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TEST FORM NUMBER

INSTRUCTIONS TO CANDIDATE

Maximum Marks : 300
Total Questions : 120
Time Allowed : 150 Min.

Read the following instructions carefully before you begin to attempt the questions.

(1) This booklet contains 120 questions.

Mathematics **120 Questions**

(2) All the questions are compulsory.

(3) Before you start to attempt the questions, you must explore this booklet and ensure that it contains all the pages and find that no page is missing or replaced. If you find any flaw in this booklet, you must get it replaced immediately.

(4) **Each question carries negative marking also as 1/3 mark will be deducted for each wrong answer.**

(5) You will be supplied the Answer-sheet separately by the invigilator. You must complete the details of Name, Roll number, Test name/Id and name of the examination on the Answer-Sheet carefully before you actually start attempting the questions. You must also put your signature on the Answer-Sheet at the prescribed place. These instructions must be fully complied with, failing which, your Answer-Sheet will not be evaluated and you will be awarded 'ZERO' mark.

(6) Answer must be shown by completely blackening the corresponding circles on the Answer-Sheet against the relevant question number by **pencil or Black/Blue ball pen** only.

(7) A machine will read the coded information in the OMR Answer-Sheet. In case the information is incompletely/ different from the information given in the application form, the candidature of such candidate will be treated as cancelled.

(8) The Answer-Sheet must be handed over to the Invigilator before you leave the Examination Hall.

(9) Failure to comply with any of the above Instructions will make a candidate liable to such action/penalty as may be deemed fit.

(10) Answer the questions as quickly and as carefully as you can. Some questions may be difficult and others easy. Do not spend too much time on any question.

(11) Mobile phones and wireless communication device are completely banned in the examination halls/rooms. Candidates are advised not to keep mobile phones/any other wireless communication devices with them even switching it off, in their own interest. Failing to comply with this provision will be considered as using unfair means in the examination and action will be taken against them including cancellation of their candidature.

(12) No rough work is to be done on the Answer-Sheet.

(13) No candidate can leave the examination hall before completion of the exam.

NAME OF CANDIDATE:...
DATE :......................... CENTRE CODE :.................
ROLL No :...

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

Mathematics

1. The following functions are defined for the set of variables $x_1, \ldots\ldots, x_n$

$f(x_i, x_1) = \left[\begin{array}{ll} x_i + j, & if\ i+j \leq n^2 \\ x_i + j - n, & if\ i+j > n^2 \end{array}\right.$ $and\ g(x_i, x_j)$

Where m is the remainder when i×j is divided by n.
Find the value of f [f(x_2,x_3), (x_5,x_6)], if n=3.

(A) x_5 **(B)** x_{10}
(C) x_{13} **(D)** x_8

2. The following functions are defined for the set of variables $x_1, \ldots\ldots x_n$

$f(x_i, x_1) = \left[\begin{array}{ll} x_i + j, & if\ i+j \leq n^2 \\ x_i + j - n, & if\ i+j > n^2 \end{array}\right.$ $and\ g(x_i, x_j)$

Where m is the remainder when i×j is divided by n.
Find the value of $g\,[g(x_2, x_3), g(x_7, x_8)]$, if n = 5

(A) x_1 **(B)** x_2
(C) x_5 **(D)** all of these

3. If f(x)=3x+10 and g(x)=x^2-1 then $(fog)^{-1}$ is equal to

(A) $\left(\frac{x-7}{3}\right)^{\frac{1}{2}}$ **(B)** $\left(\frac{x+7}{3}\right)^{\frac{1}{2}}$
(C) $\left(\frac{x-3}{7}\right)^{\frac{1}{2}}$ **(D)** $\left(\frac{x+3}{7}\right)^{\frac{1}{2}}$

4. $\sin^{-1}\left(\frac{1+t^2}{2t}\right)$is

(A) Continuous but not differentiable at t=1
(B) differentiable at t=1
(C) Neither Continuous nor differentiable at t=1
(D) Continuous every where

5. The function $f(x) = \frac{|x-4|}{x-4}$ at x = 4, is

(A) Left continuous **(B)** Right continuous
(C) Continuous **(D)** Discontinuous

6. Find order and degree of differential equation given as $3+\left(\frac{d^2y}{dx^2}\right)^{7/3} = \left(\frac{dy}{dx}\right)^2$

(A) 2 & 5 **(B)** 3 & 7
(C) 2 & 4 **(D)** 2 & 7

7. If the number $\frac{(1-i)^n}{(1+i)^{n-2}}$ is real and positive, then n is

(A) any integer **(B)** any even integer
(C) any odd integer **(D)** None of these

8. If $\frac{|z-2|}{|z-3|}$ = 2 represents a circle, then its radius is-

(A) 1 **(B)** 1/3
(C) 3/4 **(D)** 2/3

9. If mean and variance of a binomial variate x are 2 and 1 respectively, then the probability that x takes a value greater than 1 is

(A) 2/3 **(B)** 4/5
(C) 7/8 **(D)** 11/16

10. What is the principal value of $\cot^{-1} = \left(-\sqrt{3}\right)$

(A) -π/6 **(B)** π/3
(C) 5π/6 **(D)** 2π/3

11. Two poles are 10 m and 20 m high. The line joining their tops makes an angle of 15º with the horizontal. The distance between the poles is approximately equal to

(A) 36.3 m **(B)** 37.3 m
(C) 38.3 m **(D)** 39.3 m

12. The area bounded by the coordinates axis and curve $\sqrt{x} + \sqrt{y} = 1$, is

(A) 1 square unit **(B)** 1/2 square unit
(C) 1/3 square unit **(D)** 1/6 square unit

Direction (13) Read the following information and answer the two questions that follow:

13. If $\log_{30} 3$ = x and $\log_{30} 5$ = y
Find the value of $\log_{30} 45$ in terms of x and y

(A) x – y **(B)** x + y
(C) x^2 – y **(D)** 2x + y

14. How many four-digit numbers divisible by 10 can be formed using 1, 5, 0, 6,7 without repetition of digits?

(A) 24 **(B)** 36
(C) 44 **(D)** 64

15 $\int_0^{\infty} [2e^{-t}]\,dt$, where [.] denotes the greatest integer function, is equal to

(A) 2 **(B)** 0
(C) in 2 **(D)** in 3

16. In how many ways 4 boys & 3 girls can be seated in a row, so that they are alternate?

(A) 108 **(B)** 144
(C) 96 **(D)** 72

17. What is the value of $\sum_{r=1}^{n} \frac{P(n,r)}{r!}$?

(A) 2^n-1 **(B)** 2^n
(C) 2^{n-1} **(D)** 2^n+1

18. $\int \frac{dx}{1-e^{-z}}$ is equal to

(A) 1 + e^x + c **(B)** log (1 + e^{-x}) + c
(C) log (1 + e^x) + c **(D)** 2 log (1 + e^{-x}) + c

19. If sec θ – tan θ = 5/3 , then what is (cosec θ – cot θ) equal to?

(A) 1 **(B)** 1/2
(C) 1/3 **(D)** ¼

20. The solution of $\frac{dy}{dx} = \sqrt{1 - x^2 - y + x^2y^2}$ is-

(A) $\sin^{-1}$y = $\sin^{-1}$x+c
(B) 2 $\sin^{-1}$y = $\sqrt{1-x^2}$ +$\sin^{-1}$x+c
(C) 2 $\sin^{-1}$y =x $\sqrt{1-x^2}$ +$\sin^{-1}$x+c
(D) 2 $\sin^{-1}$y =x $\sqrt{1-x^2}$ +$\cos^{-1}$x+c

21. The arithmetic mean of 1, 8, 27, 64, …… up to 16 terms is given by

(A) 1024 **(B)** 1156
(C) 1283 **(D)** 972

22. For what value of K, does the equation 19x^2 + y^2 = K (x^2 – 2y^2 – 4y) represent a circle?

(A) 1 **(B)** -1
(C) 6 **(D)** 19

23. The nth term of an AP is 7n – 10, then the sum of first 25 terms is

(A) 2025 **(B)** 2050
(C) 2075 **(D)** 3000

24. The angles of elevation of the peak of a hill from two points D and C at a distance p and q from the foot of the hill arecomplementary. The height of the hill is.

(A) $\sqrt{pq}$ **(B)** p.q
(C) $\sqrt{\frac{p}{q}}$ **(D)** $\sqrt{p+q}$

25. Evaluate $\int e^y \left(\frac{1-y}{1+y^2}\right)^2 dy$

(A) $\frac{e^y}{1+y}+c$ **(B)** $\frac{1}{1+y^2}+c$

(C) $\frac{e^y}{1+y^2}+c$ **(D)** None of these

Direction (26): Read the following information and answer the two question that follow.

26. If $\log_{30} 3 = x$ and $\log_{30} 5 = y$
Find the value of $\log_{30} 8$ in terms of x and y

(A) x – y **(B)** 3(x – y)

(C) 3(1 –x – y) **(D)** None of these

27. Consider the following statements:

1) Mean is independent of change in scale and change in origin.

2) Variance is independent of change in scale but not in origin.

Which of the above statements is/are correct?

(A) 1 only **(B)** 2 only

(C) Both 1 and 2 **(D)** Neither 1 nor 2

28. If x = y cos $\frac{2\pi}{3}$= z cos $\frac{4\pi}{3}$, then xy + yz + zx equals

(A) -1 **(B)** 0

(C) 1 **(D)** 2

29. Find a quadratic equation whose sum of roots is 2 and product of roots is 1:

(A) $x^2 - 2x + 1 = 0$ **(B)** $x^2 - 3x + 1 = 0$

(C) $x^2 - 4x + 1 = 0$ **(D)** can have any value

30. If α β, are the roots of the quadratic equation $2x^2 - 4x + 1 = 0$. Then the value of $\frac{1}{\alpha+2\beta}+\frac{1}{\beta+2\alpha}$ is equal to :

(A) 12/17 **(B)** 17/12

(C) 11/17 **(D)** 13/17

31. The graphs of 2x + y = 5 & 4x – 5y + 1 = 0 meet the x –axis at two points which are separated by?

(A) 9/4 units **(B)** 11/4 units

(C) 24/5 units **(D)** 26/5 units

32. For what value of K, does the equation $19x^2 + y^2 = K(x^2 – 2y^2 – 4y)$ represent a circle?

(A) 1 **(B)** -1

(C) 6 **(D)** 19

33. In a ΔABC, a=5, b=4 and cos (A-B) = 31/32. then Find the value of side c.

(A) 2 **(B)** 6

(C) 10 **(D)** 12

34. Given two points A(-2, 0) and B(0, 4), M is a point with coordinates (x, x), x ≥ 0. P divides the joining of A & B in the ratio 2 : 1. C & D are the midpoints of BM and AM respectively.
Area of the ΔAMB is minimum if the coordinates of M are

(A) (1, 1) **(B)** (0, 0)

(C) (2, 2) **(D)** (3, 3)

35. Find set of values of y that satisfy $\frac{2^y(y-1)}{(y-2)^2} \le 0$

(A) R **(B)** R – {2}

(C) $(-\infty, 1)$ **(D)** $(-\infty, 1]$

36. If the coefficients of a^m and a^n in the expansion of $(1 + a)^{m+n}$ are α and β, then which one of the following is correct?

(A) α = 2β **(B)** α = β

(C) 2α = β **(D)** α = (m + n)β

37. Let be the mean of $x_1, x_2, x_3, \ldots, x_n$. If $x_i = a + cy_i$ for some constants a and c, then what will be the mean of $y_1, y_2, y_3, \ldots, y_n$?

(A) a – c $\bar{x}$ **(B)** a+ $\frac{1}{c}\bar{x}$

(C) $\frac{1}{c}\bar{x} - a$ **(D)** $\frac{\bar{x}-a}{c}$

38. Given two points A(-2,0) and B(0, 4), M is a point with coordinates,
P divides the joining of A & B in the ratio 2 : 1, C & D are the mid points of BM and AM respectively.
Ratio of the area of the Δ's APM & BPM is

(A) 2:1 **(B)** 1:2

(C) 2:3 **(D)** 1:3

39. Given two points A(-2,0) and B(0, 4), M is a point with coordinates (x, x), x ≥ 0.
P divides the joining of A & B in the ratio 2:1. C & D are the mid points of BM and AM respectively. Area of the ΔAMB is minimum, if the coordinates of M are

(A) (1, 1) **(B)** (0, 0)

(C) (2, 2) **(D)** (3, 3)

40. If the centre of the circle passing through the origin is (3, 4) then the intercepts cut-off by the circle on X-axis and Y-axis, respectively. are

(A) 3 units and 4 units **(B)** 6 units and 4 units

(C) 3 units and 8 units **(D)** 6 units & 8 units

41. If $\left\{\frac{1}{a^2\sin^2 x+b^2\cos^2 x}\,dx = \frac{1}{2}\tan^{-1}(3\tan x)+c\right\}$ The value of a and b are respectively

(A) ±6, ±2 **(B)** ±7, ±3

(C) ±4, ±8 **(D)** ±1, ±8

42. If $\left\{\frac{1}{a^2\sin^2 x+b^2\cos^2 x}\,dx = \frac{1}{12}\tan^{-1}(3\tan x)+c\right\}$
Maximum value of a sinx + b cosx is

(A) √41 **(B)** √40

(C) √39 **(D)** √38

43. Consider the integrals
$A = \int_0^\pi \frac{\sin x}{\sin x+\cos x}dx$ and $B = \int_0^\pi \frac{\sin x}{\sin x-\cos x}dx$
Which one of the following is correct?

(A) A=2B **(B)** B=2A

(C) A=B **(D)** A=3B

44. Determine the values of x,y and z when
$\begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ is orthogonal

(A) x = ± ½, y = ± 1/3, z = ± 1/6

(B) $x = \pm\frac{1}{\sqrt{2}}, y = \pm\frac{1}{\sqrt{6}}, z = \pm\frac{1}{\sqrt{3}}$

(C) $x = \pm\frac{1}{\sqrt{6}}, y = \pm\frac{1}{3}, z = \pm\frac{1}{\sqrt{3}}$

(D) None of these

45. If equation lx^2 9 mx + n = 0 (0 < l < m < n) has non – real complex roots Z_1 and Z_2, then

(A) $|Z_1|> 1, |Z_2|<1$ **(B)** $|Z_1|< 1, |Z_2|>1$

(C) $|Z_1|> 1, |Z_2|>1$ **(D)** $|Z_1|< 1, |Z_2|<1$

46. In a school 25% students love cricket and 15% students love hockey, 65% students neither love hockey nor cricket, 2000 students love both cricket and hockey. Find total number of students in the school.

(A) 10000 **(B)** 20000

(C) 30000 **(D)** 40000

47. Consider the integral
$A = \int_0^\pi \frac{\sin x}{\sin x+\cos x}dx$ and $B = \int_0^\pi \frac{\sin x}{\sin x-\cos x}dx$
What is the value of B?

(A) π/4 **(B)** π/2
(C) 3π/4 **(D)** π

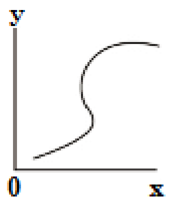
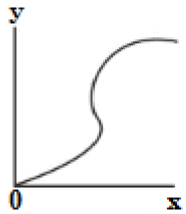
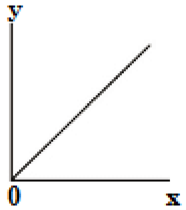
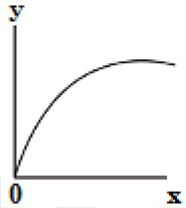
48. The area enclosed by the curves y = sinx+cosx and y = |cosx- sinx| over the interval (0,h/2)
I. 2√2(2-√2) **II.** 2√2(√2-1) **III.** 2(√2-1)
(A) Only I **(B)** Only II
(C) Only III **(D)** None of these

49. The area bounded by the circle $x^2+y^2 = 8$, then parabola $x^2 = 2y$ and the line y = x in y ≥ 0
I. Has area = $\left(2\pi + \frac{4}{3}\right)$ sq units
II. Has area = $\left(2\pi + \frac{4}{3}\right)$ sq units
III. The point of intersection of circle, parabola and line in 1 st quadrant is (2,2)
(A) Only I **(B)** Only II
(C) I & II **(D)** II and III

50. If G is the centroid of a ΔABC, then GA + GB + GC is equal to
(A) 0 **(B)** 3GA
(C) 3GB **(D)** 3GC

51. Cumulative frequency curve of given table is

Class	0−10	10−20	20−30	30−40	40−50
Frequency	4	10	25	8	2

(A) 
(B) 
(C) 
(D) 

52. The regression coefficients of a bivariate distribution are –0.64 and –0.36. Then, the correlation coefficient of the distribution is
(A) 0.48 **(B)** -0.48
(C) 0.50 **(D)** -0.50

53. If sin x is G, M of sin y and cos y, then the value of cos 2x is.
(A) 2 $\cos^2\left(\frac{\pi}{4} + y\right)$ **(B)** 5 $\cos^2\left(\frac{\pi}{4} + y\right)$
(C) 4 $\cos^2\left(\frac{\pi}{4} + y\right)$ **(D)** None of these

54. Evaluate $\int \cos x \, sec^2(sinx)dx$
(A) tan x + c **(B)** sec x + c
(C) tan(sinx) + c **(D)** tan(cos x)+ c

55. The slope of the normal to the curve given by x = a (t – sint), y = a (1 – cos t) at t = $\pi/2$
(A) -2 **(B)** 1
(C) -1 **(D)** ½

56. If m is the geometric mean of $\left(\frac{y}{z}\right)^{\log(yz)}$, $\left(\frac{z}{x}\right)^{\log(zx)}$ and $\left(\frac{x}{y}\right)^{\log(xy)}$ then what is the value of m ?
(A) 1 **(B)** 3
(C) 6 **(D)** 9

57. A die is thrown three times, if the first throw is a four, find the chance of getting 15 as the sum.
(A) 17/18 **(B)** 1/18
(C) 1/2 **(D)** None of these

58. Which one of the following is correct?
The system of equations 7x – 5z = 5, 2y + 3z = 4 and z = 3
(A) has no solution
(B) has only one solution
(C) has only two solutions
(D) has infinite number of solutions

59. What is the equation of a curve passing through (0,1) and whose differential equation is given by dy = y tan x dx ?
(A) y = cos x **(B)** y = sin x
(C) y = sec x **(D)** y = cosec x

60. The distributions X and Y with total number of observations 36 and 64 and means 4 and 3, respectively are combined. What is the mean of the resulting distribution X + Y
(A) 3.26 **(B)** 3.32
(C) 3.36 **(D)** 3.42

61. Which one of the following measures of central tendency is used in construction of index numbers?
(A) Harmonic mean **(B)** Geometric mean
(C) Median **(D)** Mode

62. The binary number expression of the decimal number 31 is
(A) 1111 **(B)** 10111
(C) 11011 **(D)** 11111

63. $\frac{1}{2} + \frac{3}{4} + \frac{7}{8} + \frac{15}{16} + \cdots \dots \dots \dots \dots \dots \dots \dots + upto\ n\ terms$
(A) $n + 2^{-n} - 1$ **(B)** $n^{-n} + 1 - 2^{-n}$
(C) $2^{-n} - 1$ **(D)** $n^{-n} + 1$

64. The equation of plane bisecting the acute angle between the planes 2x – y + 2z + 1 = 0 and 2x – 3y + 6z + 2 = 0
(A) 23x – 13y + 32z + 37 = 0
(B) 8x + 2y – 4z + 1 = 0
(C) 20x – 16y +32z +13 = 0
(D) None of these

Direction (65) Read the following information and answer the two questions that follow.

65. If x cos2a + y sin 2a = z has “tanA” and “tanB” as its solution then find tan A tan B =?
(A) $\frac{z+x}{z-x}$ **(B)** $\frac{z}{z+x}$
(C) $\frac{z-x}{z+x}$ **(D)** None of these

66. Consider the following statements with regard to correction coefficient r between random variables x and y.
I. r = + 1 or -1 means there is a linear relation between x & y
II. −1 ≤ r ≤ 1 and r^2 is a measure of the linear relationship between the variables.
Which of the above statement (S) is/ are correct?
(A) Only I **(B)** Only II
(C) Both I and II **(D)** Neither I nor II

67. What is the area of the region bounded by the lines y = x, y= 0 and x = 4?
(A) 4 sq. units **(B)** 8 sq. units
(C) 12 sq. units **(D)** 16 sq. units

68. If $\int_{-3}^{2} f(x)dx = \frac{7}{3}$ and $\int_{-3}^{9} f(x)dx = \frac{-5}{6}$, then what is the value of $\int_{2}^{9} f(x)dx$

(A) (-19)/6 **(B)** 19/6
(C) 3/2 **(D)** (–3)/2

69. Consider the function f(x) = $-2x^3-9x^2-12x+1$
The function f(x) is an increasing function in the interval

(A) (–2, –1) **(B)** (–∞, –2)
(C) (–1, 2) **(D)** (–1, ∞)

70. If a line is perpendicular to the line 5x – y = 0 and forms a triangle of area 5 square units with co-ordinate axes, then its equation is

(A) x + 5y ± 5√2=0 **(B)** x -5y ± 5√2=0
(C) 5x + y ± 5√2 = 0 **(D)** 5x - y ± 5√2 = 0

71. Consider the function f(x)=$|x^2-5x+6|$
What is f'(4) is equal to?

(A) -4 **(B)** -3
(C) 3 **(D)** 2

72. If then x = 5/6 and tan y = 1/11 then find x+y

(A) 30^0 **(B)** 45^0
(C) 15^0 **(D)** 90^0

73. Find the point of contact of the tangent 3x + y = 4 for the ellipse $\frac{x^2}{4}+\frac{y^2}{1}=1$

(A) $\left(4,\frac{1}{4}\right)$ **(B)** $\left(2,\frac{1}{2}\right)$
(C) $\left(2,\frac{1}{4}\right)$ **(D)** $\left(3,\frac{1}{4}\right)$

74. $\int_1^e \frac{(In\, x)^2}{x}$ dx

(A) 3 **(B)** 7
(C) 1/5 **(D)** 1/3

75. If f : R→ R, g : R → R be two functions given by f (x) = 2x – 3 and g (x) = x^3 + 5, then $(fog)^{-1}$ (x) is equal to

(A) $\left(\frac{x+7}{2}\right)^{\frac{1}{3}}$ **(B)** $\left(\frac{x-7}{2}\right)^{\frac{1}{3}}$
(C) $\left(x-\frac{7}{2}\right)^{\frac{1}{3}}$ **(D)** $\left(x+\frac{7}{2}\right)^{\frac{1}{3}}$

76. What is $\lim\limits_{x\to 0}\frac{x\,tanx}{1-\cos x}$ equal to ?

(A) 1 **(B)** -1
(C) 1/2 **(D)** 2

77. Consider the following statements
I. f(x) = |x-3| is continuous at x= 0
II. f(x) = |x-3| is differentiable at x = 0
Which of the above statement (s) is/are correct?

(A) Only I **(B)** Only II
(C) Both I and II **(D)** Neither I nor II

78. The lines L_1:4x-3y+7=0 and L_2:3x-4y+14=0 intersect the line L_3:x+y=0 at P and Q respectively. The bisectors of the acute angle between L_1 & L_2 intersect L_3 at R.
The equation of the bisector of acute angle is

(A) x+y+3=0 **(B)** x-y-3=0
(C) x-y+3=0 **(D)** 3x-y-7=3

79. The lines L_1: 4x-3y+7=0 and L_2: 3x-4y+14=0 intersect the line L_3 : x + y = 0 at P and Q respectively. The bisectors of the acute angle between L_1 & L_2 intersect L_3 at R.
The ratio PR : RQ equals to

(A) 2√2 : √5 **(B)** 2 : 1
(C) 1 : 1 **(D)** √5 : √2

80. The lines L_1: 4x-3y+7=0 and L_2: 3x-4y+14=0 intersect the line L_3 : x + y = 0 at P and Q respectively. The bisectors of the acute angle between L_1 & L_2 intersect L_3 at R.
Area of triangle formed by lines L_1,L_2 &L_3

(A) 13/2 sq. units **(B)** 7/2 sq. units
(C) 9/2 sq. units **(D)** 8 sq. units

81. Find distance between
3x + 4y – 9 = 0 and 3x + 4y + 11 = 0.

(A) 2 **(B)** 3
(C) 4 **(D)** 5

82. For the matrix A=$\begin{bmatrix}4 & 3\\ 1 & 1\end{bmatrix}$, the values of a and b such that A^2 + aA + bI = 0 are:

(A) -5 and 1 **(B)** 6 and 0
(C) 3 and 2 **(D)** -7 and -2

83. If all the letters of the word 'JATIN' are arranged in all possible ways and written out in alphabetical (dictionary) order, then find the rank of the given word.

(A) 50 **(B)** 48
(C) 53 **(D)** 38

84. If an angle α is divided into two parts A and B such that A – B = x and tan A : tan B = 2 : 1 then what is the sin x equal to ?

(A) 3 sin α **(B)** (2 sin α)/3
(C) (sin α)1/3 **(D)** 2 sin α

85. Let $\tan^2 x = 1 - e^2$,e is any constant. Then the value of ($\sec x + \tan^3 x$ cosec x) is

(A) $(2+e^2)^{\frac{3}{2}}$ **(B)** $(2-e^2)^{\frac{3}{2}}$
(C) $(1-e^2)^{\frac{3}{2}}$ **(D)** $(1+e^2)^{\frac{3}{2}}$

86. For the next two items that follow:
Consider the function

$$f(x) = \begin{cases} -2sinx & if \quad x \le -\frac{\pi}{2} \\ A\sin x + B & if \quad -\frac{\pi}{2} < x < \frac{\pi}{2}, \\ \cos x & if \quad x \ge \frac{\pi}{2} \end{cases}$$

which is continous in R
The value of B is

(A) 1 **(B)** 0
(C) -1 **(D)** -2

87. Let α & β (α < β) be the roots of the equation x^2 + bx + c = 0 when b > 0 and c < 0
Consider the following
I. α + β + α β > 0
II. $\alpha^2 \beta + \beta^2 \alpha > 0$
Which of the above statement(s) is/are correct?

(A) Only I **(B)** Only II
(C) Both I and II **(D)** Neither I nor II

88. Let α & β (α < β) be the roots of the equation x^2 + bx + c = 0 when b > 0 and c < 0
If x^2 – px + 4 > 0 for all real values of x, then which one of the following is correct?

(A) |P| < 4 **(B)** |P| ≤ 4
(C) |P| > 4 **(D)** |P| ≥ 4

89. The value of the infinite product
$6^{1/2} \times 6^{1/2} \times 6^{3/8} \times 6^{1/4} \times \ldots\infty$ is

(A) 6 **(B)** 36
(C) 216 **(D)** ∞

90. What does the series $1 + \frac{1}{\sqrt{3}} + 3 + \frac{1}{3\sqrt{3}} + \ldots\ldots$ represent?

(A) AP **(B)** GP
(C) HP **(D)** None of these

91. Find total number of solutions of
$\sin^2 x - \cos x = ¼$, $x \in [0,2\pi]$
(A) 1 **(B)** 2
(C) 3 **(D)** 0

92. Equation of the tangent to $y^2 = 4n(x+n)$ having slope 1 is
(A) $x - y + 2n = 0$ **(B)** $x + y + n = 0$
(C) $x - y - 2n = 0$ **(D)** $x - y - n = 0$

93. The function f defined by
$f(t) = \begin{cases} \frac{\sin t^2}{t} \text{ for } t \neq 0 \\ 0 \text{ for } t = 0 \end{cases}$ is:
(A) Continuous and derivable at t=0
(B) Neither continuous nor derivable at t=0
(C) Continuous but not derivable at t=0
(D) None of these

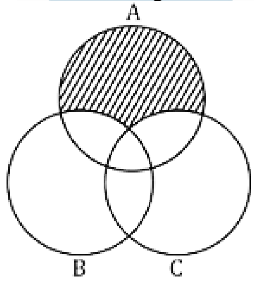
94. The angle of a triangle are in AP and the least angle is 30º . What is the greatest angle (in radian) ?
(A) π/2 **(B)** π/3
(C) π/4 **(D)** π

95. The number of ways in which a cricket team of 11 players be choosen out of a batch of 15 players so that the captain of the team always included, is
(A) 165 **(B)** 364
(C) 1001 **(D)** 1365

96. (x^3-1) is factorised as
Where, ω is one of the cube roots of units.
(A) $(x-1)(x-\omega)(x+\omega^2)(x+\omega^2)$
(B) $(x-1)(x-\omega)(x-\omega^2)$
(C) $(x-1)(x-\omega)(x+\omega^2)(x-\omega^2)$
(D) $(x-1)(x-\omega)(x+\omega^2)$

97. Let N denotes the set of natural numbers and $A=\{n^2:n\in N\}$ & $B=\{n^3:n\in N\}$. Which one of the following is correct?
(A) A ∪ B = N
(B) The complement of (A∪ B) is infinite set.
(C) A ∩ B must be finite set
(D) A ∩ B must be proper subset of $\{m^6:m\in N\}$

98. The shaded region in the given figure is



(A) A ∩ (B ∪ C) **(B)** A ∪ (B ∩ C)
(C) A – (B ∩ C) **(D)** A – (B ∪ C)

99. The mean of the series $X_1, X_2, \ldots\ldots X_n$ is X.If X_2 is replaced by λ, then what is the new mean?
(A) $\bar{X} - x_2 + \lambda$ **(B)** $\frac{X - x_2 - \lambda}{n}$
(C) $\frac{X - x_2 + \lambda}{n}$ **(D)** $\frac{nX - x_2 + \lambda}{n}$

100. If $(x^2 - 5y + 3)(y2 + y + 1) < 2y$ for all $y \in R$, then the interval in which x lies is:
(A) $\left(\frac{5-\sqrt{5}}{2}, \frac{5+\sqrt{5}}{2}\right)$ **(B)** $\left(\frac{\sqrt{5}}{2}, \frac{\sqrt{7}}{2}\right)$
(C) $\left(\frac{7-\sqrt{7}}{2}, \frac{7+\sqrt{7}}{2}\right)$ **(D)** Cannot determine

101. Find the equation of the plane passing through the point (3,4,7) which is foot of the perpendicular drawn from the origin to the plane.
(A) $2x + 4y + z - 15 = 0$ **(B)** $2x - y + 3z - 17 = 0$
(C) $3x + 4y + 7z - 74 = 0$ **(D)** $7x + 3y - z + 7 = 0$

102. The position vectors of the vertices of a triangle are $5\hat{\imath} + 3\hat{\jmath} + 4\hat{k}, 7\hat{\imath} + \hat{k}$ and $5\hat{\imath} + 5\hat{k}$, then the distance between the circumcentre the orthocentre of the triangle is-
(A) $\sqrt{358}$ **(B)** $2\sqrt{305}$
(C) $\sqrt{293}$ **(D)** $\sqrt{398}$

103. Which one of the following measures of central tendency is used in construction of index number?
(A) Harmonic mean **(B)** Geometric mean
(C) Median **(D)** Mode

104. If |a| = 3, |b| = 4 and |c| = 5 such that each is perpendicular to seem of the other two, then |a + b + c| is
(A) 5√2 **(B)** 5/√2
(C) 10√2 **(D)** 5√3

105. If f(x) is an even function, then what is $\int_0^{\pi} f(\cos x)$ dx equal to?
(A) 0 **(B)** $\int_0^{\pi/2} f(\cos x)dx$
(C) $2\int_0^{\pi/2} f(\cos x)dx$ **(D)** 1

106. Let f(x) be a function defined in 1 ≤ x ≤ ∞ by $(x) = \begin{cases} 2 - x & for \quad 1 \le x \le 2 \\ 3x - x^2 & for \quad x > 2 \end{cases}$
Consider the following statements
I. The function is continuous at every point in the interval (1, ∞).
II. The function is differentiable at x = 1.5
Which of the above statement(s) is/are correct?
(A) Only I **(B)** Only II
(C) Both I & II **(D)** Neither I nor II

107. Let f(x) be a function defined in 1 ≤ x ≤ ∞ by $f(x) = \begin{cases} 2 - x & for \quad 1 \le x \le 2 \\ 3x - x^2 & for \quad x > 2 \end{cases}$
What is the differentiable coefficient of f (x) at x = 3?
(A) 1 **(B)** 2
(C) -1 **(D)** -3

108. Let A = [2,3,-5], P = $\begin{bmatrix} 3 \\ 1 \\ 3 \end{bmatrix}$ and Q = $\begin{bmatrix} 4 \\ -1 \\ 2 \end{bmatrix}$ what is the value of A (P-Q) ?
(A) 1 **(B)** $[-1]$
(C) –1 **(D)** $\begin{bmatrix} 7 \\ -10 \\ -4 \end{bmatrix}$

109. Line AB in three dimensional space makes angles α, β & γ with the coordinate axes.
If α=45º & β=120º then the acute angle γ is equal to
(A) 60º **(B)** 75º
(C) 30º **(D)** 45º

110. Find the new coordinates of point P(3,4) when coordinate axes are rotated by 30⁰ in anticlockwise direction.
(A) $\left(2 + 3\frac{\sqrt{3}}{2}\right), \left(2\sqrt{3} - \frac{3}{2}\right)$ **(B)** $\left(\frac{3\sqrt{3}}{2}, \frac{\sqrt{5}}{2}\right)$
(C) 4,3 **(D)** None of these

111. Evaluate $\lim_{y \to \infty} \frac{ay^2+by+c}{dy^2+ey+f}$

(A) c/f **(B)** b/e
(C) a/d **(D)** a/f

112. if x = sin($\log_e$ t) and $t^2 \frac{d^2x}{dt^2} + t\frac{dx}{at} = ?$
(A) -t **(B)** t
(C) x **(D)** -x

113. Line AB in three-dimensional space makes angles α, β & γ with the coordinate axes.
Consider the following statements
I. If α=30° and β=45° then γ will be 150°
II. If α+β=90°, then γ will be 90°.
Which of the above statement(s) is/are correct?
(A) Only I **(B)** Only II
(C) Both I & II **(D)** Neither I nor II

114. If (–5, 4) divides the line segment between the coordinate axes in the ratio 1 : 2, then what is its equation?
(A) 8x + 5y + 20 = 0 **(B)** 5x + 8y – 7 = 0
(C) 8x - 5y + 60 = 0 **(D)** 5x – 8y + 57 = 0

115. The product of the perpendiculars from the two points (±4,0) to the line 3x cos Φ + 5y sin Φ = 15 is
(A) 25 **(B)** 16
(C) 9 **(D)** 8

116. $\sqrt{3+4i} = ?$
(A) 2 – i **(B)** -2 + i
(C) 3 + i **(D)** Both (A) & (B)

117. simplify $\cos^{-1} y + \cos^{-1}\left(\frac{y}{2}+\frac{\sqrt{3-3y^2}}{2}\right), y \in \left(\frac{1}{2},1\right)$
(A) $\frac{\pi}{3}$ **(B)** $\frac{\pi}{6}$
(C) $\frac{\pi}{2}$ **(D)** 2π

118. A committee of 4 students is selected at random from a group consisting of 8 boys and 4 girls. Given that there is at least one girl in the committee. Then the probability that there are exactly 2 girls in the committee.
(A) 168/425 **(B)** 168/385
(C) 257/425 **(D)** None of these

119. Events A & B are such that P(A) = 1/2, P(B) = 7/12 and P(not A or not B) = 1/4 State whether A & B are
(A) dependent **(B)** Independent
(C) Partially independent **(D)** Can't determine

120. If 2x = 3 + 5i, then what is the value of $2x^3 + 2x^2 - 7x + 72$?
(A) 4 **(B)** -4
(C) 8 **(D)** -8

Space for rough work

Mathematics

1. **Answer(B)**

$f(x_2, x_3) = x_2 + 3 = x_5 [\therefore 2+3 < 3^2]$

and $f(x_5, x_6) = x_{5+6-3}$

$= x_8$ $[\because 5+6 > 3^2]$

$\therefore f[f(x_2,x_3), +(x_5,x_6)] = f(x_5 x_8)$

$= x_5 + 8 - 3 [\because 5+8 > 3^2]$

$= x_{10}$

2. **Answer(A)**

$g(x_2, x_3) = x_1 \quad \left[\because \frac{2\times 3}{5} \to m = 1\right]$

And $g(x_7, x_8) = x_1 \quad \left[\because \frac{7\times 8}{5} \to m = 1\right]$

$\therefore g[g(x_2,x_3), g(x_7,x_8)]$

$= g(X_1, X_1) \quad \left[\because \frac{1\times 1}{5} \to m = 1\right]$

$= x_1$

3. **Answer(A)**

$f(x) = 3x + 10 \; and \; g(x) = x^2 - 1$

$\therefore$ fog = f$[g(x)] = 3\,[g(x)] + 10$

$= 3\,(x^2 - 1) + 10\; 3x^2 + 7$

Let $3x^2 + 7 = y \Rightarrow x^2 = \frac{y-7}{3}$

$\Rightarrow x = \left(\frac{y-7}{3}\right)^{\frac{1}{2}}$

So,$(fog)^{-1} = \left(\frac{x-7}{3}\right)^{\frac{1}{2}}$

4. **Answer(C)**

Sin $-1\left(\frac{1+t^2}{2t}\right)$

is defined only for t = -1 and t=1

So it is Neither Continuous nor differentiable at t=1

5. **Answer(D)**

$f\,(x) = \frac{|x-4|}{x-4}$ at x = 4

L.H.L.

(Where h is very small positive number)

$f(4-h) = \frac{|4-h-4|}{(4-h-4)} = -1$

R.H.L.

$f(4+h) = \frac{|4+h-4|}{(4+h-4)} = -1$

So L. ≠ H.L

So f(x) is discontinuous.

6. **Answer(D)**

$3 + \left(\frac{d^2y}{dx^2}\right)^{7/3} = \left(\frac{dy}{dx}\right)^2$

We can rewrite above differential equation as follows

$\left[\left(\frac{dy}{dx}\right)^2 - 3\right]^3 = \left[\frac{d^2y}{dx^2}\right]^7$

Order of D.E. = 2

Degree of D.E.

= power of highest order derivative = 7

7. **Answer(D)**

E = $\left(\frac{1-i}{1+i}\right)^{n-2} (1-i)^2$

$= \left(-\frac{2i}{2}\right)^{n-2} (-2i) = 2(-i)^{n-1}$

$= 2[(-i)^2]^{\frac{(n-1)}{2}} = 2(-1)^{\frac{(n-1)}{2}}$

since E is real and positive.

$\therefore \frac{n-1}{2} = 2\lambda$

$\therefore$ n = 4λ + 1

i.e. odd of this type but not any odd.

8. **Answer(D)**

$|z-2| = 2|z-3|$

$\Rightarrow |(x-2) + iy|^2 = 4|(x-3) + iy|^2$

$\Rightarrow (x-2)^2 + y^2 = 4\,[(x-3)^2 + y^2$

$\Rightarrow 3x^2 + 3y^2 - 20x + 32 = 0$

$\Rightarrow x^2 + y^2 - \frac{20}{3}x + \frac{32}{3} = 0$

Radius = $\sqrt{\left(\frac{-10}{3}\right)^2 - \frac{32}{3}} = \frac{2}{3}$

9. **Answer(D)**

Given.

Mean (np)=2 (i)

Variance (npq)=1 (ii)

from (i) and (ii), we get

n = 4, p = 1/2 and q = 1/2 P(X > 1)

= P (X = 2) + P (X = 3) + P (X = 4)

= $^4C_2(1/2)^4 + {}^4C_3(1/2)^4 + {}^4C_4(1/2)^4 = \frac{6}{16} + \frac{4}{16} + \frac{1}{16} = \frac{11}{16}$

10. **Answer(C)**

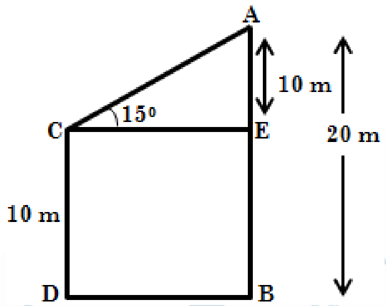
Let $cot^{-1}(\sqrt{3}) = x \Rightarrow \cot x = -\sqrt{3} \Rightarrow \cot x = -cot\frac{\pi}{6} \Rightarrow \cot x = -cot\left(\pi - \frac{\pi}{6}\right) \Rightarrow \cot x = cot\frac{5x}{6}$

$\Rightarrow \cot x \frac{5\pi}{6} \in (0, \pi)$

Hence, the principal value of $cot^{-1}(-\sqrt{3})$ *is* $\frac{5\pi}{6}$

11. **Answer(B)**

In $\Delta\, AEC\ \frac{AE}{CE} \tan 15° \Rightarrow \mathrm{CE} = \frac{10}{2679} = 37.3m$

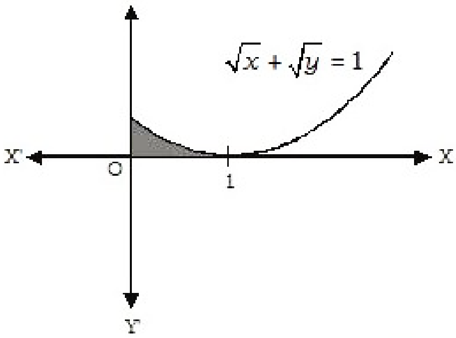


12. **Answer(D)**

Given $\sqrt{x} + \sqrt{y} = 1$

$\sqrt{y} = 1 - \sqrt{x} \Rightarrow \mathrm{y} = 1 + \mathrm{x} - 2\sqrt{x}$

$\Rightarrow$ Required are $\int_0^1 1 + x - 2\sqrt{x}$



$= \left[x + \frac{x^2}{2} - \frac{4x^{\frac{3}{2}}}{3}\right]_0^1 = 1 + \frac{1}{2} - \frac{4}{3} = \frac{1}{6}$

13. **Answer(D)**

$log_{30}45 = log_{30}(5\times 3\times 3) log_{30}5 + log_{30}3$

$+ \, log_{30}3$ = 2x + y

14. **Answer(A)**

Given digits 0, 1, 5, 6, 7

If the number is to be divided by 0, then last digit should be 0.

Since repetition is not allowed, in that case the first digit can be formed by 4 ways followed by second 3 digits and third 2 digits.

So, total possibilities are 4×3×2 =24.

15. **Answer(C)**

Let y = [2e^{-1}]

Since 0 < 2e^{-1} $\leq 2 \mathit{for\ all\ t} \in (0, \infty)$

Also [2e^{-1}] = 0, for t > in 2

16. **Answer(B)**

Possible arrangement will be the form BGBGBGB

Boys occupy 1,3,5,7 places and girls occupy 2,4,6 places.

∴ four boys can be seated in 4! ways. Three girls can be seated in 3! ways.

∴ Required number 3! × 4! = 144

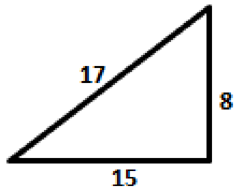
17. **Answer(A)**

$\sum_r^n \frac{p(n,r)}{r!} = \sum_{r=1}^n \frac{1}{r!}\cdot\frac{n!}{(n-r)!} \qquad \left[\therefore np_r = \frac{n!}{(n-r)!}\right]$

= $\sum_{r=1}^{n} nc_r$ $\left[\because n\,C_r = \frac{n!}{r!(n-r)^2}\right]$
= $(n\,C_1 + n\,C_2 + n\,C_3 + \cdots + n\,C_n)$
= $(1 + n\,C_1 + n\,C_2 + n\,C_3 + \cdots + n\,C_n) - 1$
= $(n\,C_0 + n\,C_1 + n\,C_2 + n\,C_3 + \cdots + n\,C_n) - 1$
= $(1+1)^n - 1 = 2^n - 1$

18. **Answer(C)**
Let I =
$$\int \frac{dx}{1-e^{-x}} = \int \frac{e^x}{1+e^x}dx$$
Put $1+e^x = t$ ⇒ $dt = e^x\,dx$
⇒ $I = \int \frac{dt}{t}$ = log t + c
⇒ I = log $(1+e^x)$ + c

19. **Answer(D)**
Given ,sec θ - tan θ = 5/3 ...(i)
$\sec^2\theta - \tan^2\theta = 1$
⇒ (secθ -tanθ)(secθ +tanθ)=1
⇒ secθ + tanθ=3/5 .....(ii)
On solving (i) and (ii) ,we get
sec θ = 17/15



⇒ cosec θ = 17/8 and cot θ = 15/8
$$cosec\,\theta - \cot\theta = \frac{17}{8} - \frac{15}{8} = \frac{2}{8} = \frac{1}{4}$$

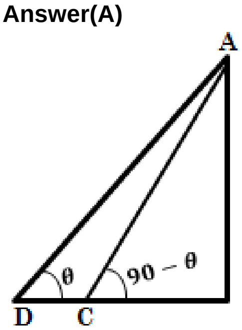
20. **Answer(C)**
$$\frac{dy}{dx} = \sqrt{1+x^2-y^2+x^2y^2}$$
⇒ $\frac{dy}{dx} = \sqrt{(1-x^2)(1-y^2)}$
⇒ $\frac{dy}{\sqrt{1-y^2}} = \sqrt{1-x^2}dx$
⇒ $sin^{-1}y = \frac{x}{2}\sqrt{1-x^2} + \frac{1}{2}sin^{-1}x + c$
⇒ $2sin^{-1}y = x\sqrt{1-x^2} + sin^{-1}x + c$

21. **Answer(B)**
We khow that $1^3+2^3...+ n^3 = \frac{|n(n+1)^2|}{4}$
⇒ $1^3+2^3...+ 16^3 = \frac{(16\times17)^2}{4}$
⇒ Arithmetic mean = $\frac{(16\times17)^2}{4\times16}$ = 1156

22. **Answer(C)**
Given equation is
$19x^2 + y^2 = K(x^2-2y^2-4y)$
⇒ $19x^2+y^2 = Kx^2-2Ky^2-4Ky$
⇒ $(19-K)x^2+(1+2K)y^2+4Ky = 0$
For the equation of circle ,we have
19-K = 1 + 2K
⇒ K = 6

23. **Answer(A)**
Given , $a_n = 7n - 10$
⇒ $a_1=-3$, $a_2=4$ $a_3 = 11$, ...
⇒ a = -3, and d = 7
Sum of first 25 terms
$S_{25} = \frac{25}{2}[2-(-3)+(25-1)7]$
$= \frac{25}{2}[162] = 2025$

24. **Answer(A)**



Length of BC= p m
Length of BD = q m
A.T.Q.
$\frac{AB}{BD} = tan\theta$
⇒ $\frac{AB}{Q} = \tan\theta - (i)$
$\frac{AB}{BC} = \tan(90^0 - \theta)$
⇒ AB = p cot θ
⇒ tan θ = p / AB ....(ii)
By equation (i) and (ii)
⇒ $\frac{AB}{q} = \frac{p}{AB}$
= AB = $\sqrt{pq}$
⇒ the height of the hill is $\sqrt{pq}$

25. **Answer(C)**
$$\int e^y\left(\frac{1-y}{1+y^2}\right)^2 dy = \int e^y\frac{(1-2y+y^2)}{(1+y^2)^2}dy$$
$= \int e^y\left(\frac{1}{(1+y^2)} - \frac{2y}{(1+y^2)^2}\right)dy = \int\left\{\frac{d}{dy}\left(\frac{e^y}{1+y^2}\right)\right\}dy$
⇒ $\frac{e^y}{1+y^2} + c$

26. **Answer(C)**
$log_{30}8 = log_{30}(2)^3 = 3log_{30}2 = 3$
$\left[log_{30}\left(\frac{30}{15}\right)\right]$
⇒ $log_{30}8 = 3[log_{30}30 - log_{30}15]$
$= 3[log_{30}30 - log_{30}5 - log_{30}3]$
⇒ $log_{30}8 = 3\,[1-x-y]$

27. **Answer(D)**
1. Changing origin or scale means applying a linear transformation to each data point. The mean is affected by a change of both but standard deviation is only affected by a change in scale.
2. Change of scale and change of origin is done either for ease of calculations (in case of grouped data) or to make the distribution look a bit standardized. Change of scale changes standard deviation and variance.

28. **Answer(B)**
$$x = y\,cos\frac{2\pi}{3} = x\,cos\frac{4\pi}{3} = k\,(say)$$
$$\frac{1}{x} = \frac{1}{k}, \frac{1}{y} = \frac{cos\frac{2\pi}{3}}{k}, \frac{1}{z} = \frac{cos\frac{4\pi}{3}}{k}$$
$\therefore \frac{1}{x}+\frac{1}{y}+\frac{1}{z} = \frac{1}{k}1 + cos\frac{2\pi}{3} + cos\frac{4\pi}{3}$
⇒ $\frac{xy+yz+zx}{xyz} = 1 - \frac{1}{2} - \frac{1}{2} = 0$
⇒ $xy+yz+zx = 0$

29. **Answer(A)**
$ax^2 + bx + c = 0$
When a=1 we can work out that:
Sum of the roots = −b/a = -b
Product of the roots = c/a = c
x^2 − (sum of the roots)x + (product of the roots) = 0
We will go through the option-
In option (a)
$x^2 - 2x + 1 = 0$
-b= 2
c = 1

30. **Answer(A)**
$$\alpha+\beta = \frac{4}{2} = 2, \alpha\beta = \frac{1}{2}$$
$$\frac{1}{\alpha+2\beta} + \frac{1}{\beta+2\alpha} = \frac{\beta+2\alpha+\alpha+2\beta}{(\alpha+2\beta)(\beta+2\alpha)}$$
$= \frac{3\alpha+3\beta}{\alpha\beta+2\alpha^2+2\beta^2+4\alpha\beta}$
$= \frac{3(\alpha+\beta)}{2(\alpha+\beta)^2+\alpha\beta} = \frac{3(2)}{2(2)^2+\frac{1}{2}} = \frac{12}{17}$

31. **Answer(B)**
At the points where each graph meets the x-axis, y-coordinate is 0.
The points of meeting are where 2x=5

And 4x =-1 i.e..., where x= 5/2, & x= -1/4
The points are (5/2, 0) & (-1/4, 0) &
These points are separated by
$\frac{5}{2} - \left(-\frac{1}{4}\right) = \frac{5}{2} + \frac{1}{4} = \frac{11}{4}$ units

32. **Answer(C)**
Given equation is –
$19x^2 + y^2 = K(x^2 - 2y^2 - 4y) \Rightarrow 19x^2 + y^2$
$= Kx^2 - 2ky^2 - 4Ky$
$\Rightarrow (19 - \mathrm{K})x^2 + (1 + 2K)y^2 + 4Ky = 0$
For the equation of circle, we have
$10 - K = 1 + 2K \Rightarrow K = 6$

33. **Answer(B)**
$\because c^2 = a^2 + b^2 - 2ab\ coc\ C$
$\therefore c^2 = 25 + 16 - 40 \times \frac{1}{8} = 36 \Rightarrow c = 6$

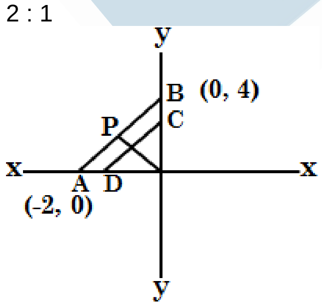
34. **Answer(B)**
Area of the $\Delta\ AMB = \frac{1}{2}\begin{vmatrix} x & x & 1 \\ -2 & 0 & 1 \\ 0 & 4 & 1 \end{vmatrix}$
$= \left|\frac{1}{2}(-4x + 2x - 8)\right| = |-(x+4)|$
Which is minimum for x=0 and thus the coordinates of M are (0,0)

35. **Answer(D)**
We can clearly see that 2y & (y – 2)^2 are always positive
So $\frac{2^y(y-1)}{(y-2)^2} \leq 0$
$\Rightarrow Y - 1 \leq 0$
$\Rightarrow y \in (-\infty, 1]$

36. **Answer(B)**
For a given polynomial $(x+y)^n$,
rth term is given as $T_{r+1} = {}^nC_r x^{n-r} y^r$
given n = m+n, x=1, y=a
$T_{r+1} = {}^{m+n}C_r 1^{m+n-r} a^r$
-for a^m , a^n put put r=m , n
${}^{m+n}C_m a^m$ and ${}^{m+n}C_n a^n$
coefficients are ${}^{m+n}C_m$ and ${}^{m+n}C_n$
(m+n)!/m!n! and (m+n)!/m!n!
Clearly a^m coefficient and a^n coefficient are equal
So α = β

37. **Answer(D)**
Xi=a+cyi
Yi=xi-a/c
Mean of y $= \frac{\bar{x} - a}{c}$

38. **Answer(A)**
As P divides AB in the radio 2 : 1. The base of the Δ's APM & BPM are in the ratio 2: 1 and the length of the perpendicular from the vertex M on the base is same. So, the ratio of the areas of the Δ APM & BPM is also 2 : 1



39. **Answer(B)**
Area of the $\Delta AMB = \frac{1}{2}\begin{vmatrix} x & x & 1 \\ -2 & 0 & 1 \\ 0 & 4 & 1 \end{vmatrix}$
$= |\frac{1}{2}(-4x + 2x - 8)| = |-(x+4)|$
Which is minimum for $x = 0$ and thus the coordinates of *M* are (0,0)

40. **Answer(D)**
We have, centre = (3, 4) and radius = 5,
equation of circle having centre (h, k) and radius a is
$(x-h)^2+(y-k)^2=a^2 \Rightarrow (x-3)^2+(y-4)^2=25$
For x - intercept
Put y= 0 we get, $(x-3)^2+16=25 \Rightarrow (x-3)^2=9$
$\Rightarrow$ x−3=3 and −3$\Rightarrow$ x=6 and 0
For y - intercept
Put x=0, we get $9+(y-4)^2=25$
$\Rightarrow$ y−4=4 and −4 $\Rightarrow$ y=8 and 0
Hence, the x-intercept is 6 and y-intercept is 8.

41. **Answer(A)**
We have,
$I = \frac{1}{a^2 sin^2 x + b^2 cos^2 x} dx$
$I = \frac{sec^2 x}{b^2 + a^2 tan^2 x} dx$
$I = \frac{1}{a} \frac{1}{b^2 + (a \tan x)^2} d\,(a \tan x)$
$I = \frac{1}{ab} tan^{-1}\left(\frac{a}{b} \tan x\right) + c$
Given that, $\frac{1}{12} tan^{-1}(3 \tan x) + c = \frac{1}{12} tan^{-1}\left(\frac{a}{b} \tan x\right) + c$
$\therefore ab = 12\ and\ \frac{a}{b} = 3$
$\Rightarrow a^2 = 36 \Rightarrow a = \pm 6$
$\therefore ab = 12 \Rightarrow \mathrm{b} = \pm 2$

42. **Answer(B)**
$a\ sinx + bcosx = \pm(6\ sinx + 2\ cosx)$
We know that
$-\sqrt{a^2 + b^2} \leq a\ sinx + b\ cosx \leq \sqrt{a^2 + b^2}$
$\therefore -\sqrt{40} \leq 6\ sinx + 2\ cosx \leq \sqrt{40}$

43. **Answer(C)**
Given,
$A = \int_0^{\pi} \frac{\sin x}{\sin x + \cos x} dx\ and\ B = \int_0^{\pi} \frac{\sin x}{\sin x - \cos x} dx$
Now,
$A = \int_0^{\pi} \frac{\sin(\pi - x)}{\sin(\pi - x) + cos(\pi - x)} \quad \left[\int_0^{\pi} f(x)d = \int_0^{a} f(a-x)dx\right]$
$= \int_0^{\pi} \frac{\sin x\, dx}{\sin x - \cos x} = B$
Thus A = B

44. **Answer(B)**
Let A = $\begin{bmatrix} 0 & 2y & z \\ z & y & -z \\ z & -y & z \end{bmatrix}$
=> A $\begin{bmatrix} 0 & x & x \\ 2y & y & y \\ Z & -z & z \end{bmatrix}$
But A is orthogonal
$\Rightarrow$ AA' =I
$\Rightarrow \begin{bmatrix} 0 & 2y & z \\ z & y & -z \\ z & -y & z \end{bmatrix} \begin{bmatrix} 0 & x & x \\ 2y & y & y \\ Z & -z & z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
$\Rightarrow \begin{bmatrix} 4y^2 + z^2 & 2y^2 - z^2 & -2y^2 + z^2 \\ 2y^2 - z^2 & x^2 + y^2 + z^2 & x^2 - y^2 - z^2 \\ -2y^2 + z^2 & z^2 - y^2 - z^2 & z^2 + y^2 + z^2 \end{bmatrix}$
$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
Equating the corresponding elements
$4y^2 + z^2 = 1 \ldots\ldots\ldots\ldots(1)$
$2y^2 - z^2 = 0 \ldots\ldots\ldots(2)$
$x^2 + y^2 + z^2 = 1 \ldots\ldots\ldots(3)$
Add (1) and (2)
$6y^2 = 1$
$y^2 = \frac{1}{6}$
Y = $\pm\sqrt{1/6}$
Put value of y and z then from (3)
$x^2 = 1 - y^2 - z^2 = 1 - \frac{1}{6} - \frac{1}{3} = \frac{1}{2}$

$x = \pm\sqrt{\frac{1}{2}}$

45. **Answer(C)**

$lx^2 + mx + n = 0 (0 < l < m < n)$

Product of roots (z_1z_2) = c/ a >1

Let z_1 =a + $i\beta$ and $z_2 = \alpha - i\beta$

$\Rightarrow (\alpha + \beta)(\alpha - i\beta) > 1$

$\Rightarrow a^2 + \beta^2 > 1$

$\Rightarrow |z_1| > 1, |z_2| > 1$

46. **Answer(D)**

Number of cricket loving students n(C) = 25%

Number of hockey loving students n(H) = 15%

We know that

n(H∪ C) = n (H) +n (C) –n (H∩C)

⇒ 35% = 15% + 25% - n (H∩C)

⇒ n(H∩C) = 5%

According to question ,

⇒ 5% = 2000

⇒ 1% = 400

⇒ 100% = 40000

So total number of students in school = 40000

47. **Answer(B)**

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

$and\ i = B = \int_0^{\pi} \frac{\sin x\, dx}{\sin x - \cos x} dx$....(ii)

$$\left[\because \int_0^a f(x)dx = \int_0^a f(a-x)dx\right]$$

On adding (i) and (ii) we get, $2I$

$\int_0^{\pi}\left(\frac{sinx}{sinx+cosx} + \frac{sinx}{sinx-cosx}\right) dx$

$\Rightarrow 2I = \int_0^{\pi} \frac{2sin^2x}{sin^2x-cos^2x} dx$

$\Rightarrow 2I = 4\int_0^{\pi/2} \frac{sin^2x}{sin^2x-cos^2x} dx$

$\Rightarrow 2I = 4\int_0^{\pi/2} \frac{cos^2x}{cos^2x-sin^2x} dx$.....(iv)

$$\left[\because \int_0^a f(x)dx = \int_0^a f(a-x)dx\right]$$

$$4I = 4\int_0^{\frac{\pi}{2}} \left(\frac{sin^2x - cos^2x}{sin^2x - cos^2x}\right) dx$$

$$4I = 4|x|_0^{\frac{\pi}{2}} = I = \frac{\pi}{2}$$

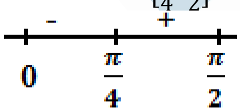
48. **Answer(B)**

Given, $y = \sin x + \cos x$

$\frac{dy}{dx} = \cos x - \sin x\ y$

$= \left[\cos x - \sin x \quad x \in \left[0, \frac{\pi}{4}\right]\right]$

$\sin x - \cos x\ \epsilon \left[\frac{\pi}{4}, \frac{\pi}{2}\right]$



Thus required area

=

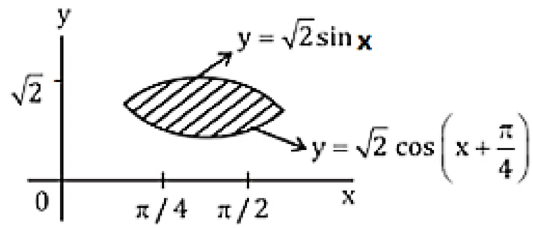
$\int_0^{\pi/4} |(\sin x + \cos x)(\cos x - \sin x)| dx + \int_{\pi/4}^{\pi/2} |2\cos x| dx$

$= \int_0^{\pi/4} |2\sin x| dx + \int_{\pi/4}^{\pi/2} |2\cos x| dx$

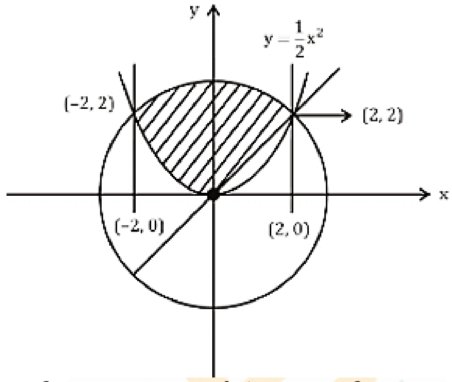
$= 2\,[-\cos x]_0^{\frac{\pi}{4}} + 2[\sin x]_{\frac{\pi}{4}}^{\frac{\pi}{2}}$

$= 2\left[\frac{1}{\sqrt{2}} + 1 + 1 - \frac{1}{\sqrt{2}}\right]$

$= 2(2 - \sqrt{2}) = 2\sqrt{2}(\sqrt{2} - 1)$



49. **Answer(D)**



$= \int_{-2}^{2}\sqrt{8 - x^2}dx - \int_{-2}^{0}\frac{1}{2}x^2dx - \int_0^2 x dx$

$= \int_0^2 \sqrt{8 - x^2}dx - \left[\frac{x^2}{6}\right]_{-2}^{0} - \left[\frac{x^2}{2}\right]_0^2$

$= 2\left[\frac{x}{2}\sqrt{8 - x^2} + \frac{8}{2}sin^{-1}\frac{x}{2\sqrt{2}}\right]_0^2 - \frac{4}{3} - 2$

$= 2\left[2 + 4 \times \frac{\pi}{4}\right] - \frac{10}{3} = \frac{2}{3} + 2\pi$

50. **Answer(A)**

Let the position vectors of the vertices be a, b & c respectively, so that the position vector of G the centroid is

$\frac{a+b+c}{3}$ $\therefore GA = P.V. of\ A - P.V. of\ G$

$= a - \frac{a+b+c}{3} = \frac{2a-b-c}{3}$

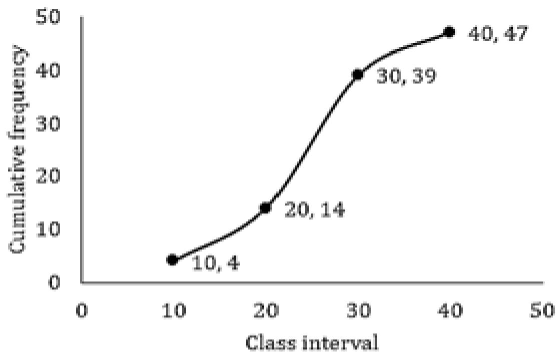
Similarly $GB = \frac{2a-c-a}{3}$

$GC = \frac{3c-a-b}{3}$

$\therefore GA + GB + GC = \frac{1}{3}\left(2\sum a - 2\sum a = 0\right)$

51. **Answer(A)**

Class interval	Frequency	Mutative	Frequency
0-10	4	4	
10-20	10	14	
20-30	25	39	
30-40	8	47	
40-50	2	49	



52. **Answer(B)**

We have $b_{xy} = -0.64, by_x = -0.36$

∴ correlation coefficient (σ) = $\sqrt{b_{xy} \times b_{yx}}$

$= \pm\sqrt{(-0.64)(-0.36)} = \pm 0.48 \Rightarrow \sigma = -0.48$

Because b_{xy}&b_{yx} both are negative.

53. **Answer(A)**
If sin x is G,M of sin y and cos y
Then $\sin^2 x = \sin y \cos y$
⇒ $2\sin^2 x = 2 \sin y \cos y$
⇒ $1 - \cos^2 x = 1 \sin 2y$
⇒ cos 2x =1 – sin 2y = 1
$+ \cos\left(\frac{\pi}{2} + 2y\right) = 1 + \cos^2\left(\frac{\pi}{4} + y\right)$
⇒ $\text{Cos}^2 x = 2\cos^2\left(\frac{\pi}{4} + y\right)$

54. **Answer(C)**
$\int \cos x . \sec^2(\sin x)dx$
Put sin x = t such that cos x dx = dt
⇒ $\int \sec^2 t\, dt$
⇒ tan (t) + c
⇒ tan (sinx) + c

55. **Answer(C)**
x = a (t – sin t),y = a (1 – cos t)
$\frac{dx}{dt} = a(1 - cost)$
$\frac{dy}{dt} = a$ (sin t)
$$\frac{dy}{dx} = \frac{\left(\frac{dy}{dt}\right)}{\left(\frac{dx}{dt}\right)} = \frac{a(sint)}{a(1 - cost)} = \frac{\sin t}{1 - \cos t}$$
The slope of the tangent (m_1) at t
$= \frac{\pi}{2} = \frac{\sin^{\pi}/2}{1 - \cos^{\pi}/2} = 1$
So slope of normal $= \frac{-1}{m_1} = -1$

56. **Answer(A)**

57. **Answer(B)**
Consider the following events:
A= Getting 15 as the sum in a throw of three dice
B= Getting 4 on the first die
Required Probability
=P(A/B)= Probability of getting 15 as the sum of the numbers if there is 4 on the first die.
[If "Total no. of ways =1×6×6=36 There are two favourable elementary enents viz. (4,6,5),(4,5,6)]
=2/36
= 1/18

58. **Answer(B)**
7x - 5z = 5
2y + 3z = 4
Z = 3
Let A = $\begin{bmatrix} 7 & 0 & -5 \\ 0 & 2 & 3 \\ 0 & 0 & 1 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ $and\ B = \begin{bmatrix} 5 \\ 4 \\ 3 \end{bmatrix}$
⇒ AX = B
Now $|A| = \begin{vmatrix} 7 & 0 & -5 \\ 0 & 2 & 3 \\ 0 & 0 & 1 \end{vmatrix} = 14$
Since $|A| \neq 0$
Therefore, this system of linear equations has only one solution.

59. **Answer(C)**
The given differential equation of the curve is, dy = y tan x dx ⇒ $\int \frac{dy}{y}$ =∫tan x·dx[on integrating]
⇒ log y=log sec x+log c
⇒ log y=log c.sec x
⇒ y=c.sec x
since the curve passes through the origin (0,1) then 1=c. sec 0⇒ c=1
∴ Required equation of curve is y = sec x

60. **Answer(C)**
Required mean
$= \frac{30 \times 4 + 64 \times 3}{36 + 64} = \frac{144 + 192}{100} = \frac{336}{100} = 3.36$

61. **Answer(B)**
Geometric mean is used in construction of index numbers.

62. **Answer(D)**

2	31	
2	15	1
2	7	1
2	3	1
2	1	1
2	0	1

So the binary number is 11111

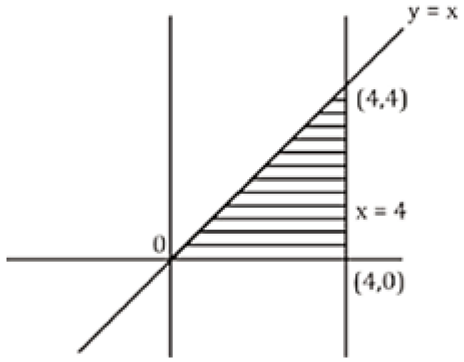
63. **Answer(A)**
1/2 +3/4+7/8 +15/16 + ……………….+upto n terms
⇒ $\frac{2-1}{2} + \frac{4-1}{4} + \frac{8-1}{8} + \frac{16-1}{16}$
⇒ 2/2 – 1/2 + 4/4 – 1/4 + 8/8 – 1/8 + 16/16 – 1/16
⇒ $1 - \frac{1}{2} + 1 - \frac{1}{4} + 1 - \frac{1}{8} + 1 - \frac{1}{16}$
⇒ n $- \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots\right)$
$\left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots\right) : it\ is$ Geometric progression with a = 1/2 and r = ½
So sum of G.P = $\frac{a(r^n - 1)}{r - 1} = \frac{\left(\frac{1}{2}\right)\left[\left(\frac{1}{2}\right)^n - 1\right]}{\left(\frac{1}{2} - 1\right)}$
⇒ n $\frac{\left(\frac{1}{2}\right)\left[\left(\frac{1}{2}\right)^n - 1\right]}{\left(\frac{1}{2} - 1\right)}$
⇒ n $+2^{-n} - 1$

64. **Answer(C)**
$a_1 a_2 + b_1 b_2 + c_1 c_2 = 4 + 3 + 12 = 19 > 0$
So that acute angle bisector is
$\frac{a_1 x + b_1 y + c_1 z + d_1}{\sqrt{a_1^2 + b1^2 + c_1^2}} = -\frac{a_2 x + b_2 y + c_2 z + d_2}{a_2^2 + b_2^2 + c_2^2}$
⇒ $\frac{2x - y + 2z + 1}{3} = -\frac{2x - 3y + 6z + 2}{7}$
⇒ 20x – 16y + 32z + 13 = 0

65. **Answer(C)**
$\tan^2 a(x + z) - 2y \tan a + (z - x) = 0$
Clearly we can see that this is a quadratic equation with *tan a* as a variable.
This has tanA and tan B as its roots
Product of roots = tan A .tan B = $\frac{Z - X}{Z + X}$

66. **Answer(C)**
I. r = + 1 or -1 means there is a linear relation between x and y.
II. -1 ≤ r ≤ 1 and r^2 is a measure of the linear relationship between the variables. Which of the above statement (S) is/are correct.

67. **Answer(B)**



$$\int_0^4 x\, dx$$
$$\left[\frac{x^2}{2}\right]_0^4$$
$$\frac{16}{2} = 8\, sq. units$$

68. **Answer(A)**
$\because \int_{-3}^{9} f(x)dx. = \int_{-3}^{2} f(x)dx + \int_{2}^{9} f(x)dx$ ……..(1)
But $\int_{-3}^{9} f(x)dx = \frac{-5}{6}$ and $\int_{-3}^{2} f(x)dx = \frac{7}{3}$
From equation (1)

$$-\frac{5}{6}=\frac{7}{3}+\int_2^9 f(x)dx$$

$$=\int_2^9 f(x)dx=\frac{-5}{6}-\frac{7}{3}=\frac{-19}{6}$$

69. **Answer(A)**

Given $f(x)=-2x^3-9x^2-12x+1$

On differentiating both sides w.r.t. x, we get $f'(x)=-6x^2-18x-12$

For f(x) to be increasing function, $f'(x)>0$

$\therefore\ -6x^2-18x-12>0$

$\Rightarrow\ x2+3x+2<0$

$\Rightarrow\ (x+2)(x+1)<0$

$\therefore\ -2<x<-1$

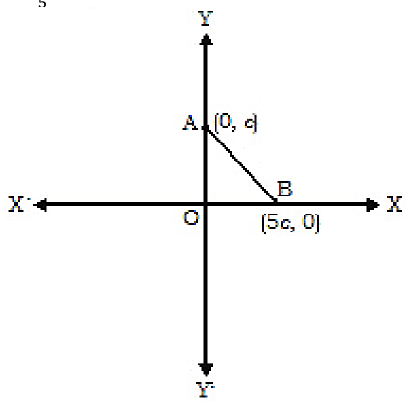
70. **Answer(A)**

Given that the required line is perpendicular to the line 5x - y = 0

$\Rightarrow$ Slope of required line = -1/5

$\Rightarrow$ Equation of required line will be

$y=\frac{-1}{5}x+c$



Area of $\Delta ABO=\frac{1}{2}\times OA\times OB$

$=5=\frac{1}{2}\times c\times 5c$

$\Rightarrow c=\pm\sqrt{2}$

$\Rightarrow$ Require equation is given by

$$y=\frac{-1}{5}x\pm\sqrt{2}$$

$\Rightarrow x+5y\pm 5\sqrt{2}=0$

71. **Answer(C)**

Given,

$f(x)=|x^2-5x+6|$

$\Rightarrow\ f(x)=|(x-2)(x-3)|$

At x=4, we take, $f(x)=(x-2)(x-3)=x^2-5x+6$

On differentiating both sides w.r.t. x, we get

$f'(x)=2x-5$

At x=4, $f'(4)=2\times4-5=3$

72. **Answer(B)**

Let x + y = A

$\Rightarrow \tan A=\tan(x+y)=\frac{\tan x+\tan y}{1-\tan x\tan y}=\frac{\frac{5}{6}+\frac{1}{11}}{1-\left(\frac{5}{6}\right)\left(\frac{1}{11}\right)}$

$=\frac{\left(\frac{61}{66}\right)}{\left(\frac{61}{66}\right)}=1$

$\Rightarrow \tan(x+y)=\tan 45^0$

$\Rightarrow x+y=45^0$

73. **Answer(D)**

Tangent of ellipse $\frac{x^2}{4}+\frac{y^2}{1}$

$=1$ is given by $\frac{xx_1}{4}+\frac{yy_1}{1}=1$

$\Rightarrow\ \frac{xx_1}{4}+\frac{yy_1}{1}=1$

$\Rightarrow\ xx_1+4yy_1=4$

Compare $xx_1+4yy_1=4$ with tangent

3x +y =4

$$x_1=3, y_1=\frac{1}{4}$$

So point of contact = $\left(3,\frac{1}{4}\right)$

74. **Answer(D)**

$\int_1^e \frac{(inx)^2}{x}dx$

Put In x = t such that dx/x = dt

$\Rightarrow \int_1^e t^2dt=\left[\frac{t^3}{3}\right]_1^e=\left[\frac{(in\ x)^3}{3}\right]_1^e$

$\Rightarrow \frac{(ine)^3}{3}-\frac{(in\ 1)^3}{3}=\frac{1}{3}-0=\frac{1}{3}e$

75. **Answer(B)**

f(x) = 2x - 3 and g(x) = x^3+5

fog(x) = f(g(x)) = f (x^3+5)

= 2 (x^3+5) - 3

= $2x^3+10-3$

= $2x^3+7$

$\Rightarrow$ fog (x) = $2x^3+7$

Now let y = $2x^3+7$

Interchange x and y,we get

x = $2y^3+7$

$\Rightarrow y^3=\frac{x-7}{2}$

$$\Rightarrow y^3=\left(\frac{x-7}{2}\right)^{\frac{1}{3}}$$

$$fog^{-1}(x)=\left(\frac{x-7}{2}\right)^{\frac{1}{3}}$$

76. **Answer(D)**

$$\lim_{x\to0}\frac{x\tan x}{1-\cos x}\left(\frac{0}{0}form\right)$$

By using L 'hospital's rule, we get

$$\lim_{x\to0}\frac{xsec^2x+\tan x}{\sin x}\left(\frac{0}{0}form\right)$$

Again, by using L 'hospital's rule, we get

$$\lim_{x\to0}\frac{2sec^2x\tan x+2sec^2x}{\cos x}=2$$

77. **Answer(C)**

$\because f(x)=|x-3|=\begin{cases}x-3, & x\ge3\\3-x, & x<3\end{cases}$

$\therefore$ LHL = $\lim_{x\to0^-}f(x)=\lim_{h\to0}f(0-h)$

$=\lim_{h\to0}f(3+h)=3$

And RHL = $\lim_{x\to0^+}f(x)=\lim_{h\to0}f(0+h)$

$=\lim_{h\to0}f(3-h)=3$

$\Rightarrow$ LHL = RHL

So, $f(x)$ is continuous at x = 0 now LHD $f'(0^-)$

$$=\log_{h\to0}\frac{f(0)-f(0-h)}{h}$$

$$=\log_{h\to0}\frac{3-(3-h)}{h}=1$$

And RHD

$$f'(0^+)=\log_{h\to0}\frac{f(0+h)-f(0)}{h}$$

$$=\log_{h\to0}\frac{3+h-3}{h}=1$$

$\Rightarrow$ LHD = RHD

$\therefore f(x)$ is differentiable at $x=0$

Hence both statements I and II are correct.

78. **Answer(C)**

The equations of lines L_1&L_2 by making constant term positive, are

$4x-3y+7=0$

$3x-4y+14=0$

$\therefore 4\times3+(-3)(-4)=24>0$

i.e. $a_1a_2+b_1b_2>0$

so the bisector of the acute angle is given by

$$\frac{4x-3y+7}{\sqrt{4^2+(-3)^2}}=\frac{3x-4y+14}{\sqrt{3^2+(-4)^2}}$$

$\Rightarrow 4x-3y+7=-3x+4y-14$

$\Rightarrow x-y+3=0$

79. **Answer(C)**

Let O be the points of intersection of lines L_1&L_2

Solving eqs. (i) & (ii) in above question, we get $0\equiv(2,5)$

Equation of L_3 is x+y=0

Solving eq. (i) & (iii), we get $P\equiv(-1,1)$

Solving eq. (ii) & (iii), we get Q=(−2,2)

∴ OP = $\sqrt{(2+1)^2+(5-1)^2}=5$

and OQ = $\sqrt{(2+2)^2+(5-2)^2}=5$

∴ In any triangle, bisector of an angle divides the triangle into two similar triangles.

∴ $\frac{PR}{RQ}=\frac{OP}{OQ}=\frac{5}{5}=\frac{1}{1}=1:1$

80. **Answer(B)**

Area of $\Delta\, OPQ=\frac{1}{2}\begin{vmatrix}2 & 5 & 1\\ -1 & 1 & 1\\ -2 & 2 & 1\end{vmatrix}$

$=\frac{1}{2}|[-2-5+0]|=\frac{7}{2}$ sq. units

81. **Answer(C)**

Slope of = 3x + 4y – 9 = 0 = $-\frac{a}{b}=\frac{-(3)}{4}=-\frac{3}{4}$

Slope of = 3x + 4y + 11 = 0 = $-\frac{a}{b}=\frac{-(3)}{4}=-\frac{3}{4}$

As slope of both lines are equal so both lines are parallel.

So distance between two parallel line

= $\left|\frac{c_1-c_2}{\sqrt{a^2+b^2}}\right|=\left|\frac{-9-11}{\sqrt{(3)^2+(4)^2}}\right|=\frac{20}{5}=4$

82. **Answer(A)**

A = $\begin{bmatrix}4 & 3\\ 1 & 1\end{bmatrix}$

So A² = $\begin{bmatrix}4 & 3\\ 1 & 1\end{bmatrix}\cdot\begin{bmatrix}4 & 3\\ 1 & 1\end{bmatrix}=\begin{bmatrix}19 & 15\\ 5 & 4\end{bmatrix}$

⇒ $A^2 + aA + bI = 0$

⇒ $\begin{bmatrix}19 & 15\\ 5 & 4\end{bmatrix}+a\begin{bmatrix}4 & 3\\ 1 & 1\end{bmatrix}+b\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$

⇒ $\begin{bmatrix}19+4a+b & 15+3a\\ 5+a & 4+a+b\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$

So we can write following equations

15 + 3a = 0

A = – 5

19 + 4a + b = 0

Also 19 – 20 + b = 0

b = 1

83. **Answer(C)**

The word 'JATIN' has 5 letters in which no letters are repeating.

Arrange letters of word 'JATIN' in ASCENDING order- AIJNT

Number of words starting with A =4!=24

Number of words starting with I =4!=24

Number of words starting with JAI =2!=2

Number of words starting with JAN =2!=2

Number of words starting with JATIN =1

Therefore, rank =24+24+2+2+1= 53

84. **Answer(C)**

Given $A+B=\alpha$

$A-B=x$

Also $\frac{\tan A}{\tan B}=\frac{2}{1}\Rightarrow\frac{\sin A}{\sin B}\cdot\frac{\cos B}{\cos A}=\frac{2}{1}$

$\Rightarrow\frac{\sin(A+B)+\sin(A-B)}{\sin(A+B)-\sin(A-B)}=\frac{2}{1}$

$\Rightarrow\frac{\sin\alpha+\sin x}{\sin\alpha-\sin x}=\frac{2}{1}$

Using componendo and dividend rule,

$\frac{2\sin\alpha}{2\sin x}=\frac{211}{2-1}\Rightarrow\frac{\sin\alpha}{\sin x}=\frac{3}{1}$

$\Rightarrow\sin x=\frac{1}{3}(\sin\alpha)$

85. **Answer(B)**

$\sec x+\tan^3 x \operatorname{cosec} x$

$=\sec x(1+\tan^3 x \operatorname{cosec} x \sec x)$

$=\sec x(1+\tan^2 x)$

$=\sec x(\sec^2 x)=\sec^3 x$

$=(\sec^2 x)^{3/2}=(1+\tan^2 x)^{3/2}$

$=(2-e^2)^{3/2}$

86. **Answer(A)**

$$f(x)=\begin{cases}-2\sin x & if \quad x\le-\frac{\pi}{2}\\ A\sin x+B & if \quad -\frac{\pi}{2}<x<\frac{\pi}{2},\\ \cos x & if \quad x\ge\frac{\pi}{2}\end{cases}$$

$\lim_{x\to\frac{-\pi}{2}^-}f(x)=\lim_{x\to\frac{-\pi}{2}^-}-2\sin x=-2\sin\left(\frac{-\pi}{2}\right)=2$

$\lim_{x\to\frac{-\pi}{2}^+}f(x)=\lim_{x\to\frac{-\pi}{2}^+}A\sin x+B=-A+B$

Since f(x) is continous at x = π/2

⇒ $-A+B=2$…..(i)

$\lim_{x\to\frac{\pi}{2}^-}f(x)=\lim_{x\to\frac{\pi}{2}^-}A\sin x+B=A+B$

$\lim_{x\to\frac{\pi}{2}^+}f(x)=\lim_{x\to\frac{\pi}{2}^+}\cos x=0$

Since f(x) is continous at x = π/2

⇒ $\lim_{x\to\frac{\pi}{2}^-}f(x)=\lim_{x\to\frac{\pi}{2}^+}f(x)$

⇒ $A+B=0$…..(ii)

From (i) and (ii) we get

A =-1 and B = 1

87. **Answer(B)**

Given α and β are the roots of equation $x^2+bx+c=0$

∴α+β=−b

and αβ=c

As b>0&c<0

So α+β<0

⇒ β<−α

and αβ<0

Also given that α<β⇒ α<0&β>0

As α+β<0 and αβ<0 ⇒ α+β+αβ<0

∴ statement 1 is not correct

Now $\alpha^2\beta+\beta^2\alpha=\alpha\beta(\alpha+\beta)$

As α+β<0&α<0

⇒ αβ(α+β)>0

∴ statement II is correct.

88. **Answer(A)**

Given α and β are the roots of equation $x^2+bx+c=0$

∴α+β=−b

and αβ=c

Asb>0&c<0

So α+β<0

⇒ β<−α

and αβ<0

Also given that α<β⇒ α<0&β>0

∵ $x^2-px+4>0$

Here a>0&f(x)>0

∴D<0

∴ $P^2-16<0$⇒ P2<16⇒ |P|<4

89. **Answer(B)**

$6^{\frac{2}{2}}\times6^{\frac{2}{2}}\times6^{\frac{3}{3}}\times6^{\frac{1}{4}}\times\ldots\infty$

$=6^{\frac{1}{2}+\frac{1}{2}+\frac{3}{8}+\frac{1}{4}+\cdots\infty}$

$=6^{\frac{1}{2}\left(1+\frac{2}{2}+\frac{3}{2^2}+\frac{4}{2^3}+\cdots\right)}$

Let S = $1+\frac{2}{2}+\frac{3}{2^2}+\frac{4}{2^3}+\cdots$

$\frac{1}{2}S=\frac{1}{1-\frac{2}{2}}=2\Rightarrow S=4$

∴ $6^{\frac{1}{2}}\times6^{\frac{2}{2}}\times6^{\frac{3}{3}}\times6^{\frac{2}{4}}\times\ldots\infty$

$=6^{\frac{1}{2}\times4}=36$

90. **Answer(D)**

Given series is $1+\frac{1}{\sqrt{3}}+3+\frac{1}{3\sqrt{3}}+\ldots\ldots$

Here between each two consecutive terms, no common difference and common ratio are form. Hence the given series does not form any series.

91. **Answer(B)**

$\sin^2 x-\cos x=1/4$

⇒ $4\sin^2 x-4\cos x=1$

⇒ $4(1-\cos^2 x)-4\cos x-1=0$

⇒ $4\cos^2 x+4\cos x-3=0$

⇒ 4 cos2 x + 6 cosx – 2 cos x – 3 = 0

⇒ 2 cos x (2 cos x +3) – (2cosx + 3) =0

⇒ cos x1/2 and cos x = - 3/2

But x ≠ – 3/2

So cos x = ½ ,x ∈ $[0,2\pi]$

$X = \frac{\pi}{3}, \frac{5\pi}{3}$

So there are two solution of above equation.

92. **Answer(A)**

Tangent whose slope is m to the parabola y^2
$= 4ax$ is $y = mx + a/m$, $m \neq 0$
Equation of the tangent to y^2
$= 4n(x+n)$ having slope
$\Rightarrow y = (x+n) + n$
$\Rightarrow y = x + 2n$
$\Rightarrow x - y + 2n = 0$

93. **Answer(A)**

$\lim_{t\to0} f(t) = \lim_{t\to0} \frac{\sin t^2}{t} = \lim_{t\to0} \left(\frac{\sin t^2}{(t^2)}\right) t = 0$
$= f(0)$
Hence function is continuous at t =0
Also R $f'(0) = \lim_{h\to0} \frac{f(0+h)-f(0)}{h}$
$= \lim_{h\to0} \frac{\frac{\sin h^2}{h}-0}{h} = \lim_{h\to0} \frac{\sin h^2}{h^2} = 1$
And $Lf'(0) = \lim_{h\to0} \frac{f(0-h)-f(0)}{-h} = \lim_{h\to0} \frac{\frac{\sin h^2}{-h}}{-h}$
$= \lim_{h\to0} \frac{\sin h^2}{h^2} = 1$
=> R$f'(0)$ = L $f'(0)$
So hence function is derivable at t = 0

94. **Answer(A)**

Let the angles of triangle be a,a+d and a+2d
Given a=30°
∵ a+a+d+a+2d=180°
∴ 3a+3d=180°
⇒ 3 ×30°+3d=180°
⇒ 3d=90°
⇒ d=30°
∴ Angle of triangle are 30°,60° and 90° Hence the greatest angle 90° = π/2

95. **Answer(C)**

The required number of ways
$= {}^{14}C_{10}$
$= \frac{14\times13\times12\times11}{4\times3\times2\times1} = 1001$

96. **Answer(B)**

$(x^3-1) = (x-1)(x^2+1+x)$
$= (x-1)(x^2+x-\omega-\omega^2) \quad [\because 1+\omega+\omega^2=0]$
$(x-1)(x^2-\omega^2+x-\omega)$
$(x-1)[(x+\omega)(x-\omega)+(x-\omega)]$
$(x-1)(x-\omega)[x+\omega+1]$
$(x-1)(x-\omega)(x-\omega^2)$

97. **Answer(D)**

∵ A $= \{n^2 : n \in N\}$ and $B = \{n^3 : n \in N\}$
So $A \cap B$ must be a proper subset of $\{m^6 : m \in N\}$

98. **Answer(D)**

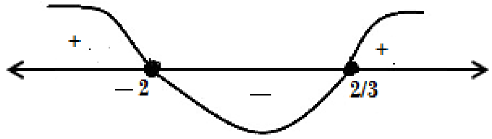
A – (B ∪ C)

99. **Answer(D)**

We know $X = \frac{x_1+x_2+\cdots+z_n}{n}$
$\Rightarrow x_1 + x_2 + \cdots + x_n = nX$
$\Rightarrow x_1 + x_3 + \cdots + x_n = nX - x_2$
$\Rightarrow x_1 + x_3 + \cdots + x_n + \lambda = nX - x_2 + \lambda$
$\Rightarrow$ Mean $= \frac{Sum\ of\ all\ values}{Total\ no.of\ values} = \frac{x_1+x_3+\cdots+z_n+\lambda}{n}$
$= \frac{nX-x_2+\lambda}{n}$

100. **Answer(A)**

Here $(x^2-5y+3)(y^2+y+1)$ <2y for all y ∈ R
$\Rightarrow x^2 - 5y + 3 < \frac{2y}{y^2+y+1}$
Let $\frac{2y}{y^2+y+1} = 1$
$\Rightarrow ty^2 + ty + t = 2y$
$\Rightarrow ty^2 + (t-2)y + t = 0$
Since y is real, D ≥ 0
$\Rightarrow (t-2)^2 - 4t^2 \geq 0$
$\Rightarrow (t-2+2t)(t-2-2t) \geq 0$
$\Rightarrow 3t-2)(-t-2) \geq 0$
$(3t-2)(t+2) \leq 0$
Apply wavy curve method to solve this inequality



$\Rightarrow -2 \leq t \leq \frac{2}{3}$
Minimum value of $\frac{2y}{y^2+y+1} = -2$
So that, $x^2 - 5y + 3 < -2$
$\Rightarrow x^2 - 5y + 5 < 0$
$x = \frac{-b\pm\sqrt{b^2-4ac}}{2a} = \frac{5\pm\sqrt{(-5)^2-4(1)(5)}}{2(1)} = \frac{5\pm\sqrt{25-20}}{2}$
$= \frac{5\pm\sqrt{5}}{2}$
$\Rightarrow \left[x - \left(\frac{5+\sqrt{5}}{2}\right)\right]\left[x - \left(\frac{5-\sqrt{5}}{2}\right)\right] < 0$
$\Rightarrow x \in \left(\frac{5-\sqrt{5}}{2}, \frac{5+\sqrt{5}}{2}\right)$

101. **Answer(C)**

The direction ratios of the normal to the plane are 3,4,7
The equation of required plane:
$\alpha(x-x_1) + b(y-y_1) + c(z-z_1) = 0$
⇒ 3 (x – 3) +4 (y – 4) +7 (y – 7) = 0
⇒ 3x – 9 + 4y – 16 + 7z – 49 = 0
⇒ 3x + 4y + 7z – 74 = 0

102. **Answer(D)**

Let $\vec{a} = 5\hat{\imath} + 3\hat{\jmath} + 4\hat{k}, \vec{b} = 7\hat{\imath} + \hat{k}, \vec{c} = 5\hat{\imath} + 5\hat{k}$
Now $|\vec{a}| = \sqrt{(5)^2+(3)^2+(4)^2} = \sqrt{50}$
$\Rightarrow |\vec{b}| = \sqrt{(7)^2+(1)^2} = \sqrt{50}$
$\Rightarrow |\vec{c}| = \sqrt{(5)^2+(5)^2} = \sqrt{50}$
⇒ Origin is the circumcentre of the triangle
⇒ Orthocentre of the triangle =
$\vec{a} + \vec{b} + \vec{c} = 5\hat{\imath} + 3\hat{\jmath} + 4\hat{k} + 7\hat{\imath} + \hat{k} + 5\hat{\imath} + 5\hat{k}$
$= 17\hat{\imath} + 3\hat{\jmath} + 10\hat{k}$
Hence distance between the circumcentre and the Orthocentre of the triangle
$= |\vec{a} + \vec{b} + \vec{c}|$
$\Rightarrow \sqrt{(17)^2+(3)^3+(10)^2} = \sqrt{289+9+100}$
$= \sqrt{398}$

103. **Answer(B)**

Geometric mean is used in construction of index numbers.

104. **Answer(A)**

a. (b+c)=0,b.(c+a)=0,c.(a+b)=0
∴ 2∑a·b=0
Now $(a+b+c)^2 = \Sigma a^2 + 2\Sigma a.b = 9+16+25+0 = 50$
⇒ |a+b+c|=5√2

105. **Answer(C)**

Given f(x)= even function
⇒ f(−x)=f(x)
Now 1= $\int_0^{\pi} f(\cos x)dx$
Here f(cosx) is also an even function, then I = $2\int_0^{\frac{\pi}{2}} f(\cos x)dx$ [by definite integral property]

106. **Answer(B)**

1. since the function is polynomial, so it is continuous as well as differentiable in its domain
[1,∞)−{2}
Now we check the continuity of the function at x=2
LHL= $f(2-0) = \lim_{h\to0} f(2-h) = \lim_{h\to0} 2-(2-h) = \lim_{h\to0} h = 0$
RHL
$= f(2+0) = \lim_{h\to0} (2+h) = \lim_{h\to0} 3(2+h)-(2+h)^2$
$= 3(2+0) - (2+0)^2$
= 6−4=2
and f(2)=2−2=0 ∵f(2)=LHL≠RHL
So the function is not continuous at every point in the interval [1,∞) i.e. not continuous at x=2.

107. **Answer(D)**

$\because f(x) = \begin{cases} 2-x & for \quad 1 \le x \le 2 \\ 3x - x^2 & for \quad x > 2 \end{cases}$

$\Rightarrow f'(x) = \begin{cases} -1 & for \quad 1 \le x \le 2 \\ 3-2x & for \quad x > 2 \end{cases}$

So the differentiable coefficient of f(x) at x=3 is f'(3)=3−2(3)=3−6=−3[∵ f'(x)=3−2x for x>2]

108. **Answer(B)**

Given A = [2,3,-5] ,P = $\begin{bmatrix} 3 \\ 1 \\ 3 \end{bmatrix}$ and Q = $\begin{bmatrix} 4 \\ -1 \\ 2 \end{bmatrix}$

⇒ P – Q = $\begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$

⇒ A (P - Q) = [2,3,-5] $\begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$ = [-2 + 6 -5] = [-1]

109. **Answer(A)**

We have 1 = cos 45° = $\frac{1}{\sqrt{2}} m = cos\ 120° = \frac{1}{2}\ and\ n =$ cos γ

$\therefore l^2 + m^2 + n^2 = 1 \Rightarrow \frac{1}{2} + \frac{1}{4} + cos^2\gamma = 1$

$\Rightarrow cos^2\gamma = \frac{1}{4} \Rightarrow cos\gamma = \frac{1}{2} \quad [\because \gamma\ is\ acute]$

⇒ γ= 60°

110. **Answer(A)**

New coordinates of point p (3,4) when coordinate axes are rotated by 30^0 in anticlockwise direction are given by

[(x cos $\theta + y\ sin\theta$),(– x sin $\theta + y\ cos\ \theta$)]

X= x cos $\theta + y$ sin $\theta = 3\ cos\ 30^0$

$= 3 \times \frac{\sqrt{3}}{2} = 4 \times \frac{1}{2} = 2 + \frac{3\sqrt{3}}{2}$

Y= – x sin $\theta + y$ cos $\theta = -3$ sin 30^0 + 4 cos 30^0

$= -3 \times \frac{1}{2} + 4 \times \frac{\sqrt{3}}{2} = -\frac{3}{2} + 2\sqrt{3}$

111. **Answer(C)**

$\lim_{y\to\infty} \frac{ay^2+by+c}{dy^2+ey+f}$

As y → ∞,we can clearly see that it is of the from $\frac{\infty}{\infty}$

So $\lim_{y\to\infty} \frac{ay^2+by+c}{dy^2+ey+f} = \lim_{y\to\infty} \frac{y^2\left(a+\frac{b}{y}+\frac{c}{y^2}\right)}{y^2\left(d+\frac{e}{y}+\frac{f}{y^2}\right)}$

$= \frac{a+0+0}{d+0+0} = \frac{a}{d}$

112. **Answer(D)**

X = sin (log_e t)

Differentiate w.r.t. t

$\Rightarrow \frac{dx}{dt} = \frac{cos\ (int)}{t}$

$\Rightarrow t\frac{dx}{dt} = cos(Int)$

Differentiate again

$T\ \frac{d^2x}{dt^2} + \frac{dx}{dt} = -\frac{sin(int)}{t}$

$\Rightarrow t^2\frac{d^2x}{dt^2} + t\frac{dx}{dt} = -sin(log_e t) = -x$

113. **Answer(B)**

I. 1 = cos 30° = $\frac{\sqrt{3}}{2}, m = ccos\ 45° = \frac{1}{\sqrt{2}}, n = cos\ \gamma$

$\therefore l^2 + m^2 + n^2 = 1$

$\Rightarrow \frac{3}{4} + \frac{1}{2} + cos^2\gamma = 1 \Rightarrow cos^2\gamma = \frac{-1}{4}$

Which is not possible so statement I is false.

II. Here $cos^2\alpha + cos^2(90° - \alpha) + cos^2\gamma = 1$

$\Rightarrow cos^2\alpha + sin^2\alpha + cos^2\gamma = 1$

$\Rightarrow cos^2\gamma = 0 \Rightarrow \gamma = 90°$

So statement II is true

114. **Answer(C)**

et A(a,0)&B(0,b) be two points on respective coordinate axes and (-5,4) divides AB in the ratio 1: 2

∴ -5 = $\frac{1\times0+2\times a}{3} \Rightarrow a = \frac{15}{2}$

and 4 = $\frac{1\times b+2\times 0}{3} \Rightarrow b = 12$

Hence equation of line joining $\left(\frac{-15}{2}, 0\right)$ and (0,12) is

(y-0) = $\frac{12-0}{0+\frac{15}{2}}\left(+\frac{15}{2}\right)$

⇒ 8x – 5y + 60 = 0

115. **Answer(C)**

Given, 3xcosϕ+5ysinϕ=15

Lengths of perpendicular from the point (±4,0)

$P_1 = \left|\frac{12\ cos\phi - 15}{\sqrt{9\ cos^2\phi + 25\ sin^2\phi}}\right|$

and $P_2 = \left|\frac{12\ cos\phi - 15}{\sqrt{9\ cos^2\phi + 25\ sin^2\phi}}\right|$

Only multiplying equation (i) \& (ii), we get

$P_1P_2 = \left|\frac{(12\ cos\phi - 15)(12\ cos\phi + 15)}{9\ cos^2\phi + 25\ sin^2\phi}\right| = \left|\frac{144\ cos^2\phi - 225}{9+16\ sin^2\phi}\right| = 9$

116. **Answer(D)**

Let $\sqrt{3+4i} = x + iy$

Square both sides

$X^2 - y^2$ + 2xyi = 3 – 4i

Comparing imaginary parts both side

2xy = – 4

⇒ xy = – 2

Comparing real parts both side

$x^2 - y^2$ =3

⇒ x^2 – $(-2/x)^2$ = 3

⇒ $x^2 - \frac{4}{x^2} = 3$

$\Rightarrow x^4 - 3x^2 - 4 = 0$

Now x^2 + 1 = 0

There is no value that satisfy x^2 + 1 = 0

Also x^2 – 4 = 0

⇒ x^2 = 4

⇒ x = ± 2

When x = 2 , y = – 1

When x = –2,y = 1

So $\sqrt{3+4i} = 2 - i\ and\ -2+i$

117. **Answer(A)**

Let y = cos θ

If y ∈ $\left(\frac{1}{2}, 1\right), \theta \epsilon \left(0\frac{\pi}{3}\right)$

Now cos^{-1} (cos θ) + cos^{-1} $\left(\frac{cos\theta}{2} + \frac{\sqrt{3-3cos^2\theta}}{2}\right)$

$\Rightarrow \theta + cos^{-1}\left(\frac{cos\theta}{2} + \frac{\sqrt{3!sin\theta!}}{2}\right)$

If, $\theta\ \epsilon\left(0\frac{\pi}{3}\right)\ then|sin\theta| = sin\theta$

$\Rightarrow \theta + cos^{-1}\left(\frac{cos\theta}{2} + \frac{\sqrt{3}\ sin\theta}{2}\right)$

$\Rightarrow \theta + cos^{-1}\left(cos\left(\theta - \frac{\pi}{3}\right)\right)$

$\Rightarrow \theta + \left(-\theta + \frac{\pi}{3}\right)$

$\Rightarrow \frac{\pi}{3}$

118. **Answer(A)**

Consider the following events:

A= there is at least one girl on the committee

B= There are exactly 2 girls on the committee

We have to find P(B/A)

Clearly

P(B/A) = $\frac{P\ (A\cap B)}{P(A)}$

Now, P(A) = 1 – P($\bar{A}$) $= 1 - \frac{C_4^8}{12C_4} = 1 - \frac{70}{495} = \frac{85}{99}$

$P(A \cap B)$ = P (Selecting 2 girls and 2 boys out of 8 boys and 4 girls)

$= \frac{C_2^4 \times C_4^8}{C_4^{12}} = \frac{6\times28}{495} = \frac{56}{165}$

∴ P (B/A) = $\frac{P\ (A\cap B)}{P(A)} = \frac{56}{165} \div \frac{85}{99} = \frac{168}{425}$

119. **Answer(A)**

We have P (not A or not B) = 1/4

$\Rightarrow P(\bar{A} \cup B) = \frac{1}{4} \Rightarrow P(A \cap B) = \frac{1}{4}$

⇒ 1 - $P(A \cap B) = \frac{1}{4}$

$\Rightarrow P(A \cap B) = \frac{3}{4}$

Thus we have, $P(A \cap B) = \frac{3}{4}$ and $P(A)P(B) = \frac{1}{2} \times \frac{7}{12} = \frac{7}{24}$

$\therefore P(A \cap B) \neq P(A)P(B)$

So A&B are not independent events.

∴ dependent events.

120. **Answer(A)**

$(2x-3)^2=(5i)^2=-25$

$\Rightarrow\ 2x^2-6x+17=0$

Dividing, $2x^3+2x^2-7x+72$ by $2x^2-6x+17$,

we get quotient $=x+4$ and remainder $= 4$

$\therefore 2x^3+2x^2-7x+72$

$=(x+4)(2x^2-6x+17)+4=4$