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Amit Katiyar

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(MCA-JNU)

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1. A ten –rupee coin is placed on a plain paper. How many coins of the same size can be placed around it so that each one touches the central and adjacent coins?
   (a)4 (b) 7
   (c) 3 (d) 6
2. The missing term in the sequence ADVENTURE, DVENTURE, DVENTUR, ……..? …….. VENTU
   (a)DVENT (b) VENTURE
   (c) VENTUR (d) DVENTU
3. Choose the ODD ONE OUT:
   (a) Rice (b) Maize
   (c) Jowar (d) Wheat
4. If DRIVER = 12, PEDESTRIAN = 20, ACCIDENT = 16, then CAR=?
   (a) 3 (b)6 (c)8 (d) 10
5. If you are facing north- east and move 10 m forward, turn left and move 7.5 cm, then you are:
   (a) North of your initial position
   (b) South of your initial position
   (c) East of your initial position
   (d) West of your initial position
6. A clock is so placed that at 12 noon its minute hand point towards north-east. In which direction does its hour hand point at 1:30 p.m.?
   (a) North (b) South (c) East (d) West
7. A frog tries to come out of a dried well 900m deep with slippery walls. Every time the frog jumps up 60 cm, he slides back 30 cm. How many jumps the frog will have to take to come out of the well?
   (a) 29 (b) 30 (c) 25 (d) 26
8. In how many ways a cricketer can hit a century if he hits only fours and sixes?
   (a)24 (b) 12 (c) 9 (d) 8
9. How many times are the hands of a clock at right angles in a day?
   (a) 24 (b) 48 (c) 22 (d) 44
10. Find the missing term in the series 2, 15, 4, 12, 6, 7, ……? ……?
    (a) 8 , 8 (b) 8,0
    (c) 3, 8 (d) 4, 8
11. A is B's sister, C is B's mother, D is C's father, E is D's mother. Then how is A related to D?
    (a) Grandmother (b) Grandfather
    (c) Daughter (d) Grand daughter
12. Find the wrong number in the series given below:
    5, 18, 34, 54, 79, 110, 158
    (a) 34 (b) 54
    (c) 18 (d) 158
13. Find the wrong number in the series given below:
    5, 6, 14, 45, 184, 920, 5556
    (a) 5 (b) 6
    (c) 920 (d) 5556
14. Win is related to Competition in the same way as invention is related to:
    (a) Product (b) Discovery
    (c) Trial (d) Laboratory
15. Pointing towards a girl in the picture, Sarita said "She is the mother of Neha whose father is my son". How is Sarita related to the girl in the picture?
    (a) Mother (b) Mother-in-Law
    (c) Aunt (d) Sister
16. If 100 cats kill 100 mice in 100 days, then 4 cats would kill 4 mice in how many days?
    (a) 1 day (b) 4 days
    (c) 40 days (d) 100 days
17. Two pipes A and B can fill a tank in 12 minutes and 16 minutes respectively. If both pipes are opened together, then after how much time B should be closed to that the tank gets filled in 9 minutes?
    (a) 2 minutes (b) 4 minutes
    (c) 8 minutes (d) 12 minutes
18. If Mathematics : Logic :: Science : ?
    (a) Facts (b) Scientist
    (c) Experiment (d) Laboratory
19. Five children take part in a tournament. Each one has to play every other one. How many games must they play?
    (a) 8 (b) 10
    (c) 24 (d) 30
20. A man has a certain number of small boxes to pack into parcels. If he packs 3, 4, 5 or 6 in a parcel, he is left with one over: if he packs 7 in a parcel none is left over. What is the number of boxes, he may have to pack?
    (a) 106 (b) 301
    (c) 309 (d) 400
21. Choose the most appropriate options to fill in the blanks as follows:
    Every human being, after the first dew days to his life, is a product of two factors: on the one hand, there is his ……endowment : and on the other hand, there is the effect of environment, including ……
    (a) constitutional : weather
    (b) Congenital : education
    (c) personal : climate
    (d) Economic : learning

22. Choose the most appropriate options to fill in the blanks as follows:
The ..... of public awareness about the disease has led to its widespread.....
(a) Dearth, incidence (b) Paucity, occurrence
(c) Lack, happening (d) Scarcity, frequency

23. In the question below, a word 'File' has been used in sentences in four different ways. Choose the option corresponding to the sentence in which the usage of the word is incorrect or inappropriate:
File
(a) You will find the paper in the file under the chair.
(b) I need to file an insurance claim.
(c) The cadets were marching in a single file.
(d) When the parade was on, a soldier broke the file.

24. In the following sentences, parts of the sentence are left blank. Beneath each sentence, four different ways of completing the sentence are indicated. Choose the best alternative:
Sentence: Police ..... Notorious gangster after relentless chase that ..... For 3 weeks.
(a) Arrest, reigned (b) nabbed, lasted
(c) Snatched, persist (d) contempt, endured

25. In the following sentence, parts of the sentence are left blank. Beneath each sentence, four different ways of completing the sentence are indicated. Choose the best alternative:
Sentence: An interview is a good chance to ..... how candidates ..... difficult situation.
(a) Discuss, improved (b) Assess, addressed
(c) Analyze, tackling (d) Evaluate, approach

26. In the question below, a word 'RUN' has been used in sentences in four different ways. Choose the option corresponding to the sentence in which the usage of the word is incorrect or inappropriate:
I. I must run fast to catch up with him.
II. Our team scored a goal against the run of play.
III. You can't run over him like that.
IV. The newly released book is enjoying a popular run.
(a) I and II only (b) II and IV only
(c) III only (d) IV only

27. The word 'Concurrence' similar in meaning to the following words except:
(a) Agreement (b) Accord
(c) Consensus (d) Harmony

28. Select the word from the choices given below that is most similar in meaning to the word '**SOLITUDE'**
(a) Musical Composition (b) Aloofness
(c) True Statement (d) Single-mindedness

29. Which is the antonym of the word 'EXODUS'
(a) Influx (b) Return
(c) Home Coming (d) Restoration

30. Choose the alternative from the following options, which can be substituted for the given words/ sentence.
'A style in which a writer makes display of his knowledge'.
(a) Ornate (b) Pedantic (c) Artificial (d) Showy

31. The set $(A \cap B') \cup (B \cap C)$ is equal to
(a) $(A' \cup B \cup C)$ (b) $(A' \cup B)$
(c) $(A' \cup C)$ (d) $(A' \cap B)$

32. Let F_1 be the set of parallelograms. F_2 the set of rectangles, F_3 the set of rhombuses, F_4 the set of squares and F_5 the set of trapeziums in a plane. Then F_1 may be equal to:
(a) $(F_2 \cap F_3)$ (b) $(F_3 \cap F_4)$
(c) $(F_4 \cup F_5)$ (d) $(F_2 \cup F_3 \cup F_4 \cup F_1)$

33. If $[x^2] - 5[x] + 6 = 0$, where [.] denote the greatest integer function, then
(a) $x \in [3, 4]$ (b) $x \in [2, 3]$
(c) $x \in (2, 3)$ (d) $x \in [2, 4)$

34. Which of the following is correct?
(a) $\sin 1^0 > \sin 1$ (b) $\sin 1^0 < \sin 1$
(c) $\sin 1^0 = \sin 1$ (d) $\sin 1^0 = \pi/180 \sin 1$

35. The value of tan 3A – tan 2A – tan A is equal to
(a) tan 3A tan 2A tan A
(b) – tan 3A tan 2A tan A
(c) tan A tan 2A –tan 2A tan 3A – tan 3A tan A
(d) None of these

36. If $\left(\frac{1+i}{1-i}\right)^x = 1$, then
(a) X = 2n+1, where $n \in N$
(b) X = 4n, where $n \in N$
(c) X = 2n, where $n \in N$
(d) X = 4n + 1, where $n \in N$

37. The complex number z which satisfies the condition $\left|\frac{i+z}{i-z}\right| = 1$ lies on
(a) Circle $x^2 + y^2 = 1$ (b) The x-axis
(c) The y-axis (d) The line x + y = 1

38. The five-digit number divisible by 3 is to be formed using the number 0, 1, 2 , 3, 4 and 5 without repetitions. The total number of ways this can be done is
(a) 216 (b) 600 (c) 240 (d) 3125

39. Given 5 different green dyes, 4 different blue dyes and 3 different red dyes, the number of combinations of dyes which can be chosen taking at least 1 green and 1 blue dye is
(a) 3600 (b) 3720 (c)3800 (d) 350

40. The total number of terms in the expansion of $(x + a)^{100} + (x - a)^{100}$ after simplification is
(a) 50 (b) 202 (c) 51 (d) 62

41. The minimum value of $4^x + 4^{1-x}$, $x \in R$, is
(a) 2 (b) 4 (c) 1 (d) 0

42. The coordinates of the foot of perpendicular from the point (2, 3) on the line y = 3x + 4 is given by
(a) $\left(\frac{37}{10}, \frac{-1}{10}\right)$ (b) $\left(\frac{-1}{10}, \frac{37}{10}\right)$ (c) $\left(\frac{10}{37}, -10\right)$ (d) $\left(\frac{2}{3}, \frac{-1}{3}\right)$

43. Equations of diagonals of the square formed by the lines x = 0, y = 0, x = 1 and y = 1 are
(a) y = x, y + x = 1 (b) y = x, y + x = 2
(c) 2 y = x, y + x = $\frac{1}{3}$ (d) y = 2x, y + 2x = 1

44. The equation of a circle with origin as centre and passing through the vertices an equilateral triangle whose median is of length 3a is:
(a) $x^2 + y^2 = 9a^2$ (b) $x^2 + y^2 = 16a^2$
(c) $x^2 + y^2 = 4a^2$ (d) $x^2 + y^2 = a^2$

45. The locus of a point for which y = 0, z = 0 is:
(a) Equation of X-axis (b) Equation of Y-axis
(c) Equation of Z-axis (d) None

46. In an A.P. the p^{th} term is q and the $(p + q)^{th}$ term is 0. Then the q^{th} term is
(a) –p (b) p
(c) p + q (d) p – q

47. Let f (x) = x – [x] : $x \in R$, [ ] denotes the greatest integer function, then $\int_{-1}^{2} f(x)dx$ is:
(a) 3/2 (b) 1
(c) 0 (d) –1

48. The standard deviation of some temperature data in ^0C is 5. If the data were converted into ^0F, the variance would be:
(a) 81 (b) 57 (c) 36 (d) 25

49. Three numbers are chosen from 1 to 20. Find the probability that they are not consecutive.
(a) $\frac{186}{190}$ (b) $\frac{187}{190}$ (c) $\frac{188}{190}$ (d) $\frac{18}{20c_3}$

50. The probability that at least one of the events A and B occurs is 0.6. If A and B occurs simultaneously with probability 0.2, then, P $(\bar{A})$ + P $(\bar{B})$ is
(a) 0.4 (b) 0.8 (c) 1.2 (d) 1.6

51. The maximum number of equivalence relations on the set A = {1, 2, 3} are
(a) 1 (b) 2 (c) 3 (d) 5

52. If the set A contains 5 elements and the set B contains 6 elements, then the number of one-one and onto mappings from A to B is:
(a) 720 (b) 120 (c) 0 (d) None

53. If $\cos^{-1}\alpha + \cos^{-1}\beta + \cos^{-1}\gamma = 3\pi$, then $\alpha(\beta + \gamma) + \beta(\gamma + \alpha) + \gamma(\alpha + \beta)$ equals
(a) 0 (b) 1 (c) 6 (d) 12

54. If A is a square matrix such that $A^2 = I$, then $(A–I)^3 + (A+I)^3 – 7A$ is equal to
(a) A (b) I –A (c) I + A (d) 3A

55. Let $f(t) = \begin{vmatrix} \cos t & t & 1 \\ 2\sin t & t & 2t \\ \sin t & t & t \end{vmatrix}$, then $\lim_{t\to 0} \frac{f(t)}{t^2}$ is equal to
(a) 0 (b) –1 (c) 2 (d) 3

56. If x, y, z are all different from zero and $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = 0$, then value of $x^{-1} + y^{-1} + z^{-1}$ is:
(a) xyz (b) $x^{-1}y^{-1}z^{-1}$
(c) –x –y –z (d) –1

57. If $f(x) = x^2 \sin\frac{1}{x}$, where $x \neq 0$, then the value of the function f at x = 0, so that the function is continuous at x = 0, is
(a) 0 (b) –1
(c) 1 (d) None

58. Maximum value of $\left(\frac{1}{x}\right)^x$ is:
(a) e (b) e^e
(c) $e^{\frac{1}{e}}$ (d) $\left(\frac{1}{e}\right)^{\frac{1}{e}}$

59. $\int \frac{\cos 2x - \cos 2\theta}{\cos x - \cos\theta} dx$ equal to
(a) 2 (sin x + x cos θ) + C
(b) 2 (sin x – x cos θ) + C
(c) 2 (xin x + 2x cos θ) + C

(d) 2 (sin x – 2x cos θ) + C

60. The degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = \frac{d^2y}{dx^2}$ is:
(a) 4 (b) $\frac{3}{2}$
(c) Not defined (d) 2

61. The solution of the differential equation $\frac{dy}{dx} e^{x-y} + x^2 e^{-y}$ is:
(a) $y = e^{x-y} - x^2 e^{-y} + c$ (b) $e^y - e^x = \frac{x^3}{3} + c$
(c) $e^x + e^y = \frac{x^3}{3} + c$ (d) $e^x - e^y = \frac{x^3}{3} + c$

62. For any vector $\vec{a}$, the value of $(\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2$ is equal to
(a) $\vec{a}^2$ (b) $\overrightarrow{3a}^2$ (c) $\overrightarrow{4a}^2$ (d) $2\vec{a}^2$

63. Number of vectors of unit length perpendicular to the vectors $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$ and b $= \hat{j} + \hat{k}$ is:
(a) one (b) two (c) three (d) infinite

64. The reflection of the point (α, β, γ) in the xy-plane is:
(a) (α, β, 0) (b) (0, 0, γ)
(c) (–α, –β, γ) (d) (α, β, –γ)

65. The locus represented by xy + yz = 0 is
(a) A pair of perpendicular lines
(b) A pair of parallel lines
(c) A pair of parallel planes
(d) A pair of perpendicular planes

66. Three persons A, B and C fire at a target in turn, starting with A. Their probabilities of hitting the target are 0.4, 0.3 and 0.2 respectively. The probability of two hits is:
(a) 0.024 (b) 0.188 (c) 0.336 (d) 0.452

67. A and B are two students. Their chances of solving a problem correctly are $\frac{1}{3}$ and $\frac{1}{4}$, respectively. If the probability of their making a common error is $\frac{1}{20}$ and they obtain the same answer, then the probability of their answer to be correct is:
(a) $\frac{1}{12}$ (b) $\frac{1}{40}$ (c) $\frac{13}{120}$ (d) $\frac{10}{13}$

68. If $a_n = \alpha^n - \beta^n$ and α, β are the roots of th equation $x^2 - 6x - 2 = 0$, then find the value of $\frac{a_{10}2a_8}{3a_9}$?
(a) 2 (b) –2 (c) 3 (d) –3

69. Let the quadratic equation $ax^2 + bx + c = 0$ where a, b, c are obtained by rolling the dice thrice. What is the probability that the equation has equal roots?
(a) $\frac{5}{216}$ (b) $\frac{1}{72}$ (c) $\frac{1}{36}$ (d) $\frac{1}{216}$

70. Find the value of $l = \int_{-1}^{1} x^2 . e^{[x^3]} dx$,
where ([ ] denotes the greatest integer function)
(a) $\frac{1}{3} - \frac{1}{3e}$ (b) $\frac{1}{3} + \frac{1}{3e}$ (c) $\frac{1}{3e} - \frac{1}{2}$ (d) 2

71. Find the number of points, where f(x) = |2x +1| –3 | x + 2| + |x^2 + x –2| is non differentiable at
(a) 2 (b) 3 (c) 4 (d) 0

72. Find the number of solutions of the equation 4 (x –1) = $\log_2$ (x –3)
(a) 0 (b) 1 (c) 2 (d) 4

73. Minimum value of $a^{a^x} + \frac{a}{a^{a^x}}$ (a > O ; a, x ∈ R)
(a) $2\sqrt{a}$ (b) $\sqrt{2a}$ (c) $2\sqrt{2a}$ (d) None

74. If 'x is a number divided by '4, leaves the remainder '3', then find the remainder if $(2020 + x)^{2022}$ is divided by '8'
(a) 1 (b) 2 (c) 3 (d) 4

75. If $x^3 - 2x^2 + 2x - 1 = 0$ has roots (α,β,γ) then find $(\alpha^{162} + \beta^{162} + \gamma^{162})$
(a) 1 (b) 2 (c) 3 (d) 4

76. Find the area bounded by the curve y = | | x – 1| – 2| with X-axis
(a) 1 (b) 2 (c) 3 (d) 4

77. If a triangle is inscribed in a circle of radius r, then which of the following triangle can have maximum area:
(a) Equilateral triangle with height $\frac{2r}{3}$
(b) Right angled triangle with side 2r, r
(c) Equilateral triangle with side $\sqrt{3}\,r$
(d) Isosceles triangle with base 2r

78. From the point A(3, 2) a line is drawn to any point on the circle $x^2 + y^2 = 1$. If locus of midpoint of this line segment is a circle, then its radius is
(a) $\frac{\sqrt{13}}{2}$ (b) ½ (c) $\frac{\sqrt{11}}{2}$ (d) 1/4

79. If slope of common tangent to curves $4x^2 + 9y^2 = 36$ and $4x^2 + 4y^2 = 31$ is m, then m^2 is equal to:
(a) 3 (b) 6 (c) 9 (d) 5

80. If A and B are matrices of same order, then (AB' – BA') is a
(a) Skew-symmetric matrix
(b) Null matrix
(c) Symmetric matrix

(d) Unit matrix

81. Which of the following statements best explains a process?
(a) It is a program
(b) It is a program in execution
(c) It is an instance of a program in execution
(d) It is a program that uses system calls

82. Files that store data in the same format as used in the program are called.
(a) Binary files (b) Source file
(c) Text files (d) Core Files

83. Match List-I and List-II and select correct group of matching.

List-I	List-II
1. DOS	P. Sun Microsystems
2. P4	Q. Microsoft Corporation
3. Java	R. IBM
4. PC	S. Intel Corporation

(a) (1,Q), (2, S), (3, P), (4,R)
(b) (1,Q), (2, R), (3, S), (4,P)
(c) (1,S), (2, P), (3, Q), (4,R)
(d) (1,R), (2, P), (3, m), (4,R)

84. Which of the following languages is case sensitive?
(a) FORTRAN (b) BASIC
(c) C (d) None

85. Kernel is:
(a) Considered as the critical part of OS
(b) The software which monitors the OS
(c) The set of primitive function upon which rest of the OS functions are built
(d) None

86. If $(123)_5 = (A3)_B$, then the number of possible values of A is:
(a) 4 (b) 1 (c) 3 (d) 2

87. The three main components of a digital computer system are
(a) Memory, I/O, DMA
(b) ALU, CPU, Memory
(c) Memory, CPU, I/O
(d) Control Circuits, ALU, Register

88. The Boolean expression AB + AB' + A'C + AC is unaffected by the value of Boolean variable:
(a) A (b) B (c) C (d)None

89. The method of communication in which transmission takes place in both the direction, but only in one direction at a time is called:
(a) Simplex (b) Four wire circuit
(c) Full duplex (d) Half duplex

90. The Topology with the highest reliability is:
(a) Bus Topology (b) Star Topology
(c) Ring Topology (d) Mesh Topology

91. C is a:
(a) High level language
(b) Low level Language
(c) High Level language with some low level features
(d) Low level language with some high level features

92. Match List-I and List-II and select correct group of matching.

List-I	List-II
1. Azim Premji	P. Microsoft
2. Narayan Murthy	Q. Wipro
3. Bill Gates	R. Satyam
4. Ramalinga Raju	S. Infosys

(a) (1,S), (2, Q), (3, P), (4,R)
(b) (1,Q), (2, S), (3, P), (4,R)
(c) (1,P), (2, R), (3, S), (4,Q)
(d) (1,S), (2, P), (3, Q), (4,R)

93. The minimum number of temporary variables needed to swap the contents of two variables is:
(a) 1 (b) 2
(c) 3 (d) 0

94. Binary equivalent of decimal number $(0.4375)_{10}$ is:
(a) $(0.0111)_2$ (b) $(0.1011)_2$
(c) $(0.1100)_2$ (d) $(0.1010)_2$

95. An important aspect in coding is
(a) Readability
(b) To use as small memory space as possible
(c) Productivity
(d) Brevity

96. C++ was originally developed by
(a) Clocksin and Mellish (b) Donalk E. Knuth
(c) Sir Richard Hadlee (d) Bjarne Stroustrup

97. Who created the first free e-mail service on the internet:
(a) B.W. Kernighan (b) Sabeer Bhatia
(c) Ray Tomlinson (d) None

98. In general, for a computer which of the following represents the memories in increasing order of their capacities?
(a) Register < RAM < Cache < Hard Disk
(b) RAM < Cache < Hard Disk < Register
(c) Register < Cache < RAM < Hard Disk
(d) Cache < RAM < Hard Disk < Register

99. In IPv4, the length of an IP address is
(a) 16 bits (b) 32 bits
(c) 48 bits (d) 64 bits

100. Which Protocol is used to send messages from a mail client to a mail server?
(a) FTP (b) IP
(c) SMTP (d) TCP/IP

ANSWER KEY

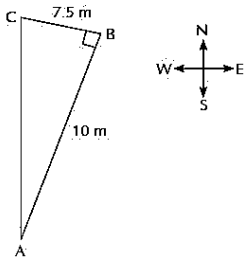
1.	d	**2.**	c	**3.**	d	**4.**	b	**5.**	a
6.	c	**7.**	a	**8.**	c	**9.**	d	**10.**	b
11.	d	**12.**	d	**13.**	c	**14.**	c	**15.**	b
16.	d	**17.**	b	**18.**	c	**19.**	b	**20.**	b
21.	b	**22.**	a	**23.**	d	**24.**	b	**25.**	b
26.	d	**27.**	d	**28.**	b	**29.**	a	**30.**	b
31.	b	**32.**	d	**33.**	d	**34.**	b	**35.**	a
36.	b	**37.**	b	**38.**	a	**39.**	b	**40.**	c
41.	b	**42.**	b	**43.**	a	**44.**	c	**45.**	a
46.	b	**47.**	a	**48.**	a	**49.**	b	**50.**	c
51.	d	**52.**	c	**53.**	c	**54.**	a	**55.**	a
56.	d	**57.**	a	**58.**	c	**59.**	a	**60.**	d
61.	b	**62.**	d	**63.**	b	**64.**	d	**65.**	d
66.	b	**67.**	d	**68.**	a	**69.**	a	**70.**	b
71.	a	**72.**	b	**73.**	a	**74.**	a	**75.**	c
76.	d	**77.**	c	**78.**	b	**79.**	a	**80.**	a
81.	c	**82.**	a	**83.**	a	**84.**	c	**85.**	c
86.	b	**87.**	c	**88.**	b	**89.**	d	**90.**	d
91.	c	**92.**	b	**93.**	d	**94.**	a	**95.**	a
96.	d	**97.**	b	**98.**	c	**99.**	b	**100.**	c

SOLTUION

1.	d	**2.**	c	**3.**	d

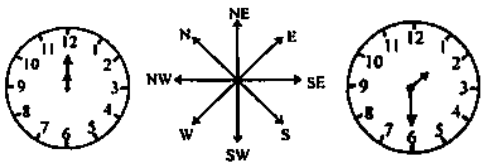
4. (a)
DRIVER = 12
PEDESTRIAN =20
ACCIDENT = 16
CAT = 3

5. (a) Clearly, the narrator starts from A, moves towards north-east a distance of 10 m up to B, turns left (90 degree anticlockwise) and moves 7.5 m up to C. Clearly, C lies to the north of A. Also, ΔABC is right-angled at B.



So, $AC^2 = AB^2 + BC^2 = (10)^2 + (7.5)^2 = 100 + 56.25 = 156.25$
$AC = \sqrt{(156.25)}$ m = 12.5 m.
Thus the narrator is 12.5 m to the north of his initial position

6. (c) The correct option is C East
The positions of the minute and hour hands at 12 noon and 1:30 p.m. are as shown in the diagram. Comparing with direction figure, we see that the hour hand at 1:30 p.m. points towards the East.

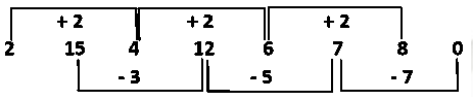


7. (a)
4.5 m = 450 cm. After 28 jumps, the frog climbs 28 x (30 – 15) = 28 x 15 = 420 cm. In the 29th jump, the frog will reach the top of the well, so it won't slip back on slippery walls.

8. (c)
22 x 4 + 6 x 2
19 x 4 + 6 x 4
16 x 4 + 6 x 6
13 x 4 + 6 x 8
10 x 4 + 6 x 10
7 x 4 + 6 x 12
4 x 4 + 6 x 14
1 x 4 + 6 x 16
Total No. of Ways= 9

9. (d)

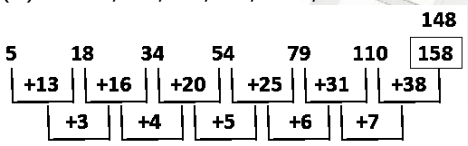
10. (b)
2, 15, 4, 12, 6, 7 .....? .....?



Ans. 8, 0

11. (d)

12. (d) 5, 18, 34, 79, 110, 158



Wrong number is 158

13. (c)
5, 6, 14, 45, 184, 920, 5556
5 x 1 + 1 = 6
6 x 2 + 2 =14
14 x 3 + 3 = 45
45 x 4 + 4 =184
184 x 5 + 5 =925
925 x 6 + 6 = 5556
920 is a wrong number.

14. (c)

15. (b)

16. (d) To solve this problem, we first need to determine the rate at which the cats kill the mice.
From the information given:
- 100 cats kill 100 mice in 100 days.
This means that:
- Each cat kills 1 mouse in 100 days.
Now, if we have 4 cats, we can calculate how many mice they would kill in the same period.
Since each of the 4 cats kills 1 mouse in 100 days:
- 4 cats would kill 4 mice in 100 days.
Therefore, **4 cats would kill 4 mice in 100 days**.

17. (b)

		E	T.	W.
A	→		12	4 → 48
B	→		16	3 → 48

Tank will be filled in 9 minutes and the whole time pipe A was opened
9 x 4 = 36
48 – 36 = 12
12 /3 = 4 minute

18. (c)

19. (b)

20. (b)
3, 4, 5, 6 leaving a remainder of 1
(60 x + 1) x = 5
divisible by 7
301.

21.	b	**22.**	c	**23.**	d	**24.**	b	**25.**	d
26.	c	**27.**	a	**28.**	b	**29.**	a	**30.**	b

31. (b)
$(A \cap B')' \cup (B \cap C)$
$(A' \cup B) \cup (B \cap C)$
$A' \cup (B \cup (B \cap C)$
$B \cup (B \cap C) = B$
$A' \cup B$

32. (b)
Since every rectangle rhombus and square is parallelogram so
$F_1 = F_2 \cup F_3 \cup F_4$

33. (b)
$[x^2] - 5[x] + 6 = 0$
$([x] - 3)([x] - 2)$
$[x] = 2, 2$
$x \in [2, 3]$

34. (b)
1 radian is approximately 57^0
Also the value of sin x is always increasing for $0 \le x \le 90^0$ (or sin x is an increasing function to= $0 \le x \le 90^0$)
$1^C < 57^0$
or 1 < 1 radian
$\sin 1^0 < \sin 1$ Ans.

35. (a)
tan 3A – tan 2A – tan A
$\tan(A + 2A) = \frac{\tan 2A + \tan A}{1 - \tan 2A \tan A}$
tan 3A – tan 3A tan 2a tan A = tan 2A + tan A
tan 3A – tan 2A – tan A = tan 3A tan 2A tan A

36. (b)

$\left(\frac{1+i}{1-i}\right)^x = 1$

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

$\left[\frac{1+i^2+2i}{1+1}\right]^x = 1$

$(i)^x=1$

x = 4n, wheren ∈ N

37. (b)

$\left|\frac{i+z}{i-z}\right| = 1$

Z = x + iy

$\left|\frac{x+(y+1)}{-x-(y-1)}\right| = 1$

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

$x^2+ (y+1)^2 = x^2 + (y-1)^2$

4y = 0, y = 0

z lies on x - axis (real axis)

38. (a)

0, 1,2,3,4,5

Live = number digit divisible by 3

1,2,3,4,5 is not include to

5 x 4 x 3 x 2 x 1

= 120

0,1,2,3,4,5 is

4 x 4 x 3 x 2 x 1 = 96

120 + 96 = 216 Ans.

39. (b)

Possible number of choosing 5 different green dyes= 2^5

Possible number of choosing 4 blue dyes = 2^4

And possible number of choosing 3 red dyes = 2^3

If atleast one blue and one green dyes are selected then the total number of selection

$= (2^5 - 1) \times (2^4 - 1) \times 2^3$

$= 31 \times 15 \times 8$

= 3720

40. (c) total number of terms in the expression $\frac{n}{2} + 1$

$\frac{100}{2} + 1 = 51$ (100 is even)

41. (b) Since

=Arithmetic mean ≥ geometric mean of 4^x and 4^{1-x}

$= \frac{4^x+4^{1-x}}{2} \geq \sqrt{4^x.4^{1-x}}$

$= \frac{4^x+4^{1-x}}{2} \geq \sqrt{4^x.4.4^{-x}}$

$= \frac{4^x+4^{1-x}}{2} \geq 2$

$=4^x + 4^{1-x} \geq 4$

Minimum value of $4^x + 4^{1-x}$ is 4.

42. (b) Let the coordinates of foot of perpendicular be $A(\alpha,\beta)$ from the point $P(2,3)$ (say) on line $y=3x+4$

Slope of AP, $m_1 = \frac{\beta-3}{\alpha-2}$

Slope of given line, $m_2=3$

Since, both are perpendicular.

$\therefore m_1 \times m_2 = -1$

$\frac{\beta-3}{\alpha-2} \times 3 = -1$

$\Rightarrow 3\beta = -\alpha+11 \ldots (i)$

Also, the point $A(\alpha,\beta)$ is on the given line.

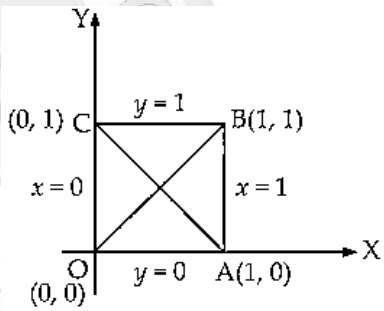
So, $A(\alpha,\beta)$ satisfy the equation of the line.

$\therefore \beta = 3\alpha+4 \ldots (ii)$

On solving (i) and (ii), we get $\alpha = -1/10$, $\beta = 37/10$

So, coordinates of foot of perpendicular is $\left(\frac{-1}{10}, \frac{37}{10}\right)$

43. (a)



Given equation x = 0, y = 0

x = 1 and y = 1 form a square of side 1 unit

From figure, we get that OABC is square having corners O(0,0), A(1,0)

B (1,1) and C (0, 1)

Equation of diagonal AC

$y - 0 = \frac{1-0}{0-1}|(x-1)$

= y = – (x – 1)

= y = – x + 1

= y + x = 1

Equation of diagonal OB is $y - 0 = \frac{1-0}{1-0}$ (x-0)

y = x

44 (c). $x^2 + y^2 = r^2$

Median = 3

i.e. radius of circle = distance of centroid from any vertex

$= \frac{2}{3}$ (median)

$= \frac{2}{3}$ (3a)

i.e. radius of circle = 2a

So equation of circle is $x^2 + y^2 = (2a)^2$

i.e. $x^2 + y^2 = 4a^2$

45. (a) y = 0, x = 0
equation of x axis

46. (b) Let a, d be the first term and common difference respectively.
Therefore, T_P = a + (p-1) d = q .... (1)
T_{p+q} = a + (p + q –1) d = 0 .... (2)
Subtracting (1), from (2) we get qd = –q
Substituting in (1) we get
a = q – (p –1) (–1) = q + p – 1
Now T_q = a + (q –1) d = q + p –1 + (q –1) (–1)
= q + p –1 – q + 1
= p

47. (a)

48. (a)
Given the standard deviation of some temperature data in °C, σC=5 We know that
$C = \frac{5}{9}(F - 32)$
= F = $\frac{9C}{5} + 32$
Now we kJnow If standard deviation of x series is 5, then standard deviation of kx series is ks, So standard deviation of some temperature data in °C, σC=5,
And hence the standard deviation of some temperature data in
$\frac{9C}{5}, \frac{9C}{5}, \sigma_C = 5 \times \frac{9}{5} = 9$
Similarly,
If standard deviation of x series is 5, then standard deviation of k + x series is 5,
So standard deviation of some temperature data in
$\frac{9C}{5}, \frac{9C}{5}, \sigma_C = 9$
And hence the standard deviation of some temperature data in 9C/5 +32 will be
$\sigma_F = \frac{9C}{5}, \sigma_C = 9$
Now for variance, we will square on both sides, we get
$\sigma_F = 9^2$
= 81
This is the required variance.

49. (b)
When we select three consecutive numbers from 1 to 20.
There are 18 possible combinations
(i.e., 1,2,3;2,3,4,.....;18,19,20}
∴ Probability of selecting three consecutive numbers
= $\frac{18}{{}^{20}C_3} = \frac{18}{\frac{20\times19\times18}{3\times2\times1}}$
= $\frac{3}{190}$
So Required probability = 1– Probability of selecting three consecutive numbers
= 1 – $\frac{3}{190}$
= $\frac{187}{190}$

50. (c) Given that : P (A U B) = 0.6
P (A ∩ B) = 0.2
So P (A U B) = P (A) + P (B) – P (A ∩ B)
= 0.6 = P (A) + P (B) – 0.2
= P(A) + P(B) = 0.6 + 0.2 = 0.8
And 1–P $(\bar{A}) + 1 - P(\bar{B}) = 0.8$
= P $(\bar{A}) + P(\bar{B}) = 2 - 0.8 = 1.2$

51. (d) Given that , A = {1,2,3}. Now the possible equivalence relations are as follows.
R_1 = {(1,1), (2,2), (3,3)}
R_2 = {(1,1), (2,2), (3,3), (1,2), (2,1)}
R_3 = {(1,1), (2,2), (3,3), (1,3), (3,1)}
R_4 = {(1,1), (2,2), (3,3), (2,3), (3,2)}
R_2 = {(1,1), (2,2), (3,3), (1,2), (1,3), (2,1), (2,3), (3,1),(3,2)}
Maximum number of equivalence relation is '5'.

52. (d) As A contains 5 elements.
∴ For any one-one onto mapping f : A→B, f(A) also contains 5 elements but *B* contains 6 elements.
∴ f(A)=B.
So, no one-one mapping from *A* to *B* can be onto.

53. (c)
The correct option is A 6
$\cos^{-1}\alpha + \cos^{-1}\beta + \cos^{-1}\gamma = 3\pi$
So $0 \leq \cos^{-1} x \leq \pi$
$\cos^{-1}\alpha + \cos^{-1}\beta + \cos^{-1}\gamma = 3\pi$
If and only if
$\cos^{-1}\alpha = \cos^{-1}\beta = \cos^{-1}\gamma = \pi$
= α = β = γ = –1
[∵ $\cos^{-1}(-1) = \pi$]
= α(β + γ) + β (γ + α) + γ (α+β)
= –1(-1 -1) – 1 (-1 -1) –1 (-1 -1) = 2 + 2 + 2 = 6

54. (a)
$(A-I)^3 + (A + I)^3 - 7A$
$= A^3 - I^3 - 3A^2I + A^3 + I^3 + 3A^2I + 3AI^2 - 7A$
$= 2A^3 + 6AI^2 - 7A$
$= 2A.\ A^2 + 6A - 7A$
= 2A.I – A (∵ $A^2 = 1$)
= 2A – A
= A

55. (a)

Given : $f(t) = \begin{vmatrix} \cos t & t & 1 \\ 2\sin t & t & 2t \\ \sin t & t & t \end{vmatrix}$

$= \frac{f(t)}{t^2} = \frac{1}{t^2}\begin{vmatrix} \cos t & t & 1 \\ 2\sin t & t & 2t \\ \sin t & t & t \end{vmatrix}$

(Divide both sides by t^2)

$= \frac{f(t)}{t^2}\begin{vmatrix} \cos t & t & 1 \\ \frac{2\sin t}{t} & 1 & 2 \\ \frac{\sin t}{t} & 1 & 1 \end{vmatrix}$

(Dividing R_2 and R_3 by 't')

$\lim_{t\to 0} \frac{f(t)}{t^2}\begin{vmatrix} 1 & 0 & 1 \\ 2 & 1 & 2 \\ 1 & 1 & 1 \end{vmatrix}$

$\lim_{t\to 0} \frac{f(t)}{t^2} = 1(1\text{-}2) - 0 + 1(2\text{-}1) = 0$

56. (d)

The correct option is (D) -1

$\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = 0$

$xyz\begin{vmatrix} \frac{1}{x}+1 & \frac{1}{x} & \frac{1}{x} \\ \frac{1}{y} & \frac{1}{y}+1 & \frac{1}{y} \\ \frac{1}{z} & \frac{1}{z} & \frac{1}{z}+1 \end{vmatrix}$

$R_1 \to + R_2 + R_3$

$xyz\begin{vmatrix} 1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z} & 1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z} & 1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z} \\ \frac{1}{y} & \frac{1}{y}+1 & \frac{1}{y} \\ \frac{1}{z} & \frac{1}{z} & \frac{1}{z}+1 \end{vmatrix}$

$xyz\left(1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)\begin{vmatrix} 1 & 1 & 1 \\ \frac{1}{y} & \frac{1}{y}+1 & \frac{1}{y} \\ \frac{1}{z} & \frac{1}{z} & \frac{1}{z}+1 \end{vmatrix} = 0$

$C_2 \to C_2 - C_1$, $C_3 \to C_3 - C_1$

$xyz\left(1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)\begin{vmatrix} 1 & 0 & 0 \\ \frac{1}{y} & 1 & 0 \\ \frac{1}{z} & 0 & 1 \end{vmatrix}$

$xyz\left(1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)[1\ (1\text{–}0)] = 0$

$1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z} = 0$

$x^{-1} + y^{-1} + z^{-1} = -1$

57. (a)

The given function is $f(x) = x^2 \sin\frac{1}{x}$, where $x \neq 0$

Now, f(x) is continuous at x = 0

So $f(0) = \lim_{x\to 0} f(x)$

$= f(0) = \lim_{z\to 0} x^2 \sin\frac{1}{x}$

$= f(0) = \lim_{z\to 0} x^2 \times \lim_{x\to 0} \sin\frac{1}{x}$

= f(0) = 0 x a finite value between –1 and 1

$(-1 \leq \sin\frac{1}{x} \leq 1)$

= f (0) = 0

Thus, the value of the function f(x) at x = 0 so that the function is continuous at x = 0 is 0.

58. (c)

The correct option is (C) $e^{1/e}$

$f(x) = \left(\frac{1}{x}\right)^x$

= log f(x) = –x log x

Differentiating wrt x, we get

$\frac{f(x)}{f(x)}$ = – log x – 1

$= f(x) = \left(\frac{1}{x}\right)^x$ (– log x –1)

Put f (x) = 0 = x = 1/e

We can verify f'(x) > 0 at x = 1/e

Therefore, f attains maximum value at x = 1/e and $f_{max} = e^{1/e}$

59. (a)

The correct option is (A) 2(sin x + x cos θ) + C

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

$= \int \frac{2(\cos x + \cos\theta)(\cos x - \cos\theta)}{\cos x - \cos\theta} dx$

$= \int 2(\cos x + \cos\theta) dx$

= 2(sin x + x cos θ) + C

60. (a)

$\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{4}} = \left(\frac{d^2y}{dx^2}\right)^{\frac{1}{3}}$

$\left(\left(1 + \left(\frac{dy}{dx}\right)^2\right)^{\frac{3}{4}}\right)^3 = \left(\left(\frac{d^2y}{dx^2}\right)^{\frac{1}{3}}\right)^3$

$\left(1 + \left(\frac{dy}{dx}\right)^2\right) = \left(\frac{d^2y}{dx^2}\right)^{\frac{9}{4}}$

$\left(\frac{d^2y}{dx^2}\right)^{\frac{9}{4}} - \left(1 + \left(\frac{dy}{dx}\right)^2\right) = 0$

The degree of the differential equation is 4.

61. (b)

Given : $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$

$\frac{dy}{dx} = e^x . e^{-y} + x^2 e^{-y}$

$\frac{dy}{dx} = \frac{e^x + x^2}{ey}$

dy.ey = (e^x + x^2) dx → this is variable seprable form taking integration on both side.

$\int e^y dy = \int e^x dx + \int x^2 dx$

$e^y = e^x + \frac{x^3}{3} + C$

$\because \int e^y dy = \frac{x^{n+1}}{n+1}$

$\because \int e^{xdx} = e^x$

62. (d) Let

$\vec{a} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$

So $\vec{a}^{\,2} = x^2 + y^2 + z^2$

So $\vec{a} = \hat{\imath} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ x & y & z \\ 1 & 0 & 0 \end{vmatrix}$

$= \hat{\imath}[0] - \hat{\jmath}[-z] + \hat{k}[-y]$

$= z\hat{\jmath} - y\hat{k}$

So $(\vec{a} \times \hat{\imath})^2 = (Z\hat{\jmath} - y\hat{k})\,(Z\hat{\jmath} - y\hat{k})$

$= y^2 + z^2$

Similarly,

$(\vec{a} \times \hat{\jmath})^2 = x^2 + z^2$

and

$(\vec{a} \times \hat{k})^2 = x^2 + y^2$

So $(\vec{a} \times \hat{\imath})^2 + (\vec{a} \times \hat{\jmath})^2 + (\vec{a} \times \hat{k})^2 = y^2 + z^2 + x^2 + z^2 + x^2 + y^2$

$= 2\,(x^2 + y^2 + z^2) = 2\vec{a}^{\,2}$

63. (a)

The answer is 2. One in the direction of the cross product of both the vectors and the other in the opposite direction!.

64. (d)

The correct option is D (α, β,–γ)

The image of of any point (x_1, x_2, x_3) about the planes

XY, YZ & ZX is $(x_1,x_2,-x_3)$, $(-x_1, x_2, x_3)$ & $x_1, -x_2, x_3)$

So, the image of (α, β,–γ) in XY plane is (α, β,–γ).

65. (d)

The correct option is D a pair of perpendicular planes

xy + yz = 0

= y (x + z) = 0

= y = 0 or x + z = 0

Which represents a pair of planes whose dot product is zero.

Therefore, the equation represents a pair of perpendicular planes.

66. (b)

We have, P(A) = 0.4, P(B) = 0.3, P(C) = 0.2

So Probability of two hits

= P (A). P(B). P(C) + P(A). P(B'). P(C)+ P(A').P(B).P(C)

= 0.4 x 0.3 x 0.8 + 0.4 x 0.7 x 0.2 + 0.6 x 0.3 x 0.2

= 0.096 + 0.056 + 0.036 = 0.188

67. (d)

Let E_1 be the event that both A and B score the problem

So $P(E_1) = \frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

Let E_2 be the event that both A and B got the incorrect solution of the problem

So $P(E_2) = \frac{2}{3} \times \frac{3}{4} = \frac{1}{2}$

Let E be the event of getting the same answer.

$= P(E/E_1) = 1$

Given probability of common error is 1/20.

$P(E/E_2) = 1/20$

We need to find $P(E_1/E) = \frac{P(E_1 \cap E)}{P(E)}$

$= \frac{P(E_1 \cap E)}{P(E)} = \frac{P(E_1 P(E/E_1)}{P(E_1).P(E/E_1)+P(E_2).P(E/E_2)}$

$= \frac{\frac{1}{12}.1}{\frac{1}{12}.1+\frac{1}{2}\times\frac{1}{20}}$

$= \frac{10}{13}$

So the probability is 10/13.

68. (a)

Explanation for the correct option:

Step: Equating the quadratic equation by substitution α and β in the equation

The given quadratic equation is

$x^2 - 6x - 2 = 0$ ...(i)

$= \alpha^2 - 6\alpha - 2 = 0$

$= \alpha^2 - 2 = 6\alpha$ ..... (ii)

And substituting x = β in (i)

$= \beta^2 - 6\beta - 2 = 0$

$= \beta^2 - 2 = 6\beta$ ..... (iii)

Step 2: Equating for $\frac{(a_{10}-2a_8)}{(3a_9)}$

Since given that $a_n = \alpha^n - \beta^n$

Therefore,

$= \frac{(a_{10}-2a_8)}{(3a_9)} = \frac{(\alpha^{10}-\beta^{10})-2(\alpha^8-\beta^8)}{3(\alpha^9-\beta^9)}$

$= \frac{\alpha^8(\alpha^2-2)-\beta^8(\beta^2-2)}{3(\alpha^9-\beta^9)}$

$= \frac{\alpha^8(6\alpha)-\beta^8(6\beta)}{3(\alpha^9-\beta^9)}$

From equation (ii) and (iii)

$= \frac{6(\alpha^9-\beta^9)}{3(\alpha^9-\beta^9)}$

$= \frac{6}{3}$

$= 2$

Thus, $\frac{(a_{10}-2a_8)}{(3a_9)} = 2$

Therefore, option (c) is the correct answer.

69. (a)

The correct option is (D) $\frac{5}{216}$

$ax^2 + bx + c = 0$

a, b, c, ∈ 1,2,3,4,5,6

n(S) = 6 x 6 x 6 = 216

D = 0 ⟶ $b^2 = 4ac$

$ac = \frac{b^2}{4}$ If b = 2, ac = 1 ⟶ a = 1, c = 1

If b = 4, ac = 4 ⟶ a = 1, c = 4

a = 4, c = 1

a = 2, c = 2

If b = 6, ac = 9 ⟶ a = 3, c = 3

So probability $\frac{5}{216}$

70. (b)

The correction option is (C) $\frac{e+1}{3e}$

$I = \int_{-1}^{0} x^2 \times e^{-1} dx + \int_{0}^{1} x^2 dx$

So $I = \frac{x^3}{3e}\int_{-1}^{0} + \frac{x^3}{3}\int_{0}^{1}$

= I = $\frac{1}{3e} + \frac{1}{3}$

71. (a)

f(x) = |2x +1| –3| x + 2| + x^2 + x –2|

$$f(x) = \begin{cases} x^2 - 7; & x \geq 1 \\ -x^2 - 2x - 3; & -\frac{1}{2} \leq x < 1 \\ -x^2 - 6x - 5: & -2 < x < \frac{-1}{2} \\ x^2 + 2x + 3: & x \leq -2 \end{cases}$$

$$\text{so f(x)} = \begin{cases} 2x; & x \geq 1 \\ -2x - 2x; & -\frac{1}{2} \leq x < 1 \\ -2x - 6: & -2 < x < -\frac{1}{2} \\ 2x + 2: & x \leq -2 \end{cases}$$

Check at 1, –2 and $\frac{-1}{2}$

Not Differentiable at x = 1 and $\frac{-1}{2}$

72. (b)

Enumerate the number of possible solutions

Given equation is $\log_4 (x-1) = \log_2 (x-3)$

$= 4^{log_4(x-1)} = 4^{log_2(x-3)}$

$= x - 1 = (2^2)^{log_2(x-3)}$ $\because [a^{log_4(x)} = x]$

$= x - 1 = (2^2)^{log_2(x-3)}$ $\because [(a^m)^n = a^{m \times n}]$

$= x - 1 = 2^{log_2(x-3)^2}$

[∵ x log a = log(a^x)]

= x – 1 = (x–3)^2

= x - 1 = x^2 + 9 – 6x

= x^2 –2x -5x + 10 = 0

= x(x–2) –5 (x–2) = 0

= (x–2) (x–5) = 0

= (x–2) (x–5) = 0

= (x–2) = 0 (x–5) = 0

= x = 2 x = 5

When x = 2,

$\log_2 (x-3) = \log_2 (2-3)$

$= \log_2 (-1)$

But log(x) is not defined for x ≤ 0

So, only x = 5 is a valid solution.

Hence, the number of solution to the equation $\log_4 (x-1) = \log_2 (x-3)$ is 1.

73. (a)

The correct option is A

$2\sqrt{a}$

Find the minimum value of the given function

Given : f(x) = $a^{a^x} + a^{1-a^2}$

Using A.M. ≥ G.M. inequality,

$\frac{a^{a^x} + \frac{a}{a^{a^x}}}{2} \geq \left(a^{a^x} \cdot \frac{a}{a^{a^x}}\right)^{\frac{1}{2}}$

$= a^{a^x} + \frac{a}{a^{a^x}} \geq 2\sqrt{a}$

$= a^{a^x} + a^{1-a^2} \geq 2\sqrt{a}$

Therefore the minimum value of

f(x) = $a^{a^x} + a^{1-a^2}$

is $2\sqrt{a}$

74. (a)

Here Dividend = r, Quotient = let k, Divisor = 4

Remainder = 3

So x = 4 k + 3

Put x = 4k + 3 in $(2020 + x)^{2022}$

$(2020 + x)^{2022} = (2020 + 4k + 3)^{2022}$

Write this in the form $(x-a)^n$

we add and subtract $1)^{2022}$

(2024 + 4k) = (506 + k) = 4(A) [let (500 + k) A]

(2024 + 4k) = 4A

So $(2024 + 4k - 1)^{2022} = (4A-1)^{2022}$

Step -2: Expand $(4A-1)^{2022}$ by the binomial theorem,

$(4A-1)^{2022} = {}^{2022}C_0 (4A)^{2022} (-1)^0 + {}^{2022}C_1 (4A)^{2021} (-1)^1 + ...$

$^{2022}C_{2021} (4A)^1 (-1)^{2021} + {}^{2022}C_{2022} (-1)^{2022}$

$= (4A)^{2022} - 2022 (4A)^{2021} + ... - 2022 (4A) + 1$

$\because {}^{2022}C_0 = 1, {}^{2022}C_1 = 2022,$

$^{2022}C_{2021} = 2022$ & $^{2022}C_{2022} = 1$

$= (4A)^{2022} - 2022 (4A)^{2021} + ... - 2022 (4A) + 1$

This is of the form

= 4 x 2μ + 1

= 8 μ + 1

This is of the form 8 μ + 1. By division algorithm

The remainder is 1.

75. (c)

Step 1: Find the roots of the equation

Let the roots of $x^3 - 2x^2 + 2x - 1 = 0$ be α,β,γ

$= (x^3 - 1) - 1 (2x^2 - 2x) = 0$

$= (x - 1) (x^2 + x + 1) - 2x (x - 1) = 0$

$= (x - 1) (x^2 - x + 1) = 0$

$= x - 1 = 0 : x^2 - x + 1 = 0$

Roots of $x^3 - 2x^2 + 2x - 1 = 0$ are $1, \omega, \omega^2$

step 2: Compute the required sum.

$\alpha^{162} + \beta^{162} + \gamma^{162} = 1^{162} + (\omega)^{162} + (\omega^2)^{162}$

$= \alpha^{162} + \beta^{162} + \gamma^{162} = 1 + (\omega)^{54} + (\omega^3)^{108}$

$= \alpha^{162} + \beta^{162} + \gamma^{162} = 1 + (1)^{54} + (1)^{108}$

$\because \omega^3 = 1$

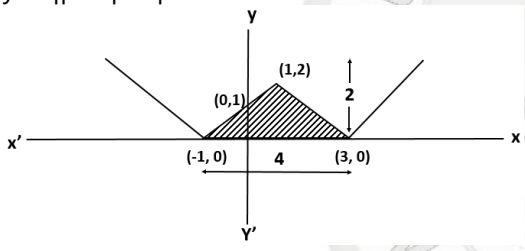
$= \alpha^{162} + \beta^{162} + \gamma^{162} = 3$

Hence, the sum of 162th power of the roots of the equation

$x^3 - 2x^3 + 2x - 1 = 0$ is 3.

76. (d)

$y = ||x-1| - 2|$ with x-axis



are of triangle = 1/2 base x height

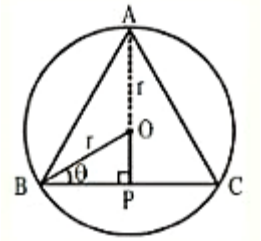
= 1/2 x 4 x 2 = 4 sq. unit

77. (d)

The correct option is (D)

An equilateral triangle having each of its side of length $\sqrt{3}r$

Solve for the maximum area of triangle



The height of the triangle is h

So h = AP

= AO + OP

= r + r sin (θ)

The base of the triangle is b

so b = BC

= BP + PC

= 2BP

=2 r cos (θ)

Area of the $\Delta ABC = \frac{1}{2} \times (b) \times (h)$

$= \Delta = \frac{1}{2}$ (2 r cos (θ) (r + sin (θ))

$= r^2 \cos(\theta) (1 + \sin(\theta))$

Now to find the maximum differentiate with respect to θ

$= \frac{d\Delta}{d\theta} = r^2 (\cos^2\theta) - \sin(\theta) - \sin^2\theta$

$= r^2 (1 - \sin(\theta) - 2\sin^2(\theta))$

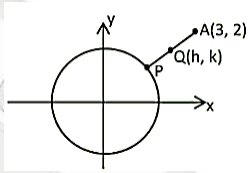
For extremum $\frac{d\Delta}{d\theta} = 0$

$= r^2 (1+\sin(\theta)) (1 - 2\sin\theta) = 0$

$= \sin(\theta) = -1, \frac{1}{2}$

78. (b)

The correct option is B $\frac{1}{2}$



So P = (2h –3, 2k –2) – on cirlce

So $\left(h - \frac{3}{2}\right)^2 + (k-1)^2 = \frac{1}{2}$

$= r = \frac{1}{2}$

79. (a)

Comparing equation of tangent to ellipse to that of circle.

Equation of ellipse is

E: $\frac{x^2}{9} + \frac{y^2}{4} = 1$

Equation of circle is

C: $x^2 + y^2 = \frac{31}{4}$

Equation of the tangent to the ellipse is

$y = mx \pm \sqrt{(9m^2 + 4)}$ .....(i)

Equation of the tangent to the circle is

$y = mx \pm \sqrt{\left(\frac{31}{4}m^2 + \frac{31}{4}\right)}$ .....(ii)

Comparing equation (i) and (ii)

$= 9m^2 + 4 = \frac{31}{4}m^2 + \frac{31}{4}$

$= 36m^2 + 16 = 31m^2 + 31$

$= 5m^2 = 15$

$= m^2 = 3$

Hence, the correct answer is 3.

80. (a)

We have

(AB' –BA') If we calculate (AB'–BA')'

= (AB)' –(BA')' = (AB')' – (BA')'

= (AB'–BA')' = (B') 'A' – (A')' B' {(AB)'=B'A}

= (AB'–BA')" = B A'–AB' {(A') =A}

= (AB'–BA')' = – (AB'–BA')

Hence (AB'–BA') is skew symmetric matrix.

So option 1 is correct.

81.	c	**82.**	a	**83.**	a	**84.**	c	**85.**	a

86. (b)

$(123)_5 = (A3)_B$

$1 \times 5^2 + 3 \times 5^1 + 3 \times 5^0 = A \times B^1 + 3 \times B^0$

$25 + 10 + 3 = AB + 3$

$AB = 35$

$A = 1, B = 35$

87. (c)

88. (d)

$AB + AB' + A'C + AC$

$A (B + B') + (A' + A) C$

$B + B' = 1$

$A' + A = 1$

Ans. A + C

89.	d	**90.**	d	**91.**	c	**92.**	b	**93.**	d
94.	a	**95.**	a	**96.**	d	**97.**	b	**98.**	c
99.	b	**100.**	c	**ANSWER KEY**					