NIMCET MCA
Solved Paper 2009

Mathematics

1. If $\theta = \tan^{-1}\frac{1}{1+2} + \tan^{-1}\frac{1}{1+(2)(3)} + \tan^{-1}\frac{1}{1+(3)(4)}$ $+\ldots+\tan^{-1}\frac{1}{1+n(n+1)}$, then $\tan\theta$ is equal to

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

2. If the distance of any point (x, y) from the origin is defined as $d(x, y) = \max(|x|, |y|)$, then the locus of the point (x, y), where $d(x, y) = 1$, is

(a) a square of area 1 sq unit
(b) a circle of radius 1 unit
(c) a triangle
(d) a square of area 4 sq units

3. The number of solutions for

$$\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2} \text{ is}$$

(a) zero (b) one
(c) two (d) infinite

4. Let ABC be an isosceles triangle with $AB = BC$. If base BC is parallel to x-axis and m_1, m_2 are slopes of medians drawn through the angular points B and C, then

(a) $m_1 m_2 = -\frac{1}{2}$
(b) $m_1 - m_2 = 0$
(c) $m_1 - m_2 = 2$
(d) $(m_1 - m_2)^2 + 2m_1m_2 = 0$

5. If $a + b + c \neq 0$, then the system of equations
$(b + c)(y + z) - ax = b - c$
$(c + a)(z + x) - by = c - a$
$(a - b)(x + y) - cz = a - b$ has

(a) a unique solution
(b) no solution
(c) infinite number of solutions
(d) finitely many solutions

6. The value of $\int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x}\, dx$ is

(a) $\frac{\pi^2}{3}$ (b) $\frac{\pi^2}{4}$
(c) $\frac{\pi^2}{6}$ (d) $\frac{\pi^2}{2}$

7. If $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$, then x is

(a) $\frac{1}{6}$ (b) $\frac{1}{3}$
(c) $\frac{1}{2}$ (d) $\frac{1}{4}$

8. If $A = \cos^2\theta + \sin^4\theta$, then for all values of θ

(a) $1 \leq A \leq 2$ (b) $\frac{13}{16} < A \leq 1$
(c) $\frac{3}{4} \leq A \leq \frac{13}{16}$ (d) $\frac{3}{4} \leq A \leq 1$

9. A man has 5 coins, two of which are double-headed, one is double-tailed and two are normal. He shuts his eyes, picks a coin at random and tosses it. The probability that the lower face of the coin is a head is

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

10. How many different paths in the xy-plane are there from $(1, 3)$ to $(5, 6)$ if a path proceeds one step at a time by going either one step to the right (R) or one step upwards (U)?

(a) 35
(b) 40
(c) 45
(d) None of the above

11. Water runs into a conical tank of radius 5 ft and height 10 ft, at a constant rate of 2 ft^3/min. How fast is the water level rising when the water is 6 ft deep?

(a) $\frac{2}{9}$ ft/min (b) $\frac{2}{9\pi}$ ft/min
(c) $\frac{2\pi}{9}$ ft/min (d) $\frac{\pi}{9}$ ft/min

12. The vector $\mathbf{B} = 3\mathbf{i} + 4\mathbf{k}$ is to be written as the sum of a vector $\mathbf{B}_1$ parallel to $\mathbf{A} = \mathbf{i} + \mathbf{j}$ and a vector $\mathbf{B}_2$ perpendicular to $\mathbf{A}$, then $\mathbf{B}_1$ is

(a) $\frac{3}{2}(\mathbf{i} + \mathbf{j})$ (b) $\frac{2}{3}(\mathbf{i} + \mathbf{j})$
(c) $\frac{1}{2}(\mathbf{i} + \mathbf{j})$ (d) None of these

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13. A and B are independent witnesses in a case. The probability that A speaks the truth is 'x' and that B speaks the truth is 'y'. If A and B agree on a certain statement, the probability that the statement is true is

(a) $\frac{xy}{xy+(1-x)(1-y)}$ (b) $\frac{xy}{(1-x)(1-y)}$

(c) $\frac{(1-x)(1-y)}{xy+(1-x)(1-y)}$ (d) $\frac{(1-x)(1-y)}{xy}$

14. There are 10 points in a plane. Out of these, 6 are collinear. The number of triangles formed by joining these points is

(a) 100 (b) 120
(c) 150 (d) None of these

15. The straight lines $\frac{x}{a}-\frac{y}{b}=k$ and $\frac{x}{a}+\frac{y}{b}=\frac{1}{k}$, $k\neq 0$ meet on

(a) a parabola (b) an ellipse
(c) a hyperbola (d) a circle

16. The total number of relations that exist from the set A with m elements into the set $A\times A$ is

(a) m^2 (b) m^3
(c) m (d) None of these

17. Let A and B be two events such that $P(\overline{A\cup B})=\frac{1}{6}$, $P(A\cap B)=\frac{1}{4}$ and $P(\overline{A})=\frac{1}{4}$. Then events A and B are

(a) independent but not equally likely.
(b) mutually exclusive and independent.
(c) equally likely and mutually exclusive.
(d) equally likely but not independent.

18. If $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$, then $I+A+A^2+\ldots\infty$ equals to

(a) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ (b) $\begin{bmatrix}-1 & -2\\ -3 & -4\end{bmatrix}$

(c) $\begin{bmatrix}\frac{1}{2} & -\frac{1}{3}\\ -\frac{1}{2} & 0\end{bmatrix}$ (d) $\begin{bmatrix}-\frac{1}{4} & \frac{1}{3}\\ 1 & 0\\ 2 & \end{bmatrix}$

19. A square with side 'a' is revolved about its centre through 45^0. What is the area common to both the squares?

(a) $2(\sqrt{2}-1)a^2$ sq units
(b) $\frac{(\sqrt{2}+1)a^2}{2}$ sq units
(c) $(\sqrt{3}-1)a^2$ sq units
(d) $(\sqrt{5}-1)a^2$ sq units

20. If $P=\{(4^n-3n-1)|n\in N\}$ and $Q=\{(9n-9)|n\in N\}$, then $P\cup Q$ is equal to

(a) N (b) P
(c) Q (d) None of these

21. Let $f(x)=[x^2-3]$ where [ ] denotes the greatest integer function. Then the number of points in the interval (1, 2) where the function is discontinuous is

(a) 4 (b) 2
(c) 6 (d) None of these

22. If $\mathbf{a},\mathbf{b}$ and $\mathbf{c}$ are unit vectors, then $|\mathbf{a}-\mathbf{b}|^2+|\mathbf{b}-\mathbf{c}|^2+|\mathbf{c}-\mathbf{a}|^2$ does not exceed

(a) 9 (b) 4
(c) 8 (d) 6

23. If $2x^4+x^3-11x^2+x+2=0$, then the values of $x+\frac{1}{x}$ are

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

24. If A is a 3×3 matrix with $\det(A)=3$, then $\det(\text{adj } A)$ is

(a) 3 (b) 9
(c) 27 (d) 6

25. If $x<-1$ and $2^{|x+1|}-2x=|2^x-1|+1$, then the value of x is

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

26. If $\sin^{-1}x+\cos^{-1}(1-x)=\sin^{-1}(-x)$, then x satisfies the equation

(a) $2x^2-x+2=0$ (b) $2x^2-3x=0$
(c) $2x^2+x-1=0$ (d) None of these

27. $\mathbf{a},\mathbf{b},\mathbf{c}$ are non-coplanar unit vectors such that $\mathbf{a}\times(\mathbf{b}\times\mathbf{c})=\frac{\mathbf{b}+\mathbf{c}}{\sqrt{2}}$, then the angle between $\mathbf{a}$ and $\mathbf{b}$ is

(a) $\frac{\pi}{4}$ (b) $\frac{3\pi}{4}$
(c) $\frac{\pi}{2}$ (d) π

28. The equation $\sin^4 x+\cos^4 x+\sin 2x+\alpha=0$ is solvable for

(a) $-\frac{1}{2}\le\alpha\le\frac{1}{2}$ (b) $-3\le\alpha\le 1$
(c) $-\frac{3}{2}\le\alpha\le\frac{1}{2}$ (d) $-1\le\alpha\le 1$

29. A and B throw a die in succession to win a bet with A starting first. Whoever throws '1' first wins an amount of ₹ 110. What are the respective expectations of A and B?

(a) ₹ 70 and ₹ 40 (b) ₹ 60 and ₹ 50
(c) ₹ 75 and ₹ 35 (d) None of these

30. The probability that a man who is 85 yr old will die before attaining the age of 90 yr is 1/3. A_1, A_2, A_3 and A_4 are four persons who are 85 yr old. The probability that A_1 will die before attaining the age of 90 yr and will be the first to die is

(a) $\frac{65}{81}$ (b) $\frac{13}{81}$
(c) $\frac{65}{324}$ (d) $\frac{13}{108}$

31. Find the value of k in the equation $x^3-6x^2+kx+64=0$, if it is known that the roots of the equation are in geometric progression.

(a) 24 (b) 16
(c) -16 (d) -24

32. If $(1+x-2x^2)^6 = 1 + a_1x + a_2x^2 + \ldots + a_{12}x^{12}$, then the value of $a_2 + a_4 + a_6 + \ldots + a_{12}$ is
(a) 1024 (b) 64
(c) 32 (d) 31

33. The smaller of the areas bound by $y = 2 - x$ and $x^2 + y^2 = 4$, is
(a) $(\pi - 1)$ sq units (b) $(\pi - 2)$ sq units
(c) $(2\pi - 1)$ sq units (d) $(2\pi - 2)$ sq units

34. The number of distinct integral values of 'a' satisfying the equation $2^{2a} - 3(2^{a+2}) + 2^5 = 0$ is
(a) 0 (b) 1
(c) 2 (d) 3

35. A_1, A_2, A_3 and A_4 are subsets of a set U containing 75 elements with the following properties : Each subset contains 28 elements; the intersection of any two of the subsets contains 12 elements; the intersection of any three of the subsets contains 5 elements; the intersection of all four subsets contains 1 element. The number of elements belonging to none of the four subsets is
(a) 15 (b) 17
(c) 16 (d) 18

36. From 50 students taking examination in Mathematics, Physics and Chemistry, 37 passed Mathematics, 24 Physics and 43 Chemistry. Atmost 19 passed Mathematics and Physics, atmost 29 Mathematics and Chemistry and atmost 20 Physics and Chemistry. The largest possible number that could have passed all three examinations is
(a) 10 (b) 12
(c) 9 (d) None of these

37. If $y = f(x)$ is an odd and differentiable function defined on $(-\infty, \infty)$ such that $f'(3) = -2$, then $f'(-3)$ equals to
(a) 4 (b) 2
(c) -2 (d) 0

38. An open-top box is to be made out of a piece of cardboard measuring 6m × 6m by cutting off equal squares from the corners and turning up the sides. The height of the box for maximum volume is
(a) 2 m (b) 2.5 m
(c) 1.2 m (d) None of these

39. An anti aircraft gun can take a maximum of four shots at an enemy plane moving away from it. The probabilities of hitting the plane at first, second, third and fourth shot are 0.4, 0.3, 0.2 and 0.1 respectively. The probability that the gun hits the plane then is
(a) 0.6972 (b) 0.6978
(c) 0.6976 (d) 0.6974

40. A set contains $(2n + 1)$ elements. If the number of subsets which contain at most n elements is 4096, then the value of n is
(a) 28 (b) 21
(c) 15 (d) 6

Analytical Ability & Logical Reasoning

41. Bala had three sons. He had some chocolates which he distributed among them. To his eldest son, he gave 3 chocolates more than half the number of chocolates with him. To his second eldest son, he gave 4 chocolates more than one-third of the remaining number of chocolates with him. To his youngest son, he gave 4 chocolates more than one-fourth of the remaining number of chocolates with him. He was left with 11 chocolates. How many chocolates did he initially have?
(a) 180 (b) 78
(c) 144 (d) 120

42. How long would it take you to count 1 billion orally if you could count 200 every minute and were given a day off every four years? Assume that you start counting on 1 January 2001.
(a) 10 yr, 107 days, 5 h, 20 min
(b) 8 yr, 287 days, 15 h, 40 min
(c) 9 yr, 187 days, 5 h, 20 min
(d) 9 yr, 278 days, 12 h, 34 min

43. Find the value of 'x', if
$$\left(\frac{1}{2^{\log_x 4}}\right)\left(\frac{1}{2^{\log_x 16}}\right)\left(\frac{1}{2^{\log_x 256}}\right)\ldots\infty = 2$$
(a) 2 (b) 1/2
(c) 4 (d) 1/4

44. Find the unit digit of $(13687)^{3265}$.
(a) 1 (b) 3
(c) 7 (d) 9

45. How many pairs of letters are there in the word 'PRISON', each of which has as many letters between its two letters in the word as there are between them in the English alphabet?
(a) Two (b) One
(c) Four (d) Three

46. Twelve villages in a district are divided into 3 zones with 4 villages per each zone. The telephone department of the district intends to connect the villages with telephone lines such that every two villages in the same zone are connected with three direct lines and every two villages belonging to different zones are connected with two direct lines. How many direct lines are required?
(a) 210 (b) 96
(c) 54 (d) 150

47. Cars are safer than planes. Fifty per cent of plane accidents result in death, while only one percent of car accidents result in death.

Which of the following, if true, would most seriously weaken the argument above?
(a) Planes are inspected more often than cars.
(b) The number of car accidents is several hundred thousand times higher than the number of plane accidents.
(c) Pilots never fly under the influence of alcohol, while car drivers often do.
(d) Plane accidents are usually the fault of air traffic controllers, not of pilots.

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48. Sum of all three digit numbers (no digit being zero) having the property that all digits are perfect squares is
(a) 3108 (b) 6216
(c) 13986 (d) None of these

49. A teacher gave a student the task of adding 'N' natural numbers starting from 1. After a while, the student reported his result as 700. The teacher replied that his result was wrong. The student realized that he has added one number twice by mistake. Find the sum of the digits of the number which the student had added twice.
(a) 5 (b) 6
(c) 7 (d) 8

50. Computer A takes 3 min to process an input while computer B takes 5 min. If computers A, B and C can process an average of 14 inputs in one h, how many minutes does computer C alone take to process one input?
(a) 10 (b) 4
(c) 6 (d) None of these

51. Arrange the following statements P, Q, R, and S in a logical order to make a sensible paragraph.
P: The logic that underlines this is two-fold.
Q: RBI is likely to cut bank rate and CRR.
R: Over the last few years, RBI has tried to implement policy changes.
S: According to sources, bank rate will be cut in April.
(a) QRPS (b) RPSQ
(c) QSRP (d) SPQR

52. If $A+B=C+D$, $B+D=2A$, $D+E>A+B$, $C+D>A+E$, then which of the following is true?
(a) $D>B>E>A>C$
(b) $A>B>D>E>C$
(c) $A>D>B>E>C$
(d) $D>A>B>E>C$

53. Reena visited her High School friend, Natasha after their 25th school reunion. " What a nice pair of children you have, are they twins?" Reena asked.
"No my sister is older than I", said Natasha's son Rahul.
"The square of my age plus the cube of her age is 7148".
"The square of my age plus the cube of his age is 5274", said Preeti, Natasha's daughter.
How old were they?
(a) Preeti 23, Rahul 14
(b) Preeti 18, Rahul 16
(c) Preeti 21, Rahul 19
(d) Preeti 19, Rahul 17

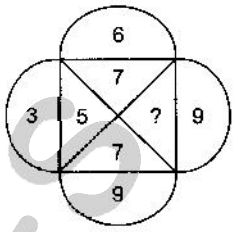
54. What will come in place of the question mark (?) in the following series?

12 22 69 272 1365 ?

(a) 8196 (b) 8195
(c) 6830 (d) 8184

55. Divide ₹ 1074 (in whole ₹ having incremental amounts) into a number of bags so that I can ask for any amount between ₹ 1 and ₹ 1074 and you can give me the proper amount by selecting a certain number of these bags without opening them. What is the minimum number of bags you will require?
(a) 12 (b) 10
(c) 9 (d) 11

56. Which number will be there in the place of question mark (?) in the following figure?



(a) 5 (b) 6
(c) 4 (d) 8

57. The remainder when $x=1!+2!+3!+\ldots+100!$ is divided by 240 is
(a) 153 (b) 33
(c) 73 (d) 187

58. Using the digits 1, 5, 2, 8 all possible four digit numbers are formed and the sum of all such numbers is between
(a) 10000 and 2000
(b) 20000 and 50000
(c) 50000 and 100000
(d) 100000 and 150000

59. The sum of the numbers from 1 to 100, which are not divisible by 3 and 5, is
(a) 2946 (b) 2732
(c) 2632 (d) 2317

60. A motorboat going downstream a river passes a raft (freely floating with the river current) at a certain point 'A'. Exactly one hour later it turned back and after some time while coming upstream it passed the same raft at a point 'B' situated at a distance of 6 km from point 'A'. What is the speed of the water current in the river expressed in km/h?
(a) 2.0 (b) 3.0
(c) 4.0 (d) 6.0

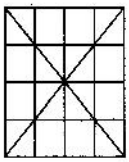
61. You are in the land logic, where there are 3 types of rabbits. Blue rabbits always tell the truth, green rabbits sometimes tell the truth and red rabbits never tell the truth. Assume you cannot distinguish colours. A rabbit says to you "I always lie". What colour of rabbit is speaking to you?
(a) Blue
(b) Red
(c) Green
(d) Cannot be concluded

62. It is wrong for doctors to lie about their patients illnesses? Aren't doctors just like any other people we hire to do a job for us? Surely, we would not tolerate not being told the truth about the condition of our automobile from the mechanic we hired to fix it, or the condition of our roof from the carpenter we employed to repair it. Just as these workers would be guilty of violating their good faith contracts with us if they were to do this, doctors who lie to their patients about their illnesses violate these contracts as well, and this is clearly wrong.
The conclusion of the argument is best expressed by which of the following?

(a) Doctors who lie to their patients about their illnesses violate their good faith contracts with their patients.
(b) Doctors often lie to their patients about their illnesses.
(c) It is wrong for doctors to lie about their patients illnesses.
(d) Doctors, like mechanics and carpenters, enter into good faith contracts with us when we hire them.

63. All the letters of the word 'INDIA' are permuted in all possible ways and the words so formed are written as in dictionary, then the 58th word in the list is
(a) NIIDA (b) INIDA (c) NIDIA (d) NIDAI

64. Identify the number of triangles in the figure given below.



(a) 44 (b) 48 (c) 36 (d) 32

Direction (Q. No. 65) *Choose the ordered pair of statements (P to S) where the first statement implies the second and two statements are logically consistent with the main statement.*

65. Each time Sachin is the captain India loses.
P. Sachin is the captain
Q. India did not win
R. Sachin is not the captain
S. India won
(a) PS (b) SR
(c) SP (d) RP

66. If all the 6's are replaced by 9's, then the algebraic sum of all the numbers from 1 to 100 (both inclusive), varies by
(a) 330 (b) 333
(c) 219 (d) 279

67. Recently, while in Bengaluru, I decided to walk down the escalator of a tube station. I did some quick calculation in my mind. I found that if I walk down twenty-six steps, I require thirty seconds to reach the bottom. However, if I am able to step down thirty-four stairs I would only require eighteen seconds to get to the bottom. If the time is measured from the moment the top step begins to descend to the time I step off the last step at the bottom, what is the height of the stairway in steps?
(a) 40 (b) 46
(c) 52 (d) 58

68. When you reverse the digits of the number 13, the number increases by 18. How many other two-digit numbers increase by 18 when their digits are reversed?
(a) 5 (b) 6
(c) 7 (d) 8

69. Pick the 1st, 2nd , 4th, 5th and 6th letters in the word REASONING to form yet another word and then write the first and last letters of the word formed.
(a) SE (b) ES
(c) NE (d) OR

70. While Hameed had his back turned, a dog ran into his butcher shop, snatched a piece of meat off the counter and ran out. Hameed was mad when he realized what had happened. He asked other shopkeepers, who had seen the dog to describe it. The shopkeepers, really did not want to help Hameed. So, each of them made a statement which contained one truth and one lie.
Shopkeeper 1 said : "The dog had black hair and a long tail".
Shopkeeper 2 said : "The dog had a short tail and wore a collar".
Shopkeeper 3 said : "The dog had white hair and no collar".
Based on the above statements which of the following could be correct description.
The dog had
(a) white hair, short tail and no collar
(b) white hair, long tail and a collar
(c) black hair, long tail, and a collar
(d) black hair, long tail and no collar

71. A train after travelling 60 km meets with an accident and then proceeds at 3/4 of its former rate and arrives at the terminus 40 min late. Had the accident happened 25 km further on, it would have arrived 10 min sooner. Find the speed of the train and the distance, respectively.
(a) 160 km/h, 150 km
(b) 160 km/h, 140 km
(c) 50 km/h, 160 km
(d) 40 km/h, 160 km

Directions (Q. Nos. 72-75) *Read the following information carefully to answer the questions.*

After months of talent searching for an administrative assistant to the president of the college the field of applicants had been narrowed down to five (A, B, C, D, and E). It was announced that the finalist would be chosen after a series of all-day group personal interviews. The examining committee agreed upon the following procedure.
1. The interviews will be held once a week.
2. Three candidates will appear at an all-day interview session.
3. Each candidate will appear atleast once.
4. If it becomes necessary to call applicants for additional interviews.
5. Because of a detail given in the written applications, it was agreed that whenever candidate B appears, A should also be present.
6. Because of travel difficulties, it was agreed that C will appear for only one interview.

72. Which of the following is a possible sequence of combinations for interviews in two successive weeks?
(a) ABC ; BDE (b) ABD ; ABE
(c) ADE ; ABC (d) BDE ; ACD

73. At the first interview, the following candidates appear : *A, B* and *D*. Which of the following combinations can be called for the interview to be held the next week?
(a) BCD (b) CDE
(c) ABE (d) ABC

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74. Which of the following correctly state (s) the procedure followed by the search committee?

I. After the second interview, all applicants might have appeared atleast once.
II. The committee interviews each applicant a second time.
III. If a third session is held, it is possible for all applicants to appear atleast twice.

(a) I only (b) II only
(c) I and II only (d) III only

75. If A,B and D appear at the interview and D is called for an additional interview the following week, which two candidates may be asked to appear with *D*?

I. A II. B
III. C IV. E

(a) I and II only (b) III and IV only
(c) II and III only (d) II and IV only

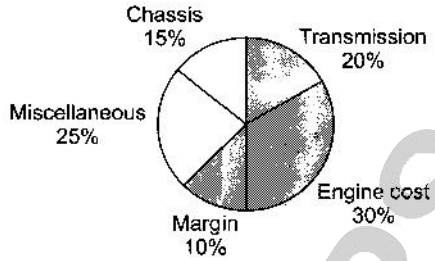
76. How many 5s are there in the following number series each of which is immediately followed by 4 but not immediately preceded by 6?

456 656 455 455 654 456 456 5454

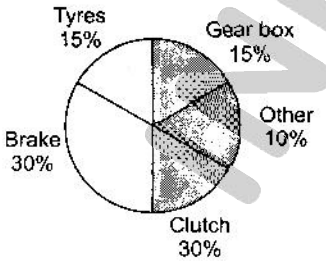
(a) One (b) Three
(c) Four (d) Two

Directions (Q. Nos. 77-81) *Study the pie charts given below and answer the following questions.*

Sale Price break-up of car



Cost break-up of transmission



Price of car = ₹ 100000

77. If transmission cost increases by 20%, by what amount is the profit reduced (total price of car remains same)?

(a) ₹ 3000
(b) ₹ 4000
(c) ₹ 6000
(d) Cannot be determined

78. If the price of tyres goes up by 25%, by what amount should the sale price be increased to maintain the amount of profit?

(a) ₹ 750 (b) ₹ 2250
(c) ₹ 3750 (d) ₹ 375

79. If transmission cost increases by 10% and engine cost increases by 20%, what is the percentage contribution of transmission cost with respect to the total cost?

(a) 20% (b) 22.44%
(c) 21.86% (d) 21.98%

80. If all the costs increase by 10% and the selling price remains the same, by what per cent will the profit be reduced?

(a) 50% (b) 90%
(c) 10% (d) Cannot be determined

81. What is the profit percentage?

(a) 10% (b) 9.09%
(c) 11.11% (d) Cannot be determined

Directions (Q. Nos. 82-84) *Read the following passage to answer the questions.*

Rajita has a unique way of attempting the question paper having 50 questions. She starts from question 1 and attempts all questions which are in AP with a common difference of 3 in the forward direction and 3 in the reverse direction. If she reaches a stage when she cannot attempt any more question, she starts in the reverse direction with the first unanswered question. She repeats the same process and when she reaches a stage when she cannot process any further, she reverses her direction again starting with the first unanswered question.

82. How many times does she reverse her direction?

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

83. Which is the last question that she answers if she attempts all the 50 questions?

(a) 50 (b) 49
(c) 48 (d) 3

84. Which is the 20th question Rajita answers?

(a) 50 (b) 48
(c) 47 (d) 44

85. If $A_1 = \{3\}$, $A_2 = \{5, 7, 9\}$, $A_3 = \{11, 13, 15, 17, 19\}$, $A_4 = \{21, 23, 25, 27, 29, 31, 33\}$ and so on. What is the average of the numbers of the set A_{20}?

(a) 761 (b) 763 (c) 765 (d) 767

Directions (Q. Nos. 86-89) *Read the following passage to answer the questions.*

In each question below are given three statements followed by three conclusions numbered I, II and III. You have to take the three given statements to be true even if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follow (s) from the given statements disregarding commonly known facts. Then decide which of the answers (a), (b), (c) and (d) is the correct answer.

86. Statements

Some trees are branches.
All buds are branches.
All flowers are trees.

Conclusions

I. Some branches are buds.
II. Some trees are flowers.

III. Some buds are trees.
(a) Only I follows (b) Only II follows
(c) Only I and II follow (d) All follow

87. Statements
Some pots are eatables.
All eatables are drinks.
No banana is pot.
Conclusions
I. Some pots are drinks.
II. All eatables are pots.
III. Some drinks are eatables.
(a) Only I follows (b) Only III follows
(c) Only II follows (d) Only I and III follow

88. Statements
All jewels are rings.
Some rings are necklaces.
Some cakes are jewels.
Conclusions
I. Some necklaces are jewels.
II. Some rings are cakes.
III. No jewel is necklace.
(a) Only II and either I or III follow
(b) Only either I or III follows
(c) Only II and III follow
(d) Only II follows

89. Statements
All actors are writers.
Some writers are dancers.
All poets are writers.
Conclusions
I. All actors are poets.
II. Some dancers are writers.
III. Some dancers are actors.
(a) None follows
(b) Only I and II follow
(c) Only II and III follow
(d) Only I and III follow

Directions (Q. Nos. 90-94) *Read the following passage to answer the questions.*

Five houses lettered A, B, C, D and E are built in a row next to each other. The houses are lined up in the order A, B, C, D and E. Each of the five houses have coloured roofs and chimneys. The roof and chimney of each house must be painted as follows.
1. The roof must be painted either green, red or yellow.
2. The chimney must be painted either white, black or red.
3. No house may have the same colour chimney as the colour of roof.
4. No house may use any of the same colours that the every next house uses.
5. House E has a green roof.
6. House B has a red roof and a black chimney.

90. Which statement is false?
(a) House A has a yellow roof.
(b) House A and C have different colour chimneys.
(c) House D has a black chimney.
(d) House E has a white chimney.

91. Which of the following is true?
(a) Atleast two houses have black chimneys.
(b) Atleast two houses have red roofs.
(c) Atleast two houses have white chimneys.
(d) Atleast two houses have green roofs.

92. What is the maximum total number of green roofs for houses?
(a) 1 (b) 2 (c) 3 (d) 4

93. Which possible combinations of roof and chimney can a house have?
I. A red roof and a black chimney.
II. A yellow roof and a red chimney.
III. A yellow roof and a black chimney.
(a) I, II and III (b) II only
(c) III only (d) I and II only

94. If house C has a yellow roof, which one of the following is true?
(a) House E has a white chimney.
(b) House E has a black chimney.
(c) House E has a red chimney.
(d) House D has a red chimney.

95. You have 13 balls which all look identical. All the balls are of the same weight except for one. Using only a balance scale, you can find the odd one out with how many minimum number of weighing?
(a) 3 (b) 5
(c) 6 (d) 4

Computer Awareness

96. On receiving an interrupt from an I/O device, the CPUs
(a) hand over the control of address and data bus to interrupting device.
(b) branch off to interrupt service subroutine immediately.
(c) branch off to interrupt service subroutine after completion of current instruction.
(d) None of the above

97. Micro-programmed control unit is
(a) faster than hard-wired unit.
(b) slower than hard-wired unit.
(c) to facilitate easy implementation of new instructions
(d) both (b) and (c)

98. Index register in a digital computer is used for
(a) pointing to the stack address.
(b) indirect addressing.
(c) keeping track of the number of times loop is executed.
(d) address modification.

99. In the virtual memory system, the address space specified by address lines of the CPU must be .... than the physical memory size and .... than the secondary storage size.
(a) smaller, smaller (b) smaller, larger
(c) larger, smaller (d) larger, larger

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100. The switching expression corresponding to $f(A, B, C, D) = \Sigma (1, 4, 5, 9, 11, 12)$ is
(a) $\bar{B}\bar{C}\bar{D} + \bar{A}\bar{C}\bar{D} + A\bar{B}\bar{D}$ (b) $A\bar{B}\bar{C} + A\bar{C}\bar{D} + \bar{B}\bar{C}\bar{D}$
(c) $A\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C} - A\bar{C}\bar{D}$ (d) $\bar{A}\bar{B}\bar{D} + A\bar{C}\bar{D} + B\bar{C}\bar{D}$

101. Assuming all numbers are in 2's complement representation, which of the following numbers is divisible by 11111011?
(a) 11100100 (b) 11010111
(c) 11011011 (d) 00000110

102. A switching circuit that produces one in a set of input bits as an output based on the control value of control bits is termed as
(a) full adder (b) inverter
(c) multiplexer (d) converter

103. A computer with a 32 bit word size uses 2's complement to represent numbers. The range of integers that can be represented by this computer is
(a) -2^{32} to 2^{32} (b) -2^{31} to 2^{32}
(c) -2^{31} to $2^{32} - 1$ (d) -2^{32} to 2^{31}

104. To change upper case to the lower case letter in ASCII, correct mask and operation should be
(a) 0100000 and NOR
(b) 0100000 and NAND
(c) 0100000 and OR
(d) None of the above

105. Why is the width of a data bus so important to the processing speed of a computer?
(a) The narrower it is, the greater the computer's processing speed.
(b) The wider it is, the more data can fit into the main memory.
(c) The wider it is, the greater the computer's processing speed.
(d) The wider it is, the slower the computer's processing speed.

General English

106. A sentence has been given in active (or passive) voice. Out of the four alternatives select the one which best expresses the same sentence in passive (or active) voice.
I know him
(a) He has been known by me.
(b) He was known to me.
(c) He is known by me.
(d) He is known to me.

107. Select the set of words that best fits the meaning of the sentence as a whole.
While the disease is in ..... state it is almost impossible to determine its existence by
(a) a dormant, postulate
(b) a critical, examination
(c) a cute, analysis
(d) a latent, observation

108. For the word "QUIBBLE" find the most appropriate meaning from the alternatives given below.
(a) Agreement (b) Appreciation
(c) Creation (d) Complain

109. If someone is "gung ho" then he/she is
(a) stupid (b) childish
(c) enthusiastic (d) loud

110. Find the antonym of the word "DISPARAGE".
(a) degrade (b) improve
(c) scatter (d) applaud

111. Fill in the blank.
I could not ..... him to attend the meeting.
(a) prevail over (b) prevail upon
(c) prevail about (d) prevail in

112. Identify the correct sentence.
(a) I have difficulty in remembering people's names.
(b) I get difficulty in remembering people's names.
(c) I have difficulty on remembering people's names.
(d) I am getting difficulty remembering people's names.

113. Choose the word which can he used to replace the underlined word in both the sentences.
I. It is certainly a thing which tempts people.
II. I take exception to what he has just said.
(a) object (b) protest (c) issue (d) prototype

114. The idiom 'I will be a monkey's uncle' means
(a) to want to keep a monkey
(b) that I have been enlightened
(c) that I have been fooled
(d) to express disbelief

115. Choose the pair of words which exhibits the same relationship between each other as the given pair of words.
WRITING : PLAGIARISM
(a) Confidence : Deception
(b) Money : Misappropriation
(c) Gold : Theft
(d) Germ : Disease

116. The pleasures of the table are never of consequence to one naturally abstemious.
The word abstemious can be replaced by
(a) indulgent (b) temperate
(c) discreet (d) profligate

117. The following passage consists of six sentences. The first sentence (S_1) is given in the beginning. The final sentence (S_6) is given in the last. The middle four sentences are jumbled up and labelled as P, Q, R and S. You are required to find out the proper sequence of the four sentences and mark accordingly.
S1 : Unlike many modern thinkers, Tagore had no blueprint for the world's salvation.
P : His thought will therefore never be out of data.
Q : He merely emphasised certain basic truths which men may ignore only at their peril.
R : He believed in no particular 'ism'.
S : He was what Gandhiji rightly termed the great sentinel.

S_6 : As a poet he will always delight, as a singer he will always enchant, as a teacher he will always enlighten.

The proper sequence should be

(a) SRPQ (b) PRQS (c) RSPQ (d) RQPS

118. Which of the underlined parts in the sentence given below is a mistake which may need to be deleted or modified.

He can be able to pass the test in flying colours without any difficulties whatsoever.

(a) be able (b) flying colours
(c) difficulties (d) whatsoever

Directions (Q. Nos. 119-120) *Read the passage and select the most suitable answer to the questions from the given choices.*

The fossil remains of the first flying vertebrates, the pterosaurs, have intrigued palaecontologists for more than two centuries. How such large creatures, which weighted in some cases as much as a piloted hang glider and had wingspans from 8 to 12 m, solved the problems of powered flight, and exactly what these creatures were-reptiles or birds-are among the questions scientists have puzzled over.

Perhaps the least controversial assertion about the pterosaurs is that they were reptiles. Their skulls, pelvises, and hind feet are reptilian. The anatomy of their wings suggests that they did not evolve into the class of birds. In pterosaurs a greatly elongated fourth finger of each forelimb supported a wing like membrane. The other fingers were short and reptilian, with sharp claws. In birds, the second finger is the principle strut of the wing, which consists primarily of feathers. If the pterosaur walked or remained stationary, the fourth finger and with it the wing, could only turn upward in an extended inverted V-shape along side of the animal's body.

The pterosaurs resembled both birds and bats in their overall structure and proportions. This is not surprising because the design of any flying vertebrate is subject to aerodynamic constraints. Both the pterosaurs and the birds have hollow bones a feature that represents a saving in weight. In the birds, however, these bones are reinforced more massively by internal struts.

119. It can be inferred from the passage that the scientists now generally agree that

(a) enormous wingspan of the pterosaurs enable them to fly great distances
(b) structure of the skeleton of the pterosaurs suggests a close evolutionary relationship to bats.
(c) fossil remains of the pterosaurs reveal how they solved the problem of powered flight.
(d) pterosaur were reptiles.

120. According to the passage, the skeleton of pterosaurs can be distinguished from that of a bird by the

(a) size of its wingspan.
(b) presence of hollow spaces in its bones.
(c) anatomic origin of its wing strut.
(d) presence of hook like projections on its hind feet.

Answers *with* Solutions

1. (c) $\theta = \tan^{-1}\frac{1}{1+2} + \tan^{-1}\frac{1}{1+(2)(3)} + \tan^{-1}\frac{1}{1+(3)(4)} + \ldots + \tan^{-1}\frac{1}{1+n(n+1)}$

$= \tan^{-1}\frac{2-1}{1+1\cdot 2} + \tan^{-1}\frac{3-2}{1+(2)(3)} + \tan^{-1}\frac{4-3}{1+(3)(4)} + \ldots + \tan^{-1}\frac{(n+1)-n}{1+n(n+1)}$

$= (\tan^{-1}2 - \tan^{-1}1) + (\tan^{-1}3 - \tan^{-1}2) + (\tan^{-1}4 - \tan^{-1}3) + \ldots + (\tan^{-1}(n+1) - \tan^{-1}n)$

$= \tan^{-1}(n+1) - \tan^{-1}1$

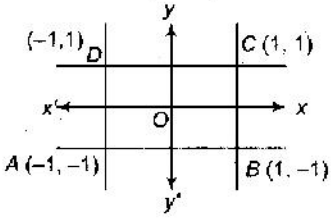
$= \tan^{-1}\frac{(n+1)-1}{1+1(n+1)} = \tan^{-1}\frac{n}{n+2} \Rightarrow \tan\theta = \frac{n}{n+2}$

2. (d) $d(x, y) = \max(|x|, |y|)$

Given, $d(x, y) = 1$,

as $\max(|x|, |y|) = 1$

$\Rightarrow$ Lines $x = 1,\ x = -1, y = 1, y = -1$



The above line forms square of side 2 units whose area is 4 sq units.

3. (c) $\because \tan^{-1}\sqrt{x(x+1)} = \cos^{-1}\frac{1}{\sqrt{x^2+x+1}}$

$\therefore \tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$

gives

$\cos^{-1}\frac{1}{\sqrt{x^2+x+1}} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$

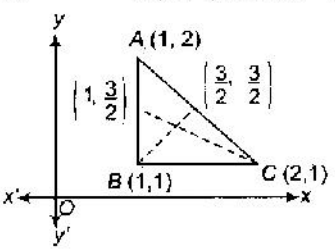
which holds if

$\frac{1}{\sqrt{x^2+x+1}} = \sqrt{x^2+x+1} \quad \left(\because \sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}\right)$

$\Rightarrow \quad x^2 + x + 1 = 1$

$\Rightarrow \quad x(x+1) = 0 \Rightarrow x = 0 \text{ or } -1$

4. (a)



From above figure

$m_1 = 1;\ m_2 = -1/2$

But $m_1 m_2 = -1/2$

$m_1 + m_2 = 1/2$

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$m_1^2 + m_2^2 = (m_1 + m_2)^2 - 2m_1 m_2 = 1/4 + 1$

$m_1^2 + m_2^2 = 5/4$

$(m_1 - m_2)^2 = (m_1 + m_2)^2 - 4m_1 m_2$

$= 1/4 - 4(-1/2) = \frac{1}{4} + 2 = 9/4$

$m_1 - m_2 = 3/2$

So, no option is correct.

5. (c) By adding the three given equations, we get

$(a + b + c)(x + y + z) = 0$

$\Rightarrow \quad x + y + z = 0$

Here, $x = \frac{c - b}{a + b + c}, y = \frac{a - c}{a - b + c}$

and $z = \frac{b - a}{a + b + c}, a + b + c \neq 0$

So, there are infinitely many solutions.

6. (b) $I = \int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x}\,dx = \int_0^{\pi} \frac{(\pi - x)\sin x}{1 + \cos^2 x}\,dx$

$2I = \pi \int_0^{\pi} \frac{\sin x}{1 + \cos^2 x}\,dx$

$\int_0^{2a} f(x)\,dx = 2\int_0^{a} f(x)\,dx \qquad [\because f(2a - x) = d(x)]$

$= 2\pi \int_0^{\pi/2} \frac{\sin x}{1 + \cos^2 x}\,dx \quad$ (even function)

$\Rightarrow \quad I = \pi \int_0^{\pi/2} \frac{\sin x}{1 + \cos^2 x}\,dx$

Let $\cos x = z \quad \Rightarrow -\sin x\,dx = dz$

$\therefore \quad I = \pi \int_1^0 -\frac{dz}{1 + z^2} = \pi \int_0^1 \frac{dz}{1 + z^2}$

$= \pi [\tan^{-1} z]_0^1 = \pi \left(\frac{\pi}{4}\right) = \frac{\pi^2}{4}$

7. (a) $\tan^{-1} 2x - \tan^{-1} 3x = \frac{\pi}{4}$

$\Rightarrow \quad \tan^{-1}\left(\frac{2x + 3x}{1 - 2x \cdot 3x}\right) = \frac{\pi}{4}$

$\Rightarrow \quad \tan^{-1} \frac{5x}{1 - 6x^2} = \frac{\pi}{4}$

$\Rightarrow \quad \frac{5x}{1 - 6x^2} = \tan\frac{\pi}{4} = 1$

$\Rightarrow \quad 1 - 6x^2 = 5x$

$\Rightarrow \quad 6x^2 + 5x - 1 = 0$

$(6x - 1)(x + 1) = 0$

$\Rightarrow \quad x = \frac{1}{6}$

8. (d) $A = \cos^2\theta + \sin^4\theta$

$= \sin^4\theta - \sin^2\theta + 1$

$= \left(\sin^2\theta - \frac{1}{2}\right)^2 + \frac{3}{4}$

As, $\quad 0 \le \sin^2\theta \le 1$

$-\frac{1}{2} \le \sin^2\theta - \frac{1}{2} \le \frac{1}{2}$

$0 \le \left(\sin^2\theta - \frac{1}{2}\right)^2 \le \frac{1}{4}$

$\frac{3}{4} \le \left(\sin^2\theta - \frac{1}{2}\right)^2 + \frac{3}{4} \le 1$

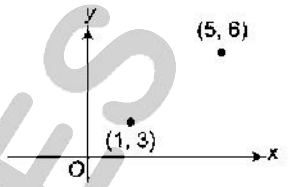
$\Rightarrow \quad \frac{3}{4} \le A \le 1$

9. (c) Required probability = P (Double head/head) + P (Double tail/head) + P (Normal Coin/head)

$= \frac{2}{5} \times 1 + \frac{1}{5} \times 0 + \frac{2}{5} \times \frac{1}{2}$

$= \frac{2}{5} + 0 + \frac{1}{5} = \frac{3}{5}$

10. (a)



To go from (1, 3) to (5, 6), total of 7 steps are needed out of which any 4 will be in right and remaining 3 in upward, which will be done in ${}^7C_4 \times {}^3C_3 = 35$ ways

11. (b) Volume of tank,

$V = \frac{1}{3}\pi r^2 h \qquad \ldots(i)$

Also, $\frac{h}{r} = \frac{10}{5} = 2 \quad \Rightarrow h = 2r \qquad \ldots(ii)$

Now, $\frac{dV}{dt} = \frac{\pi}{3}\left[r^2 \frac{dh}{dt} + 2rh \frac{dr}{dt}\right] \qquad \ldots(iii)$

Also, $\frac{dh}{dt} = 2\frac{dr}{dt}$

Then, Eq. (iii) becomes

$\Rightarrow \quad \frac{dV}{dt} = \frac{\pi}{3}\left[\frac{dh}{dt}(r^2 + rh)\right]$

$\Rightarrow \quad 2 = \frac{\pi}{3}\left[\frac{dh}{dt}(9 + 18)\right]$

$\left(\because h = 6, r = 3 \text{ and } \frac{dV}{dt} = 2\right)$

$\frac{dh}{dt} = \frac{2}{9\pi}$ ft/min

12. (a) Given, $\mathbf{B}_1 = \lambda\mathbf{A} = \lambda(\mathbf{i} + \mathbf{j})$

$\mathbf{B}_2 \cdot \mathbf{A} = 0$

$\Rightarrow \quad (\mathbf{B} - \mathbf{B}_1)\cdot\mathbf{A} = 0 \qquad [\because \mathbf{B} = \mathbf{B}_1 + \mathbf{B}_2 \text{ (given)}]$

$\Rightarrow \quad \mathbf{B}\cdot\mathbf{A} = \mathbf{B}_1\cdot\mathbf{A}$

$(3\mathbf{i} + 4\mathbf{k})\cdot(\mathbf{i} + \mathbf{j}) = \lambda(\mathbf{A}\cdot\mathbf{A}) = \lambda(1 + 1)$

$\Rightarrow \quad 3 = \lambda + \lambda = 2\lambda$

$\Rightarrow \quad \lambda = \frac{3}{2}$

$\Rightarrow \quad \therefore \quad \mathbf{B}_1 = \frac{3}{2}(\mathbf{i} + \mathbf{j})$

13. (a) Probability (statement is true | Agreement)

$= \frac{P(\text{true statement and agreement})}{P(\text{Agreement})}$

$= \frac{x \cdot y}{x \cdot y + (1 - x)(1 - y)}$

Note Agreement can be there if both are speaking truth or both are telling a lie.

14. (a) Number of triangles = (Number of ways of selecting 3 points from given 10 points) − (Number of ways selecting 3 points from 6 collinear points)

$= {}^{10}C_3 - {}^6C_3 = 120 - 20 = 100$

15. (c) $\frac{x}{a} - \frac{y}{b} = k$ and $\frac{x}{a} + \frac{y}{b} = \frac{1}{k}$ is jointly satisfied by

$\begin{pmatrix} x & y \\ a & b \end{pmatrix}\begin{pmatrix} x \\ a \end{pmatrix} + \begin{pmatrix} y \\ b \end{pmatrix} = (k)\begin{pmatrix} 1 \\ k \end{pmatrix}$

$\Rightarrow \quad \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, which is a hyperbola.

16. (d) As relation from A to B is subset of $A \times B$, so relation from A to $A \times A$ will be number of subsets of $A \times A$ which is

$$2^{n(A)n^2} = 2^{m^3}$$

17. (a) $P(\overline{A \cup B}) = \frac{1}{6}$

$$\Rightarrow \quad P(A \cup B) = 1 - \frac{1}{6} = \frac{5}{6}$$

$$P(\overline{A}) = \frac{1}{4} \Rightarrow P(A) = 1 - \frac{1}{4} = \frac{3}{4}$$

$$P(B) = P(A \cup B) + P(A \cap B) - P(A)$$
$$= \frac{5}{6} - \frac{1}{4} - \frac{3}{4} = \frac{1}{3}$$

$$\Rightarrow \quad P(A) = \frac{3}{4}, P(B) = \frac{1}{3}$$

$$\because \quad P(A \cap B) = P(A) \cdot P(B)$$
$$\frac{1}{4} = \frac{3}{4} \cdot \frac{1}{3} = \frac{1}{4}$$

$\therefore A$ and B are independent but not equally likely.

18. (c) Let λ be an eigen value of given matrix A.

Now, $1 - \lambda + \lambda^2 - \ldots \infty = \frac{1}{1 - (-\lambda)}$

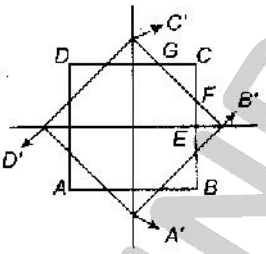
$\Rightarrow (1 - \lambda)(1 + \lambda + \lambda^2 + \ldots \infty) = 1$

By Cayley-Hamilton's theorem, "Every square matrix satisfy its characteristic equation".

$$(I - A)(I - A + A^2 - \ldots \infty) = I$$

$$\Rightarrow \quad I + A + A^2 + \ldots + \infty = (I - A)^{-1}$$
$$= \begin{bmatrix} 0 & -2 \\ -3 & -3 \end{bmatrix}^{-1} = -\frac{1}{6}\begin{bmatrix} -3 & 2 \\ -3 & 0 \end{bmatrix}$$
$$= \begin{bmatrix} \frac{1}{2} & -\frac{1}{3} \\ -\frac{1}{2} & 0 \end{bmatrix}$$

19. (a)



Side $= a \Rightarrow$ Diagonal $= \sqrt{2}a$

$$EB' = \left(\frac{\sqrt{2} - 1}{2}\right)a$$

$$\Rightarrow \quad EF = EB'$$
$$FC = \frac{a}{2} - \left(\frac{\sqrt{2} - 1}{2}\right)a = \left(\frac{2 - \sqrt{2}}{2}\right)a$$

Thus, area common to the two squares

$$= a^2 - 4 \times \frac{1}{2}\left[\left(\frac{2 - \sqrt{2}}{2}\right)a\right]^2$$
$$= a^2\left[1 - \frac{6 - 4\sqrt{2}}{2}\right]$$
$$= a^2[1 - (3 - 2\sqrt{2})]$$
$$= (2\sqrt{2} - 2)a^2$$
$$= 2(\sqrt{2} - 1)a^2 \text{ sq units}$$

20. (c) $P = \{(4^n - 3n - 1) | n \in N\}$

$$4^n - 3n - 1 = (3 + 1)^n - 3n - 1$$
$$= 1 + 3n + {}^nC_2 \cdot 3^2 + {}^nC_3 \cdot 3^3 + \ldots + {}^nC_n \cdot 3^n - 3n - 1$$
$$= 9[{}^nC_2 + 3 \cdot {}^nC_3 + \ldots]$$
$$= M(9)$$

$Q = \{(9n - 9) | n \in N\} = \{0, 9, 18 \ldots\}$

includes all non-negative integers divisible by 9.

$$\Rightarrow \quad P \subseteq Q \Rightarrow P \cup Q = Q$$

21. (b) $f(x) = x^3 - 3$ in $(1, 2)$ gives

$$f(x) = \begin{cases} -2; 1 < x < \sqrt{2} \\ -1; \sqrt{2} \le x < \sqrt{3} \\ 0; \sqrt{3} \le x < 2 \end{cases}$$

From above, we see that $f(x)$ is discontinuous at two points, viz. $\sqrt{2}$ and $\sqrt{3}$ in the interval $(1, 2)$.

22. (a) $|a + b + c|^2 = |a|^2 + |b|^2 + |c|^2 + 2(a \cdot b + b \cdot c + c \cdot a)$

$$\Rightarrow \quad 1 + 1 + 1 + 2(a \cdot b + b \cdot c + c \cdot a) \ge 0 \quad (\because |a + b + c|^2 \ge 0)$$
$$\Rightarrow \quad 2(a \cdot b + b \cdot c + c \cdot a) \ge -3$$
$$\Rightarrow \quad -2(a \cdot b + b \cdot c + c \cdot a) \le 3$$
$$\Rightarrow \quad 6 - 2(a \cdot b + b \cdot c + c \cdot a) \le 9$$
$$\Rightarrow \quad 2(|a|^2 + |b|^2 + |c|^2 - a \cdot b - b \cdot c - c \cdot a) \le 9$$
$$(|a|^2 + |b|^2 - 2a \cdot b) + (|b|^2 + |c|^2 - 2b \cdot c) + (|c|^2 + |a|^2 - 2c \cdot a) \le 9$$
$$\Rightarrow \quad |a - b|^2 + |b - c|^2 + |c - a|^2 \le 9$$

23. (a) $2x^4 + x^3 - 11x^2 + x + 2 = 0$

$$\Rightarrow \quad 2x^2 + x - 11 + \frac{1}{x} + \frac{2}{x^2} = 0 \qquad \text{(dividing by } x^2\text{)}$$
$$= 2\left(x^2 + \frac{1}{x^2}\right) + \left(x + \frac{1}{x}\right) - 11 = 0$$
$$= 2\left[\left(x + \frac{1}{x}\right)^2 - 2\right] + \left(x + \frac{1}{x}\right) - 11 = 0 \qquad \ldots(i)$$

On putting $x + \frac{1}{x} = y$, we get

$$2(y^2 - 2) + y - 11 = 0$$
$$\Rightarrow \quad 2y^2 - y - 15 = 0$$
$$\Rightarrow \quad y = \frac{-1 \pm \sqrt{1 + 120}}{4} = \frac{-1 \pm 11}{4}$$
$$\Rightarrow \quad y = \frac{5}{2}, -3 \Rightarrow x + \frac{1}{x} = -3, \frac{5}{2}$$

24. (b) As, $A(\text{adj } A) = |A| I$

$$\Rightarrow \quad |A \, \text{adj}(A)| = ||A| I|$$
$$\Rightarrow \quad |A||\text{adj}(A)| = |A|^n$$
$$\Rightarrow \quad |\text{adj}(A)| = |A|^{n-1}$$

where n is the order of A.

$$\Rightarrow \quad |\text{adj}(A)| = 3^2 = 9 \qquad [\because |A| = 3 \text{ (given)}]$$

25. (a) If $x < -1$, $|x + 1| = -(x + 1)$

and $|2^x - 1| = 1 - 2^x$

Now, $2^{|x+1|} - 2^x = |2^x - 1| + 1$

$$\Rightarrow \quad 2^{-(x+1)} - 2^x = 1 - 2^x + 1$$
$$\Rightarrow \quad \frac{1}{2 \cdot 2^x} - 2^x = 2 - 2^x$$

Let $2^x = y$

$$\Rightarrow \quad \frac{1}{2y} - y = 2 - y$$
$$\Rightarrow \quad \frac{1}{2y} = 2$$

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$\Rightarrow \quad y = \frac{1}{4}$

$\Rightarrow \quad 2^x = \frac{1}{4} = 2^{-2}$

On comparing, we get

$\Rightarrow \quad x = -2$

26. (d) $\sin^{-1} x + \cos^{-1}(1-x) = \sin^{-1}(-x) = -\sin^{-1}(x)$

$\Rightarrow \quad 2\sin^{-1} x + \cos^{-1}(1-x) = 0$

$2\sin^{-1} x + \cos^{-1}(1-x) = 0$

$\Rightarrow \quad \tan^{-1}\left(\frac{2x}{1+x^2}\right) + \tan^{-1}\left(\frac{2x-x^2}{1-x}\right) = 0$

$\Rightarrow \quad \tan^{-1}\left\{\frac{\frac{2x}{1+x^2} + \frac{x(2-x)}{(1-x)}}{1 + \frac{2x^2(2-x)}{(1+x^2)(1-x)}}\right\} = 0$

$\Rightarrow \tan^{-1}\left\{\frac{2x(1-x) + x(2-x)(1+x^2)}{(1+x^2)(1-x) + 2x^2(2-x)}\right\} = 0$

$\Rightarrow \quad 2x(1-x) + x(2-x)(1+x^2) = 0$

$x[2 - 2x + 2 - x + 2x^2 - x^3] = 0$

$\Rightarrow \quad x(-x^3 + 2x^2 - 3x + 4) = 0$

$\Rightarrow \quad x(x^3 - 2x^2 + 3x - 4) = 0$

$x = 0$ satisfies the above equation, which is satisfied by option in b, but other value of x is 3/2 which is impossible. Hence, none of these is correct option.

27. (b) $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) = (\mathbf{a}\cdot\mathbf{c})\mathbf{b} - (\mathbf{a}\cdot\mathbf{b})\mathbf{c}$ ...(i)

$\mathbf{a} \times (\mathbf{c} \times \mathbf{c}) = \frac{\mathbf{b} + \mathbf{c}}{\sqrt{2}}$ ...(ii)

From Eqs. (i) and (ii)

$\mathbf{a}\cdot\mathbf{c} = \frac{1}{\sqrt{2}}$ and $\mathbf{a}\cdot\mathbf{b} = -\frac{1}{\sqrt{2}}$

$\mathbf{a}\cdot\mathbf{b} = -\frac{1}{\sqrt{2}}$

Let θ be the angle betwen $\mathbf{a}+\mathbf{b}$.

$\Rightarrow \quad |\mathbf{a}||\mathbf{b}|\cos\theta = -\frac{1}{\sqrt{2}}$

$\Rightarrow \quad \cos\theta = -\frac{1}{\sqrt{2}}$

$\Rightarrow \quad \theta = \frac{3\pi}{4}$

28. (c) $\sin^4 x + \cos^4 x + \sin 2x + \alpha = 0$

$\Rightarrow \quad (\sin^2 x + \cos^2 x)^2 - 2\sin^2 x \cos^2 x + \sin 2x + \alpha = 0$

$\Rightarrow \quad 1 - \frac{(\sin 2x)^2}{2} + \sin 2x + \alpha = 0$

$\Rightarrow \quad (\sin 2x)^2 - 2\sin 2x - 2(1+\alpha) = 0$

$\Rightarrow \quad \sin 2x = \frac{2 \pm \sqrt{4 + 8(1+\alpha)}}{2}$

$= 1 \pm \sqrt{3 + 2\alpha}$

So, if $|1 \pm \sqrt{3+2\alpha}| \le 1$ $(\because -1 \le \sin x \le 1)$

$-1 \le 1 \pm \sqrt{3+2\alpha} \le 1$

$-2 \le \pm\sqrt{3+2\alpha} \le 0$

$0 \le 3 + 2\alpha \le 4$

$-3 \le 2\alpha \le 1$

$-\frac{3}{2} \le \alpha \le \frac{1}{2}$

$\Rightarrow \quad -\frac{3}{2} \le \alpha \le \frac{1}{2}$

Then, the given equation has solution.

29. (b) $P(1) = \frac{1}{6}$; $P(\bar{1}) = \frac{5}{6}$

$P(A \text{ wins}) = \frac{1}{6} + \frac{5}{6}\times\frac{5}{6}\times\frac{1}{6} + \ldots$

$= \frac{1}{6}\left[1 + \frac{25}{36} + \left(\frac{25}{36}\right)^2 + \ldots\right]$

$= \frac{\frac{1}{6}}{1 - \frac{25}{36}} = \frac{1/6}{11/36} = \frac{6}{11}$

$P(B \text{ wins}) = 1 - P(A \text{ wins})$

$= 1 - \frac{6}{11} = \frac{5}{11}$

$E(\text{amount of } A) = 110 \times \frac{6}{11} = 60$

$E(\text{amount of } B) = 110 \times \frac{5}{11} = 50$

30. (c) Required probability = P(atleast one person dies before 90 yr) $\times$ P (first person to die is A_1)

$= \left[1 - \left(\frac{2}{3}\right)^4\right] \times \left[\frac{3!}{4!}\right] = \left(1 - \frac{16}{81}\right) \times \frac{1}{4} = \frac{65}{324}$

31. (d) Let $\frac{a}{r}$, a and ar be the three roots. (product of roots)

Then, $\frac{a}{r} \times a \times ar = -64$

$\Rightarrow \quad a^3 = -64 \quad \Rightarrow a = -4$

Sum of the roots

$\Rightarrow \quad -4\left(1 + r + \frac{1}{r}\right) = 6$

$\Rightarrow \quad r + \frac{1}{r} = -\frac{5}{2} \quad \Rightarrow r = -2$

Now, sum of the roots taken two at a time

$2(-4) + (+16)(-2) + 8(2) = k$

$\Rightarrow \quad k = -24$

32. (d) $(1 + x - 2x^2)^6 = 1 + a_1 x + a_2 x^2 + \ldots + a_{12} x^{12}$ ...(i)

By putting $x = 1$ on both sides, we get

$0 = 1 + a_1 + a_2 + \ldots + a_{12}$ ...(ii)

By putting $x = -1$ on both sides of Eq. (i), we get

$64 = 1 - a_1 + a_2 - a_3 + \ldots\ldots + a_{12}$ ...(iii)

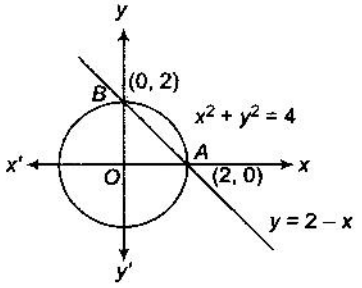
Adding Eqs. (ii) and (iii) gives

$64 = 2[1 + a_2 + a_4 + \ldots\ldots + a_{12}]$

$\Rightarrow \quad 1 + a_2 + a_4 + \ldots + a_{12} = 32$

$\Rightarrow \quad a_2 + a_4 + \ldots + a_{12} = 31$

33. (b)



From the above figure, shaded area is the smaller area bounded by the given line and circle.

$= \frac{1}{4}$ (Area of circle) − Area of ΔAOB

$= \frac{1}{4}\pi(2)^2 - \frac{1}{2}\times 2 \times 2$

$= (\pi - 2)$ sq units

34. (c) $2^{2a} - 3(2^{a+2}) + 2^5 = 0$

Let $y = 2^a$

$\Rightarrow y^2 - 12y + 32 = 0$

$\Rightarrow (y-4)(y-8) = 0$

$\Rightarrow y = 4, 8$

$2^a = 4 \Rightarrow a = 2$

$2^a = 8 \Rightarrow a = 3$

Thus, the number of integrals satisfying a is 2 (two).

35. (c) $n(A_1 \cup A_2 \cup A_3 \cup A_4)$

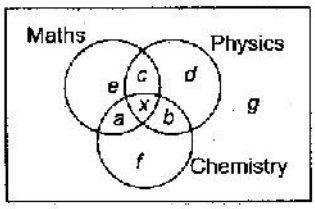
$$= \sum n(A_i) - \sum\sum_{i<j} n(A_i \cap A_j) - \sum\sum\sum_{i<j<k} n(A_i \cap A_j \cap A_k) - \sum\sum\sum\sum_{i<j<k<l} n(A_i \cap A_j \cap A_k \cap A_l)$$

$= 4 \times 28 - {}^4C_2 \times 12 + {}^4C_3 \times 5 - {}^4C_4 \times 1$

$= 112 - 72 + 20 - 1 = 59$

The number of elements belonging to none of the four subsets $= 75 - 59 = 16$

36. (d) Let x be the number of possible students who have passed all the papers.



We have the following equations and inequalities

$a + b + c + d + e + f + g + x = 50$ ...(i)

$b + d + f = 13$ ...(ii)

$a + e + f = 26$ ...(iii)

$c + d + e = 7$ ...(iv)

$c + x \le 19$

$a + x \le 29$

$b + x \le 20$

Adding Eqs. (ii), (iii) and (iv), we get

$a + b + c + d + e + f + (d + e + f) = 46$

$\Rightarrow d + e + f + 50 - g - x = 46$

$\Rightarrow g + x = 4 + d + e + f$

$n(M \cup P \cup C) = \sum n(M) - \sum\sum n(M \cap P) + n(M \cap P \cap C)$

$\Rightarrow 50 = 37 + 24 + 43 - 19 - 29 - 20 + x$

$\Rightarrow x = 14$

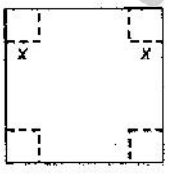
37. (c) As $f(x)$ is an odd function, so we have

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

$\Rightarrow f'(x) = f'(-x)$

$\Rightarrow f'(3) = f'(-3) = -2$

38. (d)



Let x be the length of side of square cut off from the cardboard.

So, volume,

$$V = x(6-2x)^2 \quad \text{...(i)}$$

For maximum volume,

$$\frac{dV}{dx} = (6-2x)^2 + 2(-2) \times (6-2x)$$

$$= (6-2x)(6-6x) = 0$$

$\Rightarrow x = 3, 1$

$$\frac{d^2V}{dx^2} = (6-2x)(-6) + (6-6x)(-2)$$

$$= -36 + 12x - 12 + 12x$$

$$= 24x - 48$$

At $x = 1, \frac{d^2V}{dx^2} < 0$

For maximum volume, height of the box, $x = 1$

39. (c) Required probability

$$1 - 0.8 \times 0.7 \times 0.8 \times 0.9 = 1 - \frac{3024}{10000} = \frac{6976}{10000} = 0.6976$$

40. (d) The number of required subsets

$$= {}^{2n+1}C_0 + {}^{2n+1}C_1 + \ldots + {}^{2n+1}C_n$$

$$= \frac{1}{2}|2^{2n+1}| = 2^{2n} = 4^n$$

But $4^n = 4096 = 4^6$

$\Rightarrow n = 6$

41. (b) Let x be the number of chocolates initially Bala has.

Then, $\frac{x}{2} - 3 + \frac{1}{3}\left(\frac{x}{2} - 3\right) + 4 + \frac{1}{4}\left[\frac{x}{3} - 6\right] + 4 + 11 = x$

$\Rightarrow \frac{3x}{4} + \frac{39}{2} = x \Rightarrow \frac{x}{4} = \frac{39}{2}$

$\Rightarrow x = \frac{39 \times 4}{2}$

$\Rightarrow x = 78$

42. (c) 1 billion $= 10^9$

Total time taken for counting $= \frac{10^9}{200} = 5 \times 10^6$ min

$= 83333$ h 20 min

$= 3472$ days 5 h 20 min

$= 9$ yr 187 days 5 h 20 min

43. (c) From given relation, we get

$$2^{\log_x 4 + \log_{x^2} 16 + \log_{x^3} 256 + \ldots \infty} = \frac{1}{2}$$

$$\Rightarrow 2^{\frac{1}{\log x}(\log 4 + \log 4^2 + \log 4^3 + \ldots \infty)} = \frac{1}{2}$$

$$\Rightarrow 2^{\frac{\log 4}{\log x}(1 - 2 + 3 + \ldots \infty)} = \frac{1}{2}$$

$$\Rightarrow 2^{\frac{\log 4}{\log x}\left\{\frac{1}{(1+2)^2}\right\}} = \frac{1}{2}$$

$\Rightarrow 2^{-\log_x 4} = 2^{-1} \Rightarrow \log_x 4 = 1 \Rightarrow x = 4$

44. (c) Power of last digit

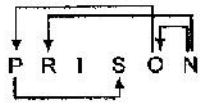
$7^1 = 7, \quad 7^2 = 9$

$7^3 = 3, \quad 7^4 = 1$

As, $(13687)^{3285} = (13687)^{816 \times 4 + 1}$

Hence, last digit of $(13687)^{3285}$ is last digit of $7^1 = 7$

45. (c)



Hence, number of such pairs are PS, NO, NR, OR.

46. (d) Number of direct lines

$= ({}^4C_2 \times 3) \times 3 + {}^3C_2 \times {}^4C_1 \times {}^4C_1 \times 2$

$= 6 \times 3 \times 3 + 3 \times 4 \times 4 \times 2$

$= 54 + 96 = 150$

47. (b) Statement b weaken the argument given

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48. (a) Digits being perfect square and non-zero include 1, 4 and 9.
At each place digit appear $2! = 2$ times, so sum of all the three digit numbers
$= (1 + 4 + 9) \times 2!(111)$
$= 28\,(111) = 3108$

49. (c) As $1 + 2 + \ldots + N = \dfrac{N(N-1)}{2}$
$\dfrac{N(N+1)}{2}$ just less than 700 is obtained for $N = 36$ and equals 666.
Thus, number $700 - 666 = 34$ was added twice.
Hence, sum of digits $= 3 + 4 = 7$

50. (c) Let x min be the time taken by C to process one input.
Then, $14 = \dfrac{20 + 12 + \frac{60}{x}}{3}$
$\Rightarrow \quad 42 = 32 + \dfrac{60}{x}$
$\Rightarrow \quad \dfrac{60}{x} = 10 \Rightarrow x = 6$

51. (c) Q S R P

52. (d) $A + B = C + D$ ...(i)
$B + D = 2A$ ...(ii)
$D + E > A + B$ ...(iii)
$C + D > A + E$ ...(iv)
From Eqs. (i) and (iv),
$A + B > A + E \Rightarrow B > E$
From Eqs. (i) and (iii),
$D + E > C + D \Rightarrow E > C$
$\Rightarrow B > E > C$
By putting in Eq. (i), we get
$A < D$
$\Rightarrow D > A > B > E > C$

53. (d) Let x be the age of Rahul and y be the age of Preeti
$\Rightarrow x^2 - y^2 = 7148$ ...(i)
$x^2 + y^2 = 5248$ ...(ii)
On solving Eqs. (i) and (ii), we get
$x = 17$ and $y = 19$

54. (d) $22 = 12 \times 2 - 2$
$69 = 22 \times 3 + 3$
$272 = 69 \times 4 - 4$
$1365 = 272 \times 5 + 5$
$? = 1365 \times 6 - 6 = 8184$

55. (d) Amounts required in the bag will be powers of 2 i.e., 1, 2, 4, 8, 16, 32, 64, 128, 256, 512 and 51
Thus, minimum number of bags required = 11

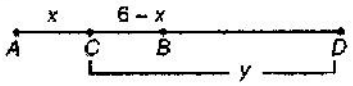
56. (d) ? will be filled by 8.
Blocks have sum,
$3 + 9 = 12, 5 + ? = 13, 7 + 7 = 14$, and $9 + 6 = 15$

57. (a) As $6! = 720$, so numbers from 6! onwards is divisible by 240.
Hence, remainder is
$1! + 2! + 3! + 4! + 5!$
$= 1 + 2 + 6 + 24 + 120 = 153$

58. (d) Sum of the numbers will be
$(1 + 5 + 2 + 8)\,3!\,(5111) = 96\,(1111) = 106656$
which lies between 100000 and 150000

59. (c) Required sum
$= (1 + 2 + \ldots + 100) - (3 + 6 + \ldots + 99)$
$- (5 + 10 + \ldots + 100) + (15 + 30 + \ldots + 90)$
$= 5050 - \dfrac{3 \times 33 \times 34}{2} - \dfrac{5 \times 20 \times 21}{2} + 15 \times 21$
$= 5050 - 1683 - 150 + 315 = 2632$

60. (b) Let x and y be speed of water current and motor boat respectively.



C and D are respectively the points where raft and motor boat are located when motor boat turns back.
$\Rightarrow \quad \dfrac{6 - x}{x} = \dfrac{y + x - 6}{y - x}$
$\Rightarrow \quad \dfrac{6}{x} = \dfrac{2y - 6}{y - x}$
$\Rightarrow \quad x = 3$
and $\quad y = 4$

61. (c) Only green rabbit can say this type of statement.

62. (a) Option (a) is the best description.

63. (c) Total number of words formed from letters of the word
$\text{INDIA} = \dfrac{5!}{2!} = 60$
60th word is NIIDA
59th word is NIIAD
58th word is NIDIA

64. (c) Number of triangles
$= 16 + 8 + 4 + 4 + 4 = 36$

65. (b) India won means Sachin is not the captain.

66. (a) In numbers from 1 to 100, 6 appears 10 times at unit place and also 10 times at ten's place.
Thus, by replacing 6 by 9, variation in the sum is
$3 \times 10 + 3 \times 10 \times 10 = 330$

67. (b) Let x be the number of steps in staircase.
Then, $\dfrac{x - 26}{30} = \dfrac{x - 34}{18}$
$\Rightarrow \quad \dfrac{x - 26}{5} = \dfrac{x - 34}{3}$
$\Rightarrow \quad 3x - 78 = 5x - 170$
$\Rightarrow \quad 2x = 92$
$\Rightarrow \quad x = 46$

68. (b) Let the required numbers be xy.
Then, $(yx) - (xy) = 18$
$10y + x - 10x - y = 18$
$\Rightarrow \quad 9(y - x) = 18$
$\Rightarrow \quad y - x = 2$
Hence, possible numbers are 24, 35, 46, 57, 68, 79 besides 13.

69. (c) 1st, 2nd, 4th, 5th and 6th letters of REASONING R E S O N : It will be rearranged to form NORSE (NE) is the first and last letter.

70. (b) White hair, long tail and a collar will give one truth and one lie in each of the three statements.

71. (c) Let x km/h be the speed of the train and y km be the distance.
Then, $\dfrac{y - 60}{\frac{3}{4}x} = \dfrac{25}{x} + \dfrac{y - 85}{\frac{3}{4}x} + \dfrac{10}{60}$
$\Rightarrow \quad \dfrac{25}{\frac{3}{4}x} = \dfrac{25}{x} + \dfrac{1}{6}$
$\Rightarrow \quad \dfrac{25}{3x} = \dfrac{1}{6}$
$\Rightarrow \quad x = 50$ km/h
and $\quad y = 160$ km

72. (c) In ADE ; ABC, only one candidate is repeated and B in there with A

73. (b) In CDE, exactly one is repeated.

74. (a) Only statement I is correct.

75. (b) Due to D there is a repetition, so rest two will be new members.

76. (d) Only two 5 satisfies the requirement.

77. (b) According to Pie chart, profit is reduced by
$$100000 \times 20\% \times 20\% = ₹\,4000$$

78. (a) Required price
$$= 100000 \times 20\% \times 15\% \times 25\% = ₹\,750$$

79. (a) Percentage contribution of transmission cost
$$= \frac{20 + 20 \times 10\%}{50 + 20 + 20 \times 10\% + 30 + 30 \times 20\%} \times 100\%$$
$$= \frac{22}{108} \times 100\% = \frac{1100}{54}\% = 20\% \text{ (approx)}$$

80. (c) If C was the cost and p was the profit,
then new cost $= \frac{11C}{10}$
$$\text{Profit} = 0 - \frac{C}{10}$$
Profit is reduced by the amount $\frac{C}{10}$.
$$\text{Percentage reduction} = \frac{C/10}{C} \times 100\% = 10\%$$

81. (b) Required profit percentage
$$= \frac{C/10}{11C/10} \times 100\% = \frac{100}{11}\% = 9.09\%$$

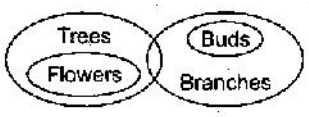
82. (a) The order of answering questions is as follows
1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43, 46, 49
1st reversal : 50, 47, 44, 41, 38, 35, 32, 29, 26, 23, 20, 17, 14, 11, 8, 5, 2
2nd reversal : 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48

83. (c) From the above last question answer is 48.

84. (d) $20 = 17 + 3$, so 3rd question of first reversal i.e., 44 is the required 20th question answered by Rajita.

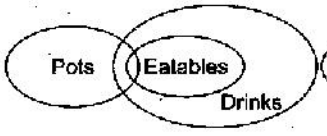
85. (b) In A_{20}, there will be $2 \times 20 - 1 = 39$ numbers in AP with common difference 2.
Also, the first term of A_{20} will be
$$3 + 2 \times 3 + 2 \times 5 + 2 \times 7 + \ldots + 2 \times 37 + 2$$
$$= 3 + 2(1 + 3 + 5 + 7 + \ldots + 37)$$
$$= 3 + 2 \times \frac{19}{2}[2 + 18 \times 2] = 3 = 2 \times 19 \times 19 - 725$$
Average of 39 numbers of A_{20}
$$= \frac{\frac{39}{2}[2 \times 725 + (39 - 1) \times 2]}{39} = 725 + 38 = 763$$

86. (c) According to the statements, Venn-diagram is



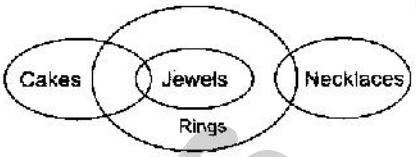
Conclusions
I. ✔
II. ✔
III. ×

87. (d) According to the statements, Venn-diagram is



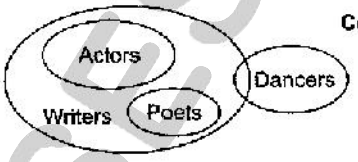
Conclusions
I. ✔
II. ×
III. ✔

88. (a) According to the statements, Venn diagram is



Conclusions
I. ✔
II. ✔
III. ✔

89. (a) According to the statements, venn-diagram is



Conclusions
I. ×
II. ✔
III. ×

Solutions (Q. Nos. 90-94)

House	A	B	C	D	E
Roof		R			G
Chimney	W	B	W		

90. (b) A and C have white chimney.

91. (c) A and C have white chimneys and E may also have white chimney.

92. (c) A,C and E can have green roofs.

93. (a) All three combinations are possible

94. (a) House E has a white chimney.

95. (d) As, $3^2 < 13 \le 3^3$ and further it is not known that ball is lighter or heavier, so, minimum number of weighing required is $3 + 1 = 4$

96. (c) Branch off to interrupt service subroutine after completion of current instruction.

97. (a) Faster than hard-wired unit.

98. (b) Indirect addressing

99. (c) larger, smaller

100. (a) For the blue group
C and D maintain the same state but A and B change.
C is zero (0) and has to be negated before it can be included. Thus, the first term is
$$\bar{A}B\bar{C}D + \bar{A}B\bar{C}\bar{D} = \bar{A}B\bar{C}(D + \bar{D}) = \bar{A}B\bar{C}$$
For the green group
Second term is $\bar{A}B\bar{C}\bar{D} + A\bar{B}\bar{C}\bar{D} = (A + \bar{A})\,BC\bar{D} = BC\bar{D}$

AB \ CD	00	01	11	10
00		1		
01	1	1		
11	1			
10		1	1	

For the red group
The third term is
$$A\bar{B}\bar{C}D + A\bar{B}\,CD = A\bar{B}D\,(C + \bar{C}) = A\bar{B}D$$
$\because f(A, B, C, D) = \bar{A}\bar{C}D + B\bar{C}\bar{D} + A\bar{B}D$

101. (a) 1's complement of 11111011 is
$$= 00000100$$
Now, it's 2's complement $= 00000100$
$$\underline{+\qquad 1}$$
$$00000101$$
Its Decimal equivalent
$$= 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 4 + 0 + 1 = 5$$
From option 0;
1's complement of 00000110 is = 11111001

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Now, it's 2's complement = 111110011
$$\begin{array}{r} +\quad\quad 1 \\ \hline 11111010 \end{array}$$
Its decimal equivalent
$1\times2^7 + 1\times2^6 + 1\times2^5 - 1\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 0\times2^0$
$= 128 + 64 + 32 + 16 + 8 + 2 = 250$
which is divisible by 5.

102. (c) Multiplexer

103. (c) Range of 2's complement with n bits is
$-(2^{n-1})$ to $2^{n-1}-1$

104. (c) Mask is 0100000 with operation OR.

105. (b) Wider the data bus more will be memory capacity.

106. (d) This is an active voice.

Active voice—	Subject	Verb	Object
	I	know	him

In passive voice object become subject and subject become object.

Passive voice—	Subject	Verb	Object
	He is	known	to me

107. (d) **Latent** Which has not developed yet.

108. (d) **Quibble** To argue is complain about something.

109. (c) **Gung-ho** Very enthusiastic, especially about something that might be dangerous.

110. (d) **Disparage** To say unpleasant things about someone or something that show you have no respect for them.
Applaud To show that you enjoyed someones performance by clapping.

111. (b) **Prevail upon** to ask or persuade someone to do something.

112. (b) I get difficulty is remembering peoples names.
Here, get is used as it refers to experience or undergo.

113. (a) In sentence (I) object is appropriate for thing as tempts means 'to attract', i.e., temptation towards an object.
In the sentence II object means 'against' a decision or statement.

114. (c) I will be a monkey's uncle mean that I have been fooled.

115. (b) **Plagiarism** The process of taking another persons work, ideas or words and using them as if they were your own.
Here, Plagiarism signifies copying or misusing somebody's writing.
Money Misappropriating shows the same relationship as above.
Misappropriation To take for yourself money that you are responsible for but that does not belong to you.

116. (a) **Abstemious** Deliberately avoiding too much food or alcohol.

117. (d) ROPS is the correct consequence or order of sentences.

118. (a) Correct Sentence: He can pass the test in flying colours without any difficulties what so ever.

119. (d) Pterosaurs are reptiles is generally agreeable statement.

120. (c) Anatomic origin of wing strut is the main point to distinguish between bird or non-bird.