

x	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
f	2	18	30	45	35	20	6	4

69. Calculate Mode from the following data

x	100 – 200	200 – 300	300 – 400	400 – 500	500 – 600
f	27	9	7	3	2

70. Find out the missing frequency of the following distribution if Mode=24 and N=100.

Expenditure	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
No. of familieis	14	–	27	–	15

71. What is H.M. ? How it is computed ? Explain its usefulness.

72. An aeroplane covers four sides of a square at varying speeds of 500, 1000, 15000 and 2000 kmph respectively. What is the average speed of the plane around the square.

73. The annual rates of growth of output of a factory is 5 years are 5.0, 7.5, 2.5, 5.0 and 10% respectively. What is the compound rate of growth of output per annum for the period.

74. Given the following distribution of income

Income in Lakh	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8
No. of Families	4	6	10	15	8	5	4	2

(i) Find out the higher income among the poorest 25%.

(ii) The lowest income among the richest 30%.

75. Form the following data calculated the 1st and 34d quartile.

x	0-20	20-40	40-60	60-80	80-100
f	10	30	36	30	14

Measures of Dispersion

76. What do you understand by dispersion? What purpose does a measure of dispersion serve?

77. Distinguish between Mean Deviation and Standard Deviation. Which is considered better and why?

78. Define dispersion. Briefly describe the absolute and relative measures of dispersion.

79. What is Quartile Deviation? Explain its advantages and limitations.

80. What is standard deviation? Discuss its merits and demerits.

81. Write notes on the followings.
    (i) Inter Quartile range
    (ii) Mean Deviation

82. Write notes on the following
    (i) Co-efficient of variation
    (ii) Range

83. From the following data calculate the standard deviation and co-efficient of variation.

Marks:	0-20	20-40	40-60	60-80	80-100
No. of Students:	8	12	30	20	10

84. Following are the scores of two batsmen for 8 matches.

Kohli:	12	115	76	42	7	19	49	80
Dhoni:	47	12	78	73	24	51	63	54

Who, among the two, is more consistent batsman?

85. Calculate mean deviation and co-efficient of mean deviation from median.

X:	10	20	30	40	50	60	70	80
f :	3	8	16	26	37	50	56	60

86. Compute co-efficient of Mean deviation from Mean, Median and Mode for the following series.

X:	0-10	10-20	20-30	30-40	40-50
f:	6	28	51	11	4

87. Calculate Quartile Deviation and Co-efficient of quartile Deviation from the following data.

Age:	50	51	52	53	54	55	56
No. of People:	10	12	15	10	14	18	6

88. Find range and Co-efficient of Range from the following data.

Marks:	20-29	30-39	40-49	50-59
No. of Students:	8	12	20	7

89. Two samples of size 100 and 150 respectively have means 50 and 60 and standard Deviation 5 and 6. Find the combined Mean and standard deviation of the samples.

90. Calculate S.D from the following data using step deviation method.

X:	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
f:	5	10	20	40	30	20	10	4

91. Calculate the Mean, Standard Deviation and Variance from the following data.

X:	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
f:	18	32	50	75	125	150	100	90	80	50

92. Standard deviation of two series are 15 and 18 and their co-efficient of variation are 75% and 90% respectively. Find their arithmetic means.