NDA/NA

National Defence Academy / Naval Academy

MATHEMATICS

II

QUESTION PAPER

2018

Time : 2:30 Hour **Total Marks : 300**

Important Instructions :

1. *This test Booklet contains* **120** *items (questions). Each item is printed in* **English**. *Each item comprises four responses (answer's). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each item.*
2. *You have to mark all your responses ONLY on the separate Answer Sheet provided.*
3. **All** *items carry equal marks.*
4. *Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions.*
5. *Penalty for wrong answers :*
   THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
   - **(i)** *There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, one·third of the marks assigned to that question will be deducted as penalty.*
   - **(ii)** *If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct and there will be same penalty as above to that question.*
   - **(iii)** *If a question is left blank, i.e., no answer is given by the candidate, there will be no penalty for that question.*

1. What is the value of $\log_7 \log_7 \sqrt{7\sqrt{7\sqrt{7}}}$ equal to?

(a) $3\log_2 7$ **(b)** $1 - 3\log_2 7$

(c) $1 - 3\log_7 2$ **(d)** $\frac{7}{8}$

2. If an infinite GP has first term x and the sum 5, then which one of the following is correct?

(a) $x < -10$ **(b)** $-10 < x < 0$

(c) $0 < x < 10$ **(d)** $x > 10$

3. Consider the following expressions:

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

(2) $\sqrt{ax^2 + bx + x - c + \frac{d}{x} - \frac{e}{x^2}}$

(3) $3x^2 - 5x + ab$

(4) $\frac{2}{x^2 - ax + b^3}$

(5) $\frac{1}{x} - \frac{2}{x+5}$

Which of the above are rational expressions?

(a) 1, 4 and 5 only **(b)** 1, 3, 4 and 5 only

(c) 2, 4 and 5 only **(d)** 1 and 2 only

4. A square matrix A is called orthogonal, if

(a) $A = A^2$ **(b)** $A' = A^{-1}$

(c) $A = A^{-1}$ **(d)** $A = A'$

where A′ is the transpose of A.

5. If A, B and C are subsets of a Universal set, then which one of the following is not correct?

(a) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

(b) $A' \cup (A \cup B) = (B' \cap A)' \cup A$

(c) $A' \cup (B \cup C) = (C' \cap B)' \cap A'$

(d) $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$

where A′ is the complement of A.

6. Let x be the number of integers lying between 2999 and 8001 which have at least two digits equal. Then, x is equal to

(a) 2480 **(b)** 2481 **(c)** 2482 **(d)** 2483

7. The sum of the series $3 - 1 + \frac{1}{3} - \frac{1}{9} + \ldots$ is equal to

(a) $\frac{20}{9}$ **(b)** $\frac{9}{20}$ **(c)** $\frac{9}{4}$ **(d)** $\frac{4}{9}$

Consider the information given below and answer the two (02) items that follow :

A survey was conducted among 300 students. It was found that 125 students like to play cricket. 145 students like to play football and 90 students like to play tennis. 32 students like to play exactly two games out of the three games.

8. How many students like to play all the three games?

(a) 14 **(b)** 21

(c) 28 **(d)** 35

9. How many students like to play exactly one game?
(a) 196 **(b)** 228
(c) 254 **(d)** 268

10. If α and β ($\neq 0$) are the roots of the quadratic equation $x^2 + \alpha x - \beta = 0$, then the quadratic expression $-x^2 + \alpha x + \beta$, where $x \in R$ has
(a) Least value $-\frac{1}{4}$ **(b)** Least value $-\frac{9}{4}$
(c) Greatest value $\frac{1}{4}$ **(d)** Greatest value $\frac{9}{4}$

11. What is the coefficient of the middle term in the binomial expansion of $(2 + 3x)^4$?
(a) 6 **(b)** 12
(c) 08 **(d)** 216

12. For a square matrix A, which of the following properties hold?
(1) $(A^{-1})^{-1} = A$
(2) $\det(A^{-1}) = \frac{1}{\det A}$
(3) $(\lambda A)^{-1} = \lambda A^{-1}$, where λ is a scalar
Select the correct answer using the code given below:
(a) 1 and 2 only **(b)** 2 and 3 only
(c) 1 and 3 only **(d)** 1, 2 and 3

13. Which one of the following factors does the expansion of the determinant $\begin{vmatrix} x & y & 3 \\ x^2 & 5y^3 & 9 \\ x^3 & 10y^5 & 27 \end{vmatrix}$ contain?
(a) $x - 3$ **(b)** $x - y$
(c) $y - 3$ **(d)** $x - 3y$

14. What is the adjoint of the matrix $\begin{pmatrix} \cos(-\theta) & -\sin(-\theta) \\ -\sin(-\theta) & \cos(-\theta) \end{pmatrix}$?
(a) $\begin{pmatrix} \cos\theta & -\sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ **(b)** $\begin{pmatrix} \cos\theta & \sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$
(c) $\begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ **(d)** $\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$

15. What is the value of $\left(\frac{-1+i\sqrt{3}}{2}\right)^{3n} + \left(\frac{-1-i\sqrt{3}}{2}\right)^{3n}$, where $i = \sqrt{-1}$?
(a) 3 **(b)** 2
(c) 1 **(d)** 0

16. There are 17 cricket players, out of which 5 players can bowl. In how many ways can a team of 11 players be selected so as to include 3 bowlers?
(a) C(17, 11) **(b)** C(12, 8)
(c) C(17, 5) × C(5, 3) **(d)** C(5, 3) × C (12, 8)

17. What is the value of $\log_9 27 + \log_8 32$?
(a) $\frac{7}{2}$ **(b)** $\frac{19}{6}$
(c) 4 **(d)** 7

18. If A and B are two invertible square matrices of same order, then what is $(AB)^{-1}$ equal to?
(a) $B^{-1}A^{-1}$ **(b)** $A^{-1}B^{-1}$
(c) $B^{-1}A$ **(d)** $A^{-1}B$

19. If $a + b + c = 0$, then one of the solutions of $\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$ is
(a) $x = a$
(b) $x = \sqrt{\frac{3(a^2+b^2+c^2)}{2}}$
(c) $x = \sqrt{\frac{2(a^2+b^2+c^2)}{3}}$
(d) $x = 0$

20. What should be the value of x so that the matrix $\begin{pmatrix} 2 & 4 \\ -8 & x \end{pmatrix}$ does not have an inverse?
(a) 16 **(b)** –16
(c) 8 **(d)** –8

21. The system of equations
$2x + y - 3z = 5$,
$3x - 2y + 2z = 5$ and
$5x - 3y - z = 16$
(a) is inconsistent
(b) is consistent, with a unique solution
(c) is consistent, with infinitely many solutions
(d) has its solution lying along x-axis in three-dimensional space

22. Which one of the following is correct in respect of the cube roots of unity?
(a) They are collinear
(b) They lie on a circle of radius $\sqrt{3}$

(c) They form an equilateral triangle

(d) None of the above

23. If u, v and w (all positive) are the p^{th}, q^{th} and r^{th} terms of a GP, then the determinant of the matrix $\begin{pmatrix} \ln u & p & 1 \\ \ln v & q & 1 \\ \ln w & r & 1 \end{pmatrix}$ is

(a) 0 **(b)** 1

(c) $(p-q)(q-r)(r-p)$ **(d)** $\ln u \times \ln v \times \ln w$

24. Let the coefficient of the middle term of the binomial expansion of $(1+x)^{2n}$ be α and those of two middle terms of the binomial expansion of $(1+x)^{2n-1}$ be β and γ. Which one of the following relations is correct?

(a) $\alpha > \beta + \gamma$ **(b)** $\alpha < \beta + \gamma$

(c) $\alpha = \beta + \gamma$ **(d)** $\alpha = \beta\gamma$

25. Let $A = \{x \in R : -1 \le x \le 1\}$, $B = \{y \in R : -1 \le y \le 1\}$ and S be the subset of $A \times B$, defined by

$S = \{(x, y) \in A \times B : x^2 + y^2 = 1\}$

Which one of the following is correct?

(a) S is a one-one function from A to B

(b) S is many-one function from A to B

(c) S is a bijective mapping from A to B

(d) S is not a function

26. Let T_r be the r^{th} term of an AP for $r = 1, 2, 3, \ldots$. If for some distinct positive integers m and n we have $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then what is T_{mn} equal to?

(a) $(mn)^{-1}$ **(b)** $m^{-1} + n^{-1}$

(c) 1 **(d)** 0

27. Suppose $f(x)$ is such a quadratic expression that it is positive for all real x.

If $g(x) = f(x) + f'(x) + f''(x)$, then for any real x

(a) $g(x) < 0$ **(b)** $g(x) > 0$

(c) $g(x) = 0$ **(d)** $g(x) \ge 0$

28. Consider the following in respect of matrices A, B and C of same order:

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

(2) $(AB)' = A'B'$

(3) $(ABC)' = C'B'A'$

where A′ is the transpose of the matrix A. Which of the above are correct?

(a) 1 and 2 only **(b)** 2 and 3 only

(c) 1 and 3 only **(d)** 1, 2 and 3

29. The sum of the binary numbers $(11011)_2$, $(10110110)_2$ and $(10011x0y)_2$ is the binary number $(101101101)_2$. What are the values of x and y?

(a) $x = 1, y = 1$ **(b)** $x = 1, y = 0$

(c) $x = 0, y = 1$ **(d)** $x = 0, y = 0$

30. Let matrix B be the adjoint of a square matrix A, I be the identity matrix of same order as A. If k ($\neq 0$), is the determinant of the matrix A, then what is AB equal to?

(a) I **(b)** kI

(c) $k^2 I$ **(d)** $\left(\frac{1}{k}\right) I$

31. If $(0.2)^x = 2$ and $\log_{10} 2 = 0.3010$, then what is the value of x to the nearest tenth?

(a) -10.0 **(b)** -0.5

(c) -0.4 **(d)** -0.2

32. The total number of 5-digit numbers that can be composed of distinct digits from 0 to 9 is

(a) 45360 **(b)** 30240

(c) 27216 **(d)** 15120

33. What is the determinant of the matrix $\begin{pmatrix} x & y & y+z \\ z & x & z+x \\ y & z & x+y \end{pmatrix}$?

(a) $(x-y)(y-z)(z-x)$ **(b)** $(x-y)(y-z)$

(c) $(y-z)(z-x)$ **(d)** $(z-x)^2(x+y+z)$

34. If A, B and C are the angles of a triangle and $\begin{vmatrix} 1 & 1 & 1 \\ 1+\sin A & 1+\sin B & 1+\sin C \\ \sin A+\sin^2 A & \sin B+\sin^2 B & \sin C+\sin^2 C \end{vmatrix} = 0$,

then which one of the following is correct?

(a) The triangle ABC is isosceles

(b) The triangle ABC is equilateral

(c) The triangle ABC is scalene

(d) No conclusion can be drawn with regard to the nature of the triangle

35. Consider the following in respect of matrices A and B of same order:

(1) $A^2 - B^2 = (A + B)(A - B)$

(2) $(A - I)(I + A) = O \Leftrightarrow A^2 = 1$

where I is the identity matrix and O is the null matrix.

Which of the above is/are correct?

(a) 1 only **(b)** 2 only

(c) Both 1 and 2 **(d)** Neither 1 nor 2

36. What is $\frac{2\tan\theta}{1+\tan^2\theta}$ equal to?

(a) $\cos 2\theta$ **(b)** $\tan 2\theta$
(c) $\sin 2\theta$ **(d)** $\operatorname{cosec} 2\theta$

37. If $\sec(\theta-\alpha)$, $\sec\theta$ and $\sec(\theta+\alpha)$ are in AP, where $\cos\alpha \neq 1$, then what is the value of $\sin^2\theta + \cos\alpha$?

(a) 0 **(b)** 1
(c) -1 **(d)** $\frac{1}{2}$

38. If $A + B + C = 180°$, then what is $\sin 2A - \sin 2B - \sin 2C$ equal to?

(a) $-4\sin A\sin B\sin C$
(b) $-4\cos A\sin B\cos C$
(c) $-4\cos A\cos B\sin C$
(d) $-4\sin A\cos B\cos C$

39. A balloon is directly above one end of bridge. The angle of depression of the other end of the bridge from the balloon is 48°. If the height of the balloon above the bridge is 122 m, then what is the length of the bridge?

(a) 122 sin 45° m **(b)** 122 tan 42° m
(c) 122 cos 48° m **(d)** 122 tan 48° m

40. A is an angle in the fourth quadrant. It satisfies the trigonometric equation $3(3 - \tan^2 A - \cot A)^2 = 1$. Which one of the following is a value of A?

(a) 300° **(b)** 315°
(c) 330° **(d)** 345°

41. The top of a hill observed from the top and bottom of a building of height h is at angles of elevation $\frac{\pi}{6}$ and $\frac{\pi}{3}$ respectively. What is the height of the hill?

(a) $2h$ **(b)** $\frac{3h}{2}$
(c) h **(d)** $\frac{h}{2}$

42. What is/are the solution(s) of the trigonometric equation $\operatorname{cosec} x + \cot x = \sqrt{3}$, where $0 < x < 2\pi$?

(a) $\frac{5\pi}{3}$ only **(b)** $\frac{\pi}{3}$ only
(c) π only **(d)** $\pi, \frac{\pi}{3}, \frac{5\pi}{3}$

43. If $\theta = \frac{\pi}{8}$, then what is the value of $(2\cos\theta + 1)^{10}(2\cos 2\theta - 1)^{10}(2\cos\theta - 1)^{10}(2\cos 4\theta - 1)^{10}$?

(a) 0 **(b)** 1
(c) 2 **(d)** 4

44. If $\cos\alpha$ and $\cos\beta$ $(0 < \alpha < \beta < \pi)$ are the roots of the quadratic equation $4x^2 - 3 = 0$, then what is the value of $\sec\alpha \times \sec\beta$?

(a) $-\frac{4}{3}$ **(b)** $\frac{4}{3}$
(c) $\frac{3}{4}$ **(d)** $-\frac{3}{4}$

45. Consider the following values of x:

(1) 8 **(2)** -4
(3) $\frac{1}{6}$ **(4)** $-\frac{1}{4}$

Which of the above values of x is/are the solution(s) of the equation

$\tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}$?

(a) 3 only **(b)** 2 and 3 only
(c) 1 and 4 only **(d)** 4 only

46. If the second term of a G.P. is 2 and the sum of its infinite terms is 8, then the G.P. is

(a) $8, 2, \frac{1}{2}, \frac{1}{8}, \ldots$ **(b)** $10, 2, \frac{2}{5}, \frac{2}{25}, \ldots$
(c) $4, 2, 1, \frac{1}{2}, \frac{1}{2^2}, \ldots$ **(d)** $6, 3, \frac{3}{2}, \frac{3}{4}, \ldots$

47. If a, b, c are in A.P. or G.P. or H.P., then $\frac{a-b}{b-c}$ is equal to

(a) $\frac{b}{a}$ or 1 or $\frac{b}{c}$ **(b)** $\frac{c}{a}$ or $\frac{c}{b}$ or 1
(c) 1 or $\frac{a}{b}$ or $\frac{a}{c}$ **(d)** 1 or $\frac{a}{b}$ or $\frac{c}{a}$

48. What is the sum of all three-digit numbers that can be formed using all the digits 3, 4 and 5, when repetition of digits is not allowed?

(a) 2664 **(b)** 3882
(c) 4044 **(d)** 4444

49. The ratio of roots of the equations $ax^2 + bx + c = 0$ and $px^2 + qx + r = 0$ are equal. If D_1 and D_2 are respective discriminants, then what is $\frac{D_1}{D_2}$ equal to?

(a) $\frac{a^2}{p^2}$ **(b)** $\frac{b^2}{q^2}$
(c) $\frac{c^2}{r^2}$ **(d)** None of the above

50. If $A = \sin^2\theta + \cos^4\theta$, then for all real θ, which one of the following is correct?

(a) $1 \le A \le 2$ **(b)** $\frac{3}{4} \le A \le 1$

(c) $\frac{13}{16} \le A \le 1$ **(d)** $\frac{3}{4} \le A \le \frac{13}{16}$

51. The equation of a circle whose end points of a diameter are (x_1, y_1) and (x_2, y_2) is

(a) $(x - x_1)(x - x_2) + (y - y_1)(y - y_2) = x^2 + y^2$

(b) $(x - x_1)^2 + (y - y_1)^2 = x_2\, y_2$

(c) $x^2 + y^2 + 2x_1x_2 + 2y_1y_2 = 0$

(d) $(x - x_1)(x - x_2) + (y - y_1)(y - y_2) = 0$

52. The second degree equation $x^2 + 4y^2 - 2x - 4y + 2 = 0$, represents

(a) A point

(b) An ellipse of semi-major axis 1

(c) An ellipse with eccentricity $\frac{\sqrt{3}}{2}$

(d) None of the above

53. The angle between the two lines $lx + my + n = 0$ and $l'x + m'y + n' = 0$ is given by $\tan^{-1}\theta$. What is θ equal to?

(a) $\left|\frac{lm' - l'm}{ll' - mm'}\right|$ **(b)** $\left|\frac{lm' + l'm}{ll' + mm'}\right|$

(c) $\left|\frac{lm' - l'm}{ll' + mm'}\right|$ **(d)** $\left|\frac{lm' + l'm}{ll' + mm'}\right|$

54. Consider the following statements:

(1) The distance between the lines $y = mx + c_1$ and $y = mx + c_2$ is $\frac{|c_1 - c_2|}{\sqrt{1 + m^2}}$.

(2) The distance between the lines $ax + by + c_1 = 0$ and $ax + by + c_2 = 0$ is $\frac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}$.

(3) The distance between the lines $x = c_1$ and $x = c_2$ is $|c_1 - c_2|$.

Which of the above statements are correct?

(a) 1 and 2 only **(b)** 2 and 3 only

(c) 1 and 3 only **(d)** 1, 2 and 3

55. What is the equation of straight line passing through the point of intersection of the lines $\frac{x}{2} + \frac{y}{3} = 1$ and $\frac{x}{3} + \frac{y}{2} = 1$, and parallel to the line $4x + 5y - 6 = 0$

(a) $20x + 25y - 54 = 0$ **(b)** $25x + 20y - 54 = 0$

(c) $4x + 5y - 54 = 0$ **(d)** $4x + 5y - 45 = 0$

56. What is the distance of the point (2, 3, 4) from the plane $3x - 6y + 2z + 11 = 0$?

(a) 1 unit **(b)** 2 units

(c) 3 units **(d)** 4 units

57. Coordinates of the points O, P, Q and R are respectively (0, 0, 0), (4, 6, 2*m*), (2, 0, 2*n*) and (2, 4, 6). Let L, M, N and K be points on the sides OR, OP, PQ and QR respectively such that LMNK is a parallelogram whose two adjacent sides LK and LM are each of length $\sqrt{2}$. What are the values of *m* and *n* respectively?

(a) 6, 2 **(b)** 1, 3

(c) 3, 1 **(d)** None of above

58. The line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ is given by

(a) $x + y + z = 6,\ x + 2y - 3z = -4$

(b) $x + 2y - 2z = -1,\ 4x + 4y - 5z - 3 = 0$

(c) $3x + 2y - 3z = 0,\ 3x - 6y + 3z = -2$

(d) $3x + 2y - 3z = -2,\ 3x - 6y + 3z = 0$

59. Consider the following statements:

(1) The angle between the planes $2x - y + z = 1$ and $x + y + 2z = 3$ is $\frac{\pi}{3}$.

(2) The distance between the planes $6x - 3y + 6z + 2 = 0$ and $2x - y + 2z + 4 = 0$ is $\frac{10}{9}$.

Which of the above statements is/are correct?

(a) 1 only **(b)** 2 only

(c) Both 1 and 2 **(d)** Neither 1 nor 2

60. Consider the following statements:

Statement I: If the line segment joining the points P(*m*, *n*) and Q(*r*, *s*) subtends an angle α at the origin, then $\cos\alpha = \frac{ms - nr}{\sqrt{(m^2 + n^2)(r^2 + s^2)}}$.

Statement II: In any triangle ABC, it is true that $a^2 = b^2 + c^2 - 2bc\cos A$.

Which one of the following is correct in respect of the above two statements?

(a) Both Statement I and Statement II are true and Statement II is the correct explanation of Statement I

(b) Both Statement I and Statement II are true, but Statement II is not the correct explanation of Statement I

(c) Statement I is true, but Statement II is false

(d) Statement I is false, but Statement II is true

61. What is the area of the triangle with vertices $\left(x_1, \frac{1}{x_1}\right), \left(x_2, \frac{1}{x_2}\right), \left(x_3, \frac{1}{x_3}\right)$?

(a) $|(x_1 - x_2)(x_2 - x_3)(x_3 - x_1)|$

(b) 0

(c) $\left|\frac{(x_1 - x_2)(x_2 - x_3)(x_3 - x_1)}{x_1 x_2 x_3}\right|$

(d) $\left|\frac{(x_1 - x_2)(x_2 - x_3)(x_3 - x_1)}{2x_1 x_2 x_3}\right|$

62. If y-axis touches the circle $x^2 + y^2 + gx + fy + \frac{c}{4} = 0$, then the normal at this point intersects the circle at the point

(a) $\left(-\frac{g}{2}, -\frac{f}{2}\right)$ **(b)** $\left(-g, -\frac{f}{2}\right)$

(c) $\left(-\frac{g}{2}, f\right)$ **(d)** $(-g, -f)$

63. Let $|\vec{a}| \neq 0, |\vec{b}| \neq 0$. $(\vec{a} + \vec{b}).(\vec{a} + \vec{b}) = |\vec{a}|^2 + |\vec{b}|^2$ holds if and only if

(a) $\vec{a}$ and $\vec{b}$ are perpendicular

(b) $\vec{a}$ and $\vec{b}$ are parallel

(c) $\vec{a}$ and $\vec{b}$ are inclined at an angle of 45°

(d) $\vec{a}$ and $\vec{b}$ are anti-parallel

64. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then what is $\vec{r}.(\hat{i} + \hat{j} + \hat{k})$ equal to?

(a) x **(b)** $x + y$

(c) $-(x + y + z)$ **(d)** $(x + y + z)$

65. A unit vector perpendicular to each of the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} - 4\hat{j} - \hat{k}$ is

(a) $\frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$ **(b)** $\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{2}\hat{j} + \frac{1}{2}\hat{k}$

(c) $\frac{1}{\sqrt{3}}\hat{i} - \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$ **(d)** $\frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} + \frac{1}{\sqrt{3}}\hat{k}$

66. If $|\vec{a}| = 3, |\vec{b}| = 4$ and $|\vec{a} - \vec{b}| = 5$, then what is the value of $|\vec{a} + \vec{b}|$?

(a) 8 **(b)** 6

(c) $5\sqrt{2}$ **(d)** 5

67. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three mutually perpendicular vectors each of unit magnitude. If $\vec{A} = \vec{a} + \vec{b} + \vec{c}$, $\vec{B} = \vec{a} - \vec{b} + \vec{c}$ and $\vec{C} = \vec{a} - \vec{b} - \vec{c}$, then which one of the following is correct?

(a) $|\vec{A}| > |\vec{B}| > |\vec{C}|$ **(b)** $|\vec{A}| = |\vec{B}| \neq |\vec{C}|$

(c) $|\vec{A}| = |\vec{B}| = |\vec{C}|$ **(d)** $|\vec{A}| \neq |\vec{B}| \neq |\vec{C}|$

68. What is $(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b})$ equal to?

(a) $\vec{0}$ **(b)** $\vec{a} \times \vec{b}$

(c) $2(\vec{a} \times \vec{b})$ **(d)** $|\vec{a}|^2 - |\vec{b}|^2$

69. A spacecraft located at $\hat{i} + 2\hat{j} + 3\hat{k}$ is subjected to a force $\lambda\hat{k}$ by firing a rocket. The spacecraft is subjected to a moment of magnitude

(a) λ **(b)** $\sqrt{3}\lambda$

(c) $\sqrt{5}\lambda$ **(d)** None of the above

70. In a triangle ABC, if taken in order, consider the following statements :

(1) $\vec{AB} + \vec{BC} + \vec{CA} = \vec{0}$

(2) $\vec{AB} + \vec{BC} - \vec{CA} = \vec{0}$

(3) $\vec{AB} - \vec{BC} + \vec{CA} = \vec{0}$

(4) $\vec{BA} - \vec{BC} + \vec{CA} = \vec{0}$

How many of the above statements are correct?

(a) One **(b)** Two

(c) Three **(d)** Four

71. Let the slope of the curve $y = \cos^{-1}(\sin x)$ be $\tan\theta$. Then, the value of θ in the interval $(0, \pi)$ is

(a) $\frac{\pi}{6}$ **(b)** $\frac{3\pi}{4}$

(c) $\frac{\pi}{4}$ **(d)** $\frac{\pi}{2}$

72. If $f(x) = \frac{\sqrt{x-1}}{x-4}$ defines a function on R, then what is its domain?

(a) $(-\infty, 4) \cup (4, \infty)$ **(b)** $[4, \infty)$

(c) $(1, 4) \cup (4, \infty)$ **(d)** $[1, 4) \cup (4, \infty)$

73. Consider the function

$$f(x) = \begin{cases} \frac{\sin 2x}{5x} & \text{if} \quad x \neq 0 \\ \frac{2}{15} & \text{if} \quad x = 0 \end{cases}$$

Which one of the following is correct in respect of the function?

(a) It is not continuous at $x = 0$

(b) It is continuous at every x

(c) It is not continuous at $x = \pi$

(d) It is continuous at $x = 0$

74. For the function $f(x) = |x - 3|$, which one of the following is not correct?

(a) The function is not continuous at $x = -3$

(b) The function is continuous at $x = 3$

(c) The function is differentiable at $x = 0$

(d) The function is differentiable at $x = -3$

75. If the function $f(x) = \dfrac{2x - \sin^{-1} x}{2x + \tan^{-1} x}$ is continuous at each point in its domain, then what is the value of $f(0)$?

(a) $-\dfrac{1}{3}$ **(b)** $\dfrac{1}{3}$

(c) $\dfrac{2}{3}$ **(d)** 2

76. If $f(x) = \sqrt{25 - x^2}$, then what is $\lim\limits_{x \to 1} \dfrac{f(x) - f(1)}{x - 1}$ equal to?

(a) $-\dfrac{1}{\sqrt{24}}$ **(b)** $\dfrac{1}{\sqrt{24}}$

(c) $-\dfrac{1}{4\sqrt{3}}$ **(d)** $\dfrac{1}{4\sqrt{3}}$

77. If $y = \tan^{-1}\left[\dfrac{5 - 2\tan\sqrt{x}}{2 + 5\tan\sqrt{x}}\right]$, then what is $\dfrac{dy}{dx}$ equal to?

(a) $-\dfrac{1}{2\sqrt{x}}$ **(b)** 1 **(c)** -1 **(d)** $\dfrac{1}{2\sqrt{x}}$

78. Which one of the following is correct in respect, of the function

$f(x) = x \sin x + \cos x + \dfrac{1}{2}\cos^2 x$?

(a) It is increasing in the interval $\left(0, \dfrac{\pi}{2}\right)$

(b) It remains constant in the interval $\left(0, \dfrac{\pi}{2}\right)$

(c) It is decreasing in the interval $\left(0, \dfrac{\pi}{2}\right)$

(d) It is decreasing in the interval $\left(\dfrac{\pi}{4}, \dfrac{\pi}{2}\right)$

79. What is $\lim\limits_{\theta \to 0^+} \dfrac{\sqrt{1 - \cos\theta}}{\theta}$ equal to?

(a) $\sqrt{2}$ **(b)** $2\sqrt{2}$

(c) $\dfrac{1}{\sqrt{2}}$ **(d)** $-\dfrac{1}{2\sqrt{2}}$

80. A function $f : A \to R$ is defined by the equation $f(x) = x^2 - 4x + 5$, where A = (1, 4). What is the range of the function?

(a) (2,5) **(b)** (1, 5)

(c) [1,5) **(d)** [1,5]

81. What is $\int\limits_a^b [x]dx + \int\limits_a^b [-x]dx$ equal to, where [.] is the greatest integer function?

(a) $b - a$ **(b)** $a - b$

(c) 0 **(d)** $2(b - a)$

82. What is $\int\limits_2^8 |x - 5|\,dx$ equal to?

(a) 2 **(b)** 3

(c) 4 **(d)** 9

83. What is $\int \sin^3 x \cos\, dx$ equal to?

(a) $\cos^4 x + c$ **(b)** $\sin^4 x + c$

(c) $\dfrac{(1 - \sin^2 x)^2}{4} + c$ **(d)** $\dfrac{(1 - \cos^2 x)^2}{4} + c$

where c is the constant of integration.

84. What is $\int e^{\ln(\tan x)}\, dx$ equal to?

(a) $\ln|\tan x| + c$ **(b)** $\ln|\sec x| + c$

(c) $\tan x + c$ **(d)** $e^{\tan x} + c$

where c is the constant of integration.

85. What is $\int\limits_{-1}^{1} \left\{\dfrac{d}{dx}\left(\tan^{-1}\dfrac{1}{x}\right)\right\} dx$ equal to?

(a) 0 **(b)** $-\dfrac{\pi}{4}$

(c) $-\dfrac{\pi}{2}$ **(d)** $\dfrac{\pi}{2}$

86. In which one of the following interval is the function $f(x) = x^2 - 5x + 6$ decreasing?

(a) $(-\infty, 2]$ **(b)** $[3, \infty)$

(c) $(-\infty, \infty)$ **(d)** 2,3

87. The differential equation of the family of curves $y = p\cos(ax) + q\sin(ax)$, where p, q are arbitrary constants, is

(a) $\dfrac{d^2y}{dx^2} - a^2y = 0$ **(b)** $\dfrac{d^2y}{dx^2} - ay = 0$

(c) $\dfrac{d^2y}{dx^2} + ay = 0$ **(d)** $\dfrac{d^2y}{dx^2} + a^2y = 0$

88. The equation of the curve passing through the point $(-1, -2)$ which satisfies $\frac{dy}{dx} = -x^2 - \frac{1}{x^3}$, is

(a) $17x^2y - 6x^2 + 3x^5 - 2 = 0$
(b) $6x^2y + 17x^2 + 2x^5 - 3 = 0$
(c) $6xy - 2x^2 + 17x^5 + 3 = 0$
(d) $17x^2y + 6xy - 3x^5 + 5 = 0$

89. What is the order of the differential equation whose solution is $y = a\cos x + b\sin x + ce^{-x} + d$, where a, b, c and d are arbitrary constants?

(a) 1 **(b)** 2
(c) 3 **(d)** 4

90. What is the solution of the differential equation $\ln\left(\frac{dy}{dx}\right) = ax + by$?

(a) $ae^{ax} + be^{by} = c$ **(b)** $\frac{1}{2}e^{ax} + \frac{1}{2}e^{by} = c$

(c) $ae^{ax} + be^{-by} = c$ **(d)** $\frac{1}{a}e^{ax} + \frac{1}{b}e^{-by} = c$

where c is an arbitrary constant.

91. If $u = e^{ax}\sin bx$ and $v = e^{ax}\cos bx$, then what is $u\frac{du}{dx} + v\frac{dv}{dx}$ equal to?

(a) ae^{2ax} **(b)** $(a^2 + b^2)e^{ax}$
(c) abe^{2ax} **(d)** $(a + b)e^{ax}$

92. If $y = \sin(\ln x)$, then which one of the following is correct?

(a) $\frac{d^2y}{dx^2} + y = 0$

(b) $\frac{d^2y}{dx^2} = 0$

(c) $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$

(d) $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$

93. A flower-bed in the form of a sector has been fenced by a wire of 40 m length. If the flower-bed has the greatest possible area, then what is the radius of the sector?

(a) 25 m **(b)** 20 m **(c)** 10 m **(d)** 5 m

94. What is the minimum value of $\left[x(x-1)+1\right]^{\frac{1}{3}}$, where $0 \le x \le 1$?

(a) $\left(\frac{3}{4}\right)^{\frac{1}{3}}$ **(b)** 1

(c) $\frac{1}{2}$ **(d)** $\left(\frac{3}{8}\right)^{\frac{1}{3}}$

95. If $y = |\sin x|^{|x|}$, then what is the value of $\frac{dy}{dx}$ at $x = -\frac{\pi}{6}$?

(a) $\frac{2^{-\frac{\pi}{6}}\left(6\ln 2 - \pi\sqrt{3}\right)}{6}$ **(b)** $\frac{2^{\frac{\pi}{6}}\left(6\ln 2 + \pi\sqrt{3}\right)}{6}$

(c) $\frac{2^{-\frac{\pi}{6}}\left(6\ln 2 + \pi\sqrt{3}\right)}{6}$ **(d)** $\frac{2^{\frac{\pi}{6}}\left(6\ln 2 - \pi\sqrt{3}\right)}{6}$

96. What is $\frac{d\sqrt{1-\sin 2x}}{dx}$ equal to, where $\frac{\pi}{4} < x < \frac{\pi}{2}$?

(a) $\cos x + \sin x$ **(b)** $-(\cos x + \sin x)$
(c) $\pm(\cos x + \sin x)$ **(d)** None of the above

97. What is $\int \frac{dx}{a^2\sin^2 x + b^2\cos^2 x}$ equal to?

(a) $c + \frac{1}{ab}\tan^{-1}\left(\frac{a\tan x}{b}\right)$

(b) $c - \frac{1}{ab}\tan^{-1}\left(\frac{b\tan x}{a}\right)$

(c) $c + \frac{1}{ab}\tan^{-1}\left(\frac{b\tan x}{a}\right)$

(d) None of the above

where c is the constant of integration.

98. Let $f(x + y) = f(x)f(y)$ and $f(x) = 1 + xg(x)\phi(x)$, where $\lim_{x\to 0} g(x) = a$ and $\lim_{x\to 0} \phi(x) = b$. Then what is $f'(x)$ equal to?

(a) $1 + abf(x)$ **(b)** $1 + ab$
(c) ab **(d)** $abf(x)$

99. What is the solution of the differential equation $\frac{dx}{dy} = \frac{x+y+1}{x+y-1}$?

(a) $y - x + 4\ln(x + y) = c$
(b) $y + x + 2\ln(x + y) = c$
(c) $y - x + \ln(x + y) = c$
(d) $y + x + 2\ln(x + y) = c$

where c is an arbitrary constant.

100. What is $\lim_{x\to\frac{\pi}{6}} \frac{2\sin^2 x + \sin x - 1}{2\sin^2 x - 3\sin x + 1}$ equal to?

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

101. If two dice are thrown and at least one of the dice shows 5, then the probability that the sum is 10 or more is

(a) $\frac{1}{6}$ **(b)** $\frac{4}{11}$

(c) $\frac{3}{11}$ **(d)** $\frac{2}{11}$

102. The correlation coefficient computed from a set of 30 observations is 0.8. Then, the percentage of variation not explained by linear regression is

(a) 80% **(b)** 20%

(c) 64% **(d)** 36%

103. The average age of a combined group of men and women is 25 years. If the average age of the group of men is 26 years and that of the group of women is 21 years, then the percentage of men and women in the group is respectively

(a) 20, 80 **(b)** 40, 60

(c) 60, 40 **(d)** 80, 20

104. If sin β is the harmonic mean of sin α and cos α, and sin θ is the arithmetic mean of sin α and cos α, then which of the following is/are correct?

(1) $\sqrt{2}\sin\left(\alpha+\frac{\pi}{4}\right)\sin\beta=\sin 2\alpha$

(2) $\sqrt{2}\sin\theta=\cos\left(\alpha-\frac{\pi}{4}\right)$

Select the correct answer using the code given below:

(a) 1 only **(b)** 2 only

(c) Both 1 and 2 **(d)** Neither 1 nor 2

105. Let A, B and C be three mutually exclusive and exhaustive events associated with a random experiment. If $P(B)=1.5P(A)$ and $P(C)=0.5P(B)$, then P (A) is equal to

(a) $\frac{3}{4}$ **(b)** $\frac{4}{13}$

(c) $\frac{2}{3}$ **(d)** $\frac{1}{2}$

106. In a bolt factory, machines X, Y, Z manufacture bolts that are respectively 25%, 35% and 40% of the factory's total output. The machines X, Y, Z respectively produce 2%, 4% and 5% defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine X?

(a) $\frac{5}{39}$ **(b)** $\frac{14}{39}$

(c) $\frac{20}{39}$ **(d)** $\frac{34}{39}$

107. 8 coins are tossed simultaneously. The probability of getting at least 6 heads is

(a) $\frac{7}{64}$ **(b)** $\frac{57}{64}$

(c) $\frac{37}{256}$ **(d)** $\frac{229}{256}$

108. Three groups of children contain 3 girls and 1 boy; 2 girls and 2 boys; 1 girl and 3 boys. One child is selected at random from each group. The probability that the three selected consist of 1 girl and 2 boys is

(a) $\frac{13}{32}$ **(b)** $\frac{9}{32}$

(c) $\frac{3}{32}$ **(d)** $\frac{1}{32}$

109. Consider the following statements:

(1) If 10 is added to each entery on a list, then the average increases by 10.

(2) If 10 is added to each entry on a list, then the standard deviation increases by 10.

(3) If each entry on a list is doubled, then the average doubles.

Which of the above statements are correct?

(a) 1, 2 and 3 **(b)** 1 and 2 only

(c) 1 and 3 only **(d)** 2 and 3 only

110. The variance of 25 observations is 4. If 2 is added to each observation, then the new variance of the resulting observations is

(a) 2 **(b)** 4

(c) 6 **(d)** 8

111. If $x_i > 0$, $y_i > 0$ (i = 1, 2, 3, ... n) are the values of two variables X and Y with geometric means P and Q respectively, then the geometric mean of $\frac{X}{Y}$ is

(a) $\frac{P}{Q}$ **(b)** antilog $\left(\frac{P}{Q}\right)$

(c) $n(\log P - \log Q)$ **(d)** $n(\log P + \log Q)$

112. If the probability of simultaneous occurrence of two events A and B is p and the probability that exactly one of A, B occurs is q. Then, which of the following is/are correct?

(1) $P(\overline{A}) + P(\overline{B}) = 2 - 2p - q$

(2) $P(\overline{A} \cap \overline{B}) = 1 - p - q$

Select the correct answer using the code given below:

(a) 1 only **(b)** 2 only
(c) Both 1 and 2 **(d)** Neither 1 nor 2

113. If the regression coefficient of Y on X is – 6, and the correlation coefficient between X and Y is $-\frac{1}{2}$, then the regression coefficient of X on Y would be

(a) $\frac{1}{24}$ **(b)** $-\frac{1}{24}$

(c) $-\frac{1}{6}$ **(d)** $\frac{1}{6}$

114. The set of bivariate observations (x_1, y_1), (x_2, y_2), ..., (x_n, y_n) are such that all the values are distinct and all the observations fall on a straight line with non-zero slope. Then the possible values of the correlation coefficient between x and y are

(a) 0 and 1 only **(b)** 0 and – 1 only
(c) 0, 1 and – 1 **(d)** – 1 and l only

115. Two integers x and y are chosen with replacement from set (0, 1, 2, ..., 10). The probability that $|x - y| > 5$ is

(a) $\frac{6}{11}$ **(b)** $\frac{35}{121}$

(c) $\frac{30}{121}$ **(d)** $\frac{25}{121}$

116. An analysis of monthly wages paid to the workers in two firms A and B belonging to the same industry gives the following result:

	Firm A	Firm B
Number of workes	500	600
Average monthly wage	1860	1750
Variance of distribution of wages	81	100

The average of monthly wage and variance of distribution of wages of all the workers in the firms A and B taken together are

(a) ₹ 1860, 100
(b) ₹ 1750, 100
(c) ₹ 1800, 81
(d) None of the above

117. Three dice having digits 1, 2, 3, 4, 5 and 6 on their faces are marked I, II and III and rolled. Let x, y and z represent the number on die-I, die-II and die-III respectively. What is the number of possible outcomes such that $x > y > z$?

(a) 14 **(b)** 16
(c) 18 **(d)** 20

118. Which one of the following can be obtained from an ogive?

(a) Mean **(b)** Median
(c) Geometric mean **(d)** Mode

119. In any discrete series (when all values are not same), if x represents mean deviation about mean and y represents standard deviation, then which one of the following is correct?

(a) $y \geq x$ **(b)** $y \leq x$
(c) $x = y$ **(d)** $x < y$

120. In which one of the following cases would you expect to get a negative correlation?

(a) The ages of husbands and wives
(b) Shoe size and intelligence
(c) Insurance companies' profits and the number of claims they have to pay
(d) Amount of rainfall and yield of crop

Answers

Q. No.	Answer Key	Topic Name	Chapter Name
1	**(c)**	Properties of Logarithm	Logarithm
2	**(c)**	G. P.	Sequence and Series
3	**(b)**	Inverse of a Matrix	Number system
4	**(b)**	Inverse Matrix	Matrices and Determinant
5	**(c)**	Operation of Sets	Sets
6	**(b)**	Combination	Permutation and Combination
7	**(c)**	G. P.	Sequence and Series
8	**(a)**	Application of Sets	Sets
9	**(c)**	Application of Sets	Sets
10	**(d)**	Relation of Roots	Quadratic Equations
11	**(d)**	Middle term	Binomial Theorem
12	**(d)**	Properties of Determinant	Matrices and Determinant
13	**(a)**	Properties of Determinant	Matrices and Determinant
14	**(a)**	Adjoints Matrix	Matrices and Determinant
15	**(b)**	Cube Roots of Unity	Complex Number
16	**(d)**	Logarithm	Logarithm
17	**(b)**	Permutation	Permutation and Combination
18	**(a)**	Value of Determinant	Determinant
19	**(d)**	Value of Determinant	Determinant
20	**(b)**	Properties of Matrix	Matrix
21	**(b)**	Identities	Trigonometry
22	**(c)**	Identities	Trigonometry
23	**(a)**	Properties of Angles	Trigonometry
24	**(c)**	Height and Distance	Trigonometry
25	**(d)**	Values	Trigonometry
26	**(c)**	Height and Distance	Trigonometry
27	**(b)**	Identities	Trigonometry
28	**(c)**	Values	Trigonometry
29	**(b)**	Properties of Roots	Quadratic Equation
30	**(b)**	Inverse Trigonometry	Trigonometry
31	**(c)**	Infinite G.P.	Sequence and Series
32	**(c)**	Properties of A.P. & G.P.	Sequence and Series
33	**(d)**	Permutation	Permutation and Combination
34	**(a)**	Properties of Roots	Quadratic Equation
35	**(b)**	Maximum and Minimum Value	Trigonometry
36	**(c)**	Circle	2D
37	**(a)**	Pair of Straight Lines	2D
38	**(d)**	Angle between Two Lines	2D
39	**(b)**	Distance Formula	2D
40	**(a)**	Equation of Line	2D

Q. No.	Answer Key	Topic Name	Chapter Name
41	**(b)**	Perpendicular Distance	3D
42	**(b)**	Distance Formula	3D
43	**(b)**	Equation of Line	3D
44	**(a)**	Properties of Plane	3D
45	**(a)**	Cosine Rule	Trigonometry
46	**(c)**	Area	2D
47	**(c)**	Circle	2D
48	**(a)**	Properties of Vector	Vector
49	**(b)**	Dot Product	Vector
50	**(b)**	Unit Vector	Vector
51	**(d)**	Properties of Vector	Vector
52	**(d)**	Properties of Vector	Vector
53	**(c)**	Properties of Vector	Vector
54	**(d)**	Momentum	Vector
55	**(a)**	Properties of Vector	Vector
56	**(a)**	Differential Coefficient	Differentiation
57	**(c)**	Domain	Function
58	**(d)**	Continuity	Continuity and Differentiability
59	**(c)**	Continuity	Continuity and Differentiability
60	**(d)**	Limits	Limits
61	**(d)**	Limits	Limits
62	**(b)**	Differential Coefficient	Differentiation
63	**(a)**	Increasing and Decreasing	Differentiation
64	**(d)**	Limits	Limits
65	**(a)**	Maximum and Minimum Value	Differentiation
66	**(d)**	Indefinite Integration	Integration
67	**(c)**	Definite Integration	Integration
68	**(c)**	Indefinite Integration	Integration
69	**(c)**	Indefinite Integration	Integration
70	**(a)**	Definite Integration	Integration
71	**(b)**	Increasing and Decreasing	Differentiation
72	**(d)**	Differential Equation	Differentiation
73	**(a)**	Differential Equation	Differentiation
74	**(b)**	Order and Degree	Differential Equation
75	**(b)**	Differential Equation	Differentiation
76	**(a)**	Differential Coefficient	Differentiation
77	**(a)**	Differential Coefficient	Differentiation
78	**(a)**	Maximum and Minimum Value	Differentiation
79	**(c)**	Maximum and Minimum Value	Differentiation
80	**(c)**	Differential Coefficient	Differentiation
81	**(b)**	Differential Coefficient	Differentiation

Q. No.	Answer Key	Topic Name	Chapter Name
82	**(d)**	Indefinite Integration	Integration
83	**(d)**	Limits	Limits
84	**(b)**	Differential Equation	Differentiation
85	**(c)**	Limits	Limits
86	**(a)**	Probability	Probability
87	**(d)**	Correlation Coefficient	Statistics
88	**(b)**	Mean	Statistics
89	**(d)**	A.P. and G.P.	Sequence and Series
90	**(d)**	Probability	Probability
91	**(a)**	Bayes Theorem	Probability
92	**(c)**	Binomial Distribution	Probability
93	**(c)**	Probability	Probability
94	**(a)**	Mean and Standard Deviation	Statistics
95	**(a)**	Standard Deviation	Statistics
96	**(a)**	Mean	Statistics
97	**(a)**	Probability	Probability
98	**(d)**	Correlation Coefficient	Statistics
99	**(c)**	Correlation Coefficient	Statistics
100	**(d)**	Probability	Probability
101	**(c)**	Mean and Variance	Statistics
102	**(b)**	Sample Space	Probability
103	**(d)**	Graphs	Statistics
104	**(c)**	Mean and Standard Deviation	Statistics
105	**(b)**	Correlation Coefficient	Statistics
106	**(a)**	Bayes Theorem	Probability
107	**(c)**	Binomial Distribution	Probability
108	**(a)**	Probability	Probability
109	**(c)**	Mean and Standard Deviation	Statistics
110	**(b)**	Standard Deviation	Statistics
111	**(a)**	Mean	Statistics
112	**(c)**	Probability	Probability
113	**(b)**	Correlation Coefficient	Statistics
114	**(d)**	Correlation Coefficient	Statistics
115	**(c)**	Probability	Probability
116	**(d)**	Mean and Variance	Statistics
117	**(d)**	Sample Space	Probability
118	**(b)**	Graphs	Statistics
119	**(d)**	Mean and Standard Deviation	Statistics
120	**(c)**	Correlation Coefficient	Statistics