ULTIMATE CA

CA PRANAV POPAT

Pre-Exam Marathon

CA Foundation Dec 23

MATH, LR & STATS

Session 2

Logical Reasoning, Index Numbers, Ratio, Proportion, Indices, Log and Equations [34 marks]

SESSION LINK:

https://www.youtube.com/live/IUopj-q2DOs?si=FqSXkuoC4iOU0prN

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ULTIMATE CA'

CA INTERMEDIATE
NOVEMBER 24

Early Bird Batch

STARTING 24TH JANUARY

CA MOHNISH VORA

CA DEEPIKA RATHI

CA TEJAS SUCHAK

CA INDRESH GANDHI

CA VIVEK GABA

CA PRANAV POPAT

Blood Relations

Past Trends	
Attempt	**Total**
May 2018	**5**
Nov 2018	**4**
Jun 2019	**4**
Nov 2019	**3**
Nov 2020	**6**
Jan 2021	**4**
Jul 2021	**4**
Dec 2021	**6**
Jun 2022	**6**
Dec 2022	**7**
June 2023	**7**

Blood Relations - Basics	

Important Relations	<table><tr><td>**Grandfather's son**</td><td>Uncle or Father</td></tr><tr><td>**Grandfather's only son**</td><td>Father</td></tr><tr><td>**Brother's Daughter**</td><td>Niece</td></tr><tr><td>**Brother's Son**</td><td>Nephew</td></tr><tr><td>**Uncle's Son**</td><td>Cousin</td></tr><tr><td>**Uncle's Daughter**</td><td>Cousin</td></tr><tr><td>**Brother's wife**</td><td>Sister-in-law</td></tr><tr><td>**Sister's Husband**</td><td>Brother-in-law</td></tr><tr><td>**Son's wife**</td><td>Daughter-in-law</td></tr><tr><td>**Husband's Mother**</td><td>Mother-in-law</td></tr><tr><td>**Husband's Father**</td><td>Father-in-law</td></tr></table>
Pro Tips to create chart in Blood Relations	- Same **Generation** in Same **Row** - Distinct marking for Gender (as soon as you know) <table><tr><td>Male</td><td>+</td></tr><tr><td>Female</td><td>−</td></tr></table> - If there is a **couple put brackets** - Make a empty box if name not given - If the information is not in proper linkage **hold that statement**, go to next one and then come back again - Convert your question requirement into a **fill in the blanks format** - If you are getting two answers for a question – just chill, check the options - For **pointing based question**, also create arrows of relation if needed.

Blood Relations – Application of Pro-Tip

Basic

Example	P is Q's brother. R is Q's mother. S is R's father. T is S's mother. How is P related to T?
	    a. Grand-Daughter b. Great Grandson
	    c. Grandson d. Grandmother

Ans: b

Choice of Answers

Example	A is the sister of B. B is the brother of C. C is the son of D. How is D related to A? a. Mother b. Daughter c. Son d. Uncle

Ans: a

Hold the Statement

Example	A is B's brother. C is D's father. E is B's mother. A and D are brothers. How is E related to C?
	    a. Sister b. Sister-in-law
	    c. Niece d. Wife

Ans: d

Use of Empty Box

Example	A and B are sisters. R and S are brothers. A's daughter is R's sister. What is B's relation to S?
	    a. Mother b. Grand Mother
	    c. Sister d. Aunt

Ans: d

Couple in Brackets

Example	A is father of C and D is son of B. E is brother of A. If C is sister of D how is B related to E?
	    a. Sister-in-law b. Sister
	    c. Brother d. Brother-in-law

Ans: a

Pointing Based Problems

Example	Pointing to a lady in a photograph. Meera said. "Her father's only son's wife is my mother-in-law "How is Meera's husband related to that lady in the photo?
	    a. Nephew b. Uncle
	    c. Son d. Father

Ans: a

Important MCQs

Example	A is B's sister, C is B's mother, D is C's father, E is D's mother, then how A is related to D?
	   a. Grandfather b. Daughter
	   c. Grandmother d. Granddaughter

Ans: d (wrong answer in study material)

Exercise (Modified)	P, Q, R, S, T, U are 6 members of a family in which there are two married couples. T, a teacher is married to a doctor who is mother of R and U. Q the lawyer is married to P. P has one son and one grandson. Of the two married ladies one is a housewife. There is also one student and one male engineer in the family. What is profession of S.
	   a. Lawyer b. Engineer
	   c. Student d. Doctor

Ans: d

Exercise	Seema is the daughter-in-law of Sudhir and sister-in-law of Ramesh. Mohan is the son of Sudhir and only brother of Ramesh. Find the relation between Seema and Mohan.
	   a. Sister-in-law b. Aunt
	   c. Cousin d. Wife

Ans: d

Exercise	Suresh introduces a man as "He is the son of the woman who is the mother of the husband of my mother". How is Suresh related to the man?
	   a. Uncle b. Son
	   c. Cousin d. Grandson

Ans: b

PYQ	If P+Q means P is the mother of Q; P÷Q means P is the father of Q; P-Q means P is the sister of Q; then which of the following relationship shows that M is the daughter of R?
	   a. R + N ÷ M b. R – M ÷ N
	   c. R ÷ M + N d. None

Ans: c

PYQ	A girl introduced a boy as the son of the daughter of father of her uncle. The boy is girl's
	   a. Brother b. Son
	   c. Son-in-law d. Uncle

Ans: a

Exercise & PYQ
 	
Ans: d
	Among her children, Ganga's favorites are Ram and Rekha. Rekha is the mother of Sharat, who is loved most by his uncle Mithun. The head of the family is Ram Lal, who is succeeded by his sons Gopal and Mohan. Gopal and Ganga have been married for 35 years and have 3 children. What is the relation between Mithun and Mohan?
	   a. Uncle b. Son
	   c. Brother d. No Relation

Exercise
 	
Ans: b
	A prisoner introduced a boy who came to visit him to the jailor as "Brothers and sisters I have none, he is my father's son's son". Who is the boy?
	   a. Nephew b. Son
	   c. Cousin d. Uncle

PYQ Jan 21
 	
Ans: d
	P is the brother of Q and R, S is the mother of R. T is the father of P, which of the following statement cannot be definitely true?
	   a. S is the mother of P b. P is son of S
	   c. T is husband of S d. Q is son of T

PYQ Jun 19
 	
Ans: d
	Pointing to a man in a photograph, a man said, "His mother's husband's sister is my aunt". Then what is the relation between that man and him?
	   a. Son b. Uncle
	   c. Nephew d. Brother

PYQ Nov 20
 	
Ans: c
	Pointing to a lady, A said, "that women is my nephew's maternal grandmother". How is that women related to A's sister who has no sister?
	   a. Cousin b. Son-in-law
	   c. Mother d. Mother-in-law

MTP June 2023 Series II
 	
Ans: b
	In a certain language, '+' means father of, '-' means daughter of, '*' means son of, and '/' means mother of. For example, X + Y – Z means that X is the father of Y and Y is the daughter of Z. If A + F – K / G + L * H then how is H related to A?
	   a. Cousin b. Son-in-law
	   c. Mother d. Mother-in-law

PYQ Nov 18
 	
Ans: b
	Ram and Mohan are brothers, Shankar is Mohan's father. Chhaya is Shankar's sister. Priya is Shankar's niece. Shubhra is Chhaya's granddaughter. How is Ram related to Shubhra?
	   a. Brother b. Uncle
	   c. Cousin d. Nephew

Seating Arrangements

Past Trends	
Attempt	**Total**
May 2018	4
Nov 2018	4
Jun 2019	4
Nov 2019	3
Nov 2020	2
Jan 2021	4
Jul 2021	4
Dec 2021	5
Jun 2022	2
Dec 2022	3
June 2023	3

Seating Arrangements - Basics	
Meaning	The process of making a group of people to sit as per a prefixed manner is called Seating Arrangement
Question Requirement	In these questions, some conditions are given on the basis of which students are required to arrange objects, either in a row or in a circular order.
Types	Linear – One Row, Linear – Two Rows, Circular
Pro-Tip of forming diagram	• We need to make the diagram taking persons Name/ Alphabet Code • First make multiple **mini-diagrams** using multiple small information. • Try to **connect** these and make a master diagram. • Be Careful about **number of objects** and their sense in the context • In some cases if information is not very clear, we may need to make **multiple diagrams** and then decide the correct one eventually
Linear Arrangement (Single Row)	The arrangement is done only on one 'axis' and hence, the position of persons or objects is important in terms of order/ position. **Useful Interpretations**

A is immediate left of P	Then it is sure no one is between A and P and A is just left of P
A is left of P •	In this case A may be on exact left of P or may be at left after some places

Linear Arrangements MCQs	
PYQ May 18 PYQ Jun 19	Five boys A, B, C, D and E are sitting in a row A is to the right of B and E is to the left of B but to the right of C. A is to the left of D. Who is second from the left end? a. D b. A c. E d. B

Ans: c

PYQ June 2019 **Ans: a**	Four girls are seated for a photograph. Shikha is to the left of Reena. Manju is to the right of Reena. Reeta is between Reena and Manju. Who is the second left in photograph? a. Reena b. Manju c. Reeta d. Shikha
Exercise (Modified) **Ans: b**	Five boys are standing in a row facing East. Pavan is to the left of Tavan, Vipin and Chavan. Tavan, Vipin and Chavan are to the left of Nakul. Chavan is between Tavan and Vipin. If Vipin is fourth from the left, then how far Tavan from the left? a. First b. Second c. Third d. Fourth
Exercise (Modified) **Ans: b**	There are eight books kept one over the other. Two books are on Organisation Behaviour, two books on TQM, three books on Industrial Relations and one book is on Economics. Counting from the top, the second, fifth and sixth books are on Industrial Relations. Two books on Industrial Relations are between two books on TQM. One book of Industrial Relations is between two books on Organizational Behaviour while the book above the book of Economics is a book of TQM. Which book is the fourth book from the top? a. Economics b. TQM c. Industrial Relations d. Organization Behaviour
Example **Ans: d**	Four Children's are sitting in arrow. A is occupying seat next to B but not next to C. If C is not sitting next to D? Who is occupying seat adjacent to D. a. B b. B and A c. Can't Say d. A
Example **Ans: b**	P, Q, R, S, T, U, V and W are sitting in a row facing North. (i) P is fourth to the right of T (ii) W is fourth to the left of S (iii) R and U, which are not at the ends, are neighbours of Q and T respectively. (iv) W is next to the left of P and P is the neighbor of Q. Who are sitting at the extreme ends? a. T and P b. T and S c. Q and R d. U and S
PYQ Dec 21 **Ans: d**	In a line P is sitting 13th from the left. Q is sitting 24th from the right and 3rd left from P. How many people are sitting in the line? a. 34 b. 31 c. 32 d. 33
Exercise **Ans: b**	Six children A, B, C, D, E and F are standing in a row. B is between F and D. E is between A and C. A does not stand next to eight F or D. C does not stand next to D. F is between which of the following pairs of children? a. B and E b. B and C c. B and D d. B and A

|	
PYQ May 18 **PYQ Jun 19** **Ans: d**	Five children are sitting in a row. S is sitting next to P but not T. K is sitting next to R, who is sitting on the extreme left and T is not sitting next to K. Who is/are adjacent to S? a. K and P b. R and P c. Only P d. P and T
PYQ Nov 19 **Ans: c**	5 person are standing in a line. One of the 2 persons at the extreme ends is a professor and the other is a businessman. An advocate is standing to the right of a student. An author is to the left of the businessman. The student is standing between the professor and advocate. Counting from left, the author is at which place? a. 2nd b. 3rd c. 4th d. None

Exercise	Ten students are A to J are sitting in a row facing west.
	    I. B and F are not sitting on either of the edges.
	    II. G is sitting left of D and H is sitting to the right of J.
	    III. There are four persons between E and A.
	    IV. I is the north of B and F is the south of D.
	    V. J is between A and D and G is in between E and F
	    VI. There are two persons between H and C

1 **Ans: d**	Who is sitting at the seventh place counting from the left? a. H b. C c. J d. H or C
2 **Ans: c**	Who among the following is definitely sitting at one of the ends? a. C b. H c. E d. Cant Say
3 **Ans: d**	Who are immediate neighbours of I? a. BC b. BH c. AH d. Cant Say
4 **Ans: a**	Who is sitting second left of D? a. G b. F c. E d. J
5 **Ans: c**	If G and A interchange their positions, then who become the immediate neighbours of E? a. G and F b. Only F c. Only A d. J and H

Two Rows Linear Arrangement	Right A B C Left
	Left D E F Right
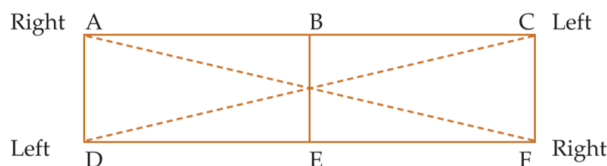	
	  • A is sitting opposite to D
	  • B is sitting opposite to E
	  • C is sitting opposite to F
	  • D and C are sitting at diagonally opposite positions
	  • A and F are sitting at diagonally opposite positions

Exercise **Ans: b**	Six persons M, N, O, P, Q and R are sitting in two rows with three persons in each row. Both the row are in front of each other. Q is not at the end of any row. P is second the left of R. O is the neighbour of Q and diagonally opposite to P. N is the neighbour of R. Who is in front N? a. R b. Q c. P d. M
PYQ Nov 18 **Ans: a**	Six flats on a floor in two rows facing North and South are allotted to P, Q, R, S, T and U. Q gets a North facing flat and it is not next to S. S and U get diagonally opposite flat. R next to U gets a South facing flat and T gets a North facing flat. Whose flat is between Q and S? a. T b. U c. R d. P

Circular Arrangements	When person facing centre	Clockwise = Left Anticlockwise = Right	
	When person facing opposite to Centre	Clockwise = Right Anticlockwise = Left	

PYQ Dec 2021
 	
1
 	
2
 	
3
	Four ladies & A, B, C and D and Four Gentlemen E, F, G and H are sitting in a circle around a table facing each other.
	    I. No two ladies or gentlemen are sitting side by side.
	    II. C, who is sitting between G and E, is facing D.
	    III. F is between D and A and facing G.
	    IV. H is to the right of B.
	Who is sitting left of A?
	    a. E b. F c. G d. H
	Ans: b
	E is facing whom?
	    a. F b. B c. G d. H
	Ans: d
	Who is immediate neighbours of B?
	    a. GH b. EF c. EH d. FH
	Ans: a

Example 11
 	
Ans: c
	Five people A, B, C, D and E are seated about a round table. Every chair is spaced equidistant from adjacent chairs.
	    I. C is seated next to A.
	    II. A is seated two seats from D.
	    III. B is not seated next to A.
	Which of the following must be true?
	    I. D is seated next to B.
	    II. E is seated next to A.
	Select the correct from the options given below:
	    a. Only I b. Only II c. Both d. None

PYQ Jun 22 **Ans: d**	If six persons are sitting in a hexagonal table are P, Q, R, S, T, U each facing the centre. P is seated opposite to Q who is between R and S. P is between T and U. T is left of S. Which of them is facing R? a. P b. Q c. U d. T
PYQ Dec 22 **Ans: b**	P, Q, R, and S are playing a game of carrom. P, R and S, Q are partners, 'S' is to the right of 'R'. If 'R' is facing West, then 'Q' is facing which direction? a. South b. North c. East d. West
MTP March 21 **Ans: a**	Eight friends A, B, C, D, E, F, G and H are sitting in circle facing the center . B is sitting G and D. H is third to the left of B and second to the right of A. C is sitting between A and G and B and E are not sitting opposite to each other ? Who is third to left of D ? a. F b. E c. A d. Cant Say
MTP Nov 19 **Ans: c**	Six friends A, B, C, D, E and F are sitting in row facing East. "C "is between 'A' and 'E'. 'B' is just to the right of 'E but left of D'. 'F' is not right end. How many persons are to the left of E ? a. 1 b. 2 c. 3 d. 4

Direction Test

Direction Test

Question Requirements	• Here questions consist of a sort of direction puzzle. • A successive follow-up of direction is formulated and • the students are required to ascertain the final direction or • direction with respect to starting points or • other related problems.

Types of Question	Type	Requirement	Remark
	Type I	Finding final direction	Distance can be ignored
	Type II	Finding the direction with respect to original point	Distances are important
	All other varieties	Multiple	No Remark

MCQs

Exercise	A man starts from a point, walks 4 miles towards north and turns left and walks 6 miles, turns right, and walks for 3 miles and again turns right and walks 4 miles and takes rest for 30 minutes. He gets up and walks straight 2 miles in the same direction and turns right and walks one mile. What is the direction he is facing? a. North b. South c. South-East d. West

Ans: b

Exercise	Arun started from point A and walked 10 kms East to point B, then turned to North and walked 3 kms to point C and then turned West and walked 12 kms to point D, then again turned South and walked 3 kms to point E. In which direction is he from his start point? a. East b. South c. West d. North

Ans: c

Exercise **Ans: b**	A tourist drives 10 km towards west and turns to left and takes a drive of another 4 km. He then drives towards east another 4 km and then turns to his right and drives 5 km. Afterwards he turns to his left and travels 6 km. In which direction is he from the starting point? a. East b. South c. West d. North
Exercise **Ans: a**	Raju facing North and moves 20 kms, then he turned to his right and moves 20 kms and then he moves 10 kms in North-East, then he turned to his right and moves 20 kms and then he turned to his right and moves 20 kms and again he turned to his left and moves 20 kms. Now in which direction Raju is facing? a. South-East b. North-East c. South-West d. North-West
Exercise **Ans: d**	Five boys A, B, C, D and E are sitting in a park in a circle. A is facing South-West, D is facing South-East, B and E are right opposite A and D respectively and C is equidistant between D and B. Which direction is C facing? a. West b. South c. North d. East
Exercise (Modified) **Ans: b**	Daily in the morning the shadow of Gol Gumbaz falls on Bara Kaman and in the evening the shadow of Bara Kaman falls on Gol Gumbaz exactly. So, in which direction is Bara Kaman to Gol Gumbaz? a. Eastern b. Western c. Northern d. Southern
Exercise **Ans: b**	If X stands on his head with his face towards south, to which direction will his left-hand point? a. East b. West c. North d. South
PYQ May 18 **Ans: b**	I stand with my right-hand extended side-ways towards South. Towards which direction will my back be? a. North b. West c. East d. South
Exercise **Ans: d**	Roy walks 2 kms to East, then turns North-West and walks 3 kms. Then he turns South and walks 5 kms. Then again, he turns West and walks 2 kms. Finally, he turns North and walks 6 kms. In which direction, is he from the starting point? a. South-East b. North-East c. South-West d. North-West
Example **Ans: c**	Gopal started walking 2 kms straight from his school. Then he turned right and walked 1 km. Again, he turned right and walked 1 km to reach his house. If his house is south-east from his school, then in which direction did Gopal start walking from the school? a. North b. West c. East d. South

MTP **Ans: a**	One evening before sunset, two friends Ravi and Raj were talking to each other face to face. If Ravi's shadow was exactly to his left side, which direction was Raj facing? a. North b. West c. East d. South
MTP **Ans: b**	Kiran walks 2 km towards North then he turns East and walks 10 km. After this he turns North and walks 3 km. Again, he turns towards East and walks 2 km. How far is he from the starting point? a. 10 km b. 13 km c. 15 km d. 17 km
MTP **Ans: c**	Ramu moved 75 meters towards North. He then turned to left and after walking about 25 meters, turned left again and walks 80m. Finally, he turned to the right at an angle of $45°$. In which direction was he moving finally? a. South-East b. North-East c. South-West d. North-West
PYQ Nov 20 **Ans: b**	One day Ram left home and cycled 10 km southward, turned right and cycled 5 km and turned right and cycled 10 km and turned left and cycled 10 km. How many kms will he have to cycle to reach his home straight? a. 10 b. 15 c. 20 d. 25
PYQ Nov 20 **Ans: a**	A man is facing west, he turns $45°$ in the clockwise direction and then another $180°$ in the same direction and then $270°$ in the anti-clockwise direction. Which direction is he facing now? a. South-West b. North-West c. West d. South
PYQ Dec 21 **Ans: a**	The hour hand of a clock is in west direction when time is 3 o'clock. What is the direction of minutes hand when time is 6:45? a. East b. North c. West d. South
PYQ Jun 19 **Ans: c**	A person facing North moves $70°$ in clockwise direction. He again moved $300°$ in clockwise direction. In which direction is he facing now? a. North – West b. South – East c. North – East d. South – West
PYQ Jul 21 **Ans: c**	One morning after sunrise, Vikram and Shailesh were standing in a down with their back towards each other. Vikram's shadow fell exactly towards left hand side. Which direction was Shailesh facing? a. South – West b. West c. South d. East-South

PYQ Nov 20 **Ans: a**	A man can walk by having long, medium and short steps. He can cover 60 meters by 100 long steps, 100 meters by 200 medium steps and 80 meters by 200 short steps, he walks taking 5000 long steps, then he turns left and walk by taking 6000 medium steps. He then turns right and walk by taking 2500 short steps. How far (in meters) is he away from his starting point? a. 5000m b. 4000m c. 6000m d. 7000m
PYQ Jan 21 **Ans: d**	Ms. N walks 10km towards North from there she walks 6km towards South. Then she walks 3km towards East. How far and in which direction is she with reference to her starting point? a. 4km West b. 6km West c. 3km East d. 5km North East
PYQ Jul 21 **Ans: b**	There are four towns P, Q, R and T. Q is the South – West of P, R is to the East of Q and South – East of P and T is to the North of R in line with QP. In which direction of P is T located? a. North b. North-East c. East d. South-East

Chp9: Number Series, Coding, Decoding, Odd Man Out

Past Trends

Attempt	Total
May 2018	3
Nov 2018	5
Jun 2019	4
Nov 2019	6
Nov 2020	6
Jan 2021	5
Jul 2021	5
Dec 2021	6
Jun 2022	7
Dec 2022	6
June 2023	5

Basics

Number Series	• In this type of questions, we need to identify the missing term of the series real according to a **specific pattern** of the series rule to form its code. • The students are required to detect the missing number of the series and answer the questions accordingly.
Alphabet Series	• Alphabet series consists of letters of the alphabet placed in a specific pattern.
Coding and Decoding	• Coding: converting original message into code • Decoding: converting code into original message • Types: Number Coding, Letters Coding etc.
Odd Man Out	• In these questions, four or five elements are given, out of which one does not belong to the group, we need to identify it.

Classification of MCQs	Quickly Identifiable	Pattern which can be identified instantly during exams
	Not Quickly Identifiable (Advance)	Pattern which required lot of thinking and even after that there is no surety that it will click on spot

MCQs

Example	2, 7, 16, _____, 46, 67, 92
	a. 31 b. 29 c. 26 d. None

Ans: b (difference of difference)

Example	Find the wrong term: 9, 29, 65, 126, 217, 344
	a. 65 b. 126 c. 217 d. 29

Ans: d (cube + 1)

Example	If in a certain language MYSTIFY is coded as NZTUJGZ, how is MENESIS coded in that language? a. NFOFTJT b. NZUJTZG c. ZUINTJ d. None

Ans: a (+1 for all letters)

Example	If in a certain language CARROM is coded as BZQQNL, which word will be coded as HORSE? a. GNQRD b. GQRDE c. IPSTF d. GNQDR

Ans: c (Coding -1 & Decoding + 1)

Example	In a certain code, MENTION is written as LNEITNO. How is PRESENT written in that code? a. OERESTN b. TNESREP c. OTRSNEE d. None

Ans: a (First letter -1 and other are pair swapping)

Example	Find wrong term: 1, 5, 14, 30, 51, 55, 91 a. 5 b. 55 c. 51 d. 91

Ans: c (Gap of squares)

Exercise	120, 80, 40, 45, ?, 15 a. 15 b. 20 c. 25 d. 30

Ans: d (RIP Logic – splitting terms)

Exercise	1, 1, 4, 8, 9, ?, 16, 64 a. 27 b. 28 c. 32 d. 40

Ans: a (alternate squares cubes)

Exercise	1, 2, 6, 7, 21, 22, 66, ?, 201 a. 69 b. 68 c. 67 d. 69

Ans: c (+1 ×3)

Exercise	2, 3, 3, 5, 10, 13, 39, ?, 172, 177 a. 42 b. 44 c. 43 d. 40

Ans: c (+1 ×1, +2 ×2, …)

Exercise	8, 28, 116, 584, ? a. 1752 b. 3502 c. 3504 d. 3508

Ans: d (×3 + 3, ×4 + 4, ×5 + 4 …)

Exercise	5, 2, 7, 9, 16, 25, 41, __ a. 65 b. 66 c. 67 d. 68

Ans: b (every new term is the sum of last two terms)

Exercise	If RED is coded as 6720 then GREEN would be coded as a. 9207716 b. 167129 c. 1677209 d. 1672091

Ans: c (letter position + 2 then reverse order)

Exercise	If MEKLF is coded as 91782 and LLLJK as 88867, how can IHJED is coded as? a. 97854 b. 64512 c. 54610 d. 75632

Ans: c (letter position starting from D as 0, E as 1 and so on)

Exercise	In a certain code '256' means 'you are good', '637' means 'we are bad' and '358' means 'good and bad'. Which of the following represents 'and' in that code?
	a. 2 b. 5 c. 8 d. 3

Ans: c (common words in sentences can be linked with common digit)

Exercise	835, 734, 642, 751, 853, 981, 532
	a. 751 b. 853 c. 981 d. 532

Ans: a (first digit is the sum of next two digits)

PYQ Jun 19	Find the next term: 7, 23, 47, 119, 167
	a. 211 b. 223 c. 287 d. 319

Ans: c (square of prime number – 2)

MTP	Find missing term of letter series A, CD, GHI, ___, UVWXY
	a. LMNO b. MNO c. MNOP d. NOPQ

Ans: c (alphabet sequence with gap and increasing number of alphabets in every next term)

MTP	In a certain code, "CLOUD" is written as "GTRKF". How is "SIGHT" written in that code?
	a. UGHHT b. UHJFW c. WFJGV d. WGJHV

Ans: d (+3, -1, +3, -1 and reverse order)

MTP	In a certain code "SOUTHERN" is written as "UVPTMQDG". How is MARIGOLD written in that code?
	a. JSBCNFKS b. JSBNHPME c. JSBNCKNF d. NBSKCJNF

Ans: c (+1 for first four terms, -1 for next four terms then reverse order for each half)

MTP	If system is coded as 131625 then TERMS will be coded as?
	a. 62251 b. 62451 c. 64251 d. 62415

Ans: b (option-based mapping)

MTP	The missing term of the series 11, 10, __, 27, 66.5, 198.5
	a. 14 b. 16 c. 21 d. 19

Ans: a (×1-1, ×1.5-1, ×2-1, …)

PYQ Jan 21	Find the missing term: P 3 C, R 5 F, T 8 I, V 12 L, ?
	a. Y17O b. X17M c. X17O d. X16O

Ans: c (+2+2+3, +2+3+3, +2+4+3, …)

PYQ Nov 20	Find wrong term in G4T, J10R, M20P, P43N, S90L
	a. M20P b. P43N c. J10R d. G4T

Ans: c (x2+1, x2+2, x2+3, x2+4)

MTP	In a certain code KAVERI is written as VAKIRE. How is MYSORE written in that code?
	a. EROSYM b. SYMORE c. SMYERP d. SYMERO

Ans: d (half half reverse)

PYQ Jun 19	Which of the following is odd one 4, 12, 44, 176, 890………..
	a. 4 b. 12 c. 44 d. 176

Ans: c (x2+4, x3+6, x4+8, x5+10)

Index Numbers

Past Trends

Attempt	Theory	Practical	Time Series	Marks
May 2018	7	2	1	10
Nov 2018	1	2	2	5
Jun 2019	2	2	3	7
Nov 2019	1	1	3	5
Nov 2020	2	1	0	3
Jan 2021	3	0	0	3
Jul 2021	0	4	1	5
Dec 2021	4	1	0	5
Jun 2022	6	0	0	6
Dec 2022	3	2	0	5
Jun 2023	2	3	0	5

Basics of Index Number	
Definition	• Index numbers are convenient devices for **measuring relative changes** of differences from **time to time** or from **place to place**. • Just as the arithmetic mean is used to represent a set of values, an index number is used to represent a set of values over **two or more different periods or localities**.
Practical Examples	• WPI : Wholesale Price Index • CPI : Consumer Price Index • NIFTY
Index Time Series	• An index time series is a **list of index numbers** for **two or more periods** of time, where each index number employs the same base year
Relatives	• Relatives are derived because **absolute numbers** measured in some **appropriate unit**, are often of little importance and **meaningless** in themselves.
Use of Index Numbers	• because some techniques for making **forecasts or inferences** about the figures are applied in terms of index number. • In regression analysis, either the independent or dependent variable or both may be in the form of index numbers. • They are less **unwieldy** than **large numbers** and are **readily understandable**.
Broad Divisions of Index Numbers	• The **simple index** is computed for one variable whereas the **composite** is calculated from two or more variables.

Important Issues in Index Creation	
Data Selection	- It **depends on the purpose** for which the index is used. - Index numbers are often constructed from the **sample**. **Random sampling**, and if need be, a **stratified random sampling** can be used to ensure that sample is representative. - Data should be **comparable** by ensuring consistency in selection method.
Base Period	- It is a **point of reference** in comparing various data. - The period should be **normal**. - It should be **relatively recent** because we are more concerned with the changes with reference to the present and not with the distant past.
Weight Selection	Due consideration should be given to the relative importance of each variable which relates to the purpose for which the index is to be used
Use of Averages	- Since we have to arrive at a single index number summarising a large amount of information, it is easy to realise that **average plays an important role** in computing index numbers. - The **geometric mean is better** in averaging relatives, but for most of the indices **arithmetic mean is used because of its simplicity**

Relatives	
Types of Relative	- Price Relative = $\dfrac{P_n}{P_0}$ - Quantity Relative = $\dfrac{Q_n}{Q_0}$ - Value Relative = $\dfrac{V_n}{V_0} = \dfrac{P_n Q_n}{P_0 Q_0}$
Link relative	$\dfrac{P_1}{P_0}, \dfrac{P_2}{P_1}, \dfrac{P_3}{P_2}, ..., \dfrac{P_n}{P_{n-1}}$ - Same can be created for quantities also
Chain relatives	- When the above relatives are in respect to a fixed base period these are also called the chain relatives $\dfrac{P_1}{P_0}, \dfrac{P_2}{P_0}, \dfrac{P_3}{P_0}, ..., \dfrac{P_n}{P_0}$

Simple Aggregative Method	
Method	Price Index is expressed as **total of commodity prices** in a given year as a percentage of total of commodity prices in the base year
Formula	$$\dfrac{\Sigma P_n}{\Sigma P_0} \times 100$$
Merits	Easy to compute
Demerits	Commodity with higher price will have greater influence in index value

	• price quotations become the concealed weights which have no logical significance • If units of prices are changed, index will also change

Simple Average of Relatives Method

Method	• Under this method, we invert the actual price for each variable into percentage of the base period. These percentages are called relatives. • The index number is the average of all such relatives.
Formula	$$\frac{\sum \frac{P_n}{P_0}}{N}$$
Merits	• One big advantage of price relatives is that they are **pure numbers**. • Price index number computed from relatives will remain the same regardless of the units by which the prices are quoted
Demerits	• Inspite of some improvement, the above method has a flaw that it gives **equal importance to each of the relatives** *(Will not be suitable if the commodities do have equal importance in Index)* • This defect can be remedied by the introduction of an appropriate weighing system

Weighted Aggregative Index Method

General Points	• Under this method we weigh the price of each commodity by a **suitable factor** often taken as the **quantity or value weight** sold during the base year or the given year or an average of some years. • There are various alternate formulas **(depends on base used)** • Here indices are shown as %

Method Name	Remark	Formula
Laspeyres' Index	Weight – Base Year Quantity	$\dfrac{\sum P_n Q_0}{\sum P_0 Q_0} \times 100$
Passche's Index	Weight – Current Year Quantity	$\dfrac{\sum P_n Q_n}{\sum P_0 Q_n} \times 100$
Marshall-Edgeworth Index	Weight – Sum of Base Year Quantity and Current Year Quantity	$\dfrac{\sum P_n (Q_0 + Q_n)}{\sum P_0 (Q_0 + Q_n)} \times 100$
Fisher's Index	GM of Laspeyres' Index and Paasce's Index	$\sqrt{\dfrac{\sum P_n Q_0}{\sum P_0 Q_0} \times \dfrac{\sum P_n Q_n}{\sum P_0 Q_n}} \times 100$
Bowley's Index	AM of Laspeyres' Index and Paasce's Index	$\dfrac{\dfrac{\sum P_n Q_0}{\sum P_0 Q_0} + \dfrac{\sum P_n Q_n}{\sum P_0 Q_n}}{2}$

	Weighted Aggregative of Relative Method
General Points	• To overcome the disadvantage of a simple average of relative method, we can use weighted average of relative method • Generally weighted arithmetic mean is used although the weighted geometric mean can also be used. • It is same as **Laspeyres' Index**
Formula	$$\frac{\sum \frac{P_n}{P_0} \times P_0 Q_0}{\sum P_0 Q_0} \times 100 = \frac{\sum P_n Q_0}{\sum P_0 Q_0} \times 100$$

	Special Formula to obtain Chain Index Numbers
General Points	• The chain index is an unnecessary complication unless of course where data for the whole period are not available or where commodity basket or the weights have to be changed.
Formula	$$\frac{\text{Link relative of current year} \times \text{Chain Index of previous year}}{100}$$

	Other Formulas
Deflated Value	Deflated Value = Current Value Price Index of the current year $$\text{Deflated Value} = \frac{\text{Current Value}}{\text{Price Index of the current year}}$$ $$\text{Deflated Value (to any period)} = \text{Current Value} \times \frac{\text{Base Price}}{\text{Current Price}}$$
Shifting Price Index	$$\text{Shifted Price Index} = \frac{\text{Original Price Index}}{\text{Price Index of the year on which it has to be shifted}} \times 100$$
Splicing Two Index Series	• Here we see, how two index covering different bases may be combined into single series by splicing • Splicing two sets of price index numbers covering different periods of time is usually required when there is a major change in quantity weights. • It may also be necessary on account of a new method of calculation or the inclusion of new commodity in the index

	Other Theory Points
Quantity Index Numbers	• Though price indices are widely used to measure the economic strength, Quantity indices are used as indicators of the level of output in economy. • IIP Index (Index of Industrial Production)

	• The industrial production index (IPI) measures levels of production and capacity in the manufacturing, mining, electric, and gas industries, relative to a base year.
Value Index Number	• Value index equals the total sum of the values of a given year divided by the sum of the values of the base year • Formula $$\frac{\Sigma V_n}{\Sigma V_0} = \frac{\Sigma P_n Q_n}{\Sigma P_0 Q_0}$$
Limitations of Index Numbers	• Chances of errors due to Sampling • It gives broad trend not real picture (as it is based on sample) • Due to many methods, at times it creates confusion
Usefulness of Index Numbers	• Index numbers are very useful in deflating (eg. Nominal wages into real) • Framing suitable policies in economics and business • They reveal trends and tendencies in making important conclusions • They are used in time series analysis to study long-term trend, seasonal variations and cyclical developments
Cost of Living Index (General Index)	• CLI is defined as the **weighted AM of index numbers** of few groups of basic necessities. • Generally for calculating CLI; food, clothing, house rent, fuel & lightning and miscellaneous groups are taken into consideration. • Examples of CLI: WPI, CPI, etc.

Test of Adequacy

Unit Test	• This test requires that the formula should be independent of the unit in which or for which prices and quantities are quoted. • Except for the simple (unweighted) aggregative index all other formulae satisfy this test.
Time Reversal Test	• It is a test to determine whether a given method will work both ways in time, forward and backward. • The test provides that the formula for calculating the index number should be such that two ratios, the current on the base and the base on the current should multiply into unity. • In other words, the two indices should be reciprocals of each other. $$P_{01} \times P_{10} = 1$$ • Laspeyres' method and Paasche's method do not satisfy this test, but Fisher's Ideal Formula does.
Factor Reversal Test	• This holds when the product of price index and the quantity index should be equal to the corresponding value index. • Symbolically $$P_{01} \times Q_{01} = V_{01}$$ • Only Fisher's Index satisfies Factor Reversal test

	• Fisher's Index Number is ideal as it satisfies Unit, Time Reversal and Factor Reversal Test
Circular Test	• It is concerned with the measurement of price changes over a period of years, when it is desirable to shift the base • This property therefore enables us to adjust the index values from period to period without referring each time to the original base. The test of this shiftability of base is called the circular test. • This test is not met by Laspeyres, or Paasche's or the Fisher's ideal index. • The **simple geometric mean of price relatives** and the **weighted aggregative with fixed weights meet this test.**

PYQ May 18 **Ans: b**	If the 1970 index with base 1965 is 200 and 1965 index with base 1960 is 150, what will be the index of 1970 on base 1960? a. 700 b. 300 c. 500 d. 600
PYQ Nov 18 **Ans: c**	If Laspeyre's Index Number is 250 and Paasche's Index Number is 160, then Fisher's Index number is a. 40,000 b. 25/16 c. 200 d. 16/25

PYQ Jun 19

The prices and quantities of 3 commodities in base and current years are as follows:

P_0	P_1	Q_0	Q_1
12	14	10	20
10	8	20	30
8	10	30	10

The Laspeyre's' price index is
    a. 118.13   b. 107.14   c. 120.10   d. None

Ans: b

PYQ Jun 19 **Ans: c**	The cost-of-living index numbers in years 2015 and 2018 were 97.5 and 115 respectively. The salary of a worker in 2015 was ₹ 19500. How much additional salary was required for him in 2018 to maintain the same standard of living as in 2015? a. 3000 b. 4000 c. 3500 d. 4500
PYQ Nov 19 **Ans: a**	The index number of prices at place in the year 2008 is 225 with 2004 as the base then there is _____ increase a. 125% b. 225% c. 110% d. 25%

PYQ Jul 21 **Ans: d**	The weighted aggregative price index turnover for 2001 with 2000 as the base year using Paasche's Index Number is: Commodity / Price (2000, 2001) / Quantity (2000, 2001): a. 112.32 b. 112.38 c. 112.26 d. 112.20

Commodity	Price		Quantity	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

PYQ Jul 21

The weighted aggregative price index turnover for 2001 with 2000 as the base year using Marshall Edgeworth Index Number is:

Commodity	Price		Quantity	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

a. 112.32   b. 112.38   c. 112.26   d. 112.20

Ans: c

PYQ Jul 21

The consumer price index goes up from 120 to 180 when salary goes up from 240 to 540, what is the increase in real terms?

a. 80   b. 150   c. 100   d. 240

Ans: c

MTP Nov 20

During the certain period the C.L.I. goes up from 110 to 200 and the Salary of a worker is also raised from 330 to 500, then the real terms is

a. Loss by ₹ 50   b. Loss by ₹ 75   c. Loss by ₹ 90   d. None

Ans: a

MTP Oct 21

From the following data for the 5 groups combined

Group	Weights	Index Number
Food	35	425
Cloth	15	235
Power and Fuel	20	215
Rent and Rates	8	115
Miscellaneous	22	150

The general index number is

a. 270   b. 269.2   c. 268.5   d. 272.5

Ans: b

MTP Oct 21

The consumer price Index for April 1985 was 125. The food price index was 120 and other items index was 135. The percentage of food out of the total weight of the index is

a. 66.67   b. 68.28   c. 90.25   d. None

Ans: a

MTP Mar 22	The index number for the year 2012 taking 2011 as the base year from the data given below by using simple average of price relative method is

Commodity	A	B	C	D	E
Price in 2011	115	108	95	85	90
Price in 2012	125	117	108	95	95

a. 112   b. 117   c. 120   d. 111

Ans: d

MTP Jun 22	The simple index number for the current year using simple aggressive method for the following data:

Commodity Base	Base Year Price	Current Year Price
Wheat	80	100
Rice	100	150
Gram	120	250
Pulses	200	300

a. 200   b. 150   c. 240   d. 160

Ans: d

MTP Dec 22 Series 1	In the data group, Bowley's and Laspeyre's index number is as follows. Bowley's index number is 150, Laspeyre's index number is 180 then Paasche's index number is

a. 120   b. 30   c. 165   d. None

Ans: a

Ratio, Proportion, Indices and Logarithm

Past Trends

Attempt	Ratio & Proportion	Indices	Log	Total
May 2018	2	1	2	5
Nov 2018	2	1	1	4
Jun 2019	1	2	2	5
Nov 2019	2	2	1	5
Nov 2020	3	1	2	6
Jan 2021	3	1	1	5
Jul 2021	3	1	1	5
Dec 2021	3	4	2	9
Jun 2022	2	1	3	6
Dec 2022	2	1	2	5
Jun 2023	0	2	2	4

Ratio Basics	
Definition	• A ratio is a comparison of the sizes of **two or more** quantities of the **same kind** by division.
Terms	• The quantities **a** and **b** are called the **terms** of the ratio, **a** is called the first term or **antecedent** and **b** is called the **second term** or **consequent.**
Simplest Form of Ratio	• Both terms of a ratio can be multiplied or divided by the same (non–zero) number. • Usually, a ratio is expressed in lowest terms (or simplest form).
Order of Terms	• The order of the terms in a ratio is important.
Quantities of same kind	• Ratio exists only between quantities of the same kind. • Example: There is no ratio between the weight of one child and age of another
Quantities of same unit	• Quantities to be compared (by division) must be in the same units. • Example: 150 gm and 2 kg cant be directly compared, convert 2kg into 2000 gm
Equivalent like fractions	• To compare two ratios, convert them into equivalent like fractions i.e. ratios with same denominator
Increase or Decrease of quantity by ratios	• If a quantity increases or decreases in the ratio **a : b** then new quantity is **b/a** times of original quantity • The fraction by which the original quantity is multiplied (i.e. b/a) to get a new quantity is called the **factor multiplying ratio.**

Properties of Ratio	
Inverse Ratio	• One ratio is the inverse of another if their **product is 1**. • Thus b : a is the inverse of **a : b** and *vice-versa*.
Compounding	• The ratio **compounded** of the two ratios a : b and c : d is ac : bd. • Compounding two or more ratios means **multiplying them**
Duplicate Ratio, Triplicate Ratio	• A ratio compounded of itself is called its duplicate ratio. • $a^2 : b^2$ is the **duplicate ratio** of a:b • $a^3 : b^3$ is the **triplicate ratio** of a:b
Sub-Duplicate Ratio, Sub-Triplicate Ratio	• $\sqrt{a} : \sqrt{b}$ is the **sub-duplicate ratio** of a:b • $\sqrt[3]{a} : \sqrt[3]{b}$ is the **sub-triplicate ratio** of a:b
Commensurable	• If the ratio of two similar quantities can be expressed as a ratio of two integers, the quantities are said to be commensurable. • Otherwise, they are said to be incommensurable • Example of Incommensurable - $\sqrt{3} : \sqrt{2}$
Continued Ratio	• **Continued Ratio:** is the relation or comparison between the magnitudes of **three or more** quantities of same kind. • The continued ratio of three similar quantities a, b, c can be written as **a:b:c**

Proportion Basics	
Definition	• An **equality** of **two ratios** is called a proportion. • Four quantities a, b, c, d are said to be in proportion if $$a:b=c:d \text{ or } a:b::c:d$$
Terms	• The quantities a, b, c, d are called **terms** of the proportion; a, b, c and d are called its first, second, third and fourth terms respectively. • **Terms** or proportion can also be called as **Proportional** • **First and fourth** terms are called **extremes** (or extreme terms). • **Second** and **third** terms are called **means** (or middle terms).
Cross Product Rule	• If a : b = c : d are in proportion then $$ad=bc$$ • Product of Extremes = Product of Means
Continued Proportion	• Three quantities a, b, c of the same kind (in same units) are said to be in continuous proportion if **a : b = b : c**

	$\dfrac{a}{b} = \dfrac{b}{c} \Rightarrow b^2 = ac$
	a = first proportional, c = third proportional and
	b is mean proportional (because b is GM of a and c)

Properties of Proportion

Invertendo	If a : b = c : d, then $$b:a=d:c$$
Alternendo	If a : b = c : d, then $$a:c=b:d$$
Componendo	If a : b = c : d, then $$a+b:b=c+d:d$$
Dividendo	If a : b = c : d, then $$a-b:b=c-d:d$$
Componendo and Dividendo	If a : b = c : d, then $$\dfrac{a+b}{a-b} = \dfrac{c+d}{c-d}$$ **or** $$\dfrac{a-b}{a+b} = \dfrac{c-d}{c+d}$$
Addendo	If a:b = c:d = e:f = … = k, then $$\dfrac{a+c+e+...}{b+d+f+...} = k$$
Subtrahendo	If a:b = c:d = e:f = … = k, then $$\dfrac{a-c-e-...}{b-d-f-...} = k$$

PYQ Nov 18	$\dfrac{3x-2}{5x+6}$ is the duplicate ratio of $\dfrac{2}{3}$ then find the value x:
	a. 2 b. 6 c. 5 d. 9

Ans: b

PYQ Nov 19	The ratio of two numbers are 3 : 4. The difference of their squares is 28, then the greater no. is:
	a. 8 b. 12 c. 24 d. 64

Ans: a

PYQ Jan 21 **Ans: a**	In a certain business A and B received profit in a certain ratio B and C received profits in the same ratio. If A gets ₹ 1600 and C gets ₹ 2500 then how much does B get? a. 2000 b. 2500 c. 1000 d. 1500
PYQ Jul 21 **Ans: c**	A vessel contained a solution of acid and water in which water was 64%. Four liters of the solution were taken out of the vessel and the same quantity of water was added. If the resulting solution contains 30% acid, the quantity (in liters) of the solution, in the beginning in the vessel, was a. 12 b. 36 c. 24 d. 2
PYQ Dec 22 **Ans: d**	A group of 400 soldiers posted at border area had a provision for 31 days. After 28 days 280 soldiers from this group were called back. Find the number of days for which the remaining ration will be sufficient? a. 3 b. 6 c. 8 d. 10
MTP June 22 **Ans: b**	X, Y, Z together starts a business, if X invests 3 times as much as Y invests and Y invests two third of what Z invests, then the ratio of capitals of X, Y, Z is a. 3:9:2 b. 6:3:2 c. 3:6:2 d. 6:2:3
PYQ Dec 22 **Ans: a**	A sum of money is to be distributed among A, B, C, D in the proportion of 5: 2: 4: 3. If C gets ₹ 1,000 more than D, what is B's share? a. 2000 b. 1500 c. 2500 d. 1000
MTP Nov 20 **Ans: c**	The ratio of the speed of the two trains is 2: 5. If the distances they travel are in the ratio 5: 9, find the ratio of times taken by them. a. 2:9 b. 18:25 c. 25:18 d. 10:45
PYQ Dec 21 **Ans: b**	A bag contains 105 coins containing some 50 paise, and 25 paise coins. The ratio of the number of these coins is 4 : 3. The total value (in ₹) in the bag is a. 43.25 b. 41.25 c. 39.25 d. 35.25

Indices Basics	
Base	Number which is raised to some power is called as Base
Power	Number of times Base is multiplied by itself
Index	Entire Number including Base and Power is Index
Indices	Plural of Index
Example	$$3^4 = 81$$ Here Base is 3, Power is 4 and Index is 3^4 and 81 is the result
Base	Number which is raised to some power is called as Base
Standard Results	• Any base raised to the power zero is defined to be 1 $$a^0 = 1$$ • Roots can also be expressed in the form of power $$\sqrt[r]{a} = a^{\frac{1}{r}}$$
Power Shifting Punch	• If $6^3 = x \Rightarrow 6 = x^{\frac{1}{3}}$ • If $5^{\frac{3}{2}} = y \Rightarrow 5 = y^{\frac{2}{3}}$

Law of Indices	
Law 1	If two or more terms with same base are multiplied, we can make them one term having the same base and power as sum of all powers. $$a^m \times a^n = a^{m+n}$$
Law 2	If two or more terms with same base are in division, we can make them one term having the same base and power as difference of power. $$\frac{a^m}{a^n} = a^{m-n}$$
Law 3	If a term having power is raised to another power, we can do product of powers to simplify the expression $$\left(a^m\right)^n = a^{m \times n}$$
Law 4	If a product of two or more terms is raised to power, we can split the two terms with same individual power to each one of them. $$\left(a \times b\right)^n = a^n \times b^n$$

PYQ Jun 19

If $2^{x^2} = 3^{y^2} = 12^{z^2}$ then

a. $\dfrac{1}{x^2} + \dfrac{1}{y^2} = \dfrac{1}{z^2}$

b. $\dfrac{1}{x^2} + \dfrac{2}{y^2} = \dfrac{1}{z^2}$

c. $\dfrac{2}{x^2} + \dfrac{1}{y^2} = \dfrac{1}{z^2}$

d. None

Ans: c

PYQ Jun 19

If $P = x^{1/3} + x^{-1/3}$ then $P^3 - 3P =$

a. 3

b. $\dfrac{1}{2}\left(x + \dfrac{1}{x}\right)$

c. $\left(x + \dfrac{1}{x}\right)$

d. $2\left(x + \dfrac{1}{x}\right)$

Ans: c

PYQ Nov 19

Value of $\left[9^{n+\frac{1}{4}} \cdot \dfrac{\sqrt{3.3^n}}{3.\sqrt{3^{-n}}}\right]^{\frac{1}{n}}$

a. 9

b. 27

c. 81

d. 3

Ans: b

MTP May 20

$5^{16} + 125^5$ is divisible by which of the following

a. 15

b. 6

c. 8

d. 9

Ans: b

PYQ Nov 19

If $X = \sqrt{3} + \dfrac{1}{\sqrt{3}}$ then evaluate $\left(X - \dfrac{\sqrt{126}}{\sqrt{42}}\right)\left(X - \dfrac{1}{x - \dfrac{2\sqrt{3}}{3}}\right)$

a. 5/6

b. 6/5

c. 2/3

d. -3/5

Ans: a

PYQ Jul 21

If xy + yz + zx = -1 then the value of $\left(\dfrac{x+y}{1+xy} + \dfrac{z+y}{1+zy} + \dfrac{x+z}{1+zx}\right)$ is:

a. xyz

b. $\dfrac{-1}{yz}$

c. $\dfrac{1}{xyz}$

d. $\dfrac{1}{x+y+z}$

Ans: c

PYQ Dec 21

The value of $\dfrac{6^{n+4} + 3^{n+3} \times 2^{n+3}}{5 \times 6^n + 6^n}$ is

a. 232

b. 242

c. 252

d. 262

Ans: c

PYQ Dec 21

If $\left(\dfrac{3a}{2b}\right)^{2x-4} = \left(\dfrac{2b}{3a}\right)^{2x-4}$ for some a and b, then the value of x is

a. 8

b. 6

c. 4

d. 2

Ans: d

PYQ Dec 21
Ans. c

The value of $\left(1 - \sqrt[3]{0.027}\left(\dfrac{5}{6}\right)\left(\dfrac{1}{2}\right)^2\right)$ is

a. 11/16

b. 13/16

c. 15/16

d. 1

	Logarithm Basics
Meaning of Log	The logarithm of a number to a given base is the **index or the power** to which the **base must be raised** to **produce** the **number**, i.e. to make it equal to the given number
Mathematical Explanation of Log	If $a^x = n$ then $\log_a n = x$ Example: If $3^4 = 81$ then $\log_3 81 = 4$
Conditions under Logarithm Function	• Log can be calculated only for Positive Number • Base should be positive and not equal to 1 $$n > 0, a > 0, a \neq 1$$
Standard Results	• Log of a number with same base as number is equal to 1 $$\log_a a = 1$$ • Log of 1 (one) for any base is equal to zero $$\log_a 1 = 0$$

	Law of Logarithm
Law 1	• Logarithm of the product of two numbers is equal to the sum of the logarithms of the numbers to the same base $$\log_a mn = \log_a m + \log_a n$$
Law 2	• The logarithm of the quotient of two numbers is equal to the difference of their logarithms to the same base $$\log_a \frac{m}{n} = \log_a m - \log_a n$$
Law 3	• Logarithm of the number raised to the power is equal to the index of the power multiplied by the logarithm of the number to the same base $$\log_a m^n = n\log_a m$$
Change of Base Theorem	• If the logarithm of a number to any base is given, then the logarithm of the same number to any other base can be determined from the following relation $$\log_b m = \frac{\log m}{\log b} = \frac{\log_a m}{\log_a b}$$
Special Relation	$$\log_b a \times \log_a b = 1$$

PYQ May 18

Ans: a

The value of the expression :

$$a^{\log_a b.\log_b c.\log_c d.\log_d t}$$

   a. t   b. abcdt   c. (a+b+c+d+t)   d. None

PYQ May 18

Ans: d

The value of $\log_4 9.\log_3 2$ is

   a. 3   b. 2   c. 9   d. 1

PYQ Jun 19

Ans: b

The value of $\log_5\left(1+\dfrac{1}{5}\right)+\log_5\left(1+\dfrac{1}{6}\right)+...+\log_5\left(1+\dfrac{1}{624}\right)$

   a. 2   b. 3   c. 5   d. 0

PYQ Nov 20

Ans: c

If $\log_a \sqrt{3} = 1/6$ find the value of a:

   a. 9   b. 81   c. 27   d. 3

PYQ Jan 21

Ans: c

If $\log_a(ab)=x$ then $\log_b(ab)$ is

   a. 1/x   b. $\dfrac{x}{1+x}$ c. $\dfrac{x}{x-1}$ d. None

PYQ Dec 21

Ans: d

Find the value of $\log(x^6)$ if $\log(x)+2\log(x^2)+3\log(x^3)=14$

   a. 3   b. 4   c. 5   d. 6

PYQ Dec 22

Ans: a

If $\log_{10} 2 = y$ and $\log_{10} 3 = x$, then the value of $\log_{10} 15$ is:

   a. $x-y+1$ b. $x+y+1$ c. $x-y-1$ d. $y-x+1$

Equations

Past Trends

Attempt	Quadratic	Other	Marks
May 2018	2	3	5
Nov 2018	2	0	2
Jun 2019	1	1	2
Nov 2019	2	2	4
Nov 2020	2	1	3
Jan 2021	3	0	3
Jul 2021	1	3	4
Dec 2021	1	3	4
Jun 2022	1	3	4
Dec 2022	2	2	4
Jun 2023	2	2	4

Equation Basics	
Definition	• It is a mathematical statement of **equality**
Solution of Equation or Root of Equation	• The value of variable (say x) that satisfies a given equation
Degree of an equation	• The highest power of variable in a given equation

Simple Equation	
Description	• Equation of one degree and having one unknown variable is simple. • A simple equation has only one root. • It can be solved directly (No Method Needed)
Format of Equation	$$ax + b = 0$$ where, a is coefficient of x, b is constant, a ≠ 0

Simultaneous Linear Equation (two variables)	
Format of Equation	$$a_1x + b_1y + c_1 = 0$$ $$a_2x + b_2y + c_2 = 0$$ where, a is coefficient of x, b is coefficient of y, c is constant, a ≠ 0
Formula	To solve linear equation in two variables, we need two such equations **Methods of Solution** • **Elimination Method:** In this method two given linear equations are reduced to a linear equation in one unknown by eliminating one of the unknowns and then solving for the other unknown. • **Substitution Method:** equation is written in the form of one variable in LHS and that value is substituted in other equation.

	• **Cross Multiplication Method:** Formula based method $$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Quadratic Equation

Description	• Equation having **degree = 2** is called as Quadratic Equation • QE will have two roots/ solutions usually denoted by α, β
Equation Format	$$ax^2 + bx + c = 0$$ where, a is coefficient of x², b is coefficient of x, c is constant, a ≠ 0
Trial and Error Method	$ax^2 + bx + c = 0$ • In this method value of **b** is split into two parts • Split is done in such a way that product of those two values is equal to **ac** • There will be four terms, we take common and form two factors • Solving factors we will get roots of the equation
Direct Formula	$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
Sum of Roots	$$\alpha + \beta = -\frac{b}{a}$$
Product of Roots	$$\alpha\beta = \frac{c}{a}$$
Construct a Quadratic Equation	$$x^2 - (\alpha + \beta)x + \alpha\beta = 0$$
Discriminant to find nature of roots of QE	Discriminant of QE is the mathematical expression which is used to understand nature of roots of QE, it is expressed as below: $b^2 - 4ac$ <table><tr><td>**Condition**</td><td>**Nature of Roots**</td></tr><tr><td>$b^2 - 4ac = 0$</td><td>Real and Equal</td></tr><tr><td>$b^2 - 4ac < 0$</td><td>Imaginary</td></tr><tr><td>$b^2 - 4ac > 0$</td><td>Real and Unequal</td></tr><tr><td>$b^2 - 4ac > 0$ and a perfect square</td><td>Real, Unequal and Rational</td></tr><tr><td>$b^2 - 4ac > 0$ and not a perfect square</td><td>Real, Unequal, and Irrational</td></tr></table>
Conjugate Pairs	• If one of the root of the equation is $m + \sqrt{n}$ • The other one is surely $m - \sqrt{n}$ • This pair of irrational roots are called as conjugate pairs

Cubic Equation	
Description	• Equation having **degree = 3** is called as Cubic Equation • Cubic Equation will have three roots
Format of Equation	$$ax^3 + bx^2 + cx + d = 0$$ where, a is coefficient of x^3, b is coefficient of x^2, c is coefficient of x, d is constant, a ≠ 0
Method of Solution	Trial and Error

PYQ May 18

If $2^{x+y} = 2^{2x-y} = \sqrt{8}$, then the respective values of x and y are ___
  a. 1, 1/2 b. 1/2, 1 c. 1/2, 1/2 d. None

Ans: a

PYQ Nov 19

Find value of $x^2 - 10x + 1$ if $x = \dfrac{1}{5 - 2\sqrt{6}}$
  a. 25 b. 1 c. 0 d. 49

Ans: c

Exercise

The diagonal of a rectangle is 5 cm and one of at sides is 4 cm. Its area is
  a. 20 sq cm b. 12 sq cm c. 10 sq cm d. None

Ans: b

PYQ Jul 21

The cost of 2 oranges and 3 apples is ₹ 28. If the cost of an apple is doubled then the cost of 3 oranges and 5 apples is ₹ 75. The original cost of 7 oranges and 4 apples (in (₹)) is:
  a. 59 b. 47 c. 71 d. 63

Ans: a

Exercise

One student is asked to divide a half of a number by 6 and other half by 4 and then to add the two quantities. Instead of doing so the student divides the given number by 5. If the answer is 4 short of the correct answer then the number was
  a. 320 b. 400 c. 480 d. None

Ans: c

PYQ Dec 21

In a multiple-choice question paper consisting of 100 questions of 1 mark each, a candidate gets 60% marks. If the candidate attempted all questions and there was a penalty of 0.25 marks for wrong answers is:
  a. 32 b. 36 c. 40 d. 38

Ans: b

Exercise

The age of a person is twice the sum of the ages of his two sons and five years ago his age was thrice the sum of their ages. Find his present age
  a. 60 years b. 52 years c. 51 years d. 50 years

Ans: d

MTP Nov 20

If 2x-3y = 1 and 5x +2y = 50, then what is the value of (x-2y)?
  a. -2 b. 6 c. 7 d. 10

Ans: a

PYQ May 18 **Ans: d**	If α, β are the roots of the equation $x^2 + x + 5 = 0$ then $\dfrac{\alpha^2}{\beta} + \dfrac{\beta^2}{\alpha}$ is equal to a. 16/5 b. 2 c. 3 d. 14/5
Exercise **Ans:**	The values of $4 + \cfrac{1}{4 + \cfrac{1}{4 + \cfrac{1}{4 + ...\infty}}}$ a. $1 \pm \sqrt{2}$ b. $2 + \sqrt{5}$ c. $2 \pm \sqrt{5}$ d. None
Exercise **Ans: d**	The roots of the equation $x^2 + (2p - 1)x + p^2 = 0$ are real if. a. $p \geq 1$ b. $p \leq 4$ c. $p \geq \dfrac{1}{4}$ d. $p \leq \dfrac{1}{4}$
PYQ Nov 18 **Ans: a**	When two roots of quadratic equations are $\alpha, \dfrac{1}{\alpha}$ then what will be the quadratic equation: a. $\alpha x^2 - (\alpha^2 + 1)x + \alpha = 0$ b. $\alpha x^2 - \alpha^2 x + 1 = 0$ c. $\alpha x^2 - (\alpha^2 + 1)x + 1 = 0$ d. None
PYQ Jun 19 **Ans: c**	Find the condition that one roots is double the other of $ax^2 + bx + c = 0$ a. $2b^2 = 3ac$ b. $b^2 = 3ac$ c. $2b^2 = 9ac$ d. $2b^2 > 9ac$
PYQ Nov 20 **Ans: c**	The rational root of the equation $0 = 2p^3 - p^2 - 4p + 2$ is: a. 2 b. -2 c. 1/2 d. -1/2
PYQ Jan 21 **Ans: c**	The value of p for which the difference between the root of equation $x^2 + px + 8 = 0$ is 2 a. ± 2 b. ± 4 c. ± 6 d. ± 8
PYQ Jan 21 **Ans: b**	The harmonic mean of the roots of the equation $(5 + \sqrt{2})x^2 - (4 + \sqrt{5})x + 8 + 2\sqrt{5} = 0$ is a. 2 b. 4 c. 6 d. 8