Availability -

Booklet code:

$\boxed{13.36}$ 16

.66 2.64

$\boxed{8}$ $\boxed{9}$

Part A

1. Ramesh joined college when his age was (1/5)th of his life span. He spent (1/10)th of his life span in studies at college. Later (1/9)th of his life span was spent as bachelor. He had a son 3 years after his marriage. His son died 5 years before him. Ramesh's age at death is double his son's age at death.How many years did Ramesh spend in his married life?

   A. 45

   B. 53

   C. 55

   D. 33

2. There are 8 boys and 7 girls in a class. Number of ways for seating arrangement in a row such that all boys sit contiguously and all girls sit contiguously is

   A. 15!

   B. 8^7

   C. $8! \times 7!$

   D. None of the above

3. If the ratio of the ages of two friends A and B is in the ratio $3:5$ and that of B and C is $3:5$ and the sum of their ages is 147, then how old is B?

   A. 75 years

   B. 49 years

   C. 15 years

   D. 45 years

4. What is the probability that two square regions(of smallest dimension) selected randomly from a chess board will have only one common corner?

   A. $\frac{7}{144}$

   B. $\frac{7}{126}$

   C. $\frac{7}{288}$

   D. $\frac{7}{72}$

5. Alice, Bhaskar and Salim belong to a class in which all the students study mathematics or computer science (or both). All students who take computer science are poor at programming. Students who take mathematics are good at theory. Alice is poor at whatever Salim is poor at. Bhaskar is poor at everything that Salim is good at. Salim is good at both programming and theory. Who takes the computer science course?

   A. Salim

   B. Bhaskar

   C. Alice

   D. None

NOTE Answer the questions 6, 7, 8 using the following information.
Alice, Bob and Charlie are logicians, who always tell the truth. They sat in a row. In each of the scenarios below their father puts a red or blue colour hat in each of their heads. Alice can see Bob's hat and Charlie's hat but not her own. Bob can see only Charlie's hat. Charlie can see none of the hats. All three of them are aware of this arrangement. Choose the correct answer describing hat colors of Alice, Bob and Charlie respectively.

6. Their father puts a hat on each of their heads and says "Each of your hats is either red or blue and atleast one of you has a red hat". Alice then says "I know the color of my hat".

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A. Blue, Red, Red

B. Red, Blue, Red

C. Red, Blue, Blue

D. Blue, Red, Blue

7. Their father puts again a new hat on each of their heads and says "Each of your hats is either red or blue and atleast one of you has a red hat". Alice then says "I don't know the color of my hat. Bob then says "I don't know the colour of my hat".

   A. Blue, Red, Red

   B. Blue, Red, Blue

   C. Red, Red, Blue

   D. None of the above

8. Their father puts again a new hat on each of their heads and says "Each of your hats is either red or blue and atleast one of you has a red hat and at least one of you has a blue hat". Alice then says "I dont know the colour of my hat". Bob then says "my hat is red".

   A. Blue, Red, Red

   B. Blue, Red, Blue

   C. Red, Red, Red

   D. None of the above

9. Ali, David and Shyam are waiting in line for theatre tickets. Five people are between Ali and Shyam and ten people are between David and Shyam. If David is next to the last in line and Shyam is fifth in the line, then the minimum number of vacancies that enables all the three enter the theatre is

   A. 14

   B. 16

   C. 13

   D. None of the above

10. Kiran on his birthday distributed an average of 5 cookies for each friend. To his teacher and the headmaster Kiran gives 10 and 15 cookies respectively. Thus the average cookie distributed per head increases to 5.5.How many friends Kiran distributed the cookies to?

    A. 30

    B. 32

    C. 28

    D. None of the above

11. Three pipes fill a tank separately in 10 hours, 20 hours and 30 hours respectively. An outlet pipe can empty it in 15 hours when no water flows in. If all the pipes are opened, when the tank is empty, then how long, in hours, will it take to fill the tank?

    A. 60/7

    B. 15/2

    C. 64/7

    D. 20/3

12. A right circular metal cone has a diameter of 6 metres and height of 12 metres. The cone is melted and drawn into a wire of diameter 0.2 metres. What would be the length of the wire?

    A. 10800 metres

    B. 3600 metres

    C. 43200 metres

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D. 2700 metres

13. Complete the series of positive integers 6, 18, 21, 7, 4, 12, ...

A. 15

B. 24

C. 8

D. 36

14. In how many rearrangements of the letters of the word SCINTILLATING will no two 'I's appear together?

A. $\frac{10!}{2!\times 2!\times 2!}$

111,10 11 22

B. $\frac{11_{C_3}\times 10!}{2!\times 2!\times 2!}$

C. $11_{C_3} \times 13!$

D. $\frac{11!}{2!\times 2!\times 2!}$

15. A cube has its six sides coloured differently. The brown side is opposite to black. The blue side is adjacent to white. The red side is adjacent to blue. The brown side is faced down. Which one of the following would be opposite to red?

A. Black

B. White

C. Brown

D. Blue

16. A person has four currency notes of Rupees 10, 20, 50, and 100 denomination. The number of different sums of money she can form from them is

A. 15

B. 16

C. 8

D. None of the Above

17. The petrol tank of a motor cycle has a capacity of 11 litres, where 2.5 litres are held in reserve. Initially 6 litres of petrol was filled. The odometer reads 21375 km, when the motor cycle comes to reserve. It was then driven for another 98 km before 7 litres of petrol was filled. After a week, the motor cycle was again on reserve and the odometer reads 21718 km. What is the mileage given by of the motor cycle in kms per liter?

A. 35

B. 61

C. 49

D. None of the Above

18. Two campers A and B made rice to eat when they camped for the night. A traveller stopped by and gave them Rs 5/-. The entire rice was consumed by the three persons equally. A had contributed 200 gms, while B contributed 300 gms to the meal. Which of the following is a fair distribution of the money(Rs 5/-)?

A. Rs 2 and 50 paise each

B. Rs 1/- to A and Rs 4/- to B

C. Rs 2/- to A and Rs 3/- to B

D. None of the above

19. A class of 25 students came to know that today was their professor's birthday and asked him for sweets. The professor did not want to make things easy for the students. He put the condition that he will give a hundred sweets to the entire class provided

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that when divided amongst the class nobody gets even number of sweets. Given the above information, which of the following is correct?

(*i*) The students will get their wish as there are many ways to divide hundred
(*ii*) The students will not get their wish since the sum of odd number of odd numbers cannot be an even number
(*iii*) The students try to obtain a solution with 12 pairs of odd numbers and another odd number and succeed

A. (*ii*) Only

B. (*iii*) Only

C. (*i*) Only

D. (*i*) and (*ii*)

20. A scientist is sent by his wife to buy 2 Kg of sugar. He is afraid of being cheated and so thinks of a trick by which even if the balance arms are not of equal length he cannot loose. Which of the following is his trick?

A. Weigh 1 Kg of sugar. Move this 1 Kg sugar to the pan with the weight and now weigh 2 Kgs of sugar

B. Weigh 1 Kg of sugar. Change the weight position to the other pan and weigh another Kg of sugar

C. Weigh 1 Kg of sugar. Replace the weight by this 1Kg of sugar and weigh another Kg of sugar

D. None of the above

21. A famous person in India was born on 29/02/1896. He declared that the interval between his previous birthday and next birthday is 12 years. W
is the date on which he could m
this statement?

A. 29/02/1904

B. 29/02/1908

C. 29/02/1900

D. None of the above

22. The product of the positive inte
in the interval [1, ..., 100] is quite a
number. However, the number of
ros on the right hand side end of
big number can be found easily as

A. 23

B. 24

C. 22

D. None of the above

23. A non-stop express train starts fr
Eastpur to Westnagar, travelling a
km per hour. At the same time
other non-stop train starts from W
nagar to Eastpur but travelling at
km per hour. We cannot locate E
pur and Westnagar on the map so
cannot say the distance between th
If we assume a distance between th
greater than 200 kms, how far ap
will they be exactly one hour be
they cross each other?

A. 95 km

B. 105 km

C. 85 km

D. 78 km

24. What is the smallest positive inte
n for which $\frac{50!}{(24)^n}$ is not an intege

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A. 32

B. 16

C. 8

D. None of these

25. A student was studying in her room when the electricity failed. She had two new candles of different thickness but same length on her desk. She lit them and went on studying. The next day her father wanted to know how long the electricity failure last. The student had not noted the times of failure and restoration of electricity. The student was worried since later last night she had cleared out her desk and thrown away the stubs, but she did remember that one stub was 4 times longer than the other, and informed the same to her father. Her father was now happy since he knew that the thicker candle lasts for 5 hours while thinner one takes 4 hours only. Using this information, the time of electricity failure was calculated as

A. 4.5 hours

B. 3.45 hours

C. 4 hours

D. 4.45 hours

8 6.46 133 8 7.54

Part B

26. If $(123)_5 = (A3)_B$, where A is a single digit, then the number of possible values of A is

A. 1

B. 3

C. 4

D. 2

27. 3428 is decimal value for which of the following binary coded decimal (BCD) groupings?

A. 11010001001000

B. 1101010000101000

C. 11010000101000

D. 110100001101010

28. The expression $\dfrac{\cos x}{1 - 2\sin x}$ is undefined when the values of x are

A. $\dfrac{\pi}{6} \pm n\pi$

B. $\dfrac{\pi}{6} \pm 2n\pi,\ \dfrac{5\pi}{6} \pm 2n\pi,\ \dfrac{\pi}{2} \pm n\pi$

C. $\dfrac{\pi}{6} \pm 2n\pi,\ \dfrac{5\pi}{6} \pm 2n\pi$

D. $\dfrac{n\pi}{2}$

29. Which is the solution of the differential equation $(x^4e^x - 2xy^2)dx + 2x^2ydy = 0$?

A. $e^x + \dfrac{y}{x} = c$

B. $e^x - \dfrac{y^2}{x^2} = c$

C. $e^x + \dfrac{y^2}{x^2} = c$

D. $e^x - \dfrac{y}{x} = c$

NOTE: Answer questions 30, 31, 32 using information given below.

Let $P = \{\{a, e, i\}, \{o, u\}, \{b, c, d, f, g, h\}, \{j, k, l, m, n, p, q\}, \{r, s, t, v, x, z\}, \{y\}\}$. Let B be a set formed by taking two elements from P at random. And Let C be any subset of P chosen randomly from all possible subsets of P.

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30. What is the probability that a meaningful noun can not be formed using the alphabets in B as defined above?

A. 2/15

B. 5/15

C. 1/15

D. 7/15

31. What is the probability that two-letter meaningful words , one of the alphabets being y, can be formed using the alphabets in B as defined above?

A. 2/15

B. 3/15

C. 1/15

D. 7/15

32. What is the probability that the word "school" can be formed using the alphabets in C as defined above?

A. 4/64

B. 5/64

C. 3/64

D. 6/64

33. The correlation coefficient between random variables X, Y where $X+Y = 80$ is

A. 1

B. 0

C. 0.5

D. -1

34. The value of the expression $\sqrt{3}\csc 20 + \sec 20$ is

A. 4

B. $\dfrac{2\sin 20}{\sin 40}$

C. 2

D. $8\cos 40$

35. A person standing on bank of river observes that the angle of elevation of the top of tree on the opposite bank of river is 60 and when he retires 40m away from the tree, the angle of elevation becomes 30. The breadth of the river is

A. 30m

B. 40m

C. 20m

D. 60m

36. The set of values of a for which the function $f(x) = x^5 - ax$ is monotonically increasing in $\mathbb{R}$ is

A. $(-\infty, 0]$

B. $[4, 5]$

C. $(0, \infty)$

D. No set exists

37. The hexadecimal equivalent of the decimal number 10767 is

A. $3A0F$

B. $4A0F$

C. $2A0F$

D. None of the above

38. $9's$ complement of 127.35 is

A. 872.65

B. 872.34

C. 872.64

D. 872.35

B = A = 1, 2, B = A = 1, 2, B = 3, 4, C = ~~4~~ 3
C = 3, 4
A ∪ C = 1, 2, 3, 4 |A − B|
(1, 2, 3, 4)

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A ∪ B = {1, 2, 3, 4} = B ∪ C = (3, 4, 5
A = B

39. For any three non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$, the product vector $\vec{a} \times (\vec{b} \times \vec{c})$ is always a linear combination of

A. $\vec{b}$ and $\vec{c}$

B. $\vec{c}$ and $\vec{a}$

C. $\vec{a}$ and $\vec{b}$

D. all three $\vec{a}, \vec{b}$ and $\vec{c}$

40. Consider the following statements about the locus of the point whose position vector $\vec{r}$ satisfying $(\vec{a} - \vec{b}) \cdot \vec{r} = \frac{1}{2}(a^2 - b^2)$, where $\vec{a}$, and $\vec{b}$ are constant vectors with magnitudes a and b respectively.

(i) the locus is a plane passing through $\frac{1}{2}(\vec{a} + \vec{b})$

(ii) the locus is a plane perpendicular to $\vec{a} - \vec{b}$

(iii) the locus is a sphere of radius $a^2 - b^2$

Which of the following is correct?

A. (ii) only

B. (i) and (ii) only

C. (i) only

D. (iii) only

41. In the range $0 \leq x < 2\pi$, number of solutions, the equation $(3 + \cos x)^2 = 4 - 2\sin^8 x$ has

A. 1

B. 2

C. 0

D. 8

42. Which of the following is TRUE about all sets A, B, C?

A. $(A - B) \cap (C - B) = (A \cap C) - B$

B. if $A \cap C = B \cap C$ then $A = B$

C. $A - (B - C) = (A - B) - C$

D. if $A \cup C = B \cup C$ then $A = B$

43. Let
$A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ 1 & -2 \end{bmatrix}$.
If matrices A, B satisfy
$(A + B)^2 = A^2 + 2AB + B^2$
then values of a, b are

$(3x+3)^2 + 18x$
$9x^2+9$

A. $-3, \frac{1}{2}$

B. $3, \frac{1}{2}$

C. $-3, -\frac{1}{2}$

D. $3, -\frac{1}{2}$

44. The coordinates of a focus of the hyperbola
$9x^2 - 16y^2 + 18x + 32y - 151 = 0$
are

$9x^2 + 18x = 16y^2 - 32y + 151$
$(3x+3)^2 = 16y^2 - 32y + 160$
$3x+3 =$

A. $(5, 1)$

B. $(4, 3)$

C. $(-1, 1)$

D. $(-6, 1)$

45. The fuel costs in running a car is proportional to the square of the speed and is $Rs.25$ per hour for a speed of 30 kmh. Other costs amount to $Rs.100$ per hour, regardless of the speed. Find the speed which will make the cost per kilometer a minimum.

A. 80 kmh

B. 50 kmh

C. 60 kmh

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D. 30 kmh

46. The equation of the plane which bisects perpendicularly the line segment joining the points $(-1, 2, 3)$ and $(1, -2, -3)$ is

A. $2x - 3y + z = 0$

B. $x - 3y - 2z = 0$

C. $x - 2y - 3z = 0$

D. None of the above

47. Let $g(x) = 1 + x - [x]$, where $[x]$ denotes the largest integer $\leq x$ and let

y

$$f(x) = \begin{cases} -1 & x < 0 \\ 0 & x = 0 \\ 1 & x > 0 \end{cases}.$$ Then

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

A. 1

~~**B.**~~ doesn't exist

C. 0

D. -1

48. On the average, one computer in 8 crashes during a thunderstorm. A certain company has 320 working computers when the area was hit by a thunderstorm. Then the expected value and variance of the number of crashed computers are

A. 40 and 80

B. 35 and 32

C. 40 and 20

D. 40 and 35

49. In a triangle ABC, $a : b : c = 4 : 5 : 6$, a, b and c being the sides, the ratio of the radius of the circumcircle to the radius of incircle is

A. 16:7

B. 7:6

C. 15:2

D. 8:3

50. A right circular cone with radius R and height H contains liquid which evaporates at a rate propotional to its surface area in contact with air. The time after which the cone becomes empty

A. depends on R only

B. depends on R and H

C. depends on H only

D. None of the above

51. Given that $6 + f(x) = 2f(-x) + 3x^2 \left(\int_{-1}^{1} f(t)dt \right)$, for all x. Then $\int_{-1}^{1} f(x)dx =$

A. 4

B. 6

C. 0

D. 2

52. If $(543)_6 = (317)_k$, then the value of the base k is

HSn = 12
n = 12

A. 11

B. 9

C. 16

D. 8

53. How many functions f are possible from $\{1, 2, 3, 4, 5\} \rightarrow \{1, 2, 3, 4\}$ such that $|Range(f)| = 3$? You may use the fact that number of partitions of $\{1, 2, 3, 4, 5\}$ into 3 blocks is 25.

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A. 100

B. 150

C. 450

D. 600

NOTE: Answer questions 54 and 55 based on the following algorithm.

```
START
$STR := '', $ASTR := 'a',
$BSTR := 'b'
WHILE LENGTH($STR) < 100
 INPUT OPTION AS 1 OR 2
 READ OPTION INTO $OPT
 IF ($OPT = 1) THEN
  APPEND $ASTR IN THE BEGINNING-
  -OF $STR
  APPEND $BSTR IN THE END OF $STR
 ENDIF
 IF ($OPT = 2) THEN
  APPEND COPY OF $STR AT THE END-
  -OF $STR
 ENDIF
 ENDWHILE
OUTPUT $STR
END
```

54. Length of $\$STR$ is

A. Multiple of 4 for length of $\$STR \geq 4$

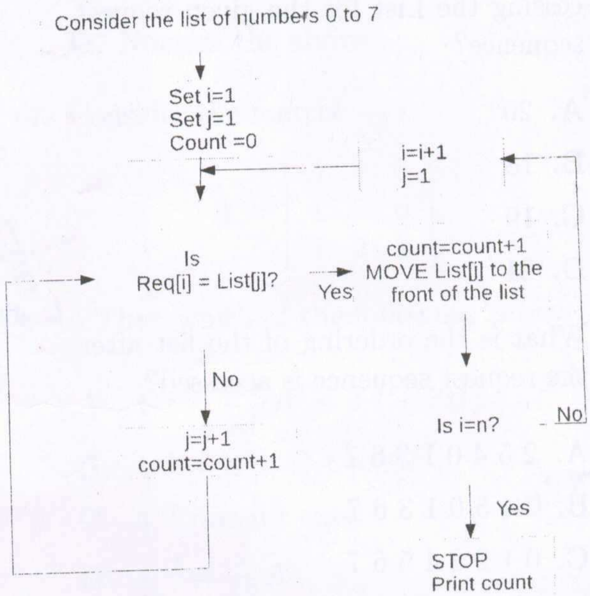
B. Can be Even or Odd

C. Always Odd

D. None of the Above

55. The number of iterations, the algorithm will go through, is dependent on the sequence of options provided by the user. What is the minimum and maximum possible values for the number of iterations assuming that the first option provided by user is 1?

Figure 1: Flow Chart



A. 7, 49

B. 7, 50

C. 6, 49

D. 6, 50

NOTE: Refer to the flowchart given in figure 1 and answer questions 56, 57 and 58. Consider a list of numbers $List[1:8] = 0$ to 7 and a request sequence $Req[1:n]$. For example $Req[1] = 5$ means search for 5 in List. Consider the request sequence Req[1:4]=5,4,5,2. In the flow chart **MOVE to front** operation indicates moving the element to the front of the list after right shifting the preceding

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elements.

56. What is the value of count after accessing the List for the given request sequence?

A. 20

B. 18

C. 19

D. 21

57. What is the ordering of the list after the request sequence is accessed?

A. 2 5 4 0 1 3 6 7

B. 2 4 5 0 1 3 6 7

C. 0 1 2 3 4 5 6 7

D. 5 4 0 1 2 3 6 7

58. If the requested element is not moved to the front of the list, which of the following case leads to more work?

A. When the same number is not requested more than once

B. When last number in the sequence is requested all the time

C. When the same number is requested more number of times

D. When numbers are requested randomly

59. Consider the function $f : \mathbb{R} \to (0, \infty)$, $f(x) = a^x$, where a is a positive constant. The following statements are made about the graph of f:

(i) It is parallel to X axis,

(ii) It is monotonically increasing in x,

(iii) It is monotonically decreasing in x.

Which of the following is true regarding these statements?

A. (ii) only

B. (iii) only

C. (i) only

D. all (i), (ii) and (iii)

60. If $f(x, y) = \dfrac{x^2 y}{x^4 + y^2}$. Then the value of

$$\lim_{(x,y)\to(0,0)} f(x, y)$$

A. doesn't exist

B. 1

C. 0

D. None of the above

61. Let $A = \begin{bmatrix} a & b & 0 & 0 \\ c & d & 0 & 0 \\ e & f & g & h \\ x & y & z & w \end{bmatrix}$.

Then det A (determinant of A) is equal to

A. $\det \begin{bmatrix} e & f \\ x & y \end{bmatrix}$

B. $\det \begin{bmatrix} a & b \\ c & d \end{bmatrix} \times \det \begin{bmatrix} g & h \\ z & w \end{bmatrix}$

C. 0

D. None of the above

62.

$$\int \frac{\sin(2x)\cos(2x)dx}{\sqrt{9 - \cos^4(2x)}} =$$

A. $-\dfrac{1}{4}\sin^{-1}\left(\dfrac{\cos^2(2x)}{3}\right) + c$

B. $\dfrac{\cos^2(2x)}{3} + c$

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C. $\sin^{-1}(\cos^2 x) + c$

D. None of the above

63. Given equation of ellipse as $9x^2 + y^2 = 36$, consider the chord in the positive quadrant between points $A(2, 0)$ and $B(0, 6)$. The area of the region above the chord but within the ellipse curve is given as

A. $3\pi - 2$ sq. units

B. $3\pi - 6$ sq. units

C. 3π sq. units

D. None of the above

64. A tangent to the curve $xy = c$ at any point on the curve, where c is a constant, forms a right angled triangle with the coordinate axes. The area of the triangle is,

A. Independent of c

B. $2c$ sq. units

C. $\frac{c}{2}$ sq. units

D. None of the above

65. A square matrix A is said to be Idempotent if $A^2 = A$. Given A is Idempotent, and $B = (I - A)$, then

A. $AB = I$

B. $BA^t = I$

C. B is not Idempotent

D. None of the above

66. Given that $\begin{bmatrix} -5 \\ -5 \\ -5 \end{bmatrix}$ is an eigenvector of $\begin{bmatrix} 4 & -2 & 1 \\ 2 & 0 & 1 \\ 2 & -2 & 3 \end{bmatrix}$. The corresponding eigenvalue is

A. 1

B. 4

C. -3

D. None of the above

67. Consider the matrix

$$A = \begin{bmatrix} 5 & 4 & 0 \\ 1 & 2 & 0 \\ 1 & 2 & 2 \end{bmatrix}$$

. Then which of the following is true

A. $A^{-1} = \frac{1}{12}(A^2 - 2A + 20I)$

B. $A^{-1} = A^2 - 2A + 20I$

C. A^{-1} doesn't exist

D. $A^{-1} = \frac{1}{12}A$

68. An airport receives on an average 4 aircrafts per hour. What is the probability that no aircraft lands in a particular 2 hour period?

A. e^{-4}

B. 1/16

C. e^{-8}

D. 1/2

69. Let R be a relation on the set of natural numbers $\mathbb{N}$ defined by $R = \{(x, y) | x, y \in \mathbb{N}, 5x^2 - 6xy + y^2 = 0\}$. Then R is

A. reflexive, not symmetric, not transitive

B. reflexive, symmetric, not transitive

C. an equivalence relation

D. not reflexive, not symmetric, transitive

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70. If the sum of two unit vectors is a unit vector then the magnitude of their difference is

A. $\sqrt{2}$

B. $\sqrt{3}$

C. 0

D. 1

71. A curve $y(x)$ is passing through the point $(1, \pi/4)$ and its slope at any point (x, y) is $\frac{y}{x} - \cos^2(y/x)$, then the equation of the curve is

A. $y(x) = x\tan^{-1}(log(x/e))$

B. $y(x) = x\tan^{-1}(log(e/x))$

C. $y(x) = \tan^{-1}(log(e/x))$

D. None of the above

72. The number of solutions for x in the equation given by the determinant below are

$$\begin{vmatrix} 2\cos^2 x & \sin(2x) & -\sin x \\ \sin(2x) & 2\sin^2 x & \cos x \\ \sin x & -cosx & 0 \end{vmatrix} = 2$$

A. only one solution

B. exactly 2 solutions

C. Zero

D. Infinitely many solutions

73. Let $A = \{1, ..., n\}$ where $n \in N$, and R be a relation "is cube of" defined in A. Let m denote the cardinality of range of R. Then which of the following is always satified?

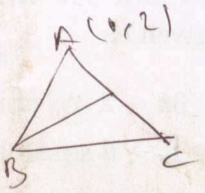
A. $(m+1) > \sqrt[3]{n}$

B. $m = n^3$

C. $m = \sqrt[3]{n}$

D. $m < \sqrt[3]{n}$

74. In a triangle ABC, the coordinates of A are $(1, 2)$ and the equations to the medians through B, C are $x + y = 5$ and $x = 4$ respectively. What are the coordinates of B?



A. $(1, 4)$

B. $(7, -2)$

C. $(-1, 6)$

D. $(3, 2)$

75. If the rank of the matrix

$$A = \begin{bmatrix} -1 & \lambda & 1 \\ 1 & 1 & \lambda \end{bmatrix}$$

is 1, then the value of λ is

A. 2

B. -1

C. 1

D. None of the above

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