NDA I 2018 Maths Paper Code-B

Date: 22–04–2018

1. If $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then what is $\frac{\tan x}{\tan y}$ equal to?

a. $\frac{a}{b}$ **b.** $\frac{b}{a}$ **c.** $\frac{a+b}{a-a}$ **d.** $\frac{a-b}{a+a}$

2. If $\sin\alpha + \sin\beta = 0 = \cos\alpha + \cos\beta$, where $0 < \beta < \alpha < 2\pi$, then which one of the following is correct?

a. $\alpha = \pi - \beta$ **b.** $\alpha = \pi + \beta$

c. $\alpha = 2\pi - \beta$ **d.** $2\alpha = \pi + 2\beta$

3. Suppose cos A is given. If only one value of $\cos\left(\frac{A}{2}\right)$ is possible, then A must be

a. An odd multiple of 90°
b. A multiple of 90°
c. An odd multiple of 180°
d. A multiple of 180°

4. If $\cos\alpha + \cos\beta + \cos\gamma = 0$, where $0 < \alpha \le \frac{\pi}{2}$, $0 < \beta \le \frac{\pi}{2}$, $0 < \gamma \le \frac{\pi}{2}$, then what is the value of $\sin\alpha + \sin\beta + \sin\gamma$?

a. 0 **b.** 3 **c.** $\frac{5\sqrt{2}}{2}$ **d.** $\frac{3\sqrt{2}}{2}$

5. The maximum value of $\sin\left(x+\frac{\pi}{5}\right)+\cos\left(x\frac{\pi}{5}\right)$, where $x \in \left(0,\frac{\pi}{2}\right)$, is attained at

a. $\frac{\pi}{20}$ **b.** $\frac{\pi}{15}$ **c.** $\frac{\pi}{10}$ **d.** $\frac{\pi}{2}$

6. What is the distance between the points which divide the line segment joining (4, 3) and (5, 7) internally and externally in the ratio 2:3?

a. $\frac{12\sqrt{17}}{5}$ **b.** $\frac{13\sqrt{17}}{5}$ **c.** $\frac{\sqrt{17}}{5}$ **d.** $\frac{6\sqrt{17}}{5}$

7. What is the angle between the straight lines $(m^2 - mn)y = (mn + n^2)x + n^3$ and $(mn + m^2)y = (mn - n^2)x + m^3$, where $m > n$?

a. $\tan^{-1}\left(\frac{2mn}{m^2+n^2}\right)$ **b.** $\tan^{-1}\left(\frac{4m^2n^2}{m^4-n^4}\right)$

c. $\tan^{-1}\left(\frac{4m^2n^2}{m^4+n^4}\right)$ **d.** 45°

8. What is the equation of the straight line cutting off an intercept 2 from the negative direction of y-axis and inclined at 30° with the positive direction of x-axis?

a. $x - 2\sqrt{3}y - 3\sqrt{2} = 0$ **b.** $x + 2\sqrt{3}y - 3\sqrt{2} = 0$

c. $x + \sqrt{3}y - 2\sqrt{3} = 0$ **d.** $x - \sqrt{3}y - 2\sqrt{3} = 0$

9. What is the equation of the line passing through the point of intersection of the lines $x + 2y - 3 = 0$ and $2x - y + 5 = 0$ and parallel to the line $y - x + 10 = 0$?

a. $7x - 7y + 18 = 0$ **b.** $5x - 7y + 18 = 0$

c. $5x - 5y + 18 = 0$ **d.** $x - y + 5 = 0$

10. Consider the following statements:

1. The length p of the perpendicular from the origin to the line $ax + by = c$ satisfies the relation $p^2 = \frac{c^2}{a^2+b^2}$.
2. The length p of the perpendicular from the origin to the line $\frac{x}{a}+\frac{y}{b}=1$ satisfies the relation $\frac{1}{p^2} = \frac{1}{a^2}+\frac{1}{b^2}$.
3. The length p of the perpendicular from the origin to the line $y = mx + c$ satisfies the relation $\frac{1}{p^2} = \frac{1+m^2+c^2}{c^2}$.

Which of the above is/are correct

a. 1, 2 and 3 **b.** 1 only

c. 1 and 2 only **d.** 2 only

11. What is the equation of the ellipse whose vertices are $(\pm 5, 0)$ and foci are at $(\pm 4, 0)$?

a. $\frac{x^2}{25}+\frac{y^2}{9}=1$ **b.** $\frac{x^2}{16}+\frac{y^2}{9}=1$

c. $\frac{x^2}{25}+\frac{y^2}{16}=1$ **d.** $\frac{x^2}{9}+\frac{y^2}{25}=1$

12. What is the equation of the straight line passing through the point (2, 3) and making an intercept on the positive y-axis equal to twice its intercept on the positive x-axis?

a. $2x + y = 5$ **b.** $2x + y = 7$

c. $x + 2y = 7$ **d.** $2x - y = 1$

13. Let the coordinates of the points A, B, C be (1, 8, 4), (0, – 11, 4) and (2, – 3, 1) respectively. What are the coordinates of the point D which is the foot of the perpendicular from A on BC?

a. (3, 4, – 2) **b.** (4, –2, 5)

c. (4, 5, – 2) **d.** (2, 4, 5)

14. What is the equation of the plane passing through the points (–2, 6, –6), (–3, 10, –9) and (–5, 0, –6)?

a. $2x - y - 2z = 2$ **b.** $2x + y + 3z = 3$

c. $x + y + z = 6$ **d.** $x - y - z = 3$

15. A sphere of constant radius r through the origin intersects the coordinate axes in A, B and C. What is the locus of the centroid of the triangle ABC?

a. $x^2 + y^2 + z^2 = r^2$ **b.** $x^2 + y^2 + z^2 = 4r^2$

c. $9(x^2 + y^2 + z^2) = 4r^2$ **d.** $3(x^2 + y^2 + z^2) = 2r^2$

16. What is the sum of all two-digit numbers which when divided by 3 leave 2 as the remainder?
a. 1565 **b.** 1585 **c.** 1635 **d.** 1655

17. If $0 < a < 1$, the value of $\log_{10} a$ is negative. This is justified by
a. Negative power of 10 is less that 1
b. Negative power of 10 is between 0 and 1
c. Negative power of 10 is positive
d. Negative power of 10 is negative

18. The third term of a GP is 3. What is the product of the first five terms?
a. 216
b. 226
c. 243
d. Cannot be determined due to insufficient data

19. If x, 3/2, z are in AP; x, 3, z are in GP; then which one of the following will be in HP?
a. x, 6, z **b.** x, 4, z **c.** z, 2, z **d.** x, 1, z

20. What is the value of the sum $\sum_{n=2}^{11}(i^n + i^{n+1})$, where $i = \sqrt{-1}$?
a. i **b.** 2i **c.** –2i **d.** 1 + i

21. If $\sin x = \frac{1}{\sqrt{5}}$, $\sin y = \frac{1}{\sqrt{10}}$, where $0 < x < \frac{\pi}{2}$, $0 < y < \frac{\pi}{2}$, then what is $(x + y)$ equal to?
a. π **b.** $\pi/2$ **c.** $\pi/4$ **d.** 0

22. What is $\frac{\sin 5x - \sin 3x}{\cos 5x + \cos 3x}$ equal to?
a. sin x **b.** cos x **c.** tan x **d.** cot x

23. What is $\sin 105° + \cos 105°$ equal to ?
a. sin 50° **b.** cos 50° **c.** $1\sqrt{2}$ **d.** 0

24. In a triangle ABC if a = 2, b = 3 and sin A = 2/3, then what is angle B equal to?
a. $\pi/4$ **b.** $\pi/2$ **c.** $\pi/3$ **d.** $\pi/6$

25. What is the principal value of $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)$?
a. $\pi/4$ **b.** $\pi/2$ **c.** $\pi/3$ **d.** $2\pi/3$

26. If x, x – y and x + y are the angles of a triangle (not an equilateral triangle) such that tan (x – y), tan x and tan (x + y) are in GP, then what is x equal to?
a. $\pi/4$ **b.** $\pi/3$ **c.** $\pi/6$ **d.** $\pi/2$

27. ABC is a triangle inscribed in a circle with centre O. Let $\alpha = \angle ABC$, where $45° < \alpha < 90°$ Let $\beta = \angle BOC$. Which one of the following is correct?
a. $\cos\beta = \frac{1-\tan^2\alpha}{1+\tan^2\alpha}$ **b.** $\cos\beta = \frac{1+\tan^2\alpha}{1-\tan^2\alpha}$
c. $\cos\beta = \frac{2\tan\alpha}{1+\tan^2\alpha}$ **d.** $\sin\beta = 2\sin^2\alpha$

28. If a flag-staff 6 m height placed on the top of a tower throws a shadow of $2\sqrt{3}$ m along the ground, then what is the angle that the sun makes with the ground?
a. 60° **b.** 45° **c.** 30° **d.** 15°

29. What is $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{3}{5}\right)$ equal to ?
a. 0 **b.** $\pi/4$ **c.** $\pi/3$ **d.** $\pi/2$

30. A spherical balloon of radius r subtends an angle α at the eye of an observer, while the angle of elevation of its centre is β. What is the height of the centre of the balloon (neglecting the height of the observer)?
a. $\frac{r\sin\beta}{\sin\left(\frac{\alpha}{2}\right)}$ **b.** $\frac{r\sin\beta}{\sin\left(\frac{\alpha}{4}\right)}$
c. $\frac{r\sin\left(\frac{\beta}{2}\right)}{\sin\alpha}$ **d.** $\frac{r\sin\alpha}{\sin\left(\frac{\beta}{2}\right)}$

31. The equation $|1 - x| + x^2 = 5$ has
a. a rational root and an irrational root
b. two rational roots
c. two irrational roots
d. no real roots

32. The binary number expression of the decimal number 31 is
a. 1111 **b.** 10111 **c.** 11011 **d.** 11111

33. What is $i^{1000} + i^{1001} + i^{1002} + i^{1003}$ equal to (where $i = \sqrt{-1}$)?
a. 0 **b.** i **c.** –i **d.** 1

34. What is $\frac{1}{\log_2 N} + \frac{1}{\log_3 N} + \frac{1}{\log_4 N} + \ldots + \frac{1}{\log_{100} N}$ equal to $(N \neq 1)$?
a. $\frac{1}{\log_{100!} N}$ **b.** $\frac{1}{\log_{99!} N}$
c. $\frac{99}{\log_{100!} N}$ **d.** $\frac{99}{\log_{99!} N}$

35. The modulus-amplitude form of $\sqrt{3}+i$, where $i = \sqrt{-1}$ is

a. $2\left(\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}\right)$ **b.** $2\left(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6}\right)$

c. $4\left(\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}\right)$ **d.** $4\left(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6}\right)$

36. What is the number of non-zero terms in the expansion of $(1 + 2\sqrt{3}x)^{11} + (1- 2\sqrt{3}x)^{11}$ (after simplification)?

a. 4 **b.** 5 **c.** 6 **d.** 11

37. What is the greatest integer among the following by which the number $5^5 + 7^5$ is divisible?

a. 6 **b.** 8 **c.** 11 **d.** 12

38. If $x = 1 - y + y^2 - y^3 + \ldots$ up to infinite terms, where $|y| < 1$, then which one of the following is correct?

a. $x = \frac{1}{1+y}$ **b.** $x = \frac{1}{1-y}$

c. $x = \frac{y}{1+y}$ **d.** $x = \frac{y}{1-y}$

39. What is the inverse of the matrix $A = \begin{pmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$?

a. $\begin{pmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$ **b.** $\begin{pmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{pmatrix}$

c. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{pmatrix}$ **d.** $\begin{pmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$

40. If A is a 2×3 matrix and AB is a 2×5 matrix, then B must be a

a. 3×5 matrix **b.** 5×3 matrix
c. 3×2 matrix **d.** 5×2 matrix

41. If $A = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ and $A^2 - kA - I_2 = O$, where I_2 is the 2×2 identity matrix, then what is the value of k?

a. 4 **b.** –4 **c.** 8 **d.** –8

42. What is the number of triangles that can be formed by choosing the vertices from a set of 12 points in a plane, seven of which lie on the same straight line?

a. 185 **b.** 175 **c.** 115 **d.** 105

43. What is C(n, r) + 2C(n, r – 1) + C(n, r) equal to?

a. C(n + 1, r) **b.** C(n –1, r + 1)
c. C(n, r + 1) **d.** C(n + 2, r)

44. Let [x] denote the greatest integer function. What is the number of solutions of the equation $x^2 - 4x + [x] = 0$ in the interval [0, 2]?

a. Zero (No solution) **b.** One
c. Two **d.** Three

45. A survey of 850 students in a University yields that 680 students like music and 215 like dance. What is the least number of students who like both music and dance?

a. 40 **b.** 45 **c.** 50 **d.** 55

46. If $n \in N$, then $121^n - 25^n + 1900^n - (-4)^n$ is divisible by which one of the following?

a. 1904 **b.** 2000 **c.** 2002 **d.** 2006

47. If n = (2017)!, then what is $\frac{1}{\log_2 n}+\frac{1}{\log_3 n}+\frac{1}{\log_4 n}+\ldots..+\frac{1}{\log_{2017} n}$ equal to?

a. 0 **b.** 1 **c.** $\frac{n}{2}$ **d.** n

48. In the expansion of $(1 + x)^{43}$, if the coefficients of $(2r + 1)^{th}$ and $(r + 2)^{th}$ terms are equal, then what is the value of $r(r \neq 1)$?

a. 5 **b.** 14 **c.** 21 **d.** 22

49. What is the principal argument of (–1 –i), where $i = \sqrt{-1}$

a. $\pi/4$ **b.** $-\pi/4$ **c.** $-3\pi/4$ **d.** $3\pi/4$

50. Let α and β be real numbers and z be a complex number. If $z^2 + \alpha z + \beta = 0$ has two distinct non-real roots with Re(z) = 1, then it is necessary that

a. $\beta \in (-1,0)$ **b.** $|\beta| = 1$
c. $\beta \in (1,\infty)$ **d.** $\beta \in (0,1)$

51. Let A and B be subsets of X and $C = (A \cap B') \cup (A' \cap B)$, where A' and B' are complements of A and B respectively in X. What is C equal to?

a. $(A \cup B') - (A \cap B')$ **b.** $(A' \cup B) - (A' \cap B$
c. $(A \cup B) - (A \cap B)$ **d.** $(A' \cup B') - (A' \cap B')$

52. How many numbers between 100 and 1000 can be formed with the digits 5, 6, 7, 8, 9, if the repetition of digits is not allowed?

a. 3^5 **b.** 5^3 **c.** 120 **d.** 60

53. The number of non-zero integral solutions of the equation $|1 - 2i|^x - 5^x$ is

a. Zero (No solution) **b.** one
c. Two **d.** Three

54. If the ratio of AM to GM of two positive numbers a and b is 5:3, then a:b is equal to

a. 3:5 **b.** 2:9 **c.** 9:1 **d.** 5:3

55. 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. $\alpha = 2\beta$ **b.** $\alpha = \beta$
c. $2\alpha = \beta$ **d.** $\alpha = (m+n)^{\beta}$

56. If $x + \log_{15}(1 + 3^x) = x \log_{15}5 + \log_{15}12$, where x is an integer, then what is x equal to?
a. –3 **b.** 2 **c.** 1 **d.** 3

57. 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

Consider the information given below and answer the two items (02) that follow:
In a class, 54 students are good in Hindi only, 63 students are good in Mathematics only and 41 students are good in English only. There are 18 students who are good in both Hindi and Mathematics. 10 students are good in all three subjects.

58. What is the number of students who are good in either Hindi or Mathematics but not in English?
a. 99 **b.** 107 **c.** 125 **d.** 130

59. What is the number of students who are good in Hindi and Mathematics but not in English?
a. 18 **b.** 12 **c.** 10 **d.** 8

60. If α and β are different complex numbers with $|\alpha| = 1$, then what is $\left|\frac{\alpha - \beta}{1 - \alpha\bar{\beta}}\right|$ equal to?
a. $|\beta|$ **b.** 2 **c.** 1 **d.** 0

61. Consider the following statements :
1. If the correlation coefficient $r_{xy} = 0$, then the two lines of regression are parallel to each other.
2. If the correlation coefficient $r_{xy} = +1$, then the two lines of regression are perpendicular to each other.
Which of the above statements is / are correct?
a. 1 only **b.** 2 only
c. Both 1 and 2 **d.** Neither 1 nor 2

62. If $4x - 5y + 33 = 0$ and $20x - 9y = 107$ are two lines of regression, then what are the values of $\bar{x}$ and $\bar{y}$ respectively?
a. 12 and 18 **b.** 18 and 12
c. 13 and 17 **d.** 17 and 13

63. Consider the following statements :
1. Mean is independent of change in scale and changes 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

64. Consider the following statements :
1. The sum of deviations from mean is always zero.
2. The sum of absolute deviations is minimum when taken around median.
Which of the above statements is / are correct?
a. 1 only **b.** 2 only
c. Both 1 and 2 **d.** Neither 1 nor 2

65. What is the median of the numbers 4.6, 0, 9.3, –4.8, 7.6, 2.3, 12.7, 3.5, 8.2, 6.1, 3.9, 5.2 ?
a. 3.8 **b.** 4.9 **c.** 5.7 **d.** 6.0

66. In a test in Mathematics, 20% of the students obtained "first class". If the data are represented by a Pie-Chart, what is the central angle corresponding to "first class" ?
a. 20° **b.** 36° **c.** 72° **d.** 144°

67. The mean and standard deviation of a set of values are 5 and 2 respectively. If 5 is added to each value, then what is the coefficient of variation for the new set of values?
a. 10 **b.** 20 **c.** 40 **d.** 70

68. A train covers the first 5 km of its journey at a speed of 30 km/hr and the next 15 km at a speed of 45 km/hr. What is the average speed of the train?
a. 35 km/hr **b.** 37.5 km/hr
c. 39.5 km/hr **d.** 40 km/hr

69. Two fair dice are rolled. What is the probability of getting a sum of 7?
a. 1/36 **b.** 1/6 **c.** 7/12 **d.** 5/12

70. If A and B are two events such that 2P(A) = 3P(B), where $0 < P(A) < P(B) < 1$, then which one of the following is correct?
a. $P(A|B) < P(B|A) < P(A \cap B)$
b. $P(A \cap B) < P(B|A) < P(A|B)$
c. $P(B|A) < P(A|B) < P(A \cap B)$
d. $P(A \cap B) < P(A|B) < P(B|A)$

71. A box has ten chits numbered 0, 1, 2, 3, ..., 9. First, one chit is drawn at random and kept aside. From the remaining, a second chit is drawn at random. What is the probability that the second chit drawn is "9"?
a. 1/10 **b.** 1/9
c. 1/90 **d.** None of the above

72. One bag contains 3 white and 2 black balls, another bag contains 5 white and 3 black balls, If a bag is chosen at random and a ball is drawn from it, what is the chance that it is white?
a. 3/8 **b.** 49/80 **c.** 8/13 **d.** 1/2

73. Consider the following in respect of two events A and B:
1. P(A occurs but not B) = P(A) – P(B) if $B \subset A$
2. P(A alone or B alone occurs) = P(A) + P(B) – P(A $\cap$ B)
3. P(A $\cup$ B) = P(A) + P(B) if A and B are mutually exclusive

Which of the above is/are correct?
a. 1 only **b.** 1 and 3 only
c. 2 and 3 only **d.** 1 and 2 only

74. A committee of three has to be chosen from a group of 4 men and 5 women. If the selection is made at random, what is the probability that exactly two members are men?
a. 5/14 **b.** 1/21 **c.** 3/14 **d.** 8/21

75. The standard deviation σ of the first N natural numbers can be obtained using which one of the following formulae?
a. $\sigma = \dfrac{N^2-1}{12}$ **b.** $\sigma = \sqrt{\dfrac{N^2-1}{12}}$
c. $\sigma = \sqrt{\dfrac{N-1}{12}}$ **d.** $\sigma = \sqrt{\dfrac{N^2-1}{6N}}$

76. The order and degree of the differential equation $y^2 = 4a(x-a)$, where 'a' is an arbitrary constant, are respectively
a. 1, 2 **b.** 2, 1 **c.** 2, 2 **d.** 1, 1

77. What is the value of $\int_{-\pi/4}^{\pi/4} (\sin x - \tan x)dx$?
a. $-\dfrac{1}{\sqrt{2}} + \ell n\left(\dfrac{1}{\sqrt{2}}\right)$ **b.** $\dfrac{1}{\sqrt{2}}$
c. 0 **d.** $\sqrt{2}$

78. If $\int_a^b x^3 dx = 0$ and $\int_a^b x^2 dx = \dfrac{2}{3}$, then what are the values of a and b respectively?
a. –1, 1 **b.** 1, 1 **c.** 0, 0 **d.** 2, –2

79. What is $\int_0^1 x(1-x)^9 dx$ equal to ?
a. 1/110 **b.** 1/132 **c.** 1/148 **d.** 1/240

80. What is $\lim\limits_{x \to 0} \dfrac{\tan x}{\sin 2x}$ equal to ?
a. 1/2 **b.** 1
c. 2 **d.** Limit does not exist

81. What is $\lim\limits_{h \to 0} \dfrac{\sqrt{2x+3h} - \sqrt{2x}}{2h}$ equal to ?
a. $\dfrac{1}{2\sqrt{2x}}$ **b.** $\dfrac{3}{\sqrt{2x}}$ **c.** $\dfrac{3}{2\sqrt{2x}}$ **d.** $\dfrac{3}{4\sqrt{2x}}$

82. If f(x) is an even function, where $f(x) \neq 0$, then which one of the following is correct?
a. $f'(x)$ is even function
b. $f'(x)$ is odd function
c. $f'(x)$ may be an even or odd function depending on the type of function
d. $f'(x)$ is a constant function

83. If $y = e^{x^2} \sin 2x$, then what is $\dfrac{dy}{dx}$ at $x = \pi$ equal to ?
a. $(1+\pi)e^{x^2}$ **b.** $2\pi\, e^{\pi^2}$
c. $2e^{\pi^2}$ **d.** e^{π^2}

84. What is the solution of $(1+2x)dy - (1-2y)dx = 0$?
a. $x - y - 2xy = c$ **b.** $y - x - 2xy = c$
c. $y + x - 2xy = c$ **d.** $x + y + 2xy = c$

85. What are the order and degree, respectively, of the differential equation $\left(\dfrac{d^3y}{dx^3}\right)^2 = y^4 + \left(\dfrac{dy}{dx}\right)^5$?
a. 4, 5 **b.** 2, 3 **c.** 3, 2 **d.** 5, 4

86. In a Binomial distribution, the mean is three times its variance. What is the probability of exactly 3 successes out of 5 trials?
a. 80/243 **b.** 40/243 **c.** 20/243 **d.** 10/243

87. Consider the following statements :
1. $P(\bar{A} \cup B) = P(\bar{A}) + P(B) - P(\bar{A} \cap B)$
2. $P(A \cap \bar{B}) = P(B) - P(A \cap B)$
3. $P(A \cap B) = P(B)P(A \mid B)$

Which of the above statements are correct?
a. 1 and 2 only **b.** 1 and 3 only
c. 2 and 3 only **d.** 1, 2 and 3

88. If the correlation coefficient between x and y is 0.6, covariance is 27 and variance of y is 25, then what is the variance of x ?
a. 9/5 **b.** 81/25 **c.** 9 **d.** 81

89. The probabilities that a student will solve Question A and Question B are 0.4 and 0.5 respectively. What is the probability that he solves at least one of the two questions?
a. 0.6 **b.** 0.7 **c.** 0.8 **d.** 0.9

90. Let $\bar{x}$ be the mean of $x_1, x_2, x_3, ..., x_n$. If $x_i = a + cy_i$ for some constants a and c, then wht will be the mean of $y_1, y_2, y_3, ..., y_n$?

a. $a + c\bar{x}$ **b.** $a - \frac{1}{e}\bar{x}$

c. $\frac{1}{e}\bar{x} - a$ **d.** $\frac{\bar{x} - a}{c}$

Consider the following information for the next three (03) items that follow :
Three sides of a trapezium be the angle between a pair of adjacent sides.

91. If the area of the trapezium is the maximum possible, then what is α equal to ?

a. $\frac{\pi}{6}$ **b.** $\frac{\pi}{4}$ **c.** $\frac{\pi}{3}$ **d.** $\frac{2\pi}{5}$

92. If the area of the trapezium is maximum, what is the length of the fourth side?

a. 8 cm **b.** 9 cm **c.** 10 cm **d.** 12 cm

93. What is the maximum area of the trapezium?

a. $36\sqrt{3}\ cm^2$ **b.** $30\sqrt{3}\ cm^2$

c. $27\sqrt{3}\ cm^2$ **d.** $24\sqrt{3}\ cm^2$

94. What is $\int_0^{\pi} e^x \sin x\, dx$ equal to?

a. $\frac{e^{\pi} + 1}{2}$ **b.** $\frac{e^{\pi} - 1}{2}$

c. $e^{\pi} + 1$ **d.** $\frac{e^{\pi} + 1}{4}$

95. If $f(x) = \frac{x^2 - 9}{x^2 - 2x - 3}, x \neq 3$ is continuous at x = 3, then which one of the following is correct?

a. f(3) = 0 **b.** f(3) = 1.5

c. f(3) = 3 **d.** f(3) = –1.5

96. What is $\int_1^e x\, \ell n\, x\, dx$ equal to ?

a. $\frac{e + 1}{4}$ **b.** $\frac{e^2 + 1}{4}$

c. $\frac{e - 1}{4}$ **d.** $\frac{e^2 - 1}{4}$

97. What is $\int_0^{\sqrt{2}} \left[x^2\right] dx$ equal to (where [.] is the greatest integer function)?

a. $\sqrt{2} - 1$ **b.** $1 - \sqrt{2}$

c. $2\left(\sqrt{2} - 1\right)$ **d.** $\sqrt{3} - 1$

98. What is the maximum value of $16\sin\theta - 12\sin^2\theta$?

a. 3/4 **b.** 4/3 **c.** 16/3 **d.** 4

99. If f : R → S defined by f(x) = 4 sin x –3 cos x + 1 is onto, then what is S equal to ?

a. [–5, 5] **b.** (–5, 5) **c.** (–4, 6) **d.** [–4, 6]

100. For f to be a function, what is the domain of f, if $f(x) = \frac{1}{\sqrt{|x| - x}}$?

a. $(-\infty, 0)$ b. $(0, \infty)$

c. $(-\infty, \infty)$ d. $(-\infty, 0]$

101. What is the solution of the differential equation x dy – y dx = 0?

a. xy = c **b.** y = cx

c. x + y = c **d.** x – y = c

102. What is the derivative of the function $f(x) = e^{\tan x} + \ell n(\sec x) - e^{\ell n x}$ **at** $x = \frac{\pi}{4}$**?**

a. e/2 **b.** e **c.** 2e **d.** 4e

103. Which one of the following differential equations has a periodic solution?

a. $\frac{d^2x}{dt^2} + \mu x = 0$ **b.** $\frac{d^2x}{dt^2} - \mu x = 0$

c. $x\frac{dx}{dt} + \mu t = 0$ **d.** $\frac{dx}{dt} + \mu x t = 0$

104. What is the period of the function f(x) = sin x ?

a. $\pi/4$ **b.** $\pi/2$ **c.** π **d.** 2π

105. What is $\int \frac{dx}{2^x - 1}$ equal to?

a. $\ell n\left(2^x - 1\right) + c$ **b.** $\frac{\ell n\left(1 - 2^{-x}\right)}{\ell n\, 2} + c$

c. $\frac{\ell n\left(2^{-x} - 1\right)}{2\, \ell n\, 2} + c$ **d.** $\frac{\ell n\left(1 + 2^{-x}\right)}{\ell n\, 2} + c$

106. The coordinates of the vertices P, Q and R of a triangle PQR are (1, –1, 1), (3, –2, 2) and (0, 2, 6) respectively. If $\angle RQP = \theta$, then what is $\angle PRQ$ equal to ?

a. 30° + θ **b.** 45° – θ

c. 60° – θ **d.** 90° – θ

107. The perpendiculars that fall from any point of the straight line 2x + 11y = 5 upon the two straight lines 24x + 7y = 20 and 4x – 3y = 2 are

a. 12 and 4 respectively

b. 11 and 5 respectively

c. Equal to each other

d. Not equal to each other

108. The equation of the line, when the portion of it intercepted between the axes is divided by the point (2, 3) in the ratio of 3 : 2, is
a. Either $x + y = 4$ or $9x + y = 12$
b. Either $x + y = 5$ or $4x + 9y = 30$
c. Either $x + y = 4$ or $x + 9y = 12$
d. Either $x + y = 5$ or $9x + 4y = 30$

109. What is the distance between the straight lines $3x + 4y = 9$ and $6x + 8y = 15$?
a. 3/2 **b.** 3/10 **c.** 6 **d.** 5

110. What is the equation to the sphere whose centre is at (–2, 3, 4) and radius is 6 units?
a. $x^2 + y^2 + z^2 + 4x - 6y - 8z = 7$
b. $x^2 + y^2 + z^2 + 6x - 4y - 8z = 7$
c. $x^2 + y^2 + z^2 + 4x - 6y - 8z = 4$
d. $x^2 + y^2 + z^2 + 4x + 6y + 8z = 4$

111. If $\vec{a}$ and $\vec{b}$ are vectors such that $|\vec{a}| = 2$, $|\vec{b}| = 7$ and $\vec{a} \times \vec{b} = 3\hat{i} + 2\hat{j} + 6\hat{k}$, then what is the acute angle between $\vec{a}$ and $\vec{b}$?
a. 30° **b.** 45° **c.** 60° **d.** 90°

112. Let $\vec{p}$ and $\vec{q}$ be the position vectors of the points P and Q respectively with respect to origin O. The points R and S divide PQ internally and externally respectively in the ratio 2 : 3. If $\overrightarrow{OR}$ and $\overrightarrow{OS}$ are perpendicular, then which one of the following is correct?
a. $9p^2 = 4q^2$ **b.** $4p^2 = 9q^2$
c. $9p = 4q$ **d.** $4p = 9q$

113. What is the moment about the point $\hat{i} + 2\hat{j} - \hat{k}$ of a force represented by $3\hat{i} + \hat{k}$ acting through the point $2\hat{i} - \hat{j} + 3\hat{k}$?
a. $-3\hat{i} + 11\hat{j} + 9\hat{k}$ **b.** $3\hat{i} + 2\hat{j} + 9\hat{k}$
c. $3\hat{i} + 4\hat{j} + 9\hat{k}$ **d.** $\hat{i} + \hat{j} + \hat{k}$

114. If $\vec{a} + 2\vec{b} + 3\vec{c} = 0$ and $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \lambda(\vec{b} \times \vec{c})$ then what is the value of λ ?
a. 2 **b.** 3 **c.** 4 **d.** 6

115. If the vectors $\vec{k}$ and $\vec{A}$ are parallel to each other, then what is $k\vec{k} \times \vec{A}$ equal to?
a. $k^2\vec{A}$ **b.** $\vec{0}$ **c.** $-k^2\vec{A}$ **d.** $\vec{A}$

116. Which one of the following is correct in respect of the function $f : R \to R^+$ defined as $f(x) = |x + 1|$?
a. $f(x)^2 = [f(x)]^2$
b. $f(|x|) = |f(x)|$
c. $f(x + y) = f(x) + f(y)$
d. None of the above

117. Suppose $f : R \to R$ is defined by $f(x) = \dfrac{x^2}{1 + x^2}$. What is the range of the function?
a. [0, 1) **b.** [0, 1] **c.** (0, 1] **d.** (0, 1)

118. If $f(x) = |x| + |x - 1|$, then which one of the following is correct?
a. f(x) is continuous at x = 0 and x = 1
b. f(x) is continuous at x = 0 but not at x = 1
c. f(x) is continuous at x = 1 but not at x = 0
d. f(x) is neither continuous at x = 0 nor at x = 1

119. Consider the function $f(x) = \begin{cases} x^2 \ell n|x| & x \neq 0 \\ 0 & x = 0 \end{cases}$. What is $f'(0)$ equal to ?
a. 0 **b.** 1
c. –1 **d.** It does not exist

120. What is the area of the region bounded by the parabola $y^2 = 6(x - 1)$ and $y^2 = 3x$?
a. $\dfrac{\sqrt{6}}{3}$ **b.** $\dfrac{2\sqrt{6}}{3}$ **c.** $\dfrac{4\sqrt{6}}{3}$ **d.** $\dfrac{5\sqrt{6}}{3}$