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REVIEWER™

FUNDAMENTALS OF BUSINESS MATHEMATICS AND STATISTICS

CMA Foundation

2nd Edition

Publisher:



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STRIVING TOWARDS KNOWLEDGE

Wavelength Educom Private Limited

202 Professional Plaza, 17 Punit Nagar,
Near Malhar point, Old Padra Road,
Vadodara – 390007, Gujarat

Reviewer™

Fundamentals of Business Mathematics and Statistics

Published by Vivitsu

2nd Edition: October 2026

ISBN: 978-81-688364-6-4

Price: ₹ 399/-

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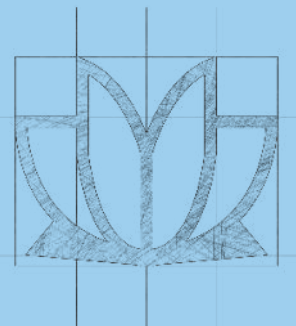
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To the one who's not just dreaming CMA —
but becoming it



CMA

Write your name here

What Matters in CMA?

1 CONCEPTUAL CLARITY

It's not enough to just learn formulas — you need to know where and how to use them. Be *clear with concepts* in maths, logic, and stats to avoid silly mistakes.

This Reviewer gives you topic-wise MCQs so you *apply what you've learned right after studying*.

2 CONSISTENCY

Speed and accuracy are built slowly. Solving even 15–20 MCQs daily helps you *develop a strong rhythm* and keeps formulas fresh.

This chapter-wise structure helps you *practice regularly* without waiting for full syllabus completion, so you're always in touch with every topic.

3 CONFIDENCE

MCQ exams test your speed, clarity, and decision-making. Confidence grows when you *solve enough varied-level questions* and stop doubting yourself.

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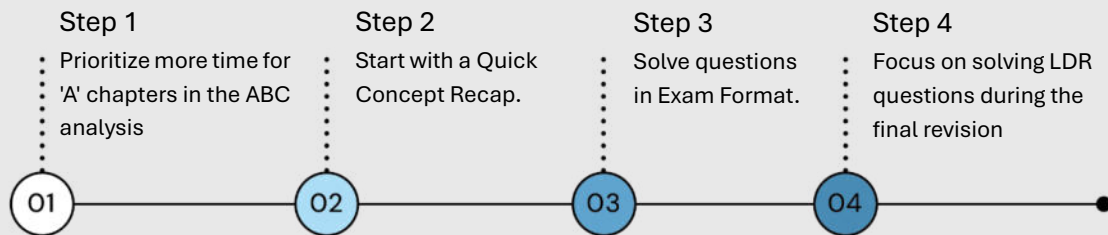


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Don't just study—study smart. Watch renowned professors solve the Vivitsu Reviewer with you on YouTube, breaking down every concept, question, and answer for better understanding and stronger retention.

60+ in Business Mathematics and Statistics



Step 1: Prioritize your chapters

Chapters in the index are categorized as A, B, or C based on their importance. Focus more on 'A' chapters, as they carry the most weight, and give adequate attention to 'B' chapters. While all chapters must be covered, this approach helps manage time efficiently for better results.



Step 2: Start with a Quick Concept Recap

Use this powerful summary for a quick brush-up on key concepts before you attempt the chapter. This helps you identify and understand the core principles. If a question gives you trouble, return to this section / main study material to solidify the concept, then come back and solve it again.



Step 3: Practice in Exam Format

Always solve the question on your own before looking at the answer. If you get confused in MCQs and options or make a conceptual mistake, be sure to mark it to review during your next revision.



Step 4: Last Day Revision (LDR)

Focus on solving LDR questions during the final revision. In the 1.5 days before the exam, prioritize these questions as they cover the most critical concepts from each chapter. You'll find a quick summary of LDR question numbers listed right before each chapter for easy reference.

5 Ways Vivitsu Reviewer will help you CLEAR CMA FOUNDATION

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										B

05

Prioritize using ABC Analysis

Each chapter is categorized as A , B or C

A : Very Important, Read on priority

B : Moderately Important

C : Less Critical but still essential



Q1. 4
Q2. 3
Ans. (a)
Solution: For continuity at $x = 3$,
L.H.L = R.H.L
L.H.L = $(2 \times 3) - 1 = 5$
R.H.L = $(3 - 3) + 5 = 2$ (Not continuous)

Q1. 5
Q2. 4

Ans. (a)
Solution: $\frac{dy}{dx} = 3x^2 - 2 = 0$
 $3x^2 = 2$ or $x = \pm \sqrt{\frac{2}{3}}$

Q3. If $y = x \log x$, then $\frac{dy}{dx}$ is. (PYP 2 Marks June'20)

Q1. $1 + \log x$
Q2. $\log x$
Q3. 1
Q4. x
Ans. (a)
Solution: $y = x \log x$
 $\frac{dy}{dx} = x \cdot \frac{1}{x} + \log x = 1 + \log x$

Q4. If $f(x) = ax + b$ and $f(1) = 3$, $f(2) = 5$, then the value of $f(3)$ is. (PYP 2 Marks Dec'20)

Q1. 6
Q2. 4
Q3. 5
Q4. 3
Ans. (a)
Solution: $f(1) = 3$
 $a + b = 3$
 $2a + b = 5$
 $a = 2$ and $b = 1$

Includes 100% coverage of SM + MCQ Bank + MQP + PYP

04

(PYP 2 Marks Dec'25)

3.2

REVENUE AND COST FUNCTION

Quick Review of Important Concepts

Revenue Concepts

- Total Revenue (TR) = $P \times Q$
(Price $\times$ Quantity sold)
- Marginal Revenue (MR) = Change in TR from selling one more unit

- Average Revenue (AR) = $\frac{TR}{Q}$
(Equal to Price per unit)

03

Topic-wise Break up

Cost Concepts

- Total Cost (TC) = $TFC + TVC$
(Fixed Cost + Variable Cost)
- Total Fixed Cost (TFC): Cost that does not change with output (e.g., rent, salaries)
- Total Variable Cost (TVC): Cost that varies with output (e.g., raw materials, wages)
- Average Cost (AC) = $\frac{TC}{Q}$
- Average Fixed Cost (AFC) = $\frac{TFC}{Q}$



5.3

Last Day Revision Questions

02

Quick Review of Important Concepts

Arithmetic Mean (A.M)

Definition: Sum of observations ÷ Number of observations.

Formulas:

(a) Individual Series / Discrete Data

- Direct Method $\bar{X} = \frac{\sum X}{N}$
- Short Cut / Assumed Mean Method $\bar{X} = A + \frac{\sum fd}{N}$, where $d = X - A$
- Step Deviation Method $\bar{X} = A + \frac{\sum fd}{N} \times i$, where $i = \frac{X_1 - X_0}{h}$

(b) Grouped Data

- Direct $\bar{X} = \frac{\sum fX}{N}$
- Short Cut $\bar{X} = A + \frac{\sum fd}{N}$
- Step Deviation $\bar{X} = A + \frac{\sum fd}{N} \times i$

(c) Combined Mean $\bar{X}_C = \frac{\sum f_1 X_1 + \sum f_2 X_2 + \dots + \sum f_n X_n}{\sum f_1 + \sum f_2 + \dots + \sum f_n}$

(d) Weighted Mean $\bar{X}_w = \frac{\sum W X}{\sum W}$

Geometric Mean (G.M)

Definition: n th root of product of all observations.

Formulas:

(a) Individual Series: $G.M = \sqrt[n]{X_1 \times X_2 \times \dots \times X_n} = \text{antilog} \left(\frac{\sum \log X}{n} \right)$

(b) Discrete / Frequency Data: $G.M = \text{antilog} \left(\frac{\sum f \log X}{N} \right)$

(c) Grouped / Continuous Data

$$G.M = \text{antilog} \left(\frac{\sum f \log X}{N} \right), \text{ where } X = \text{mid} - \text{value of class}$$

(d) Weighted G.M: $G.M = \text{antilog} \left(\frac{\sum W \log X}{\sum W} \right)$

(e) Combined G.M

$$G.C = \left(G_1^{f_1} \times G_2^{f_2} \times \dots \times G_n^{f_n} \right)^{\frac{1}{f_1 + f_2 + \dots + f_n}}$$

Property: $G.M \leq A.M$ (for positive numbers)

Harmonic Mean (H.M)

Definition: Reciprocal of the arithmetic mean of reciprocals.

Formulas:

(a) Individual Series: $H.M = \frac{N}{\sum \frac{1}{X}}$

(b) With Frequency: $H.M = \frac{N}{\sum \frac{f}{X}}$

(c) Weighted H.M: $H.M = \frac{\sum W}{\sum \frac{W}{X}}$

Property: $H.M \leq G.M \leq A.M$



1. If $Q:W = 2:3$, $W:T = 4:5$ and $T:Y = 6:7$, find $Q:Y$ (JAM, MGT (I) 2 Marks Dec'20)

(a) 35:32

(b) 35:35

(c) 35:35

(d) 35:35

Ans: (b)

Solution: $Q:W = 2:3$, $W:T = 4:5$ and $T:Y = 6:7$

$$\left[\frac{2}{3} \times \frac{5}{4} \times \frac{7}{6} \right] = \frac{35}{36} = \frac{Q}{Y} \Rightarrow Q:Y = 35:36$$

Solution: (c) 3 and 36: $3 = \frac{3}{1} \times \frac{3}{1} = 9$, $3 \times 9 = \frac{27}{1}$ or 27:4

2. Find the third proportional to 6 and 5. (JAM, MGT (I) 2 Marks)

(a) 30

(b) 35

(c) 4

(d) 8

Ans: (d)

3. Two numbers are in the ratio 3:5. If the sum of

Solution: $AB \propto XY \therefore AB = K.XY$

$$\frac{A}{B} + \frac{B}{A} = \frac{X}{Y} + \frac{Y}{X} \mid \frac{A^2+B^2}{AB} = \frac{X^2+Y^2}{XY} \mid \frac{A^2+B^2}{K.XY} = \frac{X^2+Y^2}{XY}$$

$$A^2 + B^2 = K(X^2 + Y^2) \mid \therefore A^2 + B^2 \propto X^2 + Y^2$$



01

Answers with
detailed solutions

4. If $A:B = 3:4$ and $B:C = 5:6$, find $A:C$ (JAM, MGT (I) 2 Marks Dec'20)

(a) $15A^2:32C^2$

(b) $15A^2:32C^2$

(c) $32A^2:45C^2$

(d) $32A^2:45C^2$

Ans: (b)

Solution: (b) 36 is the given ratio $(3A)^2 : (4B)^2$

= Duplicate Ratio of the given one

$$= 9A^2 : 16B^2 = 15A^2 : 32C^2$$

5. If $A:B = 3:4$ and $B:C = 5:6$, find $A:C$ (JAM, MGT (I) 2 Marks Dec'20)

(a) $\frac{1}{3}$

(b) $\frac{1}{3}$

(c) $\frac{1}{3}$

(d) $\frac{1}{3}$

Ans: (d)

Solution: $A:B = 3:4$ and $B:C = 5:6$ then $A:C = 3:8$

$\therefore 7 = \frac{1}{3}$ or $7 = 21$ for when $B=3$ then $A = \frac{7}{3}$

Ans: A = 9

10. If $AB=27$ and $\frac{1}{A} + \frac{1}{B} = \frac{1}{3}$ then (JAM)

(a) $A^2 + B^2 = 27^2 + 3^2$

(b) $A + B = 27$

(c) $AB = 27 + 3$

(d) $A + B = \frac{27}{3}$

Ans: (d)

Solution: $AB = 27$ and $AB = 3 \times 27$

$$\frac{1}{A} + \frac{1}{B} = \frac{1}{3} \mid \frac{A+B}{AB} = \frac{1}{3} \mid \frac{A+B}{27} = \frac{1}{3} \mid A+B = \frac{27}{3} = 9$$

$$A^2 + B^2 = 3(A^2 + B^2) \mid A^2 + B^2 = 27^2 + 3^2$$

11. Using the properties of proportion, solve the

following equation for x given $\frac{10}{12} = \frac{15}{20}$

(JAM, MGT (I) 2 Marks June'20, (I) Dec'20)

(a) 14

(b) 15

(c) 12

(d) 10

Ans: (b)

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ABC Analysis

A Very Important,
Read on priority

B Moderately
Important

C Less critical but still
essential

Ensure you thoroughly read all chapters without skipping any- The ABC analysis is designed to help you prioritize based on past trends, but it should not replace comprehensive preparation-

CHAPTER 1: ARITHMETIC



LDR Questions

Q 4, Q 8, Q 17, Q 22, Q 62, Q 107, Q 112, Q 117, Q 184, Q 203

1.1

RATIO, VARIATION AND PROPORTION

Quick Review of Important Concepts

➤ Ratios

- Inverse Ratio: $a:b \Rightarrow b:a$

➤ Proportion

- $a:b = c:d \Rightarrow a/b = c/d$
- Property: $ad = bc$
- Continued Proportion: $a:b = b:c \Rightarrow b^2 = ac$

➤ Mean, Third & Fourth Proportional

- Mean Proportional: $y^2 = xz \Rightarrow y = \sqrt{xz}$
- Third Proportional: $z = y^2 / x$
- Fourth Proportional: $d = bc / a$

➤ Rules of Proportion

- Invertendo: $a:b = c:d \Rightarrow b:a = d:c$
- Alternendo: $a:b = c:d \Rightarrow a:c = b:d$
- Componendo: $a:b = c:d \Rightarrow (a+b):b = (c+d):d$
- Dividendo: $a:b = c:d \Rightarrow (a-b):b = (c-d):d$
- Componendo & Dividendo: $a:b = c:d \Rightarrow (a+b):(a-b) = (c+d):(c-d)$

➤ Variations

- Direct Variation: $A \propto B \Rightarrow A = kB$
- Inverse Variation: $A \propto 1/B \Rightarrow A = k/B$
- Joint Variation: $A \propto (BCD...) \Rightarrow A = k(BCD...)$

➤ Special Ratios

- Compound Ratio: $(a:b) \times (c:d) \times (e:f) = ace : bdf$
- Duplicate Ratio: $(a:b)^2 = a^2 : b^2$
- Triplicate Ratio: $(a:b)^3 = a^3 : b^3$
- Sub-Duplicate Ratio: $\sqrt{a} : \sqrt{b}$
- Sub-Triplicate Ratio: $\sqrt[3]{a} : \sqrt[3]{b}$
- Continued Ratio: $a:b:c$

➤ Key Points

- Always convert to same units before finding ratio.
- Increase by ratio $\rightarrow$ multiply by greater ratio.
- Decrease by ratio $\rightarrow$ multiply by smaller ratio.
- If both increase & decrease are present $\rightarrow$ apply ratios step by step.



Multiple Choice Question (MCQ)

1. If Q: W = 2:3, W:T = 4:5 and T: Y = 6:7, find Q: Y. (SM, MQP (1) 2 Marks Dec'25)

- (a) 35: 51 (b) 16: 35
(c) 16: 51 (d) 51: 35

Ans: (b)

Solution: Q : W = 2:3 , W : T = 4:5 and T : Y = 6:7

$$\frac{2}{3} \times \frac{4}{5} \times \frac{6}{7} = \frac{48}{105} = \frac{16}{35} \text{ or } 16:35$$

2. Two numbers are in the ratio 7: 9, if the sum of the numbers is 288, then the smaller number is. (SM, MCQ-Bank)(MQP(1) 2 Marks-Dec'24)

- (a) 126 (b) 288
(c) 162 (d) 144

Ans: (a)

Solution: Ratio = 7:9, Sum of numbers = 288

Sum of ratios = 7+9 = 16, Smaller number

$$= \frac{288}{16} \times 7 = 126$$

3. When the number 1580 is increased in the ratio 5: 9, the new number is. (SM, MCQ-Bank, MQP (2) 2 Marks Dec'25)

- (a) 788 (b) 2488
(c) 878 (d) 2844

Ans: (d)

Solution: 1580 increased in 5: 9 = $\frac{1580}{5} \times 9 = 2844$

4. The ratio of the number of faces to the number of edges of a box is. (SM, MCQ-Bank) (MQP (1) 2 Marks-June'24, MQP (2) 2 Marks Dec'25)

- (a) 3: 8 (b) 8: 3
(c) 1: 2 (d) 2: 1

Ans: (c)

Solution: No. of faces : 6

No. of edges : 12

Ratio of no. of faces to edges = 6 : 12 = 1 : 2

5. Find the fourth proportional to 6, 8, 9 is. (SM, MCQ-Bank) (MQP(2) 2 Marks-Dec'24, (1) Dec'25)

- (a) 18 (b) 12
(c) 7 (d) 13

Ans: (b)

Solution: Let Fourth proportional to 6, 8, 9 be x

$$\frac{6}{8} = \frac{9}{x} \mid x = \frac{9 \times 8}{6} = \frac{72}{6} = 12$$

6. Find the compounded ratio of: 15: 8 and 18: 5. (SM, MCQ-Bank)

- (a) 27: 4 (b) 4: 27
(c) 27: 8 (d) 8: 27

Ans: (a)

Solution: 15 : 8 and 18: 5 = $\frac{15}{8} \times \frac{18}{5} = \frac{3}{4} \times 9 = \frac{27}{4}$
or 27:4

7. Find the third proportional to $6\frac{1}{4}$ and 5. (SM, MCQ-Bank)

- (a) $9\frac{1}{2}$ (b) $3\frac{1}{5}$
(c) 4 (d) 8

Ans: (c)

Solution: Third proportional to $6\frac{1}{4}$ and 5 is

$$6\frac{1}{4} : 5 :: 5 : Y \mid \frac{25}{4} : 5 :: 5 : Y \mid \frac{25}{4} \times Y = 5 \times 5 \mid \frac{Y}{4} = 1$$

$$\therefore Y = 4$$



8. Find the Duplicate ratio of : $8a : \sqrt{4b}$. (SM, MCQ-Bank) (MQP (1) 2 Marks-Dec'24)

- (a) $64a^2 : 2b^2$ (b) $16a^2 : b^2$
(c) $32a^2 : 4b^2$ (d) $32a^2 : 8b^2$

Ans: (b)

Solution: $8a : \sqrt{4b}$ is the given ratio $(8a)^2 : (\sqrt{4b})^2$
= Duplicate Ratio of the given one
= $64a^2 : 4b^2 = 16a^2 : b^2$

9. If $A \propto \frac{1}{B}$ and A=7 when B = 3, then when B = $2\frac{1}{3}$, A is. (SM, MQP(1) 2 Marks-Dec'24, (1) Dec'25)

- (a) $\frac{3}{7}$ (b) 3
(c) 9 (d) 1

Ans: (c)

Solution: $A \propto \frac{1}{B} \therefore A = \frac{K}{B}$. Given A = 7 when B = 3

$$\therefore 7 = \frac{K}{3} \text{ or } K = 21 \text{ So when } B = 2\frac{1}{3} = \frac{7}{3} \text{ then } A = \frac{21}{\frac{7}{3}}$$

or, A = 9

10. If $AB \propto XY$ and $\frac{A}{B} + \frac{B}{A} = \frac{X}{Y} + \frac{Y}{X}$ then. (SM)

- (a) $A^2 + B^2 \propto X^2 + Y^2$
(b) $A + B \propto XY$
(c) $AB \propto X + Y$
(d) $A + B \propto \frac{1}{X+Y}$

Ans: (a)

Solution: $AB \propto XY \therefore AB = K \cdot XY$

$$\frac{A}{B} + \frac{B}{A} = \frac{X}{Y} + \frac{Y}{X} \mid \frac{A^2+B^2}{AB} = \frac{X^2+Y^2}{XY} \mid \frac{A^2+B^2}{K \cdot XY} = \frac{X^2+Y^2}{XY}$$

$$A^2 + B^2 = K(X^2 + Y^2) \mid \therefore A^2 + B^2 \propto X^2 + Y^2$$

11. Using the properties of proportion, solve the following equation for y, given $\frac{341}{91} = \frac{y^3+3y}{3y^2+1}$.

(SM, MQP (2) 2 Marks-June'25, (1) Dec'25)

- (a) 14 (b) 11
(c) 12 (d) 10

Ans: (b)



Solution: $\frac{341}{91} = \frac{y^3+3y}{3y^2+1} \mid \frac{341+91}{341-91} = \frac{(y^3+3y)+(3y^2+1)}{(y^3+3y)-(3y^2+1)}$

[By Componendo and Dividendo]

$\frac{432}{250} = \frac{(y^3+3y+3y^2+1)}{(y^3+3y-3y^2-1)} \mid \frac{432}{250} = \frac{4y^2+3y+1}{2y^2+3y-1} \mid 6y-5y=5+6$
 $Y=11$

12. The ratio of 45 seconds to $5\frac{3}{4}$ minutes is. (SM)

- (a) 5: 21 (b) 3: 23
 (c) 2: 19 (d) 1: 27

Ans: (b)

Solution: 45 Seconds : $5\frac{3}{4}$

Minutes = $\frac{45 \text{ Seconds}}{(5\frac{3}{4} \times 60 \text{ Seconds})} \mid = \frac{45 \text{ Seconds}}{345 \text{ Seconds}} \mid = \frac{3}{23}$

13. A class consists of 48 male students and 23 female students. Find the ratio of female students to total strength of the class. (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 & Dec'23, MQP (2) 2 Marks Dec'25)

- (a) 23: 48 (b) 48: 23
 (c) 48: 71 (d) 23: 71

Ans: (d)

Solution: Male Students – 48, Female students – 23,
 Total strength of the class : Male students + Female students. Total strength : (48+23) = 71 students.
 Ratio of female students to Total strength = 23 : 71

14. The mean proportional between 80 and $\frac{1}{5}$ is. (SM)

- (a) 16 (b) 4
 (c) 8 (d) 32

Ans: (b)

Solution: Mean proportional between 80 and $\frac{1}{5}$

is $\sqrt{80 \times \frac{1}{5}} = \sqrt{16} = 4$

15. Find the Triplicate Ratio of: $\frac{1}{3} : \frac{1}{2}$. (SM)

- (a) 8: 27 (b) 27: 8
 (c) 4: 9 (d) 9: 4

Ans: (a)

Solution: $\frac{1}{3} : \frac{1}{2} = \text{Given Ratio } \left(\frac{1}{3}\right)^3 : \left(\frac{1}{2}\right)^3$

= Triplicate Ratio of the given ratio

$= \frac{1}{27} : \frac{1}{8} \mid = \frac{1}{27} \times \frac{8}{1} \mid = \frac{8}{27}$ or 8: 27

16. If 4, 6, p, 27, q are in continued proportion, find the values of p and q. (SM, MCQ-Bank) (MQP(1) 2 Marks-June & Dec'23, (1) Dec'25)

- (a) p = 9, q = 9 (b) p = 9, q = 81
 (c) p = 81, q = 9 (d) p = 81, q = 81

Ans: (b)

Solution: 4, 6, p, 27, q are in continued proportion

$\frac{4}{6} = \frac{6}{p}$ and $\frac{p}{27} = \frac{27}{q} \mid 4 \times p = 6 \times 6 \mid 4 \times p = 36$

$p = \frac{36}{4} = 9 \mid \frac{p}{27} = \frac{27}{q} \mid p \times q = 27 \times 27 \mid$

$9 \times q = 729 \mid q = \frac{729}{9} = 81 \mid p = 9 \text{ and } q = 81$



17. If a Stadium having spectators divided into groups of Young Generation and Old Generation and the number of young spectators is 1525 and old spectators are 1875. Find the ratio of Total Spectators to Young Spectators. (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 & Dec'23)

- (a) 136:75 (b) 136:85
 (c) 75:61 (d) 136:61

Ans: (d)

Solution: Young Spectators – 1525,

Old Spectators – 1875,

Total strength = (1525+1875) = 3400 spectators.

Ratio of Total Strength to Young Spectators

= 3400 : 1525 = 136 : 61

18. Find two numbers whose mean proportional is 8 and the 1st number is square of the 2nd number. (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23, Dec'23)

- (a) 8, 8 (b) 4, 2
 (c) 16, 4 (d) 64, 8

Ans: (c)

Solution: Mean proportional is 8 | 1st number is square of 2nd number | let two numbers be x^2 and x | Mean proportional of the numbers = $\sqrt{x \times x^2} \mid 8 = \sqrt{x^3}$ (given) $\mid 8^2 = (\sqrt{x^3})^2$
 $64 = x^3 \mid 4^3 = x^3 \mid x = 4 \mid x^2 = 16$. Two numbers are 16 and 4.

19. What number must be subtracted from each of the numbers 12, 13, 24 and 29 to make them proportional? (SM)

- (a) 9 (b) 8
 (c) 35 (d) 36

Ans: (a)

Solution: Number must be subtracted from 12, 13, 24 and 29 to make them proportional be y.

$(12-y):(13-y):(24-y):(29-y) \mid (12-y) \times (29-y)$
 $= (24-y) \times (13-y) \mid 348 - 12y - 29y + y^2$
 $= 312 - 24y - 13y + y^2 \mid 348 - 41y + y^2$
 $= 312 - 37y + y^2 \mid 41y - 37y = 348 - 312$
 $4y = 36 \mid y = 9$

20. The ratio of the pocket money saved by Rakesh and his sister is 5:6. If the sister saves ₹60 more, how much more the brother should save in order to keep the ratio of their savings unchanged? (SM, MQP(1) 2 Marks-June'23 & Dec'23)

- (a) ₹ 60 (b) ₹ 40
 (c) ₹ 50 (d) ₹ 70

Ans: (c)



Solution: Let the savings of Rakesh and his sister be $5x$ and $6x$, And Rakesh would save ₹ y more,
 $\frac{(5x+y)}{(6x+60)} = \frac{5}{6} \mid (5x+y) \times 6 = 5 \times (6x+60)$
 $30x + 6y = 30x + 300 \mid 6y = 300 \mid y = \frac{300}{6} = 50$

21. A woman can complete a task by working 6 hours a day for 12 days. If she increases her working hours to 9 hours per day, how many days will it take her to finish the same task?

(MQP (1) 2 Marks-June'25)

- (a) 9 Days (b) 12 Days
 (c) 8 Days (d) 10 Days

Ans: (c)

Solution

Total work = $\frac{6 \text{ hours}}{\text{day}} \times 12 \text{ days} = 72 \text{ hours}$

With $\frac{9 \text{ hours}}{\text{day}}$, days required = $72 \div 9 = 8 \text{ days}$.



22. The Monthly incomes of two persons Ram and Raja are in the ratio 5:7 and their monthly expenditures are in the ratio 7:11. If each of them saves Rs.60 per month. Find their monthly income. (MQP (2) 2 Marks-June'25)

- (a) ₹200 and ₹280
 (b) ₹250 and ₹350
 (c) ₹300 and ₹400
 (d) ₹150 and ₹210

Ans: (a)

Solution: Let incomes be $5x, 7x$ expenditures $7y, 11y$

Savings: $5x - 7y = 60 \mid 7x - 11y = 60$. | Solve: $x = 40$,

$y = 20$. Incomes: $5 \times 40 = ₹200 \mid 7 \times 40 = ₹280$.

23. Two numbers are in the ratio of 3:5, and if 10 is subtracted from each of them, the remainders are in the ratio of 1:5. Find the numbers.

(MQP (1) 2 Marks-June'25)

- (a) 9 and 15 (b) 10 and 16
 (c) 15 and 25 (d) 12 and 20

Ans: (d)

Solution: Let the numbers be x and y , so that

$\frac{x}{y} = \frac{3}{5} \mid 5x = 3y \dots \dots (1)$ Again $\frac{x-10}{y-10} = \frac{1}{5}$

$\mid 5x - 50 = y - 10 \mid 3y - 50 = y - 10$

[As $5x = 3y$ From (1)] $\mid 2y = 40 \mid$ so $y = 20$ And

$5x = 3y = 60 \mid$ so $x = 12$ and $y = 20$

24. If $x:y=3:4$, $y:z=5:6$ $z:w=7:8$ then $x:y:z:w$ is

(PYP 1 Mark Jun'13)

- (a) 3: 5: 7: 8 (b) 3: 4: 6: 8
 (c) 105: 140: 168: 192 (d) 3: 4: 24: 192

Ans: (c)

Solution: Continued ratio for $x:y:z = 5(3:4)$ and $4(5:6) = 15:20$ & $20:24 = 15:20:24$ | Continued ratios for $x:y:z:w = 7(15:20:24)$ & $24(7:8) = 105:140:168$ & $168:192 = 105:140:168:192$.

25. The average monthly consumption of petrol for a car for 12 months is 160 litres. If the average monthly consumption for the first 8 months is 145 litres, then the average monthly consumption of petrol for the last 4 months is: (PYP 1 Mark Jun'13)

- (a) 190 litres (b) 165 litres
 (c) 180 litres (d) 175 litres

Ans: (a)

Solution: Total consumption for 12 months = $160 \times 12 = 1,920$ litre | Total consumption for 8 months = $145 \times 8 = 1,160$ litre | Total Consumption for 4 months = $1,920 - 1,160 = 760$ litre

Average monthly consumption for 4 months = $760/4 = 190$ litre.

26. The monthly salaries of two persons are in the ratio of 3:5. If each receives an increase of 20 in salary, the ratio is altered to 13:21. Find the respective salaries: (PYP 1 Mark Sep'14)

- (a) ₹300, ₹500 (b) ₹130, ₹210
 (c) ₹240, ₹400 (d) ₹400, ₹240

Ans: (c)

Solution: Let Salaries be $3x$ and $5x$

Therefore, after increment, $(3x + 20)/(5x + 20)$

$= 13/21 \mid 63x + 420 = 65x + 260 \mid 65x - 63x = 420$

$- 260 \mid 2x = 160 \mid x = 80$. Salaries = $3x = 3 \times 80$

$= ₹240$ and $5x = 5 \times 80 = ₹400$.

27. If the two numbers 20 and $x + 2$ are in the ratio of 2:3; Find x : (PYP 1 Mark Sep'14)

- (a) 14 (b) 28
 (c) 32 (d) 29

Ans: (b)

Solution: $\frac{20}{(x+2)} = \frac{2}{3} \mid 60 = 2x + 4 \mid 2x = 60 - 4$

$2x = 56 \mid x = 28$

28. What must be subtracted from each of the numbers 17, 25, 31, 47 so that the remainders may be in proportion. (PYP 1 Mark Dec'14)

- (a) 12 (b) 6
 (c) 9 (d) 3

Ans: (d)

Solution: Let the number to be subtracted be x .

Therefore, $\frac{(17-x)}{(25-x)} = \frac{(31-x)}{(47-x)} \mid (17-x)(47-x)$

$= (25-x)(31-x) \mid 799 - 17x - 47x + x^2$

$= 775 - 25x - 31x + x^2 \mid 799 - 775$

$= 64x - 56x \mid 24 = 8x \mid x = 3$

29. The ratio of 200 gm to 2 kg. is: (PYP 1 Mark Dec'14)

- (a) 100:1 (b) 10:1
 (c) 1:1 (d) 1:10

Ans: (d)



Solution: 2 kg = 2,000 gm, Therefore, Ratio
= 200 : 2000 = 1:10

30. The Ratio of 5kg 55gm to 35kg 50gm:

(PYP 1 Mark Mar'15, Mar'16)

- (a) 5:7 (b) 1,011:7,010
(c) 111:710 (b) None of these

Ans: (b)

Solution: 5kg 55gm = 5,055 gm | 35 kg 50 gm
= 35,050 gm. Therefore, Ratio = 5,055:35,050
= 1,011:7,010

31. If A:B = 3:4, B:C = 2:5 then A:B:C: (PYP 1 Mark Mar'15)

- (a) 3:4:5 (b) 3:4:10
(c) 4:3:10 (d) 3:4:8

Ans: (b)

Solution: Continued ratio of A:B:C = (3:4) and 2(2:5)
= 3:4 and 4:10 = 3:4:10

32. X has Y and Z as his son and grandson. His present age is 1.5 times the age of his son and grandson. 10 years ago, his age was twice the age of his son and grandson, the present age of the father and sum of age of son and grandson are: (PYP 1 Mark Mar'15)

- (a) 93, 63 (b) 85, 67
(c) 88, 64 (d) 90, 60

Ans: (d)

Solution: Let present age of X be x and Y be y and Z be z | Therefore, $x = 1.5(y + z)$ | $x = 1.5y + 1.5z$
10 years ago: $X - 10 = 2(y - 10 + z - 10)$ | $x - 10 = 2y + 2z - 40$
 $1.5y + 1.5z - 10 = 2y + 2z - 40$
 $40 - 10 = 2y - 1.5y + 2z - 1.5z$ | $30 = 0.5y + 0.5z$
 $y + z = 30/0.5 = 60$ | $x = 1.5(y + z)$ | $x = 1.5 \times 60$ | $x = 90$

33. A two-digit no. is six times the sum of its digits. The number obtained by interchanging the digit is less by 9. The original no. is:

(PYP 1 Mark Mar'15, Dec'15)

- (a) 68 (b) 72
(c) 54 (d) 63

Ans: (c)

Solution: Let a be the digit at Ten's place and b be the digit at one's place, Therefore, $(10a + b)$ is the number. Now, $10a + b = 6(a + b)$ | $10a + b = 6a + 6b$
| $4a = 5b$ | $a = 5/4b$

After interchanging the digits, the number becomes $10b + a$, Therefore, $(10a + b) - 9 = 10b + a$
 $10a + b - 9 = 10b + a$ | $9a - 9 = 9b$

Dividing by 9 we get, $a - 1 = b$ | $5/4b - 1 = b$ | $5/4b - b = 1$ | $1.25b - b = 1$ | $0.25b = 1$ | $b = 4$ | $a = 5/4 \times 4 = 5$
So, the original number is $10a + b = 10 \times 5 + 4 = 54$

34. $\frac{(\sqrt{a}+\sqrt{b})}{\sqrt{a}-\sqrt{b}} = \frac{2}{1}$ then $\frac{(a+b)}{(a-b)}$ is equal to :

(PYP 1 Mark Mar'15, Mar'16)

- (a) 5/4 (b) 4/5
(c) 3 (d) None of these

Ans: (a)

Solution: $\frac{(\sqrt{a}+\sqrt{b})}{\sqrt{a}-\sqrt{b}} = \frac{2}{1}$

Applying Component and Dividendo on both sides

we get $\frac{(\sqrt{a}+\sqrt{b}+\sqrt{a}-\sqrt{b})}{(\sqrt{a}+\sqrt{b}+\sqrt{a}+\sqrt{b})} = \frac{(2+1)}{(2-1)}$ | $2\sqrt{a} / 2\sqrt{b} = 3/1$
 $\sqrt{a} / \sqrt{b} = 3/1$

Squaring both the sides we get $\frac{a}{b} = \frac{9}{1}$

Again, applying Component and Dividendo on both sides we get $\frac{(a+b)}{(a-b)} = \frac{(9+1)}{(9-1)}$ | $\frac{(a+b)}{(a-b)} = \frac{10}{8}$ | $\frac{(a+b)}{(a-b)} = \frac{5}{4}$

35. If A:B = 2:3, B:C = 4:5, then A:C = _____.

(PYP 1 Mark Jun'15, Dec'15, Mar'16)

- (a) 6:7 (b) 7:6
(c) 8:15 (d) 15:8

Ans: (c)

Solution: Continued ratio of A:B:C = 4(2:3) and 3(4:5)
= 8:12 and 12:15 = 8:12:15 Therefore, A:C = 8:15

36. If sum of digits of two digits No. is 9 and the digits obtained by interchanging the digits exceeds the given number by 27, then the number is:

(PYP 1 Mark Jun'15)

- (a) 36 (b) 45
(c) 23 (d) 65

Ans: (a)

Solution: Let a be the digit at Ten's place and b be the digit at one's place, Therefore, $(10a + b)$ is the number

Now, $a + b = 9$ [Equation 1]

After interchanging the digits, the number becomes

$10b + a$, Therefore, $(10a + b) + 27 = 10b + a$

$10a + b + 27 = 10b + a$ | $9a + 27 = 9b$

Dividing by 9 we get, $a + 3 = b$ | $a - b = -3$ [Equation 2]

Solving both the equations we get, $2a = 6$ | $a = 3$

Putting $a = 3$ in Equation 1 we get, $3 + b = 9$ | $b = 6$.

So, the original number is $10a + b = 10 \times 3 + 6 = 36$

37. The ratio of two numbers is 11:15. The sum of 3 times the first number and twice the second number is 630. The H.C.F. of the number is:

(PYP 1 Mark Jun'15)

- (a) 10 (b) 12
(c) 15 (d) None of these

Ans: (a)

Solution: Let the number be $11x$ and $15x$, where x signifies the H.C.F. | $3(11x) + 2(15x) = 630$ | $33x + 30x = 630$ | $63x = 630$ | $x = 10$. Therefore, H.C.F. = 10



3.1

CONCEPT OF CALCULUS AND ITS APPLICATION IN BUSINESS

Quick Review of Important Concepts

Functions

➤ Function Basics

- A function is a rule where each input x (independent variable) has exactly one output y (dependent variable).
- Notation: $y = f(x)$.

➤ Types of Functions

- **Constant:** $f(x) = c$
- **Single-valued:** One output for each input.
- **Multi-valued:** Multiple outputs (e.g., $y^2 = x$).
- **Explicit:** y given directly in terms of x (e.g., $y = 2x + 3$).
- **Implicit:** Relation not solved for y directly (e.g., $x^2 + y^2 = 1$).
- **Parametric:** Variables expressed using a parameter t . Example: $x = 2t, y = t^2 + 1$.
- **Odd Function:** $f(-x) = -f(x)$. Example: $f(x) = x$.
- **Even Function:** $f(-x) = f(x)$. Example: $f(x) = x^2$.
- **Inverse Function:** If $y = f(x)$ then $x = f^{-1}(y)$.

➤ Special Functions

- **Polynomial:** $f(x) = a_0 + a_1x + a_2x^2 + \dots + a_nx^n$.
– $n = 1$: Linear, $n = 2$: Quadratic, $n = 3$: Cubic.
- **Rational:** $\frac{P(x)}{Q(x)}$, where $Q(x) \neq 0$.
- **Domain:** Set of possible input values (x).
- **Range:** Set of corresponding output values ($f(x)$).

➤ Absolute Value

$$|a| = \begin{cases} a, & a \geq 0 \\ -a, & a < 0 \end{cases}$$

Complex Numbers

- Form: $a + ib$, where $i = \sqrt{-1}$.
- Real part = a , Imaginary part = ib .

Limits

➤ Definition

$$\lim_{x \rightarrow a} f(x) = L$$

if $f(x)$ gets arbitrarily close to L as x approaches a .

Types

- **Left-hand limit:** $\lim_{(x \rightarrow a^-)} f(x)$.
- **Right-hand limit:** $\lim_{(x \rightarrow a^+)} f(x)$.
- Limit exists only if both are equal.

Methods to Evaluate Limits

- **Factorisation** – cancel common factors.
- **Substitution:** put $x = a + h$, simplify.
- **Rationalisation:** multiply by conjugate if surds present.
- **At infinity:** divide numerator and denominator by highest power of x .



Fundamental Theorems of Limits

If $\lim_{x \rightarrow a} f(x) = l$, $\lim_{x \rightarrow a} g(x) = m$:

- $\rightarrow \lim_{x \rightarrow a} [f(x) \pm g(x)] = l \pm m$
- $\rightarrow \lim_{x \rightarrow a} [f(x) \cdot g(x)] = lm$
- $\rightarrow \lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \frac{l}{m}, (m \neq 0)$
- $\rightarrow \lim_{x \rightarrow a} k = k$ (constant).
- $\rightarrow \lim_{x \rightarrow a} kf(x) = k \lim_{x \rightarrow a} f(x).$

Differentiation

Concept

- Differentiation is based on limits.
- If $y = f(x)$, the **derivative** (or differential coefficient) is defined as: $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$
- It represents the **rate of change** of y with respect to x .

Symbols:

$\frac{dy}{dx}, f'(x), D[f(x)], y_1$.

Basic Derivatives

- $\frac{d}{dx}(x^n) = nx^{n-1}$
- $\frac{d}{dx}(c) = 0$ ($c = \text{constant}$)
- $\frac{d}{dx}(e^x) = e^x$
- $\frac{d}{dx}(a^x) = a^x \log a$
- $\frac{d}{dx}(\log x) = \frac{1}{x}$
- $\frac{d}{dx}(\log_a x) = \frac{1}{x \log a}$

Rules of Differentiation

- Sum/Difference: $\frac{d}{dx}[u \pm v] = \frac{du}{dx} \pm \frac{dv}{dx}$
- Product Rule: $\frac{d}{dx}[uv] = u \frac{dv}{dx} + v \frac{du}{dx}$
- Quotient Rule: $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$
- Chain Rule (function of a function): If $y = f(z)$ and $z = \varphi(x)$, then $\frac{dy}{dx} = \frac{dy}{dz} \cdot \frac{dz}{dx}$

Special Cases

- Implicit functions: If $f(x, y) = 0$, differentiate both sides w.r.t. x .
- Parametric functions: If $x = f_1(t)$, $y = f_2(t)$, then $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$

Higher Order Derivatives

- First derivative: $\frac{dy}{dx} = f'(x)$.
- Second derivative: $\frac{d^2y}{dx^2} = f''(x)$.
- Similarly: n th derivative = $f^{(n)}(x)$

Multiple Choice Question (MCQ)



1. $\lim_{x \rightarrow 3} (x^3 + 1)$
(SM, MCQ-Bank) (MQP(1) 2 Marks, Dec'24)
- (a) 27 (b) 53
(c) 28 (d) 54

Ans. (c)

Solution: $\lim_{x \rightarrow 3} (x^3 + 1) = 3^3 + 1 = 27 + 1 = 28$



2. $\lim_{x \rightarrow 0} (4x^2 + 7x + 5)$ (SM, MCQ-Bank)

- (a) 4 (b) 7
(c) 5 (d) 16

Ans. (c)

Solution: $\lim_{x \rightarrow 0} (4x^2 + 7x + 5)$
 $= 4(0)^2 + 7(0) + 5 = 5$

3. $\lim_{x \rightarrow 4} \left(\frac{x^2 - 16}{x - 4} \right)$ (SM, MCQ-Bank)

- (a) 2 (b) 4
(c) 8 (d) 6

Ans. (c)

Solution: $\lim_{x \rightarrow 4} \left(\frac{x^2 - 16}{x - 4} \right)$
 $= \lim_{x \rightarrow 4} \left(\frac{(x-4)(x+4)}{x-4} \right)$
 $= \lim_{x \rightarrow 4} (x + 4) = 4 + 4 = 8$

4. If $y = xe^x$ then $\frac{dy}{dx} = ?$

(SM, MCQ-Bank, MQP(2) 2 Marks-Dec'24, PYP 2 Marks Dec'23)

- (a) xe^x (b) $e^x(x + 1)$
(c) $e^x(x - 1)$ (d) $\frac{e^x}{x}$

Ans. (b)

Solution: $y = xe^x \Rightarrow \frac{dy}{dx} = e^x + xe^x = e^x(x + 1)$

5. $f(x) = \frac{x^5}{5} + \frac{x^4}{4} + \frac{x^3}{3} - 7x^2 + 18$. $f'(x) = ?$
(SM, MCQ-Bank)

- (a) $\frac{x^4}{4} + \frac{x^3}{3} + \frac{3x^2}{2} + 14$
(b) $\frac{x^6}{6} + \frac{x^5}{5} + \frac{x^4}{4} - 7x^3 + 18x$
(c) $x^4 - x^3 - \frac{3x^2}{2} + 14x$
(d) $x^4 + x^3 + \frac{3x^2}{2} - 14x$

Ans. (d)

Solution: $f(x) = \frac{x^5}{5} + \frac{x^4}{4} + \frac{x^3}{3} - 7x^2 + 18$
 $f'(x) = \frac{d}{dx} \left(\frac{x^5}{5} \right) + \frac{d}{dx} \left(\frac{x^4}{4} \right) + \frac{d}{dx} \left(\frac{x^3}{3} \right) + \frac{d}{dx} (-7x^2) + \frac{d}{dx} (18)$
 $= \frac{5x^4}{5} + \frac{4x^3}{4} + \frac{3x^2}{3} - 14x + 0$
 $= x^4 + x^3 + \left(\frac{3x^2}{2} \right) - 14x$

6. When $y = 4^x$ then derivative of y is _____
(SM, MCQ-Bank) (MQP(1) 2 Marks-Dec'24)

- (a) $x(4^{x-1})$ (b) $\frac{4^x}{2 \log 2}$
(c) $4^x 2 \log 2$ (d) None of these

Ans. (c)

Solution: $y = 4^x \mid \frac{dy}{dx} = 4^x \log 4$
 $\log 4 = \log(2^2) = 2 \ln 2 \mid \Rightarrow \frac{dy}{dx} = 4^x \cdot 2 \log 2$
 $= 4^x 2 \log 2$

7. Find the differential coefficient of $y = \frac{e^x}{e^x + 1}$
(SM, MCQ-Bank)

- (a) $\frac{e^x}{(e^x + 1)^2}$ (b) $\frac{e^{2x}}{(e^x + 1)^2}$
(c) $\frac{e^x}{(e^{2x} + 1)^2}$ (d) $\frac{e^x}{(e^x + 2)^2}$

Ans. (a)

Solution: $y = \frac{e^x}{e^x + 1} \mid \frac{dy}{dx} = \frac{[(e^x + 1)(e^x) - e^x(e^x)]}{(e^x + 1)^2}$
 $= \frac{[e^{2x} + e^x - e^{2x}]}{(e^x + 1)^2} = \frac{e^x}{(e^x + 1)^2}$

8. $y = (4x - 3)^3 + (5x - 2)^2$ Calculate y_1
(SM, MCQ-Bank) (MQP(1) 2 Marks-Dec'24, MQP (2) 2 Marks Dec'25)

- (a) $182x^2 + 13x + 29$
(b) $96x^2 + 13x + 29$
(c) $192x^2 + 238x - 88$
(d) $192x^2 - 238x + 88$

Ans. (d)

Solution: $y = (4x - 3)^3 + (5x - 2)^2$
 $y_1 = 3(4x - 3)^2 \cdot 4 + 2(5x - 2) \cdot 5$
 $= 12(16x^2 - 24x + 9) + 10(5x - 2)$
 $= 192x^2 - 288x + 108 + 50x - 20$
 $= 192x^2 - 238x + 88$

9. $\frac{x^2}{16} + \frac{y^2}{4} = 1$ is an Implicit function. The derivative of this function is — (SM, MCQ-Bank, MQP (1) 2 Marks Dec'25)

- (a) $\frac{x}{4y}$ (b) $-\frac{x}{4y}$
(c) $\frac{x}{2y}$ (d) $-\frac{x}{2y}$

Ans. (b)

Solution: $\frac{x^2}{16} + \frac{y^2}{4} = 1$
Differentiate implicitly: $\frac{2x}{16} + \frac{2y \cdot dy}{4 \cdot dx} = 0$
 $\frac{x}{8} + \frac{y \cdot dy}{2 \cdot dx} = 0 \mid \frac{y \cdot dy}{2 \cdot dx} = -\frac{x}{8} \mid \frac{dy}{dx} = -\frac{x}{(4y)}$

10. The result of differentiation of $y = \log[3x^2 + 13x + 10]$ is _____. (SM, MCQ-Bank)

- (a) $\frac{6x^2 + 13x}{3x^2 + 13x + 10}$
(b) $\frac{6x + 13}{3x^3 + 13x^2 + 10x}$
(c) $\frac{6x + 13}{3x^2 + 13x + 10}$
(d) $\frac{19}{6x + 13}$

Ans. (c)

Solution: $y = \log(3x^2 + 13x + 10)$
 $\frac{dy}{dx} = \left[\frac{1}{3x^2 + 13x + 10} \right] \cdot (6x + 13)$
 $= \frac{6x + 13}{3x^2 + 13x + 10}$



11. A function is defined as follows : $f(x) = 2x - 1, x < 3, = k, x = 3, = 8 - x, x > 3$. For what value of k, $f(x)$ is continuous at $x = 3$? (SM, MQP (2) 2 Marks-June'25)



- (a) 4 (b) 5
(c) 3 (d) 6

Ans. (b)

Solution: For continuity at $x = 3$:

$$\lim_{x \rightarrow 3^-} f(x) = (2 \times 3) - 1 = 5$$

$$\lim_{x \rightarrow 3^+} f(x) = (8 - 3) = 5. \text{ | So, } k = 5.$$

12. If $y = x \log x$, the $\frac{dy}{dx}$ is: (PYP 2 Marks June'23)

- (a) $1 + \log x$ (b) $\log x$
(c) 1 (d) x

Ans. (a)

Solution: $y = x \log x \text{ | } \frac{dy}{dx} = x \left(\frac{dy}{dx} \log x \right) + \log x \left(\frac{dy}{dx} x \right)$
 $= x \left(\frac{1}{x} \right) + \log x (1) = 1 + \log x.$

13. If $y = (2x + 3)^4$ then $\frac{dx}{dy}$ is:

(PYP 2 Marks June'24)

- (a) $4(2x + 3)^3$ (b) $8(2x + 3)^3$
(c) $32x^3$ (d) $8(2x + 3)$

Ans. (b)

Solution: Let, $z = (2x + 3)$, Therefore, $\frac{dz}{dx} = 2$

Now, $y = (2x + 3)^4 \text{ | } y = z^4 \text{ | } \frac{dy}{dz} = 4z^3$

$$\frac{dy}{dx} = \left(\frac{dz}{dx} \right) \left(\frac{dy}{dz} \right) = 2(4z^3) = 8z^3 = 8(2x + 3)^3$$

14. For the function $y = x^3 - 3x$, the value of x for which $\frac{dy}{dx} = 0$ is (PYP 2 Marks Dec'25)

- (a) ± 1 (b) $+1$
(c) ± 3 (d) $\pm \sqrt{3}$

Ans: (a)

Solution: $\frac{dy}{dx} = 3x^2 - 3 = 0 \Rightarrow 3x^2 = 3 \Rightarrow x^2 = 1 \Rightarrow x = \pm 1$

15. If $f(x) = ax + b$ and $f(-1) = 3$, $f(1) = 5$, then the value of $f(2)$ is (PYP 2 Marks Dec'25)

- (a) 0 (b) 1
(c) 6 (d) 4

Ans: (c)

Solution: $f(-1) = 3$:

$$a(-1) + b = 3$$

$$-a + b = 3 \dots (1)$$

$f(1) = 5$:

$$a(1) + b = 5$$

$$a + b = 5 \dots (2)$$

Add equations (1) and (2):

$$(-a + b) + (a + b) = 3 + 5$$

$$2b = 8$$

$$b = 4$$

Substitute $b = 4$ in equation (2):

$$a + 4 = 5$$

$$a = 1$$

$$\text{So, } f(x) = x + 4$$

$$\text{Find } f(2): f(2) = 2 + 4 = 6$$

3.2

REVENUE AND COST FUNCTION

Quick Review of Important Concepts

Revenue Concepts

- Total Revenue (TR):** $TR = P \times Q$
(Price $\times$ Quantity sold)
- Marginal Revenue (MR):** $MR = TR_{n+1} - TR_n = \frac{d(TR)}{dQ}$
(change in TR from selling one more unit; slope of TR curve)
- Average Revenue (AR):** $AR = \frac{TR}{Q} = P$
(equal to Price per unit)

Cost Concepts

- Total Cost (TC):** $TC = TFC + TVC$
(Fixed Cost + Variable Cost)
- Total Fixed Cost (TFC):** Cost that does **not change** with output (e.g., rent, license fee).
- Total Variable Cost (TVC):** Cost that **varies** with output (e.g., raw materials, wages).
- Average Cost (AC):** $AC = \frac{TC}{Q}$
- Average Fixed Cost (AFC):** $AFC = \frac{TFC}{Q}$



- **Average Variable Cost (AVC):** $AVC = \frac{TVC}{Q}$
- **Marginal Cost (MC):** $MC = TC_{n+1} - TC_n = \frac{d(TC)}{dQ}$

(extra cost of producing one more unit; independent of fixed cost)

Profit: $\text{Profit} = TR - TC$

- **Profit Maximization Condition:**

- * First order: $\frac{d(\text{Profit})}{dQ} = 0$
- * Second order: $\frac{d^2(\text{Profit})}{dQ^2} < 0$
- * Implies: $MR = MC$

Break-even Point (BEP)

- The output level where: $TR = TC$ or $\text{Profit} = 0$
- No profit, no loss situation.

Multiple Choice Question (MCQ)



16.A soft-drink manufacturer has a revenue function $R = 7Q^2 - 19Q + 30$ and the cost function is given by $9Q$. Find the number of cans produced by the firm, under perfect competition.

(SM, MCQ-Bank, MQP(2) 2 Marks-Dec'24)

- (a) 2 (b) 4
(c) 6 (d) 8

Ans. (a)

Solution: $R = 7Q^2 - 19Q + 30, C = 9Q$

$$MR = \frac{dR}{dQ} = 14Q - 19 \mid MC = \frac{dC}{dQ} = 9$$

$$\text{Set } MR = MC: 14Q - 19 = 9 \mid 14Q = 28 \mid Q = 2$$

17.A tin manufacturer has a revenue function given by: $R = 11Q^2 - 110Q + 70$ and the cost function is given by: $C = 22Q$. Find the number of tins to be produced by the manufacturer.

(SM, MCQ-Bank, MQP (1) 2 Marks Dec'25)

- (a) 2 (b) 6
(c) 10 (d) 14

Ans. (b)

Solution: $R = 11Q^2 - 110Q + 70, C = 22Q$

$$MR = \frac{dR}{dQ} = 22Q - 110 \mid MC = \frac{dC}{dQ} = 22$$

$$\text{Set } MR = MC: 22Q - 110 = 22 \mid 22Q = 132 \mid Q = 6$$



18.A demand function is given by: $P = a - bQ$ and the cost function is given by $C = Q^2$. Find the value of Q for which profit will be maximum under perfect competition. (SM, MCQ-Bank, MQP(1) 2 Marks-Dec'24)

- (a) $\frac{a}{(a+1)}$ (b) $\frac{a}{2(b+1)^2}$
(c) $\frac{a}{2(b+1)}$ (d) $\frac{b}{2(a+1)}$

Ans. (c)

Solution: $P = a - bQ, C = Q^2$

$$R = P \cdot Q = (a - bQ)Q = aQ - bQ^2$$

$$MR = \frac{dR}{dQ} = a - 2bQ \mid MC = \frac{dC}{dQ} = 2Q$$

$$\text{Set } MR = MC: a - 2bQ = 2Q \mid a = 2Q + 2bQ \\ = 2Q(1 + b) \mid Q = \frac{a}{2(b+1)}$$



19.The demand function is given by: $P = 1400 - 25Q$ and the cost function is given by $C = 10Q^2$. Find the value of Q at the equilibrium point.

(SM, MCQ-Bank, MQP(1) 2 Marks-June'24)

- (a) 10 (b) 20
(c) 30 (d) 40

Ans. (b)

Solution: $P = 1400 - 25Q, C = 10Q^2$

$$R = P \cdot Q = (1400 - 25Q)Q = 1400Q - 25Q^2$$

$$MR = \frac{dR}{dQ} = 1400 - 50Q \mid MC = \frac{dC}{dQ} = 20Q$$

$$\text{Set } MR = MC: 1400 - 50Q = 20Q$$

$$1400 = 70Q \mid Q = 20$$

20.A revenue function is given by $R = 3Q^2 - 8Q + 15$ and the cost function is given by: $C = 28Q$. Find the value of Q for achieving highest profit. (SM, MCQ-Bank)

- (a) 3 (b) 9
(c) 6 (d) 12

Ans. (c)

Solution: $R = 3Q^2 - 8Q + 15, C = 28Q$

$$MR = \frac{dR}{dQ} = 6Q - 8 \mid MC = \frac{dC}{dQ} = 28$$

$$\text{Set } MR = MC: 6Q - 8 = 28 \mid 6Q = 36 \mid Q = 6$$

21.The demand function is given by: $P = 1500 - 3Q$ and the cost function is given by $C = 12Q^2$. Find the value of Q at the equilibrium point.

(SM, MCQ-Bank)

- (a) 50 (b) 100
(c) 150 (d) 125

Ans. (a)

Solution: $P = 1500 - 3Q, C = 12Q^2$ Revenue R

$$= P \times Q = (1500 - 3Q)Q = 1500Q - 3Q^2$$

$$MR = \frac{dR}{dQ} = 1500 - 6Q \mid MC = \frac{dC}{dQ} = 24Q$$

$$\text{Set } MR = MC: 1500 - 6Q = 24Q \rightarrow 1500 = 30Q \rightarrow Q = 50$$

CHAPTER 5: MEASURES OF CENTRAL TENDENCY AND DISPERSION



LDR Questions

Q 2, Q 3, Q 13, Q 16, Q 140, Q 143, Q 152, Q 175, Q 220, Q 227

5.1

MEAN, MEDIAN, MODE, MEAN DEVIATION

Quick Review of Important Concepts

Arithmetic Mean (A.M)

Definition: Sum of observations ÷ Number of observations.

Formulas:

(a) Individual Series / Discrete Data

- Direct Method: $\bar{X} = \frac{\sum X}{N}$
- Short-Cut / Assumed Mean Method: $\bar{X} = A + \frac{\sum d}{N}$, where $d = X - A$
- Step-Deviation Method: $\bar{X} = A + \frac{\sum d'_i}{N} \times i$, $d'_i = \frac{X-A}{i}$

(b) Grouped Data

- Direct: $\bar{X} = \frac{\sum fX}{\sum f}$
- Short-Cut: $\bar{X} = A + \frac{\sum fd}{\sum f}$
- Step-Deviation: $\bar{X} = A + \frac{\sum fd'_i}{\sum f} \times i$

(c) Combined Mean $\bar{X}_c = \frac{n_1 X_1 + n_2 X_2 + \dots + n_k X_k}{n_1 + n_2 + \dots + n_k}$

(d) Weighted Mean $\bar{X}_w = \frac{\sum w_i X_i}{\sum w_i}$

Geometric Mean (G.M)

Definition: n-th root of product of all observations.

Formulas:

(a) Individual Series: $G.M = \sqrt[n]{X_1 X_2 \dots X_n} = \text{antilog} \left(\frac{\sum \log X_i}{n} \right)$

(b) Discrete / Frequency Data: $G.M = \text{antilog} \left(\frac{\sum f_i \log X_i}{\sum f_i} \right)$

(c) Grouped / Continuous Data:

$$G.M = \text{antilog} \left(\frac{\sum f_i \log m}{\sum f_i} \right), m = \text{mid - value of class}$$

(d) Weighted G.M: $G.M = \text{antilog} \left(\frac{\sum w_i \log X_i}{\sum w_i} \right)$

(e) Combined G.M:

$$G_c = (G_1^{n_1} \cdot G_2^{n_2} \dots G_k^{n_k})^{1/(n_1 + n_2 + \dots + n_k)}$$

Property: $G.M \leq A.M$ (for positive numbers)

Harmonic Mean (H.M)

Definition: Reciprocal of the arithmetic mean of reciprocals.

Formulas:

(a) Individual Series: $H.M = \frac{n}{\sum \frac{1}{X_i}}$

(b) With Frequency: $H.M = \frac{\sum f_i}{\sum \frac{f_i}{X_i}}$

(c) Weighted H.M: $H.M = \frac{\sum w_i}{\sum \frac{w_i}{X_i}}$

Property: $H.M \leq G.M \leq A.M$



Median (Md)

Definition: Middle value dividing data into two equal parts

- Ungrouped (n odd): $Md = \frac{n+1}{2}$ th term
- Ungrouped (n even): $Md = \text{Average of } \frac{n}{2} \text{th and } (\frac{n}{2} + 1) \text{th term}$
- Grouped (less than type): $Md = l + \frac{\frac{N}{2} - C_f}{f} \times h$
- Grouped (greater than type): $Md = l + \frac{\frac{N}{2} - C'_f}{f} \times h$

Partition Measures:

- Quartiles: $Q_k = l + \frac{kN/4 - C_f}{f} \times h$
- Deciles: $D_k = l + \frac{kN/10 - C_f}{f} \times h$
- Percentiles: $P_k = l + \frac{\frac{kN}{100} - C_f}{f} \times h$

Mode (Mo)

Definition: Most frequently occurring value

- Ungrouped / Discrete: Value with highest frequency
- Grouped: $Mo = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$

Where:

- l=lower boundary of modal class
- f_1 =frequency of modal class
- f_0 =frequency before modal class
- f_2 =frequency after modal class
- h=width of modal class

AM, Median, Mode (Empirical): $\text{Mode} = 3 \times \text{Median} - 2 \times \text{AM}$

Multiple Choice Question (MCQ)

1. Which one of the following is a Positional Average? (SM, MCQ-Bank) (MQP(1) 2 Marks-Dec'24, Dec'25 MQP(2) Dec'25)

- (a) Geometric Mean (b) Harmonic Mean
(c) Mode (d) Progressive Average

Ans. (c)

Solution: Positional average is Mode, as it is the value with highest frequency.



2. Because of heavy rain on Sunday average rainfall of a city for the week increased to 0.6 inch from the average rainfall 0.3 inch measured from Monday to Saturday. The rainfall on Sunday was (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 and Dec'23 and June'24 and Dec'25, (MQP(2) 2 Marks-Dec'24)

- (a) 2.4 inch (b) 0.3 inch
(c) 2.1 inch (d) 1.5 inch

Ans. (a)

Solution: Average rainfall for 7 days
 $= 0.6$ inch, so total rainfall $= 0.6 \times 7$
 $= 4.2$ inch. Rainfall Mon – Sat $= 0.3 \times 6$
 $= 1.8$ inch. Rainfall on Sunday
 $= 4.2 - 1.8 = 2.4$ inch.

3. The mean of the frequency distribution $((x_1, f_1), (x_2, f_2), (x_3, f_3) \dots \dots, (x_n, f_n))$ is (SM, MCQ-Bank) (MQP(2) 2 Marks-Dec'24)

- (a) $\frac{\sum x}{\sum f}$ (b) $\frac{\sum x}{n}$
(c) $\frac{\sum fx}{n}$ (d) $\frac{\sum fx}{\sum f}$

Ans. (d)

4. $\sum_{x=1}^{20} x = 54120$ is ; While computing this, it was observed that two entries were wrongly entered as 850 and 320 instead of 580 and 230. Correct value of $\bar{x}$ is (SM, MCQ-Bank) (MQP(1) 2 Marks-Dec'24, Dec'25)

- (a) 2688 (b) 2746.5;
(c) 2720 (d) 2662

Ans. (a)

Solution: Incorrect sum $= 54120$, Correct sum
 $= 54120 - 850 - 320 + 580 + 230$
 $= 53760, n = 20, \bar{x} = \frac{53760}{20} = 2688$



5. $\sum(X - \bar{X})$ is always equal to
(SM, MCQ-Bank) (MQP(1) 2 Marks-Dec'24, MQP(2) 2 Marks-Dec'25)

(a) 1 (b) -1
(c) 0 (d) ∞

Ans. (c)

6. The sum of the squares of deviations of a set of observations is the minimum when deviations are taken from the _____. (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 and Dec'23 and (MQP(2) 2 Marks-Dec'24, Dec'25)

(a) Geometric Mean (b) Harmonic Mean
(c) Arithmetic Mean (d) Mode

Ans. (c)

7. If each of the values of a variable x with mean $\bar{x}$, is multiplied by K then the new mean of the variable is (SM, MCQ-Bank)

(a) $\frac{\bar{x}}{K}$ (b) $K\bar{x}$
(c) $\bar{x}$ (d) Kx

Ans. (b)

8. Assumed mean is 35, $\sum fd = -425$ and $\sum f = 63$. $\bar{x}$ is (SM, MCQ-Bank) (MQP(1) 2 Marks-Dec'24)

(a) 20 (b) 25.87
(c) 28.25 (d) 19.34

Ans. (c)

Solution: $\bar{X} = \text{Assumed mean} + \left(\frac{\sum fd}{\sum f}\right) = 35 + \left(-\frac{425}{63}\right) = 35 - 6.746 = 28.254$

9. If $A = 500$, $i = 1000$ and $\sum fd' = 232$ and $\sum f = 120$ $\bar{x}$ is (SM, MCQ-Bank) (MQP(2) 2 Marks-June'25)

(a) 2433.33 (b) 527.84
(c) 527.84 (d) 1017.24

Ans. (a)

Solution: $\bar{X} = A + \left(\frac{\sum fd'}{\sum f}\right) \times i = 500 + \left(\frac{232}{120}\right) \times 1000 = 500 + 1.9333 \times 1000 = 500 + 1933.33 = 2433.33$

10. The mean daily salary paid to all employees in a certain company was ₹600. The mean daily salaries paid to the male and female employees were ₹620 and ₹520 respectively. Male to female employees ratio in the company is

Marks	4	5	6	7	8	9
No of Students	8	10	9	6	4	3

(SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 and Dec'23 and June'24 and Dec'24 and June'25, MQP(2) 2 Marks-Dec'25)

(a) 3:2 (b) 4:5
(c) 5:7 (d) 4:1

Ans. (d)

Solution: Let ratio be $m:f$.

Then $620m + 520f = 600(m + f)$,
solving gives $20m = 80f$, so $m:f = 4:1$

11. The pass result of 50 students who took up a class test is given below:

If the average marks for all the fifty students was 5.16, the average marks of the students who failed is. (SM, MCQ-Bank) (MQP(1) 2 Marks-Dec'24, Dec'25)

(a) 0.42 (b) 3.06
(c) 4.74 (d) 2.1

Ans. (d)

Solution: Total passed students = 40 students.
Total marks = $50 \times 5.16 = 258$ marks.

Sum = $32 + 50 + 54 + 42 + 32 + 27 = 237$ marks.

Total marks of failed students = Total marks - Passed students' marks
= $258 - 237 = 21$ Marks

Average marks of failed students

$$= \frac{\text{Total marks of failed students}}{\text{Number of failed students}} = \frac{21}{10} = 2.1$$

12. For a certain frequency table which has only been partly reproduced below for which the mean is 1.46

No of accidents	0	1	2	3	4	5
Frequency	46	f_1	f_2	25	10	5

If $\sum f = 200$ Unknown frequencies are

(SM, MCQ-Bank, MQP(1) 2 Marks-Dec'25)

(a) $f_1 = 0, f_2 = 114$ (b) $f_1 = 114, f_2 = 0$
(c) $f_1 = 76, f_2 = 38$ (d) $f_1 = 57, f_2 = 57$

Ans. (c)

Solution: $\sum f = 200$, so $46 + f_1 + f_2 + 25 + 10 + 5 = 200$, $f_1 + f_2 = 114$.

Mean = $1.46 = \frac{0 \cdot 46 + 1 \cdot f_1 + 2 \cdot f_2 + 3 \cdot 25 + 4 \cdot 10 + 5 \cdot 5}{200}$

$$= \frac{f_1 + 2f_2 + 75 + 40 + 25}{200} = \frac{f_1 + 2f_2 + 140}{200}. \text{ So } 1.46 \times 200 = f_1 + 2f_2 + 140, 292 = f_1 + 2f_2 + 140,$$

$$f_1 + 2f_2 = 152.$$

$$\text{Solving: } f_1 + f_2 = 114, f_1 + 2f_2 = 152, \text{ subtract: } f_2 = 38, f_1 = 76.$$



13. The sum of the deviations of a certain number of observations measured from 4 is 72 and the sum of the deviations of the observations from 7 is -3. Mean of the observations is. (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 and Dec'23 and June'24 and (MQP(2) 2 Marks-Dec'24, Dec'25)

(a) 6.88
(b) 25
(c) 3.63
(d) Cannot be ascertained with given data

Ans. (a)

Solution: Let n be number of observations.

$$\sum(x - 4) = 72 \mid \sum x - 4n = 72.$$

$$\sum(x - 7) = -3 \mid \sum x - 7n = -3.$$

$$\text{Subtract: } (\sum x - 4n) - (\sum x - 7n)$$

$$= 72 - (-3) \mid 3n = 75 \mid n = 25.$$

$$\text{Then } \sum x = 72 + 4 \times 25 = 172 \mid$$

$$\text{mean} = \frac{172}{25} = 6.88.$$



14. The mean of a certain number of items is 42. If one more item 64 is added to the data, the mean becomes 44. The no. of items in the original data is _____ (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 and Dec'23 and June'25, Dec'25)

- (a) 20 (b) 10
(c) 43 (d) 440

Ans. (b)

Solution: Let original number be n .

Original sum = $42n$ | New sum = $42n + 64$.

New mean = 44

$$= \frac{42n + 64}{n+1} | 44(n+1) = 42n + 64 |$$

$$44n + 44 = 42n + 64 | 2n = 20 | n = 10.$$

15. The weighted average from the following observation is ₹46.23

Price per tonne (₹)	45.60	50.70	?
Tonnes Purchased	135	40	25

Simple average of the observation is. (MCQ-Bank) (SM, MQP(1) 2 Marks-June'23 and Dec'23 and (MQP(2) 2 Marks-Dec'24 and June'25, Dec'25)

- (a) ₹46.23 (b) ₹46.26
(c) ₹66.63 (d) ₹46.24

Ans. (b)

Solution: Weighted average

$$= \frac{45.60 \times 135 + 50.70 \times 40 + P \times 25}{135 + 40 + 25} = 46.23.$$

$$\text{Solve: } \frac{6156 + 2028 + 25P}{200} = 46.23, 8184 + 25P$$

$$= 9246, 25P = 1062 | P = 42.48.$$

$$\text{Simple average} = \frac{45.60 + 50.70 + 42.48}{3} = \frac{138.78}{3} = 46.26.$$



16. In a certain factory a unit of work is completed by A in 4 minutes, by B in 5 minutes, by C in 6 minutes, by D in 10 minutes, and by E in 12 minutes. Average number of units of work completed per minute is. (SM, MCQ-Bank) (MQP(1) 2 Marks-June'24 and Dec'24)

- (a) $\frac{25}{4}$ (b) $\frac{5}{48}$
(c) $\frac{4}{25}$ (d) $\frac{25}{48}$

Ans. (c)

Solution: Work rate of each worker:

Work rate = Work done per minute

$$= \frac{1 \text{ unit}}{\text{time in minutes}}. \text{ Total work done per minute:}$$

$$= \frac{15}{60} + \frac{12}{60} + \frac{10}{60} + \frac{6}{60} + \frac{5}{60} = \frac{15+12+10+6+5}{60} = \frac{48}{60} = \frac{4}{5}.$$

Average work done per minute:

$$\text{Average} = \frac{\text{Total units per minute}}{5} = \frac{\frac{4}{5}}{5} = \frac{4}{25}$$

17. A person walks 8 km at 4km an hour, 6km at 3km an hour and 4km at 2km an hour. Average speed per hour is (MCQ-Bank) (SM, MQP(1) 2 Marks-June'24 and (MQP(2) 2 Marks-Dec'24, Dec'25)

- (a) 0.33 (b) 2
(c) 3 (d) 0.5

Ans. (c)

Solution: Total distance = $8 + 6 + 4 = 18$ km.

$$\text{Time for 8km at } \frac{4\text{km}}{\text{h}} = 2\text{h} | 6\text{km at } \frac{3\text{km}}{\text{h}} = 2\text{h} |$$

$$4\text{km at } \frac{2\text{km}}{\text{h}} = 2\text{h. Total time} = 6\text{h.}$$

$$\text{Average speed} = \frac{18}{6} = \frac{3\text{km}}{\text{h}}$$

18. It is the most suitable average when it is desired to give greater weight to smaller observations and less weight to larger ones. It is _____. (SM, MCQ-Bank) (MQP(1) 2 Marks-June'23 and Dec'23 and June'24 and (MQP(2) 2 Marks-June'25, Dec'25)

- (a) AM (b) HM
(c) GM (d) Median

Ans. (b)

19. Which one of the following is not a feature of Arithmetic Mean (AM)? (SM, MCQ-Bank, MQP (1 & 2) 2 Marks Dec'25)

- (a) AM is affected very much by extreme values.
(b) AM is widely used in the study of qualitative phenomenon.
(c) AM provides a good basis for comparison.
(d) AM is rigidly defined so different interpretation by different people are not possible.

Ans. (b)

20. Which one of the following is a feature of Geometric Mean (GM)? (SM, MCQ Bank)

- (a) GM is affected much by the presence of externally small or large observations.
(b) GM gives the actual value of the series
(c) GM is useful when a given phenomenon has a limit for lower value.
(d) GM is imaginary if any of the observations is zero

Ans. (c)

21. If $y = 3x + 30$ and mean of x is 20, then the mean of y is (MQP (2) 2 Marks-Dec'24)

- (a) 90 (b) 80
(c) 70 (d) 100

Ans. (a)

Solution: $y = 3x + 30$,

$$\text{Mean of } y = 3 \times 20 + 30 = 90$$

22. $\bar{X}$ of 20 terms was found to be 35. But afterwards it was detected that two terms 42 and 34 were misread as 46 and 39 respectively. Find correct $\bar{X}$ (MQP (1) 2 Marks-June'25)

- (a) 34.55 (b) 36.67
(c) 31.63 (d) 35.51

Ans. (a)



Solution: $\bar{X}$ of 20 terms = 35 | Incorrect Total of 20 terms = $35 \times 20 = 700$
 Correct Total = $700 + 42 + 34 - 46 - 39 = 691$
 Correct $\bar{X} = \frac{691}{20} = 34.55$

23. The mean of wages in factory A of 100 workers is ₹720 per week. The mean wages of 30 female workers in the factory is ₹650 per week. Find out average wage of male workers in the factory (MQP 1) 2 Marks-June'25)

- (a) 850 (b) 700
 (c) 750 (d) 800

Ans. (c)

Solution: $N_f + N_m = 100 = N$ |
 $\bar{X} = 720 =$ Mean wage of total workers
 $= \frac{\text{Total wage of all workers}}{N}$ | So total wage of all workers = $720 \times N = 720 \times 100 = 72000$ $\bar{X}_f = 650$
 $=$ Mean wage of total female workers
 $= \frac{\text{Total wage of female workers}}{N_f}$, So total wage of female workers = $650 \times N_f = 650 \times 30 = 19500$
 So total wage of male workers = $72000 - 19500 = 52500$. No of male workers in the factory = $100 - 30 = 70$, So Mean wage of total male workers = $\bar{X}_m = \frac{52500}{70} = ₹750$ per week

24. The sum of deviations of a certain number of observations (ungrouped data) measured from 4 is 72 and the sum of the deviations of the observations from 7 is -3. Find the number of observations and their mean. (MQP 2) 2 Marks-June'25)

- (a) 30 observations, mean = 7.2
 (b) 25 observations, mean = 6.88
 (c) 25 observations, mean = 7
 (d) 30 observations, mean = 6.5

Ans. (b)

Solution: In this problem mean is obtained by the formula $\bar{X} = A + \frac{\sum d}{n}$, So by question we can write that $4 + \frac{72}{n} = 7 - \frac{3}{n}$ | $4n + 72 = 7n - 3$
 $3n = 75$ | $n = 25$ | so mean = $4 + \frac{72}{25} = 6.88$

25. In a class of 50 students, 10 students failed with an average of 2.5 marks. The total marks of the class were 200. Find the average marks of the passed students. (MQP 2) 2 Marks-June'25)

- (a) 4 (b) 4.5
 (c) 4.375 (d) 5

Ans. (c)

Solution: Average marks of passed students
 $= \frac{200 - 10 \times 2.5}{40} = \frac{200 - 25}{40} = \frac{175}{40} = 4.375$

26. A class has 50 students with average weight of 45 kgs. Out of these there are 30 girls with average weight of 42.5 kgs. Find average weight of boys. (MQP 2) 2 Marks-June'25)

- (a) 48.25 (b) 49.50
 (c) 50.90 (d) 48.75

Ans. (d)

Solution: $\bar{X} = \frac{X_1 \times n_1 + X_2 \times n_2 + \dots + X_n \times n_n}{n_1 + n_2 + \dots + n_n}$ |

$\bar{X}$ = combined mean of boys and girls = 45 and
 n = Total of boys and girls = 50 | $\bar{X}_1$ = Mean of girls = 42.5 and n_1 = Total of girls = 30 | Total of boys = $n_2 = n - n_1 = 50 - 30 = 20$ | Total weight of boys and girls = $\bar{X} \times n = 45 \times 50 = 2250$ | Total weight of girls = $\bar{X}_1 \times n_1 = 42.5 \times 30 = 1275$ | Total weight of boys = Total weight of boys and girls - Total weight of girls = $2250 - 1275 = 975$,
 So Average weight of boys = $\frac{975}{20} = 48.75$

27. Mean weight of students in a class is 48 kg. If mean weight of girl students is 40 kg. and that of boys is 60 kg. (MQP 2) 2 Marks-June'25)

- (a) Boys = 50%, Girls = 50%
 (b) Boys = 40%, Girls = 60%
 (c) Boys = 30%, Girls = 70%
 (d) Boys = 60%, Girls = 40%

Ans. (b)

Solution: Let there are x no of boy students. So there are $75 - x$ no of girls So by question we can write: $48 = \frac{x \times 60 + (75 - x) \times 40}{75}$ | $75 \times 48 = 60x + 75 \times 40 - 40x$ | $3600 = 20x + 3000$ | $x = \frac{600}{20} = 30$ | So no of girls students = $75 - 30 = 45$ % age of boys and girls = $\frac{30}{75} \times 100 = 40\%$ and $\frac{45}{75} \times 100 = 60\%$

28. For a shoemaker, which one of the following measures is most suitable to decide on the shoe sizes to manufacture? (PYP 1 Mark June'13)

- (a) Median (b) Arithmetic mean
 (c) Mode (d) Geometric mean

Ans. (c)

29. _____ is known as positional average. (PYP 1 Mark Dec'15)

- (a) Median (b) Mean
 (c) Mode (d) Range

Ans. (a)

30. The average discovers: (PYP 1 Mark Dec'15)

- (a) Uniformity in variability
 (b) Variability in uniformity of distribution
 (c) Both (a) and (b)
 (d) None of these

Ans. (a)

31. Median is: (PYP 1 Mark June'16)

- (a) Average point
 (b) Mid-point
 (c) Most likely point
 (d) Most remote point

Ans. (b)