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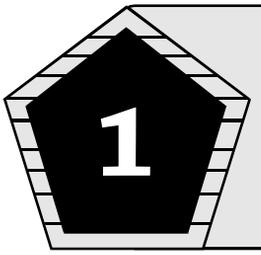


Analogy

The meaning of analogy is 'similar properties' or similarity. If an object or word or digit or activity shows any similarity with another object or word or digit or activity in terms of properties, type, shape, size, trait etc., then the particular similarity will be called analogy. For example, cricket : ground and chess: table are the analogous pairs (why?). In fact, both pairs of words have similar relationship in terms of place of playing as cricket is played in the ground and similarly chess is played on the table.

TYPES OF ANALOGY.

1. **Tool & object based analogy:** This establishes a relationship between a tool and the object in which it works. Similar relations has to be discovered from answer choices.
   Examples:
   Pencil : Paper
   Saw : Wood
   Eraser : Paper
2. **Synonym based analogy :** In such type of analogy two words have similar meaning.
   Examples:
   Big : Large
   Huge : Gigantic
   Notion : Idea
   Huge : Big
3. **Worker & tool based analogy:** This establishes a relationship between a particular tool and the person of that particular profession who uses that tool.
   Examples:
   Writer : Pen
   Barber : Scissors
   Hunter : Gun
4. **Worker & product based analogy:** This type of analogy gives a relationship between a person of particular profession and his/her creations.
   Examples:
   Batsman : Run
   Writer : Book
   Journalist : News
5. **Cause & effect based analogy:** In such type of analogy 1st word acts and the 2nd word is the effect of that action.
   Examples:
   Work : Tiredness
   Bath : Freshness
6. **Opposite relationship (Antonym) based analogy :** In such type of analogy the two words of the question pair are opposite in meaning. Similar relations has to be discovered from the answer choice word pairs.
   Examples:
   Poor : Rich
   Big : Small
   Light : Dark
   Avoid : Meet
7. **Gender based analogy:** In such type of analogy, one word is masculine and another word is feminine of it. In fact, it is a 'male and female' or 'gender' relationship.
   Examples:
   Man : Woman
   Bull : Cow
   Duck : Drake
8. **Classification based analogy:** This type of analogy is based on biological, physical, chemical or any other classification. In such problems the 1st word may be classified by the 2nd word and vice-versa.
   Examples:
   Cow : Animal
   Girl : Human
   Oxygen : Gas
   Snake : Reptile
9. **Function based analogy :** In such type of analogy, 2nd word describes the function of the 1st word.
   Examples:
   Singer : Sings
   Player : Plays
   Surgeon : Operates
10. **Quantity and unit based analogy:** In such type of analogy 2nd word is the unit of the first word and vice-versa.
    Examples:
    Distance : Mile
    Mass : Kilogram
    Length : Meter
11. **Finished product & raw material based analogy :** In such type of analogy the 1st word is the raw material and 2nd word is the end product of that raw material and vice-versa.
    Examples:
    Yarn : Fabric
    Milk : Curd
    Grape : Wine
12. **Utility based analogy :** In such type of analogy the 2nd word shows the purpose of the 1st word or vice-versa.

Examples:

Pen	:	Writing
Food	:	Eating
Bed	:	Sleeping

13. **Symbolic relationship based analogy:** In such type of analogy, the 1st word is the symbol of the 2nd word and vice-versa.

Examples:

White	:	Peace
Black	:	Sorrow
Swastika	:	Fortune

14. **Adult & young one based analogy :** In such type of analogy, the 1st word is the adult one and 2nd word is the young one of the 1st word or vice-versa.

Examples:

Cow	:	Calf
Human	:	Child
Dog	:	Puppy

15. **Subject & specialist based analogy:** In such type of analogy the 2nd word is the specialist of 1st word (subject) or vice-versa.

Examples:

Heart	:	Cardiologist
Skin	:	Dermatologist

16. **Habit based analogy:** In this type of analogy 2nd word is the habit of 1st and vice-versa.

Examples:

Cat	:	Omnivorous
Cow	:	Herbivorous
Goat	:	Herbivorous

17. **Instrument and measurement based analogy:** We see in this type of analogy, the 1st word is the instrument to measure the 2nd word and vice-versa:

Examples:

Hygrometer	:	Humidity
Barometer	:	Pressure
Thermometer	:	Temperature

18. **Individual & group based analogy :** Second word is the group of 1st word (or vice-versa) in such type of analogy.

Examples:

Cow	:	Herd
Sheep	:	Flock
Singer	:	Chorus

19. **State & capital based analogy:** 1st word is the state and 2nd word is the capital of that state (1st word) (or vice-versa) in the analogy like this.

Examples:

Bihar	:	Patna
West Bengal	:	Kolkata
Maharashtra	:	Mumbai

20. **Analogy based on individual & dwelling place :** In such type of analogy 1st word is the individual & 2nd word is the dwelling place of that individual (1st word) and vice-versa.

Examples:

Horse	:	Stable
Birds	:	Aviary
Human	:	House

21. **Analogy based on worker and working place:** In this type of analogy the 1st word represents a person of particular profession and 2nd word represents the working place of that person (1st word) and vice-versa.

Examples :

Doctor	:	Hospital
Cook	:	Kitchen
Professor	:	College

22. **Analogy based on topic study:** 1st word is the study of the 2nd word (or vice-versa) in the analogy like this.

Examples:

Birds	:	Ornithology
Earth quakes	:	Seismology
Eggs	:	Zoology

23. **Analogy based on letters (or meaningless words)**

Case I : (Forward alphabetical sequence)

Examples:

CD : FG : : PQ : UV

Here CD and FG are in the natural alphabetical sequence. Similarly, PQ & UV are in the natural alphabetical sequence.

Case II: (Backward or opposite alphabetical sequence)

Example:

DC : GF : : QP : VU

In fact this case is opposite of case I

Case III: (Vowel – consonant relation)

Example

ATL : EVX : : IPR : ORS

Here, the 1st two words start with the 1st two vowels A & E and the next two words start with the next two vowels I & O. Last two letter of every word are consonants.

Case IV: Example (Skip letter relation)

ABC : FGH : : IJK : NOP

Here between ABC & FGH two letters skip and they are D & E. Similarly, between IJK & NOP two letters skip and they are L & M.

EXERCISE

1. Which of the following is related to 'Melody' in the same way as 'Delicious' is related to 'Taste'?
   (a) Memory (b) Highness
   (c) Voice (d) Speak
2. In a certain way 'Diploma' is related to 'Education'. Which of the following is related to 'Trophy' in a similar way?
   (a) Sports (b) Athlete
   (c) Winning (d) Prize
3. 'Clock' is related to 'Time' in the same way as 'Vehicle' is related to which of the following?
   (a) Driver (b) Road
   (c) Passenger (d) Journey
4. "Illness" is related to "Cure" in the same way as "Grief' is related to
   (a) Happiness (b) Ecstasy
   (c) Remedy (d) Solicitude
5. 'Bouquet' is related to 'Flowers' in the same way as 'sentence' is related to
   (a) Letters (b) Paragraph
   (c) Content (d) Words
6. 'Electricity' is related to 'Wire' in the same way as 'Water' is related to
   (a) Bottle (b) Jug
   (c) River (d) Pipe
7. Mathematics is related to Numbers in the same way History is related to :
   (a) People (b) Events
   (c) Dates (d) Wars
8. 'Locker' is related to 'Jewellery' in the same way as 'Godown' is related to
   (a) Storage (b) Grasim
   (c) Garments (d) Goods
9. *Distil* is related to Whiskey in the same way as *Brew* is related to .....?.....
   (a) Ferment (b) Gin
   (c) Beer (d) Sugar
10. 'Story' is related to 'Novel' in the same way as 'Sea' is related to which of the following?
   (a) Ocean (b) Water
   (c) River (d) Pond
11. 'Hygrometer' is related to 'Humidity' in the same way as 'Sphygmomanometer' is related to
   (a) Pressure (b) Blood Pressure
   (c) Precipitation (d) Heart Beat
12. 'Engineer' is related to 'Machine' in the same way as 'Doctor' is related to
   (a) Hospital (b) Body
   (c) Disease (d) Medicine
13. 'Dream' is related to 'Reality' is the same way as 'Falsehood' is related to which of the following.
   (a) Untruth (b) Truth
   (c) Fairness (d) Correctness
14. 'Frame work' is related to 'House' in the same way as 'Skeleton' is related to which of the following?
   (a) Ribs (b) Skull
   (c) Body (d) Grace

DIRECTIONS (Qs. 15 - 50) : *In each of the following questions, there are two words / set of letters / numbers to the left of the sign :: which are connected in some way. The same relationship obtains between the third words / set of letters / numbers and one of the four alternatives under it. Find the correct alternative in each question.*

15. Import : Export :: Expenditure : ?
   (a) Deficit (b) Income
   (c) Debt (d) Tax
16. Ocean : Water :: Glacier : ?
   (a) Refrigerator (b) Ice
   (c) Mountain (d) Cave
17. Medicine : Sickness :: Book : ?
   (a) Ignorance (b) Knowledge
   (c) Author (d) Teacher
18. Bank : River :: Coast : ?
   (a) Flood (b) Waves
   (c) Sea (d) Beach
19. Thunder : Rain :: Night : ...
   (a) Day (b) Dusk
   (c) Darkness (d) Evening
20. Breeze : Cyclone : : Drizzle : ?
   (a) Earthquake (b) Storm
   (c) Flood (d) Downpour
21. Disease : Pathology :: Planet : ?
   (a) Astrology (b) Geology
   (c) Astronomy (d) Palaeontology
22. Foresight : Anticipation :: Insomnia : ?
   (a) Treatment (b) Disease
   (c) Sleeplessness (d) Unrest
23. Oasis : Sand :: Island : ?
   (a) River (b) Sea
   (c) Water (d) Waves
24. Major : Battalion :: Colonel : ?
   (a) Company (b) Regiment
   (c) Army (d) Soldiers
25. Shout : Whisper :: Run : ?
   (a) Stay (b) Stand
   (c) Walk (d) Hop
26. Smoke : pollution : : war : ?
   (a) victory (b) peace
   (c) treaty (d) destruction
27. Hour : second : : tertiary : ?
   (a) ordinary (b) secondary
   (c) primary (d) intermediary
28. Safe : secure : : Protect : ?
   (a) guard (b) lock
   (c) sure (d) conserve

29. Penology : Punishment : Seismology : ..... .
(a) Law (b) Earthquake
(c) Liver (d) Medicine

30. DRIVEN : EIDRVN :: BEGUM : ?
(a) EUBGM (b) MGBEU
(c) BGMEU (c) UEBGM

31. NUMBER : UNBMER : : GHOST : ?
(a) HOGST (b) HOGTS
(c) HGOST (d) HGSOT

32. MASTER : OCUVGT : : LABOUR : ?
(a) NCDQWT (b) NDERWT
(c) NBCRWT (d) NEDRWT

33. RIDE : LNBE : : HELP : ?
(a) NINP (b) BAJP
(c) JPCH (d) BJJP

34. MUMBAI : LTLAZH : : DELHI : _____
(a) CDKGJ (b) IHLED
(c) CDKGH (d) BCKGH

35. RATIONAL : RATNIOLA :: _____ : TRILBA
(a) TIRLAB (b) TRIBAL
(c) TRIALB (d) TIRBAL

36. HEATER : KBDQHO : : COOLER : ?
(a) ALRHV (b) FLRIHO
(c) FLIRHO (d) FRLIHO

37. ACE : HIL :: MOQ : ?
(a) XVT (b) TVX
(c) VTX (d) TUX

38. ACBD : EFGH : : OQPR –
(a) STUV (b) RSTU
(c) UVWX (d) QRST

39. TSR : FED :: WVU ?
(a) CAB (b) MLK
(c) PQS (d) GFH

40. CJDL : FMGR :: IKJR: ?
(a) OQPT (b) RSTU
(c) LSMT (d) KRMO

41. BCDA : STUR :: KLMJ : ?
(a) VWXU (b) EFHG
(c) SRTU (d) QSRP

42. CEG : EGC : : LNP :
(a) LPN (b) UWY
(c) NPL (d) MOP

43. KLM : PON : : NOP : .....
(a) LMK (b) MLK
(c) NML (d) KLN

44. ACE : FGH :: LNP : ?
(a) QRS (b) PQR
(c) QST (d) MOQ

45. 14 : 9 :: 26 : ?
(a) 12 (b) 13
(c) 15 (d) 31

46. 11 : 17 : : 19 : ?
(a) 29 (b) 27
(c) 23 (d) 21

47. 3 : 27 : : 4 : ?
(a) 140 (b) 75
(c) 100 (d) 64

48. 12 : 30 : : 20:?
(a) 25 (b) 32
(c) 35 (d) 42

49. 3 : 10 :: 8, ?
(a) 10 (b) 13
(c) 14 (d) 17

50. 13 : 19 :: ? : 31
(a) 21 (b) 23
(c) 25 (d) 26

DIRECTIONS (Qs. 51-56): *In the following Six Questions, select the related word/letters/number from the given alternatives.*

[SSC CGL, Tier-I-2015]

51. Haematology : Blood : : Phycology : ?
(a) Fungi (b) Fishes
(c) Algae (d) Diseases

52. Pride of Lions : : _____ of cats
(a) Herd (b) School
(c) Clowder (d) Bunch

53. MAN : PDQ : : WAN : ?
(a) ZDQ (b) NAW
(c) YQD (d) YDQ

54. AEFJ : KOPT : : ? : QUVZ
(a) GLKP (b) GKLP
(c) HLKP (d) HKQL

55. 2 : 32 : : 3 : ?
(a) 243 (b) 293
(c) 183 (d) 143

56. D × H : 4 × 8 as M × Q: ?
(a) 12 × 17 (b) 12 × 16
(c) 13 × 17 (d) 14 × 18

DIRECTIONS (Qs. 57-59) : *Select the related word/letters/numbers from the given alternatives:*

[SSC CGL, Tier-I-2016]

57. Medicine : Patient : : Education : ?
(a) Teacher (b) School
(c) Student (d) Tuition

58. LAMP : IXJM :: FISH : ?
(a) CGPF (b) CFQE
(c) CFPE (d) CGQF

59. 13 : 20 : : 17 : ?
(a) 25 (b) 26
(c) 27 (d) 28

DIRECTIONS (Qs. 60 - 62) : *In the following question, select related word pair/number from the given alternatives.*

60. Fire : Burn : : ? : ? **[SSC CGL, Tier-I-2017]**
(a) Water : Drink (b) Wood : Tress
(c) Ice : Freeze (d) Flower : Rose

61. KLMN : IJKL : : TUVW : ?
(a) RSUT (b) VWXY
(c) STUV (d) RSTU

62. 3 : 27 : : 4 : ?
(a) 63 (b) 64
(c) 65 (d) 15

63. Select the option that is related to the third number in the same way as the second number is related to the first number.
12 : 192 :: 15 : ? **[SSC CGL, Tier-I-2018]**
(a) 245 (b) 240
(c) 225 (d) 250

64. Select the word-pair in which the two words are related in the same way as the two words in the following word-pair.
Dirty : Filthy **[SSC CGL, Tier-I-2018]**
(a) Perfect : Unique (b) Shy : Timid
(c) Cute : Child (d) Bright : Sunlight

65. 'Heart' is related to 'Circulation in the same way as 'Kidney' is related to _____. **[SSC CGL, Tier-I-2018]**
(a) Reproduction (b) Respiration
(c) Energy Production (d) Excretion

66. Select the word pair in which the two words are related in the same way as the two words in the following word-pair.i
Season : Winter **[SSC CGL, Tier-I-2018]**
(a) Week : Calendar (b) Summer : Autumn
(c) Year : Century (d) Month : April

67. 'China' is related to 'Yuan' in the same way as 'Japan' is related to '_____'. **[SSC CGL, Tier-I-2018]**
(a) Rand (b) Sushi (c) Lira (d) Yen**1**

68. Select the option in which the words share the same relationship as that shared by the given pair of words. **[SSC CGL, Tier-I-2020]**
Handwriting : Graphology
(a) Soil : Ornithology (b) Earthquakes : Pomology
(c) Matter : Physics (d) Fossils : Pedology

69. Select the option that is related to the third number in the same way as the second number is related to the first number and the sixth number is related to the fifth number.
13 : 4 : : 19 : ? : : 16 : 5 **[SSC CGL, Tier-I-2020]**
(a) 6 (b) 2 (c) 3 (d) 5

70. Select the option in which the numbers are related in the same way as are the numbers of the following set.
(7, 52, 346) **[SSC CGL, Tier-I-2020]**
(a) (8, 67, 515) (b) (4, 19, 70)
(c) (6, 39, 217) (d) (5, 25, 128)

71. Select the option that is related to the third word in the same way as the second word is related to the first word. **[SSC CGL, Tier-I-2020]**
Nascent : Young : : Adjunct : ?
(a) Against (b) Supportive
(c) Functional (d) Rigid

72. Select the option that is related to the third number in the same way as the second number is related to the first number. **[SSC CGL, Tier-I-2021]**
223 : 350 :: 519 : ?
(a) 736 (b) 645
(c) 687 (d) 654

73. Select the option that is related to the third word in the same way as the second word is related to the first word. **[SSC CGL, Tier-I-2022]**
(The words must be considered as meaningful English words and must not be related to each other based on the number of letters/number of consonants/vowels in the word.)
Library : Books :: Museum : ?
(a) Building (b) Artefacts
(c) People (d) Gallery

74. Select the set in which the numbers are related in the same way as are the numbers of the following set.
(3, 14, 1) **[SSC CGL, Tier-I-2022]**
(4, 36, 2)
(a) (8, 12, 2) (b) (5, 81, 4)
(c) (7, 40, 3) (d) (8, 260, 2)

75. Select the option that is related to the third word in the same way as the second word is related to the first word. **[SSC CGL, Tier-I-2022]**
Phone : Talk :: Television : ?
(a) Remote (b) View
(c) Read (d) Channel

76. Select the option that is related to the fifth number in the same way as the second number is related to the third number and the fourth number is related to the third number. **[SSC CGL, Tier-I-2022]**
19 : 324 :: 25 : 576 :: 9 : ?
(a) 16 (b) 64
(c) 88 (d) 72

77. Select the set in which the numbers are related in the same way as are the numbers of the following sets.
(20, 6, 4) **[SSC CGL, Tier-I-2022]**
(24, 7, 5)
(a) (65, 9, 4) (b) (22, 5, 2)
(c) (40, 8, 5) (d) (42, 7, 3)

78. Select the set in which the numbers are related in the same way as are the numbers of the following sets.
(5, 5, 25) **[SSC CGL, Tier-II-2022]**
(2, 5, 10)
(a) (9, 3, 26) (b) (4, 4, 20)
(c) (7, 3, 14) (d) (3, 3, 9)

79. Select the option that is related to the third word in the same way as the second word is related to the first word.
(The words must be considered as meaningful English words and must not be related to each other based on the number of letters/number of consonants/vowels in the word.) **[SSC CGL, Tier-II-2022]**
Crowd : Dense : : Slope : ?
(a) Fill (b) Plain
(c) Tight (d) Sleep

80. What approximate value will come in place of the question mark (?) in the following equation? 49.85 – 5.31 + 9.97 = ? **[SSC CGL, Tier-II-2022]**
(a) 1.6 (b) 19
(c) 55 (d) 37

81. Select the set in which the numbers are related in the same way as are the numbers of the following sets.
(1000, 100, 10) **[SSC CGL, Tier-I-2023]**
(38, 19, 2)
(a) (3, 3, 9) (b) (125, 25, 5)
(c) (16, 8, 4) (d) (5, 5, 5)

82. Select the option that is related to the fifth letter-cluster in the same way as the second letter-cluster is related to the first letter-cluster and the fourth letter-cluster is related to the third letter cluster. **[SSC CGL, Tier-I-2023]**
FRENCH : RFNEHC :: RESCUE : ERCSEU :: ANIMAL : ?
(a) NALAMI (b) INALAM
(c) NAMILA (d) NAMIAL

83. Select the set in which the numbers are related in the same way as are the numbers of the following sets.
(6, 14, 40) **[SSC CGL, Tier-I-2023]**
(10, 14, 48)
(a) (11, 5, 87) (b) (5, 9, 28)
(c) (5, 6, 45) (d) (10, 5, 91)

84. Select the option that is related to the fifth number in the same way as the second number is related to the first number and the fourth number is related to the third number. **[SSC CGL, Tier-I-2023]**
6 : 16 :: 10 : 28 :: 3 : ?
(a) 14 (b) 12
(c) 7 (d) 6

85. 'Kidney' is related to 'Organ' in the same way as 'Apple' is related to '_____'. **[SSC CGL, Tier-I-2023]**
(a) Juicy (b) Red
(c) Fruit (d) Medicine

86. Select the set in which the numbers are related in the same way as are the numbers of the following sets.
(300, 100, 100) **[SSC CGL, Tier-I-2023]**
(88, 66, 11)
(a) (60, 40, 20) (b) (44, 22, 11)
(c) (90, 50, 70) (d) (50, 4, 25)

87. Which of the following letter-clusters should replace # and % so that the pattern and relationship followed between the letter-cluster pair on the left side of :: is the same as that on the right side of ::?
: CLQ:: NDK: % **[SSC CGL, Tier-II-2023]**
(a) # = AJS, % = MAM (b) # = AOO, % = PAM
(c) # = EIT, % = QBN (d) # = DIS, % = PBN

88. Select the set in which the numbers are related in the same way as are the numbers of the following set.
(7, 3, 43) **[SSC CGL, Tier-II-2023]**
(5, 2, 21)
(a) (11, 5, 111) (b) (15, 6, 34)
(c) (13, 23, 131) (d) (12, 3, 43)

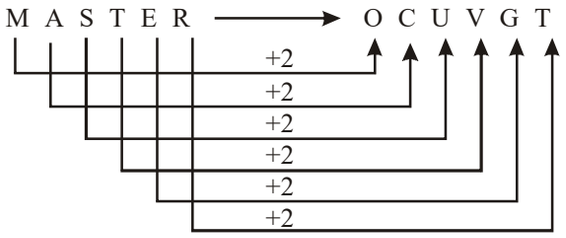
ANSWER KEY

1	(c)	**10**	(a)	**19**	(c)	**28**	(a)	**37**	(d)	**46**	(a)	**55**	(a)	**64**	(b)	**73**	(b)	**82**	(c)
2	(a)	**11**	(b)	**20**	(d)	**29**	(b)	**38**	(a)	**47**	(d)	**56**	(c)	**65**	(d)	**74**	(d)	**83**	(b)
3	(d)	**12**	(c)	**21**	(c)	**30**	(b)	**39**	(b)	**48**	(d)	**57**	(c)	**66**	(d)	**75**	(b)	**84**	(c)
4	(c)	**13**	(b)	**22**	(c)	**31**	(d)	**40**	(c)	**49**	(d)	**58**	(a)	**67**	(d)	**76**	(b)	**85**	(c)
5	(d)	**14**	(c)	**23**	(c)	**32**	(a)	**41**	(a)	**50**	(b)	**59**	(d)	**68**	(c)	**77**	(a)	**86**	(b)
6	(d)	**15**	(b)	**24**	(b)	**33**	(d)	**42**	(c)	**51**	(c)	**60**	(c)	**69**	(a)	**78**	(d)	**87**	(b)
7	(b)	**16**	(b)	**25**	(c)	**34**	(c)	**43**	(b)	**52**	(c)	**61**	(d)	**70**	(a)	**79**	(d)	**88**	(a)
8	(d)	**17**	(a)	**26**	(d)	**35**	(b)	**44**	(a)	**53**	(a)	**62**	(b)	**71**	(b)	**80**	(c)		
9	(c)	**18**	(c)	**27**	(c)	**36**	(b)	**45**	(c)	**54**	(b)	**63**	(b)	**72**	(a)	**81**	(b)		

Hints & Explanations

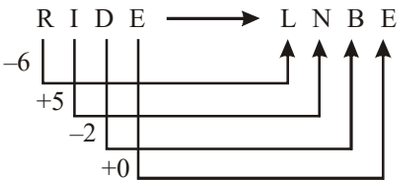
1. (c) 'Delicious' is the adjective used for 'Taste'. Similarly, 'Melodious' is the adjective used for 'Voice'.
2. (a) A successful finish of 'Education' equips one with 'Diploma'. Similary, a successful finish in 'Sports' equips one with 'Trophy'.
3. (d) The clock makes a journey of time.
4. (c) Cure ensures removal of illness in the same way as remedy insures removal of grief.
5. (d) Bouquet is a bunch of flowers. Similarly, Sentence is a set of words that is complete in itself.
6. (d) Wire is the medium to transmit Electricity. Similarly, Pipe is the medium to carry Water.
7. (b) Mathematics is related to the numbers in the same way History is related to Events.
8. (d) Goods are stored in godown.
9. (c) First is process of preparing the second.

10. (a) First is the shorter form of second.
11. (b) First is an instrument to measure the second.
12. (c) First tackles the second.
13. (b) Dream is antonym of Reality. Similarly, falsehood is antonym of truth.
14. (c) Framework is foundation on which house is built. Similarly, body is built around skeleton.
15. (b) The words in each pair are antonyms.
16. (b) First consists of the second.
17. (a) As medicine cures sickness, in the same way, books remove ignorance.
18. (c) Bank is the land beside a river.
    Similarly, coast is the land beside a sea.
19. (c) As 'Rain' is followed by 'Thunder', similarly 'Darkness' is followed by 'Night'.
20. (d) Second is more intense than the first.
21. (c) Diseases are studied under Pathology.
    Similarly, planets are studied in Astronomy.
22. (c) The words in each pair are synonyms.
23. (c) 'Oasis' is a water pool amidst sand.
    Similarly, island is a piece of land amidst water.
    Remember : 'Sea' would have been the answer if we had 'desert' in place of 'sand'.
24. (b) As Major heads a battalion, the Colonel commands a regiment.
25. (c) Whisper is of lesser intense than shouting, so is walking to running.
26. (d) Smoke cause pollution
    similarly, destruction is the result of war.
27. (c) Second is smallest of hour and similarly, primary is initial stage
28. (a) Safe is synonyms of secure and protect is synonyms of guard.
29. (b) Penology is the study of punishment in the same say seismology is the study of earthquake.
30. (b) Fifth and third letters of the first term are first and second letters of the second term and first two letters of the first term are third and fourth letters of the second term.
31. (d) First two letters of the first term are in reverse order in the second term and so are the next two letters.
32. (a) M A S T E R → O C U V G T



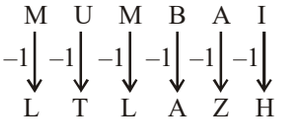
Similarly
LABOUR → NCDQWT

33. (d) R I D E → L N B E



Similarly HELP → BJJP

34. (c)



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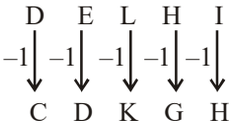
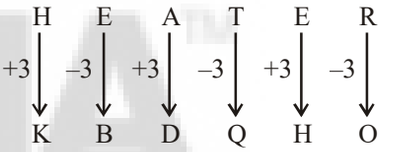


35. (b) **RATIONAL : RATNIOLA** **TRIBAL : TRILBA**
    First 3 Remain Same Place TRI
    Then coming III[rd] one LBA ⇒ **TRIBAL**
    Comes in IV[th] place. Then
    left two took place and last
    if digit comes inter change them.

36. (b)



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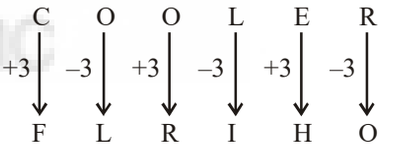
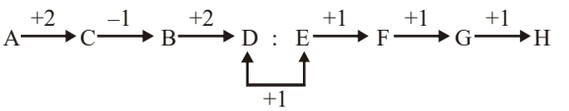


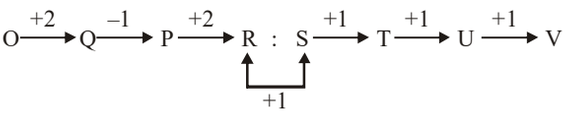
37. (d) As,
    $A \xrightarrow{+7} H$
    $C \xrightarrow{+6} I$
    $E \xrightarrow{+7} L$

    Similarly,
    $M \xrightarrow{+7} T$
    $O \xrightarrow{+6} U$
    $Q \xrightarrow{+7} X$

38. (a)



Similarly,



39. (b) The letters are consecutive and written in reverse order.

40. (c) In each set of letters, the 1st and 3rd letters are consecutive.

C J D L : F M G R : : I K J R : L S M T

41. (a) In each group the first three letters are consecutive and they follows the fourth letter.

(A)BCD : (S)TUR : : (J)KLM : (U)VWX

42. (c) The second set EGC is formed by simply putting the first letter of CEG at last to form EGC, and so on.

43. (b) Because KLM are assigned No. 11, 12 & 13 from A onwards, this corresponds to PON, which are also numbered 11, 12 and 13 from Z to A in reverse order. Hence NOP will correspond to MLK.

44. (a) The three letters moved 5, 4, and 3 and steps forward respectively.

45. (c) The relationship is $(2x-4) : x$.

46. (a) 11 : 17 alternate prime number (skipping 13) 19 : 29 alternate prime number (skipping 23)

47. (d) Second term = (First term)^3
$\therefore$ Fourth term = (Third term)^3

48. (d) $12 = 3^2 + 3$, $30 = 5^2 + 5$:
$20 = 4^2 + 4$: $? = 6^2 + 6$

49. (d) $3 = 2^2 - 1$, $10 = 3^2 + 1$
$8 = 3^2 - 1$, $? = 4^2 + 1$

50. (b) 13 and 19 are primes with 17 left out in between.

51. (c) Hematology is the branch of medicine concerned with the study and prevention of diseases related to the blood.
Similarly, phycology is the scientific study of algae.

52. (c) A group of Lions is called a pride.
A group of Cats is called a clowder.

53. (a)

M	A	N		W	A	N
↓+3	↓+3	↓+3	Similarly,	↓+3	↓+3	↓+3
P	D	Q		Z	D	Q

54. (b)

A	E	F	J
↓+10	↓+10	↓+10	↓10
K	O	P	T

Similarly,

G	K	L	P
↑–10	↑–10	↑–10	↑–10
Q	U	V	Z

55. (a) $2^5 = 32$
$3^5 = 243$

56. (c)

D	×	H		M	×	Q
↓		↓	Similarly,	↓		↓
4	×	8		13	×	17

Respective place value of letters in English alphabet.
Hence, option (c) in the correct answer.

57. (c) Medicine is given to patient similarly Education is given to student.

58. (c)

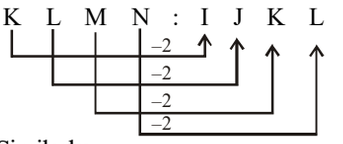
L	A	M	P
–3↓	–3↓	–3↓	–3↓
I	X	J	M

F	I	S	H
–3↓	–3↓	–3↓	–3↓
C	F	P	E

59. (d) As $20 = 13 \times 2 - 6$
$\therefore$ $28 = 17 \times 2 - 6$

60. (c) As, Fire will burn
Similarly, Ice will freeze.

61. (d) As,



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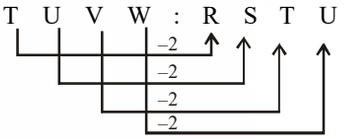


62. (b) As, $(3)^3 = 27$ Similarly, $(4)^3 = 64$.

63. (b)

64. (b) Dirty and Filthy are Similar word like that Shy and timid are similar word.

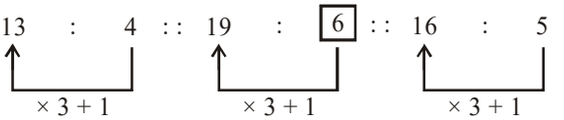
65. (d) Heart function is to circulated blood mix with oxygen into different parts of the body, like that kidney function is excretion of wastes from the body.

66. (d) As winter is a season like that April is a month.

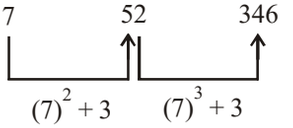
67. (d) China currency is 'Yuan' like that Japan currency is 'Yen'.

68. (c) As, in Graphology, we study about handwriting. Similarly, in Physics, we study about matter.

69. (a)



70. (a) As,



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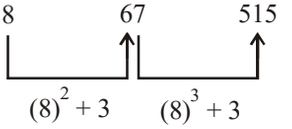


71. (b) As, Nascent is synonyms of young.
Similarly, Adjunct is synonyms of Supportive.

72. (a)

73. (b) Collection of books are kept in Library, so collection of artefacts are kept in museum.

74. (d) $(3, 14, 1) \rightarrow [(3)^3 + (1)^3] \div 14 \rightarrow 2$

$(4, 36, 2) \rightarrow [(4)^3 + (2)^3] \div 36 \rightarrow 2$

Similarly,

$(8, 260, 2) \rightarrow [(8)^3 + (2)^3] \div 260 \rightarrow 2$

75. (b) Phone is used for talking where as on Television we can view picture or used to view pictures.

76. (b) $19 : 324 :: 25 : 576 :: 9 : \boxed{64}$

As

$19 : (19-1)^2 \rightarrow 19 : (18)^2$

$25 : (25-1)^2 \rightarrow 25 : (24)^2$

$9 : (9-1)^2 \rightarrow 9 : (8)^2$

77. (a) $(20, 6, 4) \rightarrow [(6)^2 - (4)^2] = 20$

$(24, 7, 5) \rightarrow [(7)^2 - (5)^2] = 24$

Similarly,

$(65, 9, 4) \rightarrow [(9)^2 - (4)^2] = 65$

78. (d) Pattern is that:

$5 \times 5 = 25$

$2 \times 5 = 10$

so, $3 \times 3 = 9$

79. (d) As crowd and dense are synonyms. Similarly, steep is synonyms of slope.

80. (c) $49.85 - 5.31 + 9.97 = ?$

$\Rightarrow ? = 50 - 5 + 10$

$\Rightarrow ? = 55$

81. (b) Pattern is that-

$100 \times 10 = 1000$

$19 \times 2 = 38$

Similarly,

$25 \times 5 = 125$

82. (c) As,

F R E N C H

R F N E H C

And,

R E S C U E

E R C S E U

Similarly,

A N I M A L

N A M I L A

83. (b) Pattern is that-

$(6 + 14) \times 2 = 40$

$(10 + 14) \times 2 = 48$

Similarly,

$(5 + 9) \times 2 = 28$

84. (c) Pattern is that

$6 \rightarrow 6 \times 3 - 2 = 16$

$10 \rightarrow 10 \times 3 - 2 = 28$

Similarly,

$3 \rightarrow 3 \times 3 - 2 = 7$

85. (c) As 'Kidney' is an 'Organ'. Similarly, 'Apple' is a 'Fruit'.

86. (b) Pattern is that-

$$\frac{300}{100} - \frac{100}{100} = 3 - 1 = 2$$

$$\frac{88}{11} - \frac{66}{11} = 8 - 6 = 2$$

Similarly,

$$\frac{44}{11} - \frac{22}{11} = 4 - 2 = 2$$

87. (b) # : A O O

$+2\downarrow \; -3\downarrow \; +2\downarrow$

C L Q

% : N D K

$+2\downarrow \; -3\downarrow \; +2\downarrow$

P A M

88. (a) $(7, 3, 43) \rightarrow (7)^2 - 3 \times 2) = 43$

$(5, 2, 21) \rightarrow (5)^2 - (2 \times 2) = 21$

Similarly,

$(11, 5, 111) = (11)^2 - (5 \times 2) = 111$

1 Number System & Simplification

The ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 are called *digits,* which can represent any number.

Natural Numbers : These are the numbers (1, 2, 3, etc.) that are used for counting. It is denoted by N.

There are infinite natural numbers and the smallest natural number is one (1).

Even numbers : Natural numbers which are divisible by 2 are even numbers. It is denoted by E.

E = 2, 4, 6, 8,...

Smallest even number is 2. There is no largest even number.

Odd numbers : Natural numbers which are not divisible by 2 are odd numbers.

It is denoted by O.

O = 1, 3, 5, 7, ...

Smallest odd number is 1.

There is no largest odd number.

Based on divisibility, there could be two types of natural numbers : Prime and Composite.

(a) Prime Numbers : Natural numbers which have exactly two factors, i.e., 1 and the number itself are called prime numbers.

The lowest prime number is 2.

2 is also the only even prime number.

(b) Composite Numbers : It is a natural number that has atleast one divisor different from unity and itself.

Every composite number can be factorised into its prime factors.

For Example : 24 = 2 × 2 × 2 × 3. Hence, 24 is a composite number.

The smallest composite number is 4.

Whole Numbers : The natural numbers along with zero (0), form the system of whole numbers.

It is denoted by W.

There is no largest whole number and

The smallest whole number is 0.

Integers : The number system consisting of natural numbers, their negative and zero is called integers.

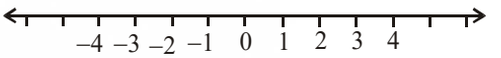
It is denoted by Z or I.

The smallest and the largest integers cannot be determined.

Remember

- ★ 1 is neither prime nor composite.
- ★ 1 is an odd integer.
- ★ 0 is neither positive nor negative.
- ★ 0 is an even integer.
- ★ 2 is prime & even both.
- ★ All prime numbers (except 2) are odd.

The number line : The number line is a straight line between negative infinity on the left to positive infinity on the right.



Real Numbers : All numbers that can be represented on the number line are called real numbers.

It is denoted by R.

R^+ : Positive real numbers and

R^- : Negative real numbers.

Real numbers = Rational numbers + Irrational numbers.

(a) Rational numbers : Any number that can be put in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$, is called a rational number.

It is denoted by Q.

Every integer is a rational number.

Zero (0) is also a rational number. The smallest and largest rational numbers cannot be determined. Every fraction (and decimal fraction) is a rational number.

$$Q = \frac{p}{q}\frac{(\text{Numerator})}{(\text{Denominator})}$$

If x and y are two rational numbers, then $\frac{x+y}{2}$ is also a rational number and its value lies between the given two rational numbers x and y.

An infinite number of rational numbers can be determined between any two rational numbers.

Example 1 :

Find three rational numbers between 3 and 5.

Solution :

$$1\text{st rational number} = \frac{3+5}{2} = \frac{8}{2} = 4$$

2nd rational number (i.e., between 3 and 4)

$$= \frac{3+4}{2} = \frac{7}{2}$$

3rd rational number (i.e., between 4 and 5)

$$= \frac{4+5}{2} = \frac{9}{2}.$$

(b) Irrational numbers : The numbers which are not rational or which cannot be put in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$, is called irrational number.

It is denoted by Q' or Q^c.

$\sqrt{2}, \sqrt{3}, \sqrt{5}, 2+\sqrt{3}, 3-\sqrt{5}, 3\sqrt{3}$ are irrational numbers.

NOTE :

(i) Every positive irrational number has a negative irrational number corresponding to it.

(ii) $\sqrt{2}+\sqrt{3} \neq \sqrt{5}$

$\sqrt{5}-\sqrt{3} \neq \sqrt{2}$

$\sqrt{3} \times \sqrt{2} = \sqrt{3 \times 2} = \sqrt{6}$

$\sqrt{6} \div \sqrt{2} = \sqrt{\frac{6}{2}} = \sqrt{3}$

(iii) Some times, product of two irrational numbers is a rational number.

For example : $\sqrt{2} \times \sqrt{2} = \sqrt{2 \times 2} = 2$

$(2+\sqrt{3}) \times (2-\sqrt{3}) = (2)^2 - (\sqrt{3})^2 = 4-3 = 1$

Both rational and irrational numbers can be represented on number line. Thus real numbers is the set of the union of rational and irrational numbers.

$R = Q \cup Q'$

Every real number is either rational or irrational.

Fraction : A fraction is a quantity which expresses a part of the whole.

$$\text{Fraction} = \frac{\text{Numerator}}{\text{Denominator}}$$

TYPES OF FRACTIONS :

(a) Proper fraction : If numerator is less than its denominator, then it is a proper fraction.

For example : $\frac{2}{5}, \frac{6}{18}$

(b) Improper fraction : If numerator is greater than or equal to its denominator, then it is a improper fraction.

For example : $\frac{5}{2}, \frac{18}{7}, \frac{13}{13}$

NOTE :

If in a fraction, its numerator and denominator are of equal value then fraction is equal to unity i.e. 1.

(c) Mixed fraction : It consists of an integer and a proper fraction.

For example : $1\frac{1}{2}, 3\frac{2}{3}, 7\frac{5}{9}$

NOTE :

Mixed fraction can always be changed into improper fraction and vice versa.

For example : $7\frac{5}{9} = \frac{7 \times 9 + 5}{9} = \frac{63+5}{9} = \frac{68}{9}$

and $\frac{19}{2} = \frac{9 \times 2 + 1}{2} = 9 + \frac{1}{2} = 9\frac{1}{2}$

(g) Simple fraction : Numerator and denominator are integers.

For example : $\frac{3}{7}$ and $\frac{2}{5}$.

(h) Complex fraction : Numerator or denominator or both are fractional numbers.

For example : $\frac{2}{\frac{5}{7}}, \frac{2\frac{1}{3}}{5\frac{2}{3}}, \frac{2+\frac{1+\frac{2}{7}}{3}}{2}$

(i) Decimal fraction : Denominator with the powers of 10.

For example : $\frac{2}{10} = (0.2), \frac{9}{100} = (0.09)$

(j) Vulgar fraction : Denominators are not the power of 10.

For example : $\frac{3}{7}, \frac{9}{2}, \frac{5}{193}$.

Example 2 :

After doing 3/5 of the Biology homework on Monday night, Sanjay did 1/3 of the remaining homework on Tuesday night. What fraction of the original homework would Sanjay have to do on Wednesday night to complete the Biology assignment ?

Solution :

Remaining homework on Monday night

$$= 1 - \frac{3}{5} = \frac{2}{5}$$

Work done on Tuesday night = $\frac{1}{3}$ of $\frac{2}{5} = \frac{2}{15}$

Remaining homework to complete the biology assignment

$$= \frac{2}{5} - \frac{2}{15} = \frac{6-2}{15} = \frac{4}{15}$$

Rounding off (Approximation) of Decimals : There are some decimals in which numbers are found upto large number of decimal places.

For example : 3.4578, 21.358940789.

But many times we require decimal numbers upto a certain number of decimal places. Therefore,

If the digit of the decimal place is five or more than five, then the digit in the preceding decimal place is increased by one and if the digit in the last place is less than five, then the digit in the precedence place remains unchanged.

Operations : The following operations of addition, subtraction, multiplication and division are valid for real numbers.

(a) Commutative property of addition :

$a + b = b + a$

(b) Associative property of addition :

$(a + b) + c = a + (b + c)$

(c) Commutative property of multiplication:

$a * b = b * a$

(d) Associative property of multiplication :

$(a * b) * c = a * (b * c)$

(e) Distributive property of multiplication with respect to addition :

$(a + b) * c = a * c + b * c$

Complex numbers : A number of the form $a + bi$, where a and b are real number and $i = \sqrt{-1}$ (imaginary number) is called a complex number. It is denoted by C.

For Example : $5i$ ($a = 0$ and $b = 5$), $\sqrt{5} + 3i$ ($a = \sqrt{5}$ and $b = 3$)

NOTE :

$i = \sqrt{-1}$, $i^2 = -1$, $i^3 = -i$, $i^4 = 1$

DIVISIBILITY RULES

Divisibility by 2 : A number is divisible by 2 if it's unit digit is even or 0.

Divisibility by 3 : A number is divisible by 3 if the sum of it's digits are divisible by 3.

Divisibility by 4 : A number is divisible by 4 if the last 2 digits are divisible by 4, or if the last two digits are 0's.

Divisibility by 5 : A number is divisible by 5 if it's unit digit is 5 or 0.

Divisibility by 6 : A number is divisible by 6 if it is simultaneously divisible by 2 and 3.

Divisible by 7 : We use osculator (– 2) for divisibility test.

$99995 : 9999 - 2 \times 5 = 9989$

$9989 : 998 - 2 \times 9 = 980$

$980 : 98 - 2 \times 0 = 98$

Now 98 is divisible by 7, so 99995 is also divisible by 7.

Divisible by 11 : In a number, if difference of sum of digit at even places and sum of digit at odd places is either 0 or multiple of 11, then no. is divisible by 11.

For example, $12342 \div 11$

Sum of even place digit $= 2 + 4 = 6$

Sum of odd place digit $= 1 + 3 + 2 = 6$

Difference $= 6 - 6 = 0$

$\therefore$ 12342 is divisible by 11.

Divisible by 13 : We use (+ 4) as osculator.

e.g., $876538 \div 13$

$876538 : 8 \times 4 + 3 = 35$

$5 \times 4 + 3 + 5 = 28$

$8 \times 4 + 2 + 6 = 40$

$0 \times 4 + 4 + 7 = 11$

$1 \times 4 + 1 + 8 = 13$

13 is divisible by 13.

$\therefore$ 876538 is also divisible by 13.

Divisible by 17 : We use (– 5) as osculator.

e.g., $294678 : 29467 - 5 \times 8 = 29427$

$27427 : 2942 - 5 \times 7 = 2907$

$2907 : 290 - 5 \times 7 = 255$

$255 : 25 - 5 \times 5 = 0$

$\therefore$ 294678 is completely divisible by 17.

Divisible by 19 : We use (+ 2) as osculator.

e.g: $149264 : 4 \times 2 + 6 = 14$

$4 \times 2 + 1 + 2 = 11$

$1 \times 2 + 1 + 9 = 12$

$2 \times 2 + 1 + 4 = 9$

$9 \times 2 + 1 = 19$

19 is divisible by 19

$\therefore$ 149264 is divisible by 19.

Divisibility by a Composite number:

A number is divisible by a given composite number if it is divisible by all factors of composite number.

Example 3:

Is 2331024 divisible by 12

Solution :

$12 = 4 \times 3$

2331024 is divisible by 3 as (2+3+3+1+2+4) = 15 is divisible by 3

2331024 is also divisible by 4 because last two digits (24) is divisible by 4

Therefore 2331024 is divisible by 12

Example 4 :

What is the value of M and N respectively if M39048458N is divisible by 8 and 11, where M and N are single digit integers?

Solution :

A number is divisible by 8 if the number formed by the last three digits is divisible by 8.

i.e., 58N is divisible by 8.

Clearly, N = 4

Again, a number is divisible by 11 if the difference between the sum of digits at even places and sum of digits at the odd places is either 0 or is divisible by 11.

i.e. $(M+9+4+4+8)-(3+0+8+5+N)$

$= M+25-(16+N)$

$= M-N+9$ must be zero or it must be divisible by 11

i.e. $M-N=2 \Rightarrow M=2+4=6$

Hence, $M=6, N=4$

Example 5 :

The highest power of 9 dividing 99! completely, is:

Solution :

(c) $9=3\times3=3^2$

Highest power of 3 in 99!

$$=\left[\frac{99}{3}\right]+\left[\frac{99}{3^2}\right]+\left[\frac{99}{3^3}\right]+\left[\frac{99}{3^4}\right]$$

$=33+11+3+1=48$

But we have 3^2

highest power of 9 in 99! $=\frac{48}{2}=24$

DIVISION ALGORITHM:

Dividend = (Divisor × Quotient) + Remainder

where, Dividend = The number which is being divided

Divisor = The number which performs the division process

Quotient = Greatest possible integer as a result of division

Remainder = Rest part of dividend which cannot be further divided by the divisor.

Complete remainder : A complete remainder is the remainder obtained by a number by the method of successive division.

Complete remainder = [I divisor × II remainder] + I remainder

$$\boxed{\text{C.R.} = d_1r_2+r_1}$$

$$\boxed{\text{C.R.} = d_1d_2r_3+d_1r_2+r_1}$$

Two different numbers x and y when divided by a certain divisor D leave remainder r_1 and r_2 respectively. When the sum of them is divided by the same divisor, the remainder is r_3. Then,

$$\boxed{\text{divisor } D = r_1+r_2-r_3}$$

Method to find the number of different divisors (or factors) (including 1 and itself) of any composite number N :

STEP I : Express N as a product of prime numbers as $N=x^a\times y^b\times z^c$ .....

STEP II : Number of different divisors (including 1 and itself) $=(a+1)(b+1)(c+1)$.....

Example 6 :

Find the number of different divisors of 50, besides unity and the number itself.

Solution :

If you solve this problem without knowing the rule, you will take the numbers in succession and check the divisibility. In doing so, you may miss some numbers. It will also take more time.

Different divisors of 50 are : 1, 2, 5, 10, 25, 50

If we exclude 1 and 50, the number of divisors will be 4.

By rule : $50=2\times5\times5=2^1\times5^2$

$\therefore$ the number of total divisors $=(1+1)\times(2+1)=2\times3=6$

or, the number of divisors excluding 1 and 50 $=6-2=4$

Counting Number of Zeros

Sometimes we come across problems in which we have to count number of zeros at the end of factorial of any numbers. for example -

Number of zeros at the end of 10!

$10!=10\times9\times8\times7\times6\times5\times4\times3\times2\times1$

Here basically we have to count number of fives, because multiplication of five by any even number will result in 0 at the end of final product. In 10! we have 2 fives thus total number of zeros are 2.

Short cut :-

Counting number of zeros at the end of n! value will be

$$\frac{n}{5}+\frac{n}{5^2}+\frac{n}{5^3}+\frac{n}{5^4}+\cdots\cdots\cdots$$

The integral value of this number will be the total number of zeros.

Example 7 :

Number of zeros at the end of 10!

Solution : $\frac{10}{5}+\frac{10}{5^2}+\cdots\cdots$ Integral value

$=2+0$

So, number of zeros in 10! = 2.

Note:- Here $\frac{10}{5^2}$ is less than 1 so will not count it.

Example 8 :

Number of zeros at the end of 126!

Solution :

$$\frac{126}{5}+\frac{126}{5^2}+\frac{126}{5^3}+\cdots\cdots\cdots$$

$\Rightarrow$ integral value will be

$=25+5+1=31$ zeros.

Example 9 :

Number of zeros at the end of 90!

Solution :

$$\frac{90}{5}+\frac{90}{5^2}+\frac{90}{5^3}+\cdots\cdots\cdots=18+3=21 \text{ zeros}$$

Power of a number contained in a factorial

Highest power of a prime number P in N!

$$=\left[\frac{N}{P}\right]+\left[\frac{N}{P^2}\right]+\left[\frac{N}{P^3}\right]+---+\left[\frac{N}{P^r}\right]$$, where [x] denotes the greatest integers less than or equal to x and is a natural number such that $P^r < n$.

Example 10 :

Find highest power of 7^n in 50!

Solution :

The highest power 7 in 50!

$$=\left[\frac{50}{7}\right]+\left[\frac{50}{7^2}\right]=7+1=8$$

Example 11 :

Find highest power 15 in 100!

Solution :

Here given number 15 is not a prime number so first convert 15 as product of Primes $15 = 3 \times 5$ therefore we will find the highest power of 3 and 5 in 100!

Highest power of 3 in 100!

$$=\left[\frac{100}{3}\right]+\left[\frac{100}{3^2}\right]+\left[\frac{100}{3^3}\right]+\left[\frac{100}{3^4}\right]$$

$= 33 + 11 + 3 + 1 = 48$

Highest power of 5 in 100!

$$=\left[\frac{100}{5}\right]+\left[\frac{100}{5^2}\right]=20+4=24$$

So 100! contains $(3)^{48} \times (5)^{24}$. Hence it contains 24 pairs of 3 and 5. Therefore, required power of 15 is 24, which is actually the power of the largest prime factor 5 of 15, because power of largest prime factor is away equal to or less than the other prime factor of any number.

TO FIND THE LAST DIGIT OR DIGIT AT THE UNIT'S PLACE OF a^n.

(i) If the last digit or digit at the unit's place of a is 1, 5 or 6, whatever be the value of n, it will have the same digit at unit's place, i.e.,

$(.....1)^n = (.....1)$
$(.....5)^n = (.....5)$
$(.....6)^n = (.....6)$

(ii) If the last digit or digit at the units place of a is 2, 3, 5, 7 or 8, then the last digit of a^n depends upon the value of n and follows a repeating pattern in terms of 4 as given below :

n	last digit of $(....2)^n$	last digit of $(....3)^n$	last digit of $(....7)^n$	last digit of $(....8)^n$
4x+1	2	3	7	8
4x+2	4	9	9	4
4x+3	8	7	3	2
4x	6	1	1	6

(iii) If the last digit or digit at the unit's place of a is either 4 or 9, then the last digit of a^n depends upon the value of n and follows repeating pattern in terms of 2 as given below.

n	last digit of $(....4)^n$	last digit of $(....9)^n$
2x	6	1
2x+1	4	9

Example 12 :

Find unit digit of 2^{323}.

Solution : Here, 2, 4, 8, 6 will repeat after every four interval till 320 next digit will be 2, 4, $\boxed{8}$, so unit digit of 2^{323} will be 8.

Example 13 :

Find unit digit of $963^{63} \times 73^{73}$.

Solution : Unit digit of $963^{63} = 7$

Unit digit of $73^{73} = 3$

So unit digit of $963^{63} \times 73^{73} = 7 \times 3 = 21$. i.e. 1.

REMAINDER THEOREM

Remainder of expression $\frac{a \times b \times c}{n}$ [i.e. $a \times b \times c$ when divided by n] is equal to the remainder of expression $\frac{a_r \times b_r \times c_r}{n}$ [i.e. $a_r \times b_r \times c_r$ when divided by n], where

a_r is remainder when a is divided by n.
b_r is remainder when b is divided by n. and
c_r is remainder when c is divided by n.

Example 14 :

Find the remainder of $15 \times 17 \times 19$ when divided by 7.

Solution :

Remainder of Expression $\frac{15 \times 17 \times 19}{7}$ will be equal to

$$\frac{1 \times 3 \times 5}{7}=\frac{15}{7}=2\frac{1}{7} \text{ i.e. } 1$$

On dividing 15 by 7, we get 1 as remainder.
On dividing 17 by 7, we get 3 as remainder.
On dividing 19 by 7, we get 5 as remainder.

And combined remainder will be equal to remainder of $\frac{15}{7}$ i.e. 1.

POLYNOMIAL THEOREM

This is very powerful theorem to find the remainder.
According to polynomial theorem.

$(x + a)^n = x^n + {}^nc_1\, x^{n-1} \cdot a^1 + {}^nc_2\, x^{n-2}\, a^2 + {}^nc_3\, x^{n-3}\, a^3 + \ldots\ldots\ldots {}^nc_{n-1}\, x^1 a^{n-1} + a^n \quad \ldots(i)$

$$\therefore \quad \frac{(x+a)^n}{x} = \frac{x^n + {}^nc_1\, x^{n-1}\, a^1 + {}^nc_2\, x^{n-2}\, a^2 + \ldots\ldots + {}^nc_{n-1}\, x^1\, a^{n-1} + a^n}{x} \quad \ldots(ii)$$

remainder of expression (ii) will be equal to remainder of $\frac{a^n}{x}$ because rest of the term contains x are completely divisible by x.

Example 15 :

Find the remainder of $\frac{9^{99}}{8}$.

Solution :

$$\frac{9^{99}}{8} = \frac{(8+1)^{99}}{8}$$

According to polynomial theorem remainder will be equal to remainder of the expression $\frac{1^{99}}{8} = \frac{1}{8}$, 1

Example 16 :

Find remainder of $\frac{9^{100}}{7}$.

Solution :

$$\frac{9^{100}}{7} \Rightarrow \frac{(7+2)^{100}}{7}$$

$$= \frac{2^{100}}{7} = \frac{2^{99} \times 2}{7} = \frac{2^{3 \times 33} \times 2}{7} = \frac{8^{33} \times 2}{7}$$

$$= \frac{(7+1)^{33}}{7} \times 2 = \frac{1 \times 2}{7} = \frac{2}{7} \text{. i.e. } 2$$

Example 17 :

Find remainder of $\frac{3^{50}}{7}$.

Solution :

$$\frac{3^{50}}{7} = \frac{(3^2)^{25}}{7} \Rightarrow \frac{(7+2)^{25}}{7} = \frac{2^{25}}{7} = \frac{(2^3)^8 \times 2}{7}$$

$$= \frac{(7+1)^8 \times 2}{7} = \frac{1 \times 2}{7}$$

$\Rightarrow$ Remainder is 2.

LAW OF SURDS

- ❖ $\left(a^{\frac{1}{n}}\right)^n = a$
- ❖ $a^{\frac{1}{n}} b^{\frac{1}{n}} = (ab)^{\frac{1}{n}}$
- ❖ $\left(a^{\frac{1}{n}}\right)^{\frac{1}{m}} = a^{\frac{1}{mn}}$

LAW OF INDICES

- ❖ $a^m \times a^n = a^{m+n}$
- ❖ $a^m \div a^n = a^{m-n}$
- ❖ $(a^m)^n = a^{mn}$
- ❖ $a^{\frac{1}{m}} = \sqrt[m]{a}$
- ❖ $a^{-m} = \frac{1}{a^m}$
- ❖ $a^{m/n} = \sqrt[n]{a^m}$
- ❖ $a^0 = 1$

Addition and subtraction of Surds

Example: $5\sqrt{2} + 20\sqrt{2} - 3\sqrt{2} = 22\sqrt{2}$

Example: $\sqrt{45} - 3\sqrt{20} + 4\sqrt{5} = 3\sqrt{5} - 6\sqrt{5} + 4\sqrt{5} = \sqrt{5}$

EXERCISE

1. Minimum difference between x and y such that 1x 71y 61 is exactly divisible by 11 is,
   (a) 2 (b) 3 (c) 1 (d) 0
2. If 'n' is a natural number then the greatest integer less than that or equal to $\left(2+\sqrt{3}\right)^n$ is
   (a) odd
   (b) even
   (c) even when 'n' is even and odd when 'n' is odd
   (d) even when 'n' is odd and odd when n is even
3. How many numbers, between 1 and 300 are divisible by 3 and 5 together?
   (a) 16 (b) 18 (c) 20 (d) 100
4. What is the remainder when 1! + 2! + 3! + ... + 100! is divided by 7 ?
   (a) 0 (b) 5 (c) 6 (d) 3
5. Two different numbers when divided by the same divisor, left remainder 11 and 21 respectively, and when their sum was divided by the same divisor, remainder was 4. What is the divisor?
   (a) 36 (b) 28 (c) 14 (d) 9
6. A number when successively divided by 7 and 8 leaves the remainders 3 and 5 respectively. What is the remainder when the same number is divided by 56?
   (a) 38 (b) 31 (c) 37 (d) 26
7. A boy wanted to write the numbers from the smallest number to the greatest number of three digits. How many times he needs to press the keys of the computer to do this job?
   (a) 2708 (b) 2889 (c) 2644 (d) 2978
8. A number being successively divided by 3, 5 and 8 leaves 1,2 and 4 as remainders respectively. What are the remainders if the order of divisors be reversed?
   (a) 3, 3, 1 (b) 3, 1, 3
   (c) 1, 3, 3 (d) None of these

9. A boy multiplied a certain number x by 13. He found that the resulting product consisted of all nines entirely. Find the smallest value of x.
(a) 76913 (b) 76933 (c) 76923 (d) 75933

10. A certain number is divided by 385 by division by factors. The quotient is 102, the first remainder is 4, the second is 6 and the third is 10. Find the number.
(a) 39654 (b) 32754
(c) 38554 (d) None of these

11. Two numbers when divided by a certain divisor leave the remainders 4375 and 2986 respectively; but when the sum of the two numbers be divided by the same divisor, the remainder is 2361. The divisor is
(a) 2014 (b) 5000 (c) 625 (d) 2639

12. Which digits should come in place of * and $ if the number 62684*$ is divisible by both 8 and 5?
(a) 4, 0 (b) 0, 4 (c) 0, 0 (d) 4, 4

13. A boy multiplies 987 by a certain number and obtains 559981 as his answer. If in the answer, both 9's are wrong but the other digits are correct, then the correct answer will be:
(a) 553681 (b) 555181 (c) 555681 (d) 556581

14. There is one number which is formed by writing one digit 6 times (e.g. 111111, 444444 etc.). Such a number is always divisible by:
(a) 7 and 11 (b) 11 and 13
(c) 7, 11 and 13 (d) None of these

15. A number when divided successively by 4 and 5 leaves remainder 1 and 4 respectively. When it is successively divided by 5 and 4, then the respective remainders will be:
(a) 1, 2 (b) 2, 3 (c) 3, 2 (d) 4, 1

16. If the product of first sixty positive consecutive integers be divisible by 8^n, where n is an integer, then the largest possible value of n is
(a) 18 (b) 19 (c) 17 (d) 16

17. The digit in the unit's place of the number represented by $(7^{95} - 3^{58})$ is:
(a) 0 (b) 4 (c) 6 (d) 7

18. $55^3 + 17^3 - 72^3$ is divisible by
(a) both 3 and 13 (b) both 7 and 17
(c) both 3 and 17 (d) both 7 and 13

19. What is the sum of all two-digit numbers that give a remainder of 3 when they are divided by 7?
(a) 666 (b) 676 (c) 683 (d) 777

20. Let x and y be positive integers such that x is prime and y is composite. Then
(a) y – x cannot be an even integer
(b) xy cannot be an even integer.
(c) (x + y)/x cannot be an even integer
(d) None of the above statements is true.

21. Arranging the following in descending order $2^{57}, 4^{38}, 15^{19}$ we get
(a) $2^{57} > 4^{38} > 15^{19}$ (b) $4^{38} > 15^{19} > 2^{57}$
(c) $15^{19} > 2^{57} > 4^{38}$ (d) $2^{57} > 15^{19} > 4^{38}$

22. The sum of four numbers is 48. When 5 and 1 are added to the first two; and 3 & 7 are subtracted from the 3rd & 4th, the numbers will be equal. The numbers are
[SSC CGL, Tier-I-2015]
(a) 4, 12, 12, 20 (b) 5, 11, 13, 19
(c) 6, 10, 14, 18 (d) 9, 7, 15, 17

23. The value of **[SSC CGL, Tier-I-2015]**
$$\frac{1}{\sqrt{7}-\sqrt{6}} - \frac{1}{\sqrt{6}-\sqrt{5}} + \frac{1}{\sqrt{5}-2} - \frac{1}{\sqrt{8}-\sqrt{7}} + \frac{1}{3-\sqrt{8}} \text{ is}$$
(a) 0 (b) 1 (c) 5 (d) 7

24. Choose the incorrect relation(s) from the following : **[SSC CGL, Tier-I-2015]**
(i) $\sqrt{6}+\sqrt{2} = \sqrt{5}+\sqrt{3}$
(ii) $\sqrt{6}+\sqrt{2} < \sqrt{5}+\sqrt{3}$
(iii) $\sqrt{6}+\sqrt{2} > \sqrt{5}+\sqrt{3}$
(a) (i) (b) (ii)
(c) (i) and (iii) (d) (ii) and (iii)

25. The value of $\dfrac{(0.67\times0.67\times0.67)\times(0.33\times0.33\times0.33)}{(0.67\times0.67)+(0.67\times0.33)\div(0.33\times0.33)}$
[SSC CGL, Tier-II-2015]
(a) 11 (b) 0.34 (c) 1.1 (d) 3.4

26. There is a number consisting of two digits, the digit in the units place is twice that in the tens place and if 2 be subtracted from the sum of the digits, the difference is equal to 1/6th of the number. The number is
[SSC CGL, Tier-II-2015]
(a) 26 (b) 23 (c) 25 (d) 24

27. Let *x* be the smallest number, which when added to 2000 makes the resulting number divisible by 12, 16, 18 and 21. The sum of the digits of *x* is **[SSC CGL, Tier-II-2015]**
(a) 4 (b) 7 (c) 6 (d) 5

28. The value of **[SSC CGL, Tier-II-2015]**
$$4 - \cfrac{4}{1 + \cfrac{1}{3 + \cfrac{1}{2 + \cfrac{1}{4}}}}$$
(a) $\frac{1}{8}$ (b) $\frac{1}{64}$ (c) $\frac{1}{16}$ (d) $\frac{1}{32}$

29. Twenty one times of a positive number is less than its square by 100. The value of the positive number is
[SSC CGL, Tier-II-2016]
(a) 25 (b) 26 (c) 42 (d) 41

30. The product of two numbers is 48. If one number equals "The number of wings of a bird plus 2 times the number of fingers on your hand divided by the number of wheels of a Tricycle". Then the other number is
[SSC CGL, Tier-II-2016]
(a) 9 (b) 10 (c) 12 (d) 18

31. Two baskets together have 640 oranges. If (1/5)th of the oranges in the first basket be taken to the second basket to have equal number of oranges in both the basket. The number of oranges in the first basket is
[SSC CGL, Tier-II-2016]
(a) 800 (b) 600 (c) 400 (d) 300

32. What is the unit digit of the sum of first 111 whole numbers? **[SSC CGL, Tier-II-2017]**
(a) 4 (b) 6 (c) 5 (d) 0

33. How many 100 digit positive number are there?
[SSC CGL, Tier-II-2017]
(a) 9×10^{99} (b) 9×10^{100}
(c) 10100 (d) 11×10^{98}

34. Which of the following is **TRUE? [SSC CGL, Tier-II-2017]**

I. $\frac{1}{\sqrt[3]{12}} > \frac{1}{\sqrt[4]{29}} > \frac{1}{\sqrt{5}}$ II. $\frac{1}{\sqrt[4]{29}} > \frac{1}{\sqrt[3]{12}} > \frac{1}{\sqrt{5}}$

III. $\frac{1}{\sqrt{5}} > \frac{1}{\sqrt[3]{12}} > \frac{1}{\sqrt[4]{29}}$ IV. $\frac{1}{\sqrt{5}} > \frac{1}{\sqrt[4]{29}} > \frac{1}{\sqrt[3]{12}}$

(a) Only I (b) Only II
(c) Only III (d) Only IV

35. N is the largest two digit number, which when divided by 3, 4 and 6 leaves the remainder 1, 2 and 4 respectively. What is the remainder when N is divided by 5?
[SSC CGL, Tier-II-2017]
(a) 4 (b) 2 (c) 0 (d) 1

36. A and B are positive integers. If $A + B + AB = 65$, then what is the difference between A and B ($A, B \le 15$)?
[SSC CGL, Tier-II-2017]
(a) 3 (b) 4 (c) 5 (d) 6

37. What is the value of
$\sqrt{4600 + \sqrt{540 + \sqrt{1280 + \sqrt{250 + \sqrt{36}}}}}$?
[SSC CGL, Tier-II-2017]
(a) 69 (b) 68 (c) 70 (d) 72

38. If 50 less had applied and 25 less selected, the ratio of selected to unselected would have been 9 : 4. So how many candidates had applied if the ratio of selected to unselected was 2 : 1. **[SSC CGL, Tier-II-2017]**
(a) 125 (b) 250 (c) 375 (d) 500

39. Let a, b and c be the fractions such that $a < b < c$. If c is divided by a, the result is $\frac{5}{2}$, which exceeds b by $\frac{7}{4}$. If $a + b + c = 1\frac{11}{12}$, then $(c - a)$ will be equal to:
[SSC CGL, Tier-II-2018]
(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{1}{2}$

40. If $(\sqrt{2} + \sqrt{5} - \sqrt{3}) \times k = -12$, then what will be the value of k? **[SSC CGL, Tier-II-2018]**
(a) $\sqrt{2} + \sqrt{5} + \sqrt{3}$
(b) $(\sqrt{2} + \sqrt{5} + \sqrt{3})(2 - \sqrt{10})$
(c) $(\sqrt{2} + \sqrt{5} - \sqrt{3})(2 + \sqrt{5})$
(d) $(\sqrt{2} + \sqrt{5} + \sqrt{3})(2 - \sqrt{5})$

41. When 12, 16,18, 20 and 25 divide the least number x, the remainder in each case is 4 but x is divisible by 7. What is the digit at the thousands' place in x ?
[SSC CGL, Tier-II-2018]
(a) 5 (b) 8 (c) 4 (d) 3

42. The sum of the digits of a two-digit number is $\frac{1}{7}$ of the number. The units digit is 4 less than the tens digit. If the number obtained on reversing its digits is divided by 7, the remainder will be: **[SSC CGL, Tier-II-2018]**
(a) 4 (b) 5 (c) 1 (d) 6

43. Find the greatest value of b so that $30a68b$ ($a > b$) is divisible by 11.
[SSC CGL, Tier-I-2020]
(a) 4 (b) 6 (c) 3 (d) 9

44. Atul purchased Bread costing ₹ 20 and gave a 100 rupee note to the shopkeeper. The shopkeeper gave the balance money in coins of denomination ₹ 2, ₹ 5 and ₹ 10. If these coins are in the ratio 5 : 4 : 1, then how many ₹ 5 coins did the shopkeeper give? **[SSC CGL, Tier-I-2020]**
(a) 6 (b) 5 (c) 4 (d) 8

45. The value of 90 ÷ 20 of 6 × [11 ÷ 4 of {3 × 2 – (3 – 8)}] ÷ (9 ÷ 3 × 2) is: **[SSC CGL, Tier-I-2020]**
(a) $\frac{9}{8}$ (b) $\frac{3}{8}$ (c) $\frac{1}{36}$ (d) $\frac{1}{32}$

46. Find the greatest number 23a68b, which is divisible by 3 but NOT divisible by 9. **[SSC CGL, Tier-I-2021]**
(a) 238689 (b) 239685
(c) 239688 (d) 237687

47. Find the value of the following expression:
$372 \div 56 \times 7 - 5 + 2$ **[SSC CGL, Tier-I-2021]**
(a) 58 (b) $-2\frac{95}{98}$
(c) $43\frac{1}{2}$ (d) $2\frac{93}{98}$

48. Some students (only boys and girls) from different schools appeared for an Olympiad exam. 20% of the boys and 15% of the girls failed the exam. The number of boys who passed the exam was 70 more than that of the girls who passed the exam. A total of 90 students failed. Find the number of students that appeared for the exam.
[SSC CGL, Tier-I-2021]
(a) 420 (b) 400
(c) 500 (d) 350

49. Which fraction among the following is the least?

$\frac{5}{11}, \frac{7}{12}, \frac{8}{13}, \frac{9}{17}$ **[SSC CGL, Tier-II-2021]**

(a) $\frac{5}{11}$ (b) $\frac{7}{12}$

(c) $\frac{9}{17}$ (d) $\frac{8}{13}$

50. What is the value of $99\frac{11}{99}+99\frac{13}{99}+99\frac{15}{99}+....+99\frac{67}{99}$?

[SSC CGL, Tier-II-2021]

(a) $\frac{94220}{33}$ (b) $\frac{95120}{33}$

(c) $\frac{97120}{33}$ (d) $\frac{96220}{33}$

51. What is the value of **[SSC CGL, Tier-II-2021]**

$\frac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}} \div \frac{\sqrt{14}+\sqrt{10}}{\sqrt{14}-\sqrt{10}} - \frac{\sqrt{10}}{\sqrt{5}}$?

(a) $\sqrt{2}+2$ (b) $2\sqrt{2}+2$

(c) $\sqrt{2}+1$ (d) $2\sqrt{2}+1$

52. If $\sqrt[3]{N}$ lies between 6 and 7, where N is an integer then how many values N can take?

[SSC CGL, Tier-II-2021]

(a) 126 (b) 127

(c) 128 (d) 125

53. What is the value of $\frac{\sqrt{29.16}}{\sqrt{1.1664}}+\frac{\sqrt{0.2916}}{\sqrt{116.64}}+\frac{\sqrt{0.0036}}{\sqrt{0.36}}$?

[SSC CGL, Tier-II-2021]

(a) $\frac{26}{5}$ (b) $\frac{103}{20}$

(c) $\frac{27}{5}$ (d) $\frac{101}{20}$

54. If the digits of a two digit number is reversed, then the number is decreased by 36. Which of the following is correct regarding the number?

[SSC CGL, Tier-II-2021]

I. The difference of the digits is 4.

II. The value of number can be 84.

III. Number is always a composite number.

(a) I, II, and III (b) II and III

(c) I and III (d) I and II

55. What is the sum of all the common terms between the given series S1 and S2? **[SSC CGL, Tier-II-2021]**

Sl = 2, 9, 16, ... , 632

S2 = 7, 11 , 15, ... , 743

(a) 6974 (b) 6750

(c) 7140 (d) 6860

56. Which of the following given value is greater than $\sqrt[3]{12}$?

[SSC CGL, Tier-II-2021]

(a) $\sqrt[6]{121}$ (b) $\sqrt[12]{33214}$

(c) $\sqrt[5]{60}$ (d) $\sqrt[9]{1500}$

57. If $A=\frac{\sqrt{0.0004}\times\sqrt[3]{0.000008}}{\sqrt[4]{16000}\times\sqrt[3]{125000}\times\sqrt[4]{810}}$ and

$B=\frac{\sqrt[3]{0.729}\times\sqrt[4]{0.0016}}{\sqrt{0.16}}$, then what is $A \times B$?

[SSC CGL, Tier-II-2021]

(a) 7×10^{-7} (b) $\left(\frac{7}{4}\right)\times10^{-8}$

(c) 5×10^{-8} (d) $\left(\frac{7}{3}\right)\times10^{-7}$

58. What is the sum of first 20 terms of the following series?

$1\times2+2\times3+3\times4+4\times5+...$

[SSC CGL, Tier-II-2021]

(a) 3160 (b) 2940

(c) 3240 (d) 3080

59. What is the value of

$\frac{7}{2}+\frac{11}{3}+\frac{7}{6}+\frac{11}{15}+\frac{7}{12}+\frac{11}{35}+....+\frac{7}{156}+\frac{11}{575}$?

[SSC CGL, Tier-II-2021]

(a) $\frac{3917}{355}$ (b) $\frac{3816}{325}$

(c) $\frac{3714}{345}$ (d) $\frac{3216}{315}$

60. How many numbers are there from 400 to 700 in which the digit 6 occurs exactly twice?

[SSC CGL, Tier-II-2021]

(a) 19 (b) 18

(c) 21 (d) 20

61. If $A=0.3\overline{12}, B=0.4\overline{15}$ and $C=0.30\overline{9}$, then what is the value of $A+B+C$? **[SSC CGL, Tier-II-2021]**

(a) $\frac{1141}{1100}$ (b) $\frac{1097}{1100}$ (c) $\frac{1211}{1100}$ (d) $\frac{1043}{1100}$

62. How many composite numbers are there from 53 to 97 ?

[SSC CGL, Tier-II-2021]

(a) 36 (b) 38 (c) 37 (d) 35

63. Which of the following numbers is a divisor of $(49^{15}-1)$?

[SSC CGL, Tier-I-2022]

(a) 46 (b) 14 (c) 8 (d) 50

64. If $\frac{(17)^3+(7)^3}{(17^2+7^2-k)}$, then what is the value of k?
[SSC CGL, Tier-I-2022]
(a) 119 (b) 128 (c) 24 (d) 109

65. If $\frac{4\left[(17)^3-(7)^3\right]}{(17^2+7^2+p)}=40$, then what is the value of p?
[SSC CGL, Tier-I-2022]
(a) –119 (b) –129 (c) 119 (d) 129

66. If $A=\frac{58^2-25^2}{46^2-37^2}$, $B=\frac{26^2-15^2}{56^2-15^2}$, then the value of $\frac{1}{B}-\frac{20}{A}$ is:
[SSC CGL, Tier-II-2022]
(a) 2 (b) 1 (c) 0 (d) –1

67. A six-digit number 11p9q4 is divisible by 24. Then the greatest possible value for pq is: **[SSC CGL, Tier-II-2022]**
(a) 42 (b) 32 (c) 56 (d) 68

68. Find the value of $\frac{\sqrt{1.24}\times\sqrt{2.79}}{\sqrt{2.64}\times\sqrt{5.94}}$ **[SSC CGL, Tier-II-2022]**
(a) $\frac{31}{44}$ (b) $\frac{33}{64}$ (c) $\frac{31}{66}$ (d) $\frac{33}{31}$

69. What is the value of **[SSC CGL, Tier-II-2022]**
$\left[\frac{1}{8}+\left\{\frac{1}{6}\times\left(\frac{36}{45}\div\frac{24}{25}\right)-\left(\frac{12}{21}\times\frac{14}{15}\div\frac{24}{25}\right)\right\}+\frac{27}{36}\right]$?
(a) $\frac{1}{27}$ (b) $\frac{1}{108}$ (c) $\frac{1}{72}$ (d) $\frac{1}{36}$

70. Which number among 34936, 35508, 35580 and 36508 is divisible by 33? **[SSC CGL, Tier-I-2023]**
(a) 35580 (b) 35508 (c) 36508 (d) 34936

71. Simplify: $[0.08-\{3.5-4.9-(12.5-7.8-4.6)\}]$
[SSC CGL, Tier-I-2023]
(a) 2.58 (b) 0.08 (c) 12.58 (d) 1.58

72. Find the value of the given expression.
$\sqrt{20-\sqrt{20-\sqrt{20-\sqrt{20-...\infty}}}}$ **[SSC CGL, Tier-II-2023]**
(a) 4 (b) 6 (c) 5 (d) 2

73. The number 2918245 is divisible by which of the following numbers? **[SSC CGL, Tier-II-2023]**
(a) 3 (b) 11 (c) 12 (d) 9

74. Find the value of given expression.
$[76-\{90\div5\times(24-36\div3)\div3\}]$ **[SSC CGL, Tier-II-2023]**
(a) 71.5 (b) 75.5 (c) 4 (d) 77.5

ANSWER KEY

1	(a)	**9**	(c)	**17**	(b)	**25**	(b)	**33**	(a)	**41**	(b)	**49**	(a)	**57**	(*)	**65**	(c)	**73**	(b)
2	(a)	**10**	(a)	**18**	(c)	**26**	(d)	**34**	(c)	**42**	(d)	**50**	(b)	**58**	(d)	**66**	(b)	**74**	(c)
3	(c)	**11**	(b)	**19**	(b)	**27**	(b)	**35**	(a)	**43**	(c)	**51**	(c)	**59**	(b)	**67**	(c)		
4	(b)	**12**	(a)	**20**	(d)	**28**	(a)	**36**	(c)	**44**	(d)	**52**	(a)	**60**	(d)	**68**	(c)		
5	(b)	**13**	(c)	**21**	(b)	**29**	(a)	**37**	(b)	**45**	(d)	**53**	(b)	**61**	(a)	**69**	(c)		
6	(a)	**14**	(c)	**22**	(c)	**30**	(c)	**38**	(c)	**46**	(b)	**54**	(d)	**62**	(d)	**70**	(b)		
7	(b)	**15**	(b)	**23**	(c)	**31**	(c)	**39**	(d)	**47**	(c)	**55**	(a)	**63**	(c)	**71**	(d)		
8	(a)	**16**	(a)	**24**	(c)	**32**	(c)	**40**	(b)	**48**	(c)	**56**	(b)	**64**	(a)	**72**	(a)		

Hints & Explanations

1. (a) As 1x 71y 61 is exactly divisible by 11.
$(1+7+y+1)-(x+1+6)=0$ or multiple of 13 for minimum difference
$9+y-7-x=0$
$\Rightarrow x-y=2$

2. (a) putting n = 1, we get $2+\sqrt{3}$ = whose integral part is 3
putting n= 2, we get $(2+\sqrt{3})^2=4+3+4\sqrt{3}$
whose integral part is 11
which is again an odd number
Now, through the options it can be judged that the greatest integer must always be an odd number.

3. (c) LCM of 3 and 5 = 15
Number divisible by 15 are 15, 30, 45 .....300.
Let total numbers are n
$300=15+(n-1)\times15$
$300=15+15n-15$
$\Rightarrow n=20$

4. (b) $7!+8!+9!+10!+.....+100=7.6!+8.7.6!+9.8.7.6!+$ ..... + 100! is completely divisible by 7 as each of the terms contain at least one 7 in it.
Now, $1!+2!+3!+4!+5!+6!$
$=1+2+6+24+120+720=873$
which leaves a remainder of 5 when divided by 7.

5. (b) Divisor = [Sum of remainders]
– [Remainder when sum is divided]
$=11+21-4=28$

6. (a) $\because 56 = d_1 \times d_2$
$\therefore$ required remainder $= d_1r_2 + r_1$ where $d_1 = 7$ and $r_1 = 3$ and $r_2 = 5$.
i.e $7 \times 5 + 3 = 38$

7. (b) He wants to write from 1 to 999. He has to write 9 numbers of one digit, 90 numbers of two digits and 900 numbers of three digits.
Total number of times $= 1 \times 9 + 2 \times 90 + 3 \times 900 = 2889$

8. (a) $\therefore$ Complete remainder $= d_1d_2r_3 + d_1r_2 + r_1$
$= 3 \times 5 \times 4 + 3 \times 2 + 1 = 67$
Divided 67 by 8, 5 and 3, the remainders are 3, 3, 1.

9. (c) By actual division, we find that 999999 is exactly divisible by 13. The quotient 76923 is the required number.

10. (a) Let the number be z. Now $385 = 5 \times 7 \times 11$

5	z	Remainders
7	y	4
11	x	6
	102	10

$x = 11 \times 102 + 10 = 1132$
$y = 7x + 6 = 7 \times 1132 + 6 = 7930$
$z = 5y + 4 = 5 \times 7930 + 4 = 39654$

11. (b) Required Divisor = (sum of remainders)
– Remainder when sum is divided
$= [4375 + 2986] - 2361 = 5000$

12. (a) Since the given number is divisible by 5, so 0 or 5 must come in place of \$. But, a number ending with 5 is never divisible by 8. So, 0 will replace \$.
Now, the number formed by the last three digits is 4*0, which becomes divisible by 8, if * is replaced by 4.
Hence, digits in place of * and \$ are 4 and 0 respectively.

13. (c) $987 = 3 \times 7 \times 47$
So, required number must be divisible by each one of 3, 7, 47.
None of the numbers in (a) and (b) are divisible by 3, while (d) is not divisible by 7.
$\therefore$ Correct answer is (c).

14. (c) Since 111111 is divisible by each one of 7, 11 and 13, so each one of given type of numbers is divisible by each one of 7, 11, and 13. as we may write, $222222 = 2 \times 111111$, $333333 = 3 \times 111111$, etc.

15. (b) Complete remainder $= d_1r_2 + r_1$
$= 4 \times 4 + 1 = 17$
Now, 17 when divided successively by 5 and 4
$\therefore$ The remainders are 2, 3.

16. (a) Product of first sixty consecutive integers = 60!
$8 = 2 \times 2 \times 2 = 2^3$
highest power of 2 is 60!

$$= \left[\frac{60}{2}\right] + \left[\frac{60}{2^2}\right] + \left[\frac{60}{2^3}\right] + \left[\frac{60}{2^4}\right] + \left[\frac{60}{2^5}\right]$$

$= 30 + 15 + 7 + 3 + 1 = 56$

highest power of 80 or $(2^3) = \left[\frac{56}{3}\right] = 18$

17. (b) Unit digit in 7^4 is 1. So, unit digit in 7^{92} is 1.
$\therefore$ Unit digit in 7^{95} is 3.
Unit digit in 3^4 is 1.
$\therefore$ Unit digit in 3^{56} is 1.
$\therefore$ Unit digit in 3^{58} is 9.
$\therefore$ Unit digit in $(7^{95} - 3^{58}) = (13 - 9) = 4$.

18. (c) $55^3 + 17^3 - 72^3 = (55)^3 + (17)^3 - (55 + 17)^3$
$= 55^3 + 17^3 - [(55)^3 + (17)^3 + 3 \times 55 \times 17 \times 72]$
$= -3 \times 55 \times 17 \times 72$

19. (b) Number is of the form = 7n + 3; n = 1 to 13

$$\text{So, } S = \sum_{n=1}^{13}(7n+3) = \frac{7n(n+1)}{2} + 3n$$

Putting n = 13 we get $7 \times 13 \times 7 + 39 = 676$

20. (d) x is prime say 7
y is not prime but composite no. say 8, 9, 21
(a) $9 - 7 = 2$
(b) $7 \times 8 = 56$
(c) $\frac{21+7}{7} = 4$
Put x = 2 and y = 6 and check for the options.
By hit and trial all the 3 options can be proved wrong

21. (b) $2^{57} = (2^3)^{19} = 8^{19}$
$4^{38} = (4^2)^{19} = 16^{19}$
$4^{38} > 15^{19} > 2^{57}$

22. (c) Let four numbers are a, b, c, d, then
$a + b + c + d = 48$ ...(i)
and $a + 5 = b + 1$ ...(ii)
or, $a = b - 4$ ...(iii)
and $c - 3 = d - 7$ ...(iv)
$c = d - 4$ ...(v)
Substituting equations (iii) and (v) in equation (i) we get
$b - 4 + b + d - 4 + d = 48$
$b + d = 28$ ...(vi)
But we know,
$b + 1 = d - 7$
$\therefore \quad b = d - 8$
Substituting in equation (vi) we get
$d - 8 \neq d = 28$
$d = 18$
Solving this way we get a = 6, b = 10, c = 14 and d = 18

23. (c) $\frac{1}{\sqrt{7}-\sqrt{6}} - \frac{1}{\sqrt{6}-\sqrt{5}} + \frac{1}{\sqrt{5}-2} - \frac{1}{\sqrt{8}-\sqrt{7}} + \frac{1}{3-\sqrt{8}}$
$\Rightarrow$

$$\frac{1}{\sqrt{7}-\sqrt{6}} \times \frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}+\sqrt{6}} - \frac{1}{\sqrt{6}-\sqrt{5}} \times \frac{\sqrt{6}+\sqrt{5}}{\sqrt{6}+\sqrt{5}} + \frac{1}{\sqrt{5}-2}$$

$$\times \frac{\sqrt{5}+2}{\sqrt{5}+2} - \frac{1}{\sqrt{8}-\sqrt{7}} \times \frac{\sqrt{8}+\sqrt{7}}{\sqrt{8}+\sqrt{7}} + \frac{1}{3-\sqrt{8}} \times \frac{3+\sqrt{8}}{3+\sqrt{8}}$$

$$\Rightarrow \frac{\sqrt{7}+\sqrt{6}}{7-6} - \frac{\left(\sqrt{6}+\sqrt{5}\right)}{6-5} + \frac{\sqrt{5}+2}{5-4}$$

$$-\frac{\left(\sqrt{8}+\sqrt{7}\right)}{8-7}+\frac{3+\sqrt{8}}{9-8}$$

$\Rightarrow \sqrt{7}+\sqrt{6}-\sqrt{6}-\sqrt{5}+\sqrt{5}+2-\sqrt{8}-\sqrt{7}+3+\sqrt{8}$

$\Rightarrow 5$

24. (c) By squaring the given relations, we get (i) and (iii) are incorrect relations from the given statement.

25. (b) $\frac{a^3-b^3}{a^2+ab+b^2}=a-b=0.67-0.33=0.34$

26. (d) Number $=xy \Rightarrow y=2x$

$x+2x-2=\frac{1}{6}(10x+2x) \Rightarrow x=2 \Rightarrow y=4$

$\therefore$ Number = 24.

27. (b) L.C.M. (12, 16, 18, 21) = 1008

$\therefore$ Number to be added = 2(1008) – 2000 = 16

$\therefore$ Sum of digits = 1 + 6 = 7.

28. (a) $4-\cfrac{5}{1+\cfrac{1}{3+\cfrac{1}{2+\frac{1}{4}}}}=4-\cfrac{5}{1+\cfrac{1}{3+\frac{4}{9}}}$

$=4-\frac{5}{1+\frac{9}{31}}=4-\frac{5\times 31}{40}=\frac{32-31}{8}=\frac{1}{8}.$

29. (a) Let the value of positive number be x.

According to question,

$x^2-21x=100$

$\therefore \quad x^2-21x-100=0$

$\therefore \quad x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$=\frac{-(-21)\pm\sqrt{(-21)^2-4\times 1\times(-100)}}{2\times 1}$

$\Rightarrow \quad \frac{21\pm 29}{2}=\frac{50}{2},\frac{-8}{2} \Rightarrow 25,\ -4$

$\therefore$ The value of positive number = 25.

30. (c) Let first number be x and second number be y.

The number of wings = 2

Number of fingers in a hand = 5

According to question,

$x=\frac{(2+5\times 2)}{3}=\frac{12}{3}=4 \quad \therefore$ First number = 4

$\because$ Product of two numbers = 48

$\therefore \quad 4\times y=48$

$\therefore \quad y=\frac{48}{4}=12$

$\therefore$ Other number = 12.

31. (c) Let the number of oranges in the first basket be x. then, the number of oranges in the second basket be (640 – x).

According to question,

$\Rightarrow \quad x-\frac{x}{5}=(640-x)+\frac{x}{5}$

$\Rightarrow \quad \frac{4x}{5}=(640-x)+\frac{x}{5}$

$\Rightarrow \quad 640-x=\frac{4x}{5}-\frac{x}{5}$

$\Rightarrow \quad 640-x=\frac{3x}{5}$

$\Rightarrow \quad 3x=3200-5x$

$\Rightarrow \quad 8x=3200$

$\therefore \quad x=\frac{3200}{8}=400$

32. (c) The whole number is starting from 0 so (0, 1, 2 ... 110) are first 111 whole number

We know the sum of number $=\frac{n\times(n+1)}{2}$

Sum of the number $=\frac{110\times 111}{2}=6105$

So the unit digit is 5

33. (a) From 1 to 100 digit number

Total number of one digit number $=9\times 1=9$

Total number of two digit number $=9\times 10=90$

Total number of three digit number

$=9\times 10^2=900$

So like that total number of positive 100 digit number

$=9\times 1000 \ldots 99 \text{ times}=9\times 10^{99}$

34. (c) Taking $\sqrt[3]{12}$, $\sqrt[4]{29}$ and $\sqrt{5}$ from the given expression

LCM of 3, 4 and 2 = 12

(n^{th} root of the given expression)

So $(12)^{12/3}$, $(29)^{12/4}$, $(5)^{12/2}$

$\downarrow \qquad \downarrow \qquad \downarrow$

$12^4 \qquad 29^3 \qquad 5^6$

$12^4 \longrightarrow 20736, 29^3 \longrightarrow 24389, 5^6 \longrightarrow 15625$

So the right descending order is

$\frac{1}{\sqrt{5}}>\frac{1}{\sqrt[3]{12}}>\frac{1}{\sqrt[4]{29}}$

35. (a) LCM of 3, 4, 6 = 12

According to the question

When divided by 3, 4, 6 leaves the remainder 1, 2 and 4 respectively

So [3 – 1 = 4 – 2 = 5 – 3 = 2]

Common number is $12k-2$

Putting the value k = 8

The common number = $12 \times 8 - 2 = 94$

So dividing by 5,

The remainder equals to 4

36. (c) Given $A + B + AB = 65$

Let $A = 10, B = 5$ $(\because B \le 15)$

$\therefore \quad A - B = 10 - 5 = 5$

37. (b) Given

$$\sqrt{4600 + \sqrt{540 + \sqrt{1280 + \sqrt{250 + \sqrt{36}}}}}$$

$$\sqrt{4600 + \sqrt{540 + \sqrt{1280 + \sqrt{250 + 6}}}}$$

$$\sqrt{4600 + \sqrt{540 + \sqrt{1280 + 16}}}$$

$$\sqrt{4600 + \sqrt{540 + \sqrt{1296}}}$$

$$\sqrt{4600 + \sqrt{540 + 36}}$$

$$\sqrt{4600 + \sqrt{576}}$$

$$\sqrt{4600 + 24}$$

$$\sqrt{4624} = 68$$

38. (c) Let us say

total no. of candidate applied = $3x$

and selected candidate = $2x$

According to question

$$\frac{3x - 50}{2x - 25} = \frac{13}{9}$$

$27x - 450 = 26x - 325$

$x = 125$

So total no. of candidate applied = $3 \times 125 = 375$

39. (d) Ratio of $\frac{c}{a} = \frac{5}{2}$ ... (i)

According to question

$$b = \frac{5}{2} - \frac{7}{4} = \frac{3}{4}$$

so, $a + c = \frac{23}{12} - \frac{9}{12} = \frac{14}{12} \Rightarrow a + c = \frac{7}{6}$ ... (ii)

from (i) and (ii)

$$a + \frac{5}{2}a = \frac{7}{6} \Rightarrow \frac{7a}{2} = \frac{7}{6}$$

$$a = \frac{1}{3},\ c = \frac{5}{2} \times \frac{1}{3} = \frac{5}{6}$$

$$\therefore\ c - a = \frac{5}{6} - \frac{1}{3} = \frac{1}{2}$$

40. (b) By option method

$$(\sqrt{2} + \sqrt{5} - \sqrt{3})k = -12$$

$\downarrow \quad \downarrow \quad \downarrow$

$1.4 + 2.2 - 1.7$

$\approx 2k = -12$

$k = -6$

Option (a) is not possible because all are positive and their sum is 5.

Option (b) is posible because

$(\sqrt{2} + \sqrt{5} + \sqrt{3})(2 - \sqrt{10})$

$(1.4 + 2.2 + 1.7)(2 - 3.16)$

$(5.2) \times (-1.16) \approx -6$

41. (b) Number = $[\text{LCM}(12, 16, 18, 20, 25)] \times k + 4$

$\downarrow$

$= [144 \times 25] \times k + 4$

or $= 3600k + 4$

This expression should be divisible by 7, according to question.

For $k = 5$

$\therefore$ The actual number $= 3600 \times 5 + 4$

$= 18004$

$\rightarrow$ Thousands place

So, digit at thousands place = 8

42. (d) Let no be $10a + b$

so according to question

$$(a + b) = \frac{1}{7}[10a + b]$$

$(7a + 7b) = 10a + b$

$3a = 6b \Rightarrow a = 2b$ ... (i)

$a - b = 4$ ... (ii)

from (i) and (ii) a = 8, b = 4

number $(10a + b) = 84$

after reversing the no = 48

after dividing remainder by $7 = \frac{48}{7} = 6$

43. (c) $30\,a\,68\,b$

When a number is divisible by 11, then the difference of sum of odd places digits and the sum of even places digits is 0 or multiple of 11.

$(8 + a + 3) - (b + 6 + 0)$

$= (11 + a) - (6 + b)$

From the option,

If $b = 3$ then, $a = 9$

and it will divisible by 11.

44. (d) Balance money $y = 100 - 20 =$ ₹ 80

Ratio of ₹ 2, ₹ 5 and ₹ 10 coins = 5 : 4 : 1

$\therefore$ Total amount $= 5 \times 2 + 4 \times 5 + 10 \times 1$

$= 10 + 20 + 10 = 40$

According to the question,

$40 \rightarrow 80$

$1 \rightarrow 2$

$\therefore$ Number of ₹ 5 coins $= 2 \times 4 = 8$

45. (d) $90 \div 20 \text{ of } 6 \times [11 \div 4 \text{ of } \{3 \times 2 - (3-8)\}] \div (9 \div 3 \times 2)$

$\Rightarrow 90 \div 120 \times [11 \div 4 \text{ of } \{6+5\}] \div (3 \times 2)$

$\Rightarrow \frac{3}{4} \times [11 \div 4 \times 11] \div 6$

$\Rightarrow \frac{3}{4}[11 \div 44] \div 6$

$\Rightarrow \frac{3}{4} \times \frac{1}{4} \div 6$

$\Rightarrow \frac{3}{4} \times \frac{1}{24}$

$\Rightarrow \frac{1}{32}$

46. (b) 239685 is the graetest number which is divisible by 3 but not by 9.

$2+3+9+6+8+5 = 33$ is divisible by 3.

47. (c) $\frac{372}{56} \times 7 - 5 + 2 = \frac{93}{2} - 5 + 2$

$= \frac{93-10+4}{2} = \frac{87}{2} = 43\frac{1}{2}$

48. (c) $\frac{b}{5} + \frac{3g}{20} = 90$

$4b + 3g = 1800 \quad \ldots(1)$

$\frac{4b}{5} = 70 + \frac{17g}{20}$

$\frac{4b}{5} = \frac{1400+17g}{20}$

$16b = 1400 + 17g$

$16b - 17g = 1400 \quad \ldots(2)$

Multiply eq. (1) by 4,

$16b + 12g = 7200$

$16b - 17g = 1400$

$(-) \quad (+) \quad -$

$29g = 5800$

$g = 200$

$4b = 1200 \Rightarrow b = 300$

Total number of students = 200 + 300 = 500

49. (a) $\frac{5}{11} = 0.45$ (Least value)

$\frac{7}{12} = 0.58$

$\frac{8}{13} = 0.62$

$\frac{9}{17} = 0.53$

50. (b) $\left(99+\frac{11}{99}\right) + \left(99+\frac{13}{99}\right) + \left(99+\frac{15}{99}\right) + \ldots + \left(99+\frac{67}{99}\right)$

To find number of terms,

$67 = 11 + (n-1) \times 2$

$\Rightarrow (n-1) = \frac{56}{2} = 28$

$\Rightarrow n = 29$ terms.

$\therefore 99 \times 29 + \frac{1}{99}(11+13+15+\ldots.+67)$

$= 2871 + \frac{1}{99} \times \frac{29}{2} \times (11+67) = 2871 + \frac{29}{99} \times 39$

$= \frac{284229+1131}{99} = \frac{285360}{99} = \frac{95120}{33}$

51. (c) $\frac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}} \div \frac{\sqrt{14}+\sqrt{10}}{\sqrt{14}-\sqrt{10}} + \frac{\sqrt{10}}{\sqrt{5}}$

$\Rightarrow \left(\frac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}}\right) \div \frac{\sqrt{2}(\sqrt{7}+\sqrt{5})}{\sqrt{2}(\sqrt{7}-\sqrt{5})} + \frac{\sqrt{2}\sqrt{5}}{\sqrt{5}}$

$\Rightarrow 1 + \sqrt{2} = \sqrt{2} + 1$

52. (a) $6 < \sqrt[3]{N} < 7$

$\Rightarrow 216 < N < 343$

Hence, N take value = $(343 - 216 + 1) - 2 = 126$

53. (b) $\frac{\sqrt{29.16}}{\sqrt{1.1664}} + \frac{\sqrt{0.2916}}{\sqrt{116.64}} + \frac{\sqrt{0.0036}}{\sqrt{0.36}}$

$= \left[\frac{54}{10} \times \frac{100}{108}\right] + \left[\frac{54}{100} \times \frac{10}{108}\right] + \left[\frac{6}{100} \times \frac{10}{6}\right]$

$= \frac{5}{1} + \frac{1}{20} + \frac{1}{10} = \frac{103}{20}$

54. (d) Let the number is $10x + y$

$\therefore 10y + x = 10x + y - 36$

$\Rightarrow x - y = 4 \quad \ldots(i)$

From (i) : $x - y = 4$ correct.

From (ii) : $48 = 84 - 36 = 48$ correct.

From (iii) : $37 = 73 - 36 = 37$

As, 37 and 73 are prime number, so it is not correct.

55. (a) $S_1 = 2, 9, 16, \ldots 632.$

$S_2 = 7, 11, 15, \ldots 743.$

Let S_3 be the series of common terms between S_1 & S_2

$S_3 = (23, 51, 79, \ldots)$

For finding the n^{th} term of S_3 we assume

$a_{22} = a + 21d = 23 + 21\,(28) \qquad \{d = a_2 - a_1\}$

$a_{22} = 611$

$$S_n = \frac{n}{2}(2a + (n+1) \times d)$$

$$= \frac{22}{2}[2(23) + (22-1) \times 28]$$

$$\Rightarrow 11 \times 634 \Rightarrow 6974$$

56. (b) $\sqrt[3]{12} = (12)^{1/3} = (12^4)^{1/12} = (20736)^{1/12}$

Using options

(a) $(121)^{1/6} = (121^2)^{1/12} = (14,641)^{1/12}$

(b) $(33214)^{1/12}$

Clearly option (b) is greater than $\sqrt[3]{12}$

57. (*) $A = \dfrac{\sqrt{0.0004} \times \sqrt[3]{0.000008}}{\sqrt[4]{16000} \times \sqrt[3]{125000} \times \sqrt[4]{810}}$;

$$B = \frac{\sqrt[3]{0.729} \times \sqrt[4]{0.016}}{\sqrt{0.16}}$$

$$A = \frac{\frac{2}{100} \times \frac{2}{100}}{2 \times 50 \times 3 \times \sqrt[4]{1000} \times \sqrt[4]{10}} = \frac{4}{3 \times 10^7}$$

$$B = \frac{\frac{9}{10} \times \frac{2}{10}}{\frac{4}{10}}$$

$$\therefore A \times B = \frac{4}{3 \times 10^7} \times \frac{9}{2 \times 10^1} = 6 \times 10^{-8}$$

58. (d) $1 \times 2 + 2 \times 3 + 3 \times 4 + 4 \times 5 + \ldots$

We will find the 20th term i.e.

$n(n+1) = 20(20+1) = 20 \times 21$

Now, $1 \times 2 + 2 \times 3 + 3 \times 4 \ldots + n(n+1)$

$$= \frac{n(n+1)(n+2)}{3}$$

According to question,

$1 \times 2 + 2 \times 3 + 3 \times 4 \ldots + n(n+1)$

$$= \frac{20(20+1)(20+2)}{3}$$

$$= \frac{9240}{3} = 3080$$

59. (b) $\left[\frac{7}{2} + \frac{7}{6} + \frac{7}{12} \ldots + \frac{7}{156}\right] + \left[\frac{11}{3} + \frac{11}{15} + \frac{11}{35} \ldots + \frac{11}{575}\right]$

$$= 7\left[\frac{1}{1 \times 2} + \frac{1}{2 \times 3} \ldots + \frac{1}{12 \times 13}\right] + \frac{11}{2}\left[\frac{1}{1} - \frac{1}{3} + \frac{1}{3} - \frac{1}{5} \ldots \frac{1}{23} - \frac{1}{25}\right]$$

$$= 7\left[\frac{1}{1} - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} \ldots \frac{1}{12} - \frac{1}{13}\right] + \frac{11}{2}\left[\frac{1}{1} - \frac{1}{25}\right]$$

$$= 7\left[\frac{1}{1} - \frac{1}{13}\right] + \frac{11}{2}\left[\frac{1}{1} - \frac{1}{25}\right]$$

$$= \frac{3816}{325}$$

60. (d) 6 occurs exactly twice between 400 – 499 = 466

6 occurs exactly twice between 500 – 599 = 566

6 occurs exactly twice between 600 – 699 = 606, 616, 626, 636, 646, 656, 676, 686, 696, 660, 661, 662, 663, 664, 665, 667, 668, 669

Hence, 6 occurs exactly twice from 400 – 700 = 20 numbers

61. (a) $A = 0.3\overline{12}$

$990A = 309$

$A = \dfrac{309}{990}$

$B = 0.4\overline{15}$

$990B = 411$

$B = \dfrac{411}{990}$

$C = 0.30\overline{9} \Rightarrow C = \dfrac{279}{900}$

$A + B + C = \dfrac{3423}{3300} = \dfrac{1141}{1100}$

62. (d) Total number from 53 to 97 = (97 – 53) + 1 = 45

Prime numbers between 53 to 97 = 10

Composite number = 45 – 10 = 35

63. (c) $(49^{15} - 1)$

$\rightarrow (7^2)^{15} - (1^2)^{15} \rightarrow (7^{30} - 1^{30})$

$a^n - b^n$ is divisible by $(a + b)$ if n is even.

$= 7 + 1 = 8$

64. (a) $(17)^3 + (7)^3 = 24(17^2 + 7^2 - k)$

$(17 + 7)(17^2 + 7^2 - 119) = 24(17^2 + 7^2 - k)$

$\because \; a^3 + b^3 = (a + b)/(a^2 + b^2 - ab)$

$(24)(219) = 24(338 - k)$

$k = 119$

65. (c) $\dfrac{(17)^3 - (7)^3}{17^2 + 7^2 + P} = \dfrac{40}{4}$

$(17)^3 - (7)^3 = 10(17^2 + 7^2 + P)$

$(17 - 7)(17^2 + 7^2 + 119) = 10(289 + 49 + P)$

$10(457) = 10(338 + P)$

$P = 119$

66. (b) $A=\frac{58^2-25^2}{46^2-37^2}, B=\frac{26^2-15^2}{56^2-15^2}$

$A=\frac{(58+25)(58-25)}{(46+37)(46-37)}$

$A=\frac{83\times 33}{83\times 9}=\frac{11}{3}$

$B=\frac{(26+15)(26-15)}{(56+15)(56-15)}$

$B=\frac{41\times 11}{71\times 41}=\frac{11}{71}$

$\frac{1}{B}-\frac{20}{A}=,$

$=\frac{71}{11}-20\times\frac{3}{11}=\frac{71}{11}-\frac{60}{11}=\frac{11}{11}\Rightarrow 1$

67. (c) As, 11p9q4 is divisible by 24.
So, pq4 is divisible by 8 for q = 4, 8
As, 11p9q4 is divisible by 3
So, p + q = 15 for greatest possible value.
Now p = 7 and q = 8 for greatest possible value.
pq $\Rightarrow 7\times 8\Rightarrow 56$

68. (c) $\frac{\sqrt{1.24}\times\sqrt{2.79}}{\sqrt{2.64}\times\sqrt{5.94}}$

$\Rightarrow\frac{2\sqrt{0.31}\times 3\sqrt{0.31}}{2\sqrt{0.66}\times 3\sqrt{0.66}}$

$\Rightarrow\frac{31}{61}$

69. (c) $\left[\frac{1}{8}+\left\{\frac{1}{6}\times\left(\frac{36}{45}\div\frac{24}{25}\right)-\left(\frac{12}{21}\times\frac{14}{15}\div\frac{24}{45}\right)\right\}+\frac{27}{36}\right]$

$\Rightarrow\left[\frac{1}{8}+\left\{\left(\frac{1}{6}\times\frac{5}{6}\right)-1\right\}+\frac{27}{36}\right]$

$\Rightarrow\left[\frac{1}{8}+\left\{\frac{5}{36}-1\right\}+\frac{27}{36}\right]$

$\Rightarrow\left[\frac{1}{8}+\left(-\frac{31}{36}\right)+\frac{27}{36}\right]$

$\Rightarrow\left[\frac{1}{8}-\frac{4}{36}\right]$

$\Rightarrow\left[\frac{1}{8}-\frac{1}{9}\right]$

$\Rightarrow\frac{1}{72}$

70. (b) A number is divisible by 3 if sum of digits of the number is divisible by 3.
A number is divisible by 11 if the difference of the sum of digits at odd position and sum of digits at even position in a number is 0 or 11.
Only 35508 and 35580 is divisible by 3.
Now check for 11-
$|(3+5+8)-(5+0)|=|16-5|=11$
$|(3+5+0)-(5+8)|=|8-13|=5$
(Not divisible)
So, 35508 is divisible by 11.
Hence, 35508 is divisible by 33.

71. (d) $0.08-\{3.5-4.9-(12.5-7.8-4.6)\}$
$=0.08-\{-1.4-0.1\}$
$=0.08+1.5=1.58$

72. (a) Let $x=\sqrt{20-\sqrt{20-\sqrt{20-\sqrt{20-...\infty}}}}$

$\Rightarrow x=\sqrt{20-x}$
By squaring both sides
$\Rightarrow x^2=20-x$
$\Rightarrow x^2+x-20=0$
$\Rightarrow x^2+5x-4x-20=0$
$\Rightarrow (x+5)(x-4)=0$
$\Rightarrow x=4,-5$ (x cannot be negative)
$\therefore x=4$

73. (b) $2+9+1+8+2+4+5=31$
So, this number is not divisible by 3, 9 and 12
and, $2+1+2+5=10,\ 9+8+4=21$
$\therefore 21-10=11$
So, 2918245 is divisible by 11.

74. (c) $[76-\{90\div 5\times(24-36\div 3)\div 3\}]$

$=\left[76-\left\{\frac{90}{5}\times\frac{12}{3}\right\}\right]$

$=76-18\times 4$

$=76-72=4$