DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 2 December 2025. Morning Paper. **Time Allowed: 3 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks.

1. If a line has an equation 5y = x +10, what are the coordinates of the point where the line intersects with the y-axis?
   A. (0, 10)
   B. (10, 0)
   C. (2, 0)
   D. (0, 2) (2 marks)

2. Find the equation of a line with a gradient of 3/7 and is passing through point (3, -1).
   A. 3y = 7x - 24
   B. 7y = 3x - 16
   C. 7y = 3x + 16
   D. 3y = 7x +24 (2 marks)

3. Determine the equation of a line A that is perpendicular to another line B of equation 2y = 3x + 10.
   A. 2y = -3x - 10
   B. -2y = -3x + 10
   C. 3y = -2x +15
   D. 3y = 2x -15 (2 marks)

4. A matrix has 2 columns and 4 rows. What is the order of the matrix?
   A. 4 x 2
   B. 2 x 2
   C. 2 x 4
   D. 4 x 4 (2 marks)

5. A delivery rider travels 5 km east and then 12 km north. Using the x-axis to represent east and the y-axis to represent north, determine the magnitude of the resultant displacement vector.
   A. 12 km
   B. 14 km
   C. 17 km
   D. 13 km (2 marks)

Use the following information to answer Question 6 to Question 12.
A system of linear equations is modelled using matrix algebra as AX = B, where $A = \begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix}$, $X = \begin{pmatrix} x \\ y \end{pmatrix}$, $B = \begin{pmatrix} 100 \\ 120 \end{pmatrix}$

6. Determine the determinant of A, denoted as |A|.
   A. 5
   B. 6
   C. 7
   D. 4 (2 marks)

7. Determine the inverse of A.

A. $^1/_5 \begin{pmatrix} 3 & -1 \\ -1 & 2 \end{pmatrix}$

B. $^1/_5 \begin{pmatrix} 2 & -1 \\ -3 & 1 \end{pmatrix}$

C. $^1/_6 \begin{pmatrix} 3 & -1 \\ -1 & 2 \end{pmatrix}$

D. $^1/_5 \begin{pmatrix} 3 & 1 \\ 1 & 2 \end{pmatrix}$ (2 marks)

8. Compute the value of X.

A. 38
B. 36
C. 40
D. 42 (2 marks)

9. Determine the value of Y.

A. 26
B. 30
C. 28
D. 32 (2 marks)

10. If each unit of product X contributes Sh.50 and each unit of product Y contributes Sh.70 in profit, what is the total profit?

A. Sh.3,220
B. Sh.3,760
C. Sh.3,860
D. Sh.4,000 (2 marks)

11. Determine the condition for the inverse of A to exist.

A. $|A| = 0$
B. $|A| \neq 0$
C. A is systematic
D. A is diagonal (2 marks)

12. The method used to determine the above solution (using A^{-1} B) is called _____.

A. Gaussian elimination
B. Cramer's rule
C. Matrix inversion method
D. Determinant expansion (2 marks)

Use the following information to answer Question 13 to Question 15.

A financial analyst is modelling the relationship between input costs and output returns for two products, A and B, using matrices. The analyst defines:

$M = \begin{pmatrix} 2 & 3 \\ x & 4 \end{pmatrix}$, $N = \begin{pmatrix} 5 & y \\ 2 & 1 \end{pmatrix}$ and their product is $P = M \times N = \begin{pmatrix} 16 & 7 \\ 23 & 10 \end{pmatrix}$

13. Solve for y.

A. 1.5
B. 2.0
C. 3.0
D. 4.0 (2 marks)

14. Solve for x.

A. 3.0
B. 3.2
C. 3.4
D. 3.8 (2 marks)

15. Which one of the following conditions must be **TRUE** for matrix multiplication to be possible?
    A. Columns of the first = Rows of the second
    B. Rows of both equal
    C. Columns of both equal
    D. Order of both matrices must be 2×2 (2 marks)

Use the following information to answer Question 16 to Question 20.
A footwear trader namely David Oketch bought 8 pairs of shoes and 15 pairs of gumboots for Sh.20,200 in week 1. In week 2 he bought 13 pairs of shoes and 9 pairs of gum boots at a cost of Sh.23,600. He intends to sell the footwears and make a 15% and 20% markup on the shoes and gum boots respectively.

Required:
16. Determine the cost price of a pair of shoes.
    A. Sh.900
    B. Sh.600
    C. Sh.1,600
    D. Sh.1,400 (2 marks)

17. Determine the cost price of pair of gumboots.
    A. Sh.800
    B. Sh.600
    C. Sh.1,600
    D. Sh.1,400 (2 marks)

18. Determine the selling price of a pair of shoes.
    A. Sh.720
    B. Sh.1,610
    C. Sh.1,650
    D. Sh.750 (2 marks)

19. Determine the selling price of a pair of gum boots.
    A. Sh.720
    B. Sh.1,610
    C. Sh.1,650
    D. Sh.750 (2 marks)

20. Given Mr. Oketch sold 14 pairs of shoes and 9 pairs of gum boots in week 3, determine the total profit he earned in that week.
    A. Sh.3,570
    B. Sh.4,850
    C. Sh.4,020
    D. Sh.5,600 (2 marks)

Use the data below to answer Question 21 to Question 26.
The following grouped frequency distribution shows the profit earned in Sh."000" by 72 companies in a certain industry:

Profit (Sh."000")	**Number of companies**
20 – 30	4
30 – 40	11
40 – 50	17
50 – 60	23
60 – 70	10
70 – 80	5
80 – 90	2

21. Find the mean profit.
    A. 13.76
    B. 51.53
    C. 53.16
    D. 51.74 (2 marks)

22. Find the standard deviation.
    A. 9.42
    B. 4.32
    C. 13.76
    D. 6.88 (2 marks)

23. Determine the median profit.
    A. 13.76
    B. 51.53
    C. 53.16
    D. 51.74 (2 marks)

24. Determine the modal profit.
    A. 13.76
    B. 51.53
    C. 53.16
    D. 51.74 (2 marks)

25. Determine the coefficient of variation.
    A. 25.9%
    B. 29.2%
    C. 26.7%
    D. 31.5% (2 marks)

26. Which one of the following statements is **FALSE** about the characteristics of the mode as a measure of central tendency?
    A. Easy to understand and calculate
    B. It is affected by extreme values
    C. The mode is easy to identify in a data set and in a discrete frequency distribution
    D. The mode is useful for qualitative data (2 marks)

27. Which one of the following is **NOT** an advantage of convenience sampling method?
    A. Data can be collected quickly and easily
    B. It can be a less expensive method compared to other sampling approaches
    C. The sample may be representative of the broader population
    D. Researchers can adapt the samples based on their needs and resources (2 marks)

28. When constructing an Ogive curve, the vertical axis typically represents _____.
    A. class frequency of occurrence
    B. categories of data
    C. upper class limits of the variable
    D. cumulative frequency (2 marks)

29. _____ is a probability sampling technique that divides a population into subgroups and then randomly selects samples within each subgroup.
    A. Sample random sampling
    B. Stratified sampling
    C. Systemic sampling
    D. Cluster sampling (2 marks)

30. Which one of the following statements is **FALSE** on the benefits of random sampling?
    A. A list or directory of the population is needed
    B. Findings from the sample can be more confidently generalised to the larger population
    C. Allows for the use of statistical methods to analyse data and make inferences about the population
    D. Ensures that the selection process is objective and free from researcher bias (2 marks)

31. Which one of the following statements is **NOT** an importance of measuring the dispersion of data?
    A. It helps in understanding the homogeneity or heterogeneity of the data
    B. It helps to determine the probability of events
    C. It allows for a more comprehensive comparison of different datasets
    D. It identifies and address outliers in the data (2 marks)

32. A checklist is a tool commonly used in the _____ technique during data collection.
A. focus
B. interview
C. observation
D. survey (2 marks)

33. _____ a visual representation of the possible outcomes of a probability space, especially when dealing with multiple events.
A. Contingency table
B. Decision tree
C. Probability tree
D. Matrix (2 marks)

Use the following information to answer Question 34 to Question 37.
A company's revenue function is determined by the price at which it sells a product. The company demand function is given by; $5Q = P - 16$. The total cost function is given by; $TC_{(Q)} = 9Q^2 + 4Q + 7$, where Q represents the quantity of units produced.

34. Determine the total revenue function.
A. $R = 16Q^2 + 5Q$
B. $R = 5Q^2 + 16Q$
C. $R = 5Q^2 – 16Q$
D. $R = 16Q – 5Q^2$ (2 marks)

35. Determine the profit function.
A. $\Pi = -4Q^2 + 12Q – 7$
B. $\Pi = 4Q^2 + 12Q – 7$
C. $\Pi = 4Q^2 + 12Q + 7$
D. $\Pi = 4Q^2 - 12Q + 7$ (2 marks)

36. Determine the break-even quantity.
A. 2.21 units and 0.79 units
B. 0.5 units
C. 2.81 units and 0.2 units
D. 5 units (2 marks)

37. Determine the quantity that maximises profit.
A. 0.7 units
B. 1.5 units
C. 20 units
D. 12 units (2 marks)

38. Evaluate the definite integral:

$$\int_0^5 (9x^3 + 5x^2 + 7x)\, dx$$

A. 1,406.3
B. 0
C. 1702.1
D. 208.3 (2 marks)

39. Find the derivative of $f(x) = 1/3x^3 + 1/4x^2 + 5x + 4$.
A. $x^2 + ½x + 5$
B. $x^2 + 2x + 5$
C. $^1/_3x^2 + {}^1/_2x + 5$
D. $^1/_3x^4 + {}^1/_4x^3 + 5x^2 + 4x$ (2 marks)

Use the information below to answer Question 40 to Question 45.
A bank is reviewing customer loan applications. Based on historical data, 60% of applicants are salaried employees (S) and 40% are self-employed (SE). For salaried applicants, the probability of loan approval (A) is 0.8. For self-employed applicants, the probability of loan approval (A) is 0.5. All other applicants who are not approved are rejected (R). The bank wishes to understand the overall approval rate and evaluate probabilities using a probability tree.

40. Determine the probability that a randomly selected applicant is salaried and approved.
    A. 0.24
    B. 0.30
    C. 0.48
    D. 0.60 (2 marks)

41. Determine the overall probability of approval, regardless of employment status.
    A. 0.60
    B. 0.68
    C. 0.64
    D. 0.70 (2 marks)

42. The probability that an applicant is rejected, given that they are salaried is _____.
    A. 0.2
    B. 0.3
    C. 0.5
    D. 0.6 (2 marks)

43. Given that a loan was approved, what is the probability that the applicant was salaried?
    A. 0.48
    B. 0.68
    C. 0.70
    D. 0.71 (2 marks)

44. If 1,000 loan applicants are processed, the expected number of approved loans is _____.
    A. 320
    B. 480
    C. 680
    D. 700 (2 marks)

Use the following information answer Question 45 to Question 45.
Excel Ltd. has 200 employees, which include 80 females. 70% of the employees are graduates. 100 graduates are male. One employee is selected at random for supervisory duties.

Required:
45. Determine the number of employees who are not graduates and are not male.
    A. 40
    B. 60
    C. 140
    D. 20 (2 marks)

46. What is the probability that the employee is male?
    A. 0.70
    B. 0.20
    C. 0.60
    D. 0.5 (2 marks)

47. What is the probability that the employee is female or a non-graduate?
    A. 0.50
    B. 0.20
    C. 0.70
    D. 0.90 (2 marks)

48. What is the probability that the employee is a graduate given he is male?
A. 0.50
B. 0.83
C. 0.60
D. 0.70 (2 marks)

49. A firm tosses a coin to decide whether to advertise on TV (H = advertise, T = don't advertise). If this experiment is repeated twice, what is the sample space?
A. {H, T}
B. {HH, HT, TH, TT}
C. {HH, HT, TT}
D. {H, T, HH, TT} (2 marks)

50. In a lottery where numbers 1–50 are available, selecting the number "25" is an example of:
A. A compound event
B. A mutually inclusive event
C. A dependent event
D. An elementary event (2 marks)

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DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 19 August 2025. Morning Paper. **Time Allowed: 3 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks.

1. Find the derivative of $f(x) = 4x^3 – 2x^2 + x – 5$.
   A. $3x^2 – 2x + 1$
   B. $12x^2 – 2x + 1$
   C. $12x^2 + 4x + 1$
   D. $12x^2 – 4x + 1$ (2 marks)

2. Find the definite integral of the function $f(x) = 3x^2$ from $x = 1$ to $x = 4$.
   A. 48
   B. 45
   C. 42
   D. 63 (2 marks)

3. Find the antiderivative of $f(x) = 6x^2$.
   A. $2x^3 + C$
   B. $3x^2 + C$
   C. $3x^3 + C$
   D. $2x^2 + C$ (2 marks)

4. What does the second derivative of a function tell us?
   A. Slope of the tangent
   B. Rate of change
   C. Concavity of the curve
   D. Area under the curve (2 marks)

5. Which one of the following methods is used to compute the area under a curve?
   A. Derivative
   B. Antiderivative
   C. Definite integral
   D. Chain rule (2 marks)

6. Determine equation of a line that passes through point (0,2) and has a slope of 3.
   A. Y = 3x + 2
   B. Y = 2x + 3
   C. Y = 3x –2
   D. Y = 3x + 0 (2 marks)

7. The slope of a vertical line is _____.
   A. 0
   B. 1
   C. undefined
   D. constant (2 marks)

8. The intercept of the line Y = 2x – 6 is _____.
   A. (2,0)
   B. (–3,0)
   C. (3,0)
   D. (–6,0) (2 marks)

9. If a line has equation 4x + 2y = 12, what is its slope?
   A. –2
   B. –1
   C. 2
   D. 4 (2 marks)

10. Find the equation of a line that passes through points (1,2) and (3,6).
   A. Y = 2x + 1
   B. Y = 2x
   C. Y = 3x – 1
   D. Y = x + 2 (2 marks)

11. The graph of y = –x + 3 is _____.
   A. decreasing from left to right
   B. increasing from left to right
   C. horizontal
   D. vertical (2 marks)

12. What is the dimension of a matrix with 3 rows and 2 columns?
   A. 6
   B. 2 x 3
   C. 3 x 2
   D. Square (2 marks)

13. Which one of the following operations is **NOT** valid between vectors?
A. Addition
B. Scalar multiplication
C. Division
D. Subtraction (2 marks)

14. Find the magnitude of vector A = (3, 4).
A. 5
B. 7
C. 25
D. 12 (2 marks)

15. A column vector has _____.
A. one row only
B. one column only
C. equal rows and columns
D. no dimension (2 marks)

16. If A is a 2 x 2 matrix, which one of the following conditions must be met for A^{-1} (inverse) to exist?
A. All elements must be positive
B. A must be systematic
C. Trace > 0
D. $Determinant \neq 0$ (2 marks)

17. If a square matrix has a determinant of zero, it is _____.
A. invertible
B. symmetrix
C. singular
D. skewed (2 marks)

18. Given that $X \cdot \begin{pmatrix} 2 & -1 \\ 0 & 3 \end{pmatrix} = \begin{pmatrix} 6 & -3 \\ 0 & 9 \end{pmatrix}$

Find unknown X scalar multiplication.

A. 1
B. 2
C. 3
D. 4 (2 marks)

19. If A = $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$, B = $\begin{pmatrix} x & 0 \\ 0 & x \end{pmatrix}$ and AB = $\begin{pmatrix} 5 & 10 \\ 15 & 20 \end{pmatrix}$

Find the value of x.
A. 1
B. 2
C. 5
D. 10 (2 marks)

20. Which one of the following values of **x** will make the matrix $\begin{pmatrix} 2 & x \\ 6 & 3 \end{pmatrix}$ singular?

A. 1
B. 4
C. 6
D. 5 (2 marks)

21. If $A = \begin{pmatrix} 2 & 4 \\ x & 6 \end{pmatrix}$ and $A^T = A$, find x.

A. 2
B. 6
C. 3
D. 0 (2 marks)

22. Given that $A = \begin{pmatrix} 2 & 4 \\ 6 & x \end{pmatrix}$ and $A^{-1} = \begin{pmatrix} -1 & 0.5 \\ 0.75 & -0.25 \end{pmatrix}$

Find the value of x.

A. 4.5
B. 4
C. 6
D. 8 (2 marks)

23. Conditional probability is denoted by_____.

A. P(BUA)
B. P(A|B)
C. P(B|A) – P(B)
D. P(A∩B) (2 marks)

24. Events A and B are independent if_____.

A. P(A and B) = P(A) + P(B)
B. P(A or B) = 0
C. P(A|B) = P(A)
D. A and B cannot occur together (2 marks)

25. A die is rolled twice. Determine the probability of getting a 6 on both rolls.

A. $^1/_{36}$
B. $^1/_6$
C. $^1/_{12}$
D. $^2/_6$ (2 marks)

26. If P(A) = 0.3 and P(B) = 0.4 and A and B are mutually exclusive, find P(A or B).

A. 0.12
B. 1.0
C. 0.7
D. 0.5 (2 marks)

Use the following information to answer Question 27 to Question 29.

A box contains 3 red balls and 2 green balls. Two balls are drawn one after the other without replacement.

27. What is the probability that at least one red ball is drawn?
    A. $^{3}/_{10}$
    B. $^{1}/_{10}$
    C. $^{9}/_{10}$
    D. $^{21}/_{25}$ (2 marks)

28. Use a tree diagram to find the probability that the second ball is red given the first ball was red.
    A. ½
    B. $^{3}/_{10}$
    C. $^{3}/_{5}$
    D. $^{9}/_{25}$ (2 marks)

29. What is the probability that the first ball is red and the second is green?
    A. $^{6}/_{25}$
    B. $^{3}/_{10}$
    C. $^{4}/_{25}$
    D. $^{7}/_{10}$ (2 marks)

Use the information below to answer Question 30 to Question 34.

A class of 60 students was surveyed on their preference beverage coffee or tea. The results were as follows:

- 35 students prefer coffee
- 25 students prefer tea
- 15 students prefer both coffee and tea

30. Find the number of students who prefer coffee only.
    A. 15
    B. 20
    C. 25
    D. 35 (2 marks)

31. Find the number of students who prefer neither coffee nor tea.
    A. 5
    B. 10
    C. 15
    D. 20 (2 marks)

32. What is the probability that a randomly selected student prefer tea only?
    A. $^{1}/_{6}$
    B. $^{1}/_{4}$
    C. $^{1}/_{3}$
    D. $^{5}/_{12}$ (2 marks)

33. What is the probability that a randomly selected student prefers coffee or tea?
A. 1
B. $^3/_4$
C. $^1/_4$
D. $^7/_{12}$ (2 marks)

34. What is the probability that a randomly selected student prefers coffee given that they prefer tea?
A. $^3/_7$
B. ¼
C. $^3/_5$
D. $^1/_6$ (2 marks)

35. Which one of the following measures **BEST** reflects the spread of data?
A. Mean
B. Standard deviation
C. Mode
D. Median (2 marks)

36. Which one of the following measures of central tendency is **MOST** suitable for categorical data?
A. Mean
B. Median
C. Mode
D. Range (2 marks)

37. Which one of the following is **MOST** affected by extreme values?
A. Median
B. Mean
C. Mode
D. Frequency (2 marks)

38. The mean of a data set is 40 and standard deviation is 0. What does this indicate?
A. Data is widely spread
B. Data contains outliers
C. All values are 40
D. Mean is not correct (2 marks)

39. What is the variance of the data: 4, 8, 6, 10?
A. 4
B. 5
C. 6
D. 8 (2 marks)

40. Find the derivative of $y = (3x^2 + 2x - 1)^4$
A. $Y^1 = 4(3x^2 + 2x - 1)^3$
B. $Y^1 = 12x(3x^2 + 2x - 1)^3$
C. $Y^1 = (12x + 2)(3x^2 + 2x - 1)^3$
D. $Y1 = 4(3x^2 + 2x - 1)^3(6x + 2)$ (2 marks)

41. Differentiate $Y = \frac{2x + 1}{x^2 + 3}$

A. $Y^1 = \frac{2(x^2 + 3) - (2x + 1)2x}{(x2 + 3)^2}$

B. $Y^1 = \frac{(2x + 1)2x}{(x^2 + 3)^2}$

C. $Y^1 = \frac{2x^2 + 3}{(2x + 1)}$

D. $Y^1 = \frac{(x^2 + 3)\ (2)\ (-\ 2x + 1)2x}{(x^2 + 3)^2}$ (2 marks)

Use the data below to answer Question 42 to Question 46.

The frequency distribution table below shows the marks scored by a group of students in a test:

Class interval	**Frequency**
10 – 19	1
20 – 29	**x**
30 – 39	5
40 – 49	**y**
50 – 59	5
Total	**20**

42. Determine the value of x given that the mean is 40.
A. 2
B. 3
C. 6
D. 9 (2 marks)

43. Determine the median.
A. 41.2
B. 44.5
C. 34.5
D. 47.3 (2 marks)

44. What percentage of students scored 40 or more?
A. 40%
B. 35%
C. 55%
D. 70% (2 marks)

45. Determine the mode.
A. 34.5
B. 39
C. 44.5
D. 49 (2 marks)

46. Determine the standard deviation.
A. 28.73
B. 11.61
C. 24.51
D. 32.68 (2 marks)

47. A line graph is typically used to display_____.
A. frequency
B. relationships
C. change over time
D. proportions (2 marks)

48. Convenience sampling is prone to_____.
A. high accuracy
B. bias
C. time consuming process
D. stratification (2 marks)

49. Stratified sampling involves_____.
A. random sampling across all data
B. division into subgroups
C. personal judgement
D. frequential numbering (2 marks)

50. Which one the following sampling methods is probabilistic?
A. Judgemental
B. Convenience
C. Cluster
D. snowball (2 marks)

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DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

WEDNESDAY: 23 April 2025. Morning Paper. **Time Allowed: 3 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks.

1. Which one of the following is an example of a linear equation in one variable?
   A. $2x + 5 = 0$
   B. $x^2 + 3x + 7 = 0$
   C. $3x + 2y = 7$
   D. $xy = 10$ (2 marks)

2. What is the slope of a line given by the equation $2x – 3y = 6$?
   A. $^2/_3$
   B. $-^2/_3$
   C. $^3/_2$
   D. $-^3/_2$ (2 marks)

3. If a line passes through the point (2, 3) with a slope of 4, which equation represents it in a point slope form?
   A. $y + 3 = 4 (x – 2)$
   B. $y = 4x + 3$
   C. $y = 2x + 4$
   D. $y -3 = 4 (x – 2)$ (2 marks)

4. If a line passes through (4, -2) and (8, 6), calculate its slope.
   A. ½
   B. $-^1/_2$
   C. -2
   D. 2 (2 marks)

5. If two lines have the same slope but different y-intercepts, they are _____.
   A. parallel
   B. perpendicular
   C. coincident
   D. intersecting (2 marks)

6. The solution of the system of equation x + y = 6 and x – y = 2 is _____.
   A. (2, 4)
   B. (4, 2)
   C. (3, 3)
   D. (-4, 2) (2 marks)

Use the following information to answer Question 7 to Question 10.

Given the matrix $A = \begin{pmatrix} 4 & 3 \\ 2 & 1 \end{pmatrix}$ $B = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and that $AB = \begin{pmatrix} 57 & 50 \\ 25 & 22 \end{pmatrix}$

7. Find the value of a.
   A. 7
   B. 8
   C. 9
   D. 53 (2 marks)

8. Find the value of b.
   A. 6
   B. 8
   C. 7
   D. 47 (2 marks)

9. Find the value of c.
   A. 7
   B. 6
   C. 8
   D. 23 (2 marks)

10. Find the value of d.
    A. 9
    B. 8
    C. 21
    D. 6 (2 marks)

11. If vector A = (3, 4), what is its magnitude?
    A. 25
    B. 10
    C. 5
    D. 7 (2 marks)

12. A vector with a magnitude of 1 is called a _____.
    A. zero vector
    B. unit vector
    C. position vector
    D. null vector (2 marks)

13. The dimension of a vector is determined by _____.
    A. the number of components in the vector
    B. the magnitude of the vector
    C. the direction of the vector
    D. the unit vector of the given vector (2 marks)

14. The deviation of a function represents _____.
    A. the area under the curve
    B. the slope of the tangent line to the function
    C. the maximum value of the function
    D. the integral of the function (2 marks)

15. Find the derivative of $f(x) = x^3$?
    A. $3x^2$
    B. x^2
    C. $3x$
    D. x^3 (2 marks)

16. Find $\int(4x^3 + 2x + 5)\,dx$ for an interval between $x = 1$ and $x = 3$.
    A. 38
    B. 96
    C. 98
    D. 112 (2 marks)

17. Find the integral of $f(x) = x^2$.
    A. x^3
    B. $\frac{x^3}{3} + c$
    C. $2x$
    D. $\frac{x^2}{2} + c$ (2 marks)

18. The area under a curve from a to b is given by _____.
    A. the definite integral
    B. the derivative
    C. the slope of the function
    D. the fundamental theorem of calculus (2 marks)

19. The chain rule is used to differentiate _____.
    A. sum of functions
    B. product of functions
    C. composition of functions
    D. function divided by another function (2 marks)

20. The power rule states that the derivative of x^n is _____.

A. nx^{n+1}
B. nx^{n-1}
C. x^{n-1}
D. nx^n (2 marks)

21. Given matrix A = $\begin{pmatrix} 7 & 4 \\ 3 & 2 \end{pmatrix}$, find A^{-1}.

A. $\begin{pmatrix} 1 & -2 \\ -1.5 & 3.5 \end{pmatrix}$
B. $\begin{pmatrix} -1 & 1.5 \\ 2 & -3.5 \end{pmatrix}$
C. $\begin{pmatrix} 2 & -4 \\ -3 & 7 \end{pmatrix}$
D. $\begin{pmatrix} -7 & 3 \\ 4 & -2 \end{pmatrix}$ (2 marks)

22. Using chain rule, differentiate $f(x) = (3x^2 + 5x)^4$.

A. $4(3x^2 + 5x)^3$
B. $12x(3x^2 + 5x)^3$
C. $4(3x^2 + 5x)^3 (6x + 5)$
D. $(3x^2 + 5x)^3 (6x + 5)$ (2 marks)

23. Find the derivative of $f(x) = (x^2 + 1)(x^3 - 2)$.

A. $5x^4 + 3x^2 - 4x$
B. $3x^5 + 2x^4 - 6x^2 - 4x$
C. $x^5 - 2x^2 + x^3 - 2$
D. $3x^4 + 3x^2$ (2 marks)

24. A function of a curve is given as $Y = 3x^2 - 2x + 5$.

Find the integral equation of the function.

A. $x^3 - x^2 + 5x + c$
B. $6x - 2$
C. $3x^3 - 2x^2 + 5x + c$
D. $3x - 2x + 5$ (2 marks)

25. Which one of the following statements is an example of a simple event?

A. Rolling a prime number on a die
B. Getting heads on a coin toss
C. Drawing a red or black card from a deck
D. Getting an even number on a die (2 marks)

26. An elementary event is an event that contains _____.

A. exactly one outcome
B. more than one outcome
C. no outcomes at all
D. a probability of 1 (2 marks)

27. Two outcomes are mutually inclusive if _____.
A. they are dependent on each other
B. they share atleast one outcome
C. they cannot happen at the same time
D. one event follows the other (2 marks)

28. Which one of the following statements is an example of dependent events?
A. Rolling a die and flipping a coin
B. Drawing a card and not replacing it before drawing another
C. Tossing two different coins
D. Choosing a number from 1 to 10 and rolling a die (2 marks)

29. The addition rule of probability is used when _____.
A. two events are independent
B. one event depends on another
C. two events are mutually exclusive or inclusive
D. an experiment is repeated multiple times (2 marks)

30. Probability trees are used to _____.
A. count the total number of outcomes
B. represent the sequence of events and their probabilities
C. add probabilities of independent events
D. multiply probabilities of mutually exclusive events (2 marks)

31. A company finds that 70% of its customers buy product A and 50% buy product B. Assuming that 30% buy both, what is the probability that a customer buys either product A or product B?
A. 0.9
B. 1.0
C. 0.7
D. 0.8 (2 marks)

32. A probability tree is constructed for a game where a fair die is rolled and if the outcome is even a coin is flipped. What is the probability of rolling an even number and flipping heads?
A. $^1/_6$
B. ¼
C. $^1/_3$
D. $^1/_{12}$ (2 marks)

33. A box contains 5 red balls, 4 blue balls and 3 green balls. Two balls are drawn randomly without replacement. What is the probability that both are red?
A. $^{25}/_{144}$
B. $^{25}/_{132}$
C. $^5/_{12}$
D. $^5/_{33}$ (2 marks)

34. A class has 60% males and 40% females. 70% of males pass an exam, while 80% of females pass. If a randomly selected student passed, what is the probability they are female?
A. 0.57
B. 0.30
C. 0.43
D. 0.8 (2 marks)

Use the data below to answer Question 35 and Question 36:
A manufacturing plant has three machines: A, B and C. They produce 50%, 30% and 20% of the total output respectively. The probability of a defective product from A, B and C is 2%, 3% and 5% respectively.

35. If a product is found defective, what is the probability it came from machine B?
A. 0.009
B. 0.09
C. 0.291
D. 0.310 (2 marks)

36. If a product is not found defective, what is the probability it came from machine "C"?
A. 0.345
B. 0.01
C. 0.196
D. 0.28 (2 marks)

37. Which one of the following is a primary source of data?
A. Census reports
B. Research survey conducted by a student
C. Government statistical publications
D. Newspapers (2 marks)

38. What is the difference between "probability sampling" and "non-probability sampling"?
A. Probability sampling relies on chance while non-probability sampling relies on researcher judgment
B. Non-probability sampling is always more accurate than the probability sampling
C. Probability sampling is only used for small populations while non-probability sampling is used for large population
D. Non-probability sampling requires computer algorithms whereas probability sampling does not (2 marks)

39. The following are probability sampling methods, **EXCEPT** _____.
A. Purposive sampling
B. Simple random sampling
C. Stratified sampling
D. Systematic sampling (2 marks)

40. Which one of the following measures of central tendency is least affected if a data set has an extreme outlier?
A. Mean
B. Median
C. Mode
D. Range (2 marks)

41. A company determines that the mean salary of its employees is Sh.50,000. Assuming that all salaries increase by Sh.5,000, what happens to the mean?
    A. It remains unchanged
    B. It increases by Sh.5,000
    C. It decreases by Sh.5,000
    D. It doubles (2 marks)

42. A university professor wants quick feedback on a new teaching method, so she asks the first 50 students who enter her classroom to complete a survey. What type of sampling method is she using?
    A. Cluster sampling
    B. Convenience sampling
    C. Simple random sampling
    D. Quota sampling (2 marks)

Use the data below to answer Question 43 to Question 45.

A teacher recorded the following test scores for students in a class:

Score range	**Frequency**
40 -50	5
51 – 60	X
61 – 70	10
71 – 80	7

43. Determine the value of X assuming the mode is 64.5.
    A. 4
    B. 8
    C. 9
    D. 2 (2 marks)

44. Determine the arithmetic mean.
    A. 60.54
    B. 70.5
    C. 61.75
    D. 65.5 (2 marks)

45. Determine the standard deviation.
    A. 10.29
    B. 7.86
    C. 9.00
    D. 10.18 (2 marks)

46. A factory produces 5, 8, 6, 7, x, 10 defective products per day over 6 days. If the arithmetic mean is 7.5, find x.
    A. 7
    B. 9
    C. 10
    D. 11 (2 marks)

47. An investor analyses two stocks as follows:
Stock A: mean return = 100,000
Standard deviation = 14,200
Stock B: mean return = 10,000
Standard deviation = 7,000

Which stock is less risky based on coefficient of variation?
A. Stock A
B. Stock B
C. Both are equally risky
D. Cannot be determined (2 marks)

48. A factory produces 5, 8, 6, 7, 9, 10 defective products per day over 6 days. Find the mean deviation.
A. 7.5
B. 1.5
C. 1.7
D. 2.9 (2 marks)

49. A grocery store analysed its weekly sales in thousand of shillings as follows:
15, 18, 20, 22, 25, 27, 30, 35, 38, 40

Calculate the semi-interquartile range.
A. 2.5
B. 6
C. 6.5
D. 7.5 (2 marks)

50. What does a standard deviation of 0 indicate about a dataset?
A. The dataset has only positive values
B. All values in the dataset are the same
C. The mean is negative
D. The dataset has multiple models (2 marks)

……..

DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 3 December 2024. Morning Paper. **Time Allowed: 3 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks.

1. If a line has an equation $3y = {}^{3}/_{2}x + 9$, what are the coordinates of the point where the line intersects with the y-axis?
   A. (0, 9)
   B. (9, 0)
   C. (0, 3)
   D. $(0, {}^{3}/_{2})$ (2 marks)

2. Find the equation of a line with a gradient of 4 and is passing through point (0, -2).
   A. Y = 4x - 2
   B. Y = 4x + 2
   C. Y = 4x - 8
   D. Y = 2x - 4 (2 marks)

3. Determine the gradient of a line given by the equation, 5y = -15x + 20.
   A. 15
   B. -15
   C. -3
   D. 3 (2 marks)

4. A matrix has 4 columns and 5 rows. What is the order of the matrix?
   A. 4 x 4
   B. 5 x 5
   C. 5 x 4
   D. 4 x 5 (2 marks)

5. A matrix is of order 3 x 3, how many elements does the matrix contain?
   A. 3
   B. 6
   C. 9
   D. 12 (2 marks)

6. If $A = \begin{pmatrix} 5 & 5 \\ 4 & 6 \end{pmatrix}$ and $A^{-1} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$, find the value of b.

A. -5
B. 5
C. -0.5
D. -0.4 (2 marks)

7. A medical test for a disease is 90% accurate, meaning that the probability of correctly identifying someone with the disease is 0.9 and the probability of correctly identifying someone without the disease is also 0.9. The disease occurs in 1% of the population. If a randomly selected person tests positive, what is the probability that the person actually has the disease?

A. 0.09
B. 0.891
C. 0.10
D. 0.90 (2 marks)

Use the information below to answer Question 8 to Question 10:

A factory has two machines namely; Machine A and Machine B. Machine A produces 40% of the items and Machine B produces 60% of the items. The probability that an item produced by Machine A is defective is 2% and the probability that an item produced by Machine B is defective is 4%. An item is chosen at random and found to be defective.

8. What is the probability that an item selected will be defective?

A. 0.008
B. 0.392
C. 0.024
D. 0.032 (2 marks)

9. What is the probability that the defective item was produced by machine A?

A. 0.25
B. 0.008
C. 0.024
D. 0.392 (2 marks)

10. What is the probability that the defective item was produced by machine B?

A. 0.750
B. 0.576
C. 0.024
D. 0.040 (2 marks)

Use the data below to answer Question 11 to Question 16:

The following grouped frequency distribution shows the test scores of 100 students of a class with arithmetic mean equal to 52.65:

Range of scores	**Number of students**
40 - 44	12
45 - 49	**x**
50 - 54	30
55 - 59	25
60 - 64	**y**

11. Find the value of x.
    A. 13
    B. 15
    C. 18
    D. 20 (2 marks)

12. Find the value of y.
    A. 15
    B. 13
    C. 20
    D. 33 (2 marks)

13. Determine the median score.
    A. 50
    B. 54.5
    C. 52
    D. 60 (2 marks)

14. Determine the modal score.
    A. 30
    B. 50
    C. 53
    D. 55 (2 marks)

15. Determine the standard deviation.
    A. 7.42
    B. 7.07
    C. 7.28
    D. 6.12 (2 marks)

16. Determine the coefficient of variation.
    A. 14.84%
    B. 14.14%
    C. 13.73%
    D. 11.60% (2 marks)

Use the information provided below to answer Question 17 to Question 21:

A company's revenue function is determined by the price at which it sells a product. The company sells 20 units of the product at a price of Sh.80 per unit and 40 units at a price of Sh.60 per unit. The marginal cost function is given by; $MC(q) = 10 + 2q$, where q represents the quantity of units produced. The fixed cost is Sh.200.

17. Determine the demand function.
    A. $P = 80 – 20q$
    B. $P = 100 + q$
    C. $P = 100 – q$
    D. $P = 60 – 40q$ (2 marks)

18. Determine the total revenue function.
A. $P = 80q - 20q^2$
B. $P = 100q + q^2$
C. $P = 60q - 40q^2$
D. $P = 100q - q^2$ (2 marks)

19. Determine the total cost function.
A. $C = 10q + q^2 + 200$
B. $C = 10q + 2q^2 + 200$
C. $C = 10q + q^2 + 200q$
D. $C = 10q^2 + q^3 + 200q$ (2 marks)

20. Determine the total profit function.
A. $\Pi = 90q - 2q^2 + 200$
B. $\Pi = 90q - 2q^2 - 200$
C. $\Pi = 90q - 200$
D. $\Pi = 110q + 2q^2 + 200$ (2 marks)

21. Determine the price charged at maximum profit.
A. Sh.77.5
B. Sh.22.5
C. Sh.80
D. Sh.60 (2 marks)

22. Evaluate the definite integral:

$$\int_1^4 (3x^2 - 2x)\,dx$$

A. 30
B. 32
C. 42
D. 48 (2 marks)

23. Find the equation of a line that passes through points A (1, 3) and B (-2, 4).
A. $x + 3y = 10$
B. $x + 3y = 14$
C. $y + 3x = 10$
D. $y + 3x = 14$ (2 marks)

24. Find the derivative of $f(x) = 2x^3 - 3x + 4$
A. $2x^2 - 3$
B. $\frac{x^4}{4} - 3\frac{x^2}{2}$
C. $\frac{x^4}{4} - 3\frac{x^2}{2} + 4x$
D. $6x^2 - 3$ (2 marks)

Use the information below to answer Question 25 to Question 28:

Given the matrix $A = \begin{pmatrix} 3 & 3 \\ 1 & 4 \end{pmatrix}$ $B = \begin{pmatrix} 4 & 3 \\ 2 & 1 \end{pmatrix}$ $X = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and that $AB = 3x$

25. Find the value of a.
    A. 5
    B. 2
    C. 8
    D. 6 (2 marks)

26. Find the value of b.
    A. 7
    B. 3
    C. 10
    D. 5 (2 marks)

27. Find the value of c.
    A. 1
    B. 8
    C. 4
    D. 6 (2 marks)

28. Find the value of d.
    A. 2
    B. 9
    C. 4
    D. 5 (2 marks)

Use the information below to answer Question 29 to Question 33:

The following are scores of 8 students in a Mathematical Concepts and Data Science class:
14, 12, 20, 24, 6, 15, 28, 17.

29. Determine the 60^{th} percentile (P_{60}).
    A. 12
    B. 14
    C. 17
    D. 20 (2 marks)

30. Determine the 1^{st} quartile (Q_1).
    A. 12
    B. 14
    C. 15
    D. 17 (2 marks)

31. Determine the 8^{th} decile (D_8).
    A. 20
    B. 22
    C. 24
    D. 28 (2 marks)

32. Determine the variance.
    A. 3.96
    B. 6.50
    C. 17.00
    D. 42.25 (2 marks)

33. Determine the coefficient of variation.
    A. 6.50%
    B. 17.00%
    C. 38.24%
    D. 52.25% (2 marks)

34. A company has 80 female employees and 20 male employees. A researcher wants to select 8 women and 2 men which gives a representative of 10 people. Which one of the following sampling method will the researcher use?
    A. Cluster sampling
    B. Stratified sampling
    C. Systematic sampling
    D. Simple random sampling (2 marks)

35. The following are qualities of a good questionnaire as a data collection tool, **EXCEPT** _____.
    A. proper sequence of question
    B. limited number of questions
    C. exclude objective type questions
    D. exclude undesirable questions (2 marks)

36. The following are characteristics of a good measure of central tendency, **EXCEPT** _____.
    A. based on the value of data
    B. most affected by fluctuations of sampling
    C. applicable to further mathematical calculations
    D. should not be affected by extreme values (2 marks)

Use the information below to answer Question 37 to Question 40:

Brandy Ltd. has 140 employees, which include 30 supervisors. Eighty of the employees are married and 20% of the married employees are supervisors.

37. Determine the number of employees who are not married and are not supervisors.
    A. 16
    B. 14
    C. 46
    D. 64 (2 marks)

38. What is the probability that the employee is not a supervisor?
A. 0.10
B. 0.21
C. 0.33
D. 0.79 (2 marks)

39. What is the probability that the employee is married or a supervisor?
A. 0.57
B. 0.1197
C. 0.66
D. 0.78 (2 marks)

40. What is the probability that the employee is married and is a supervisor?
A. 0.1143
B. 0.2000
C. 0.5714
D. 0.4286 (2 marks)

41. Two events are said to be _____ if one event takes place if and only if the other event does not take place.
A. impossible
B. complementary
C. dependent
D. independent (2 marks)

42. A list of collectively exhaustive events contains _____.
A. all possible elementary events for an experiment
B. all list of events that are mutually inclusive
C. events that overlap and intersect
D. all impossible elementary events for an experiment (2 marks)

Use the information below to answer Question 43 to Question 45:

The following joint probability table shows the results of a national survey of executives who were asked to identify the geographical location of their company and their company's industry type.

		Geographical location			
		D	**E**	**F**	**G**
Industry type	**A**	0.12	0.05	0.04	0.07
	B	0.15	0.03	0.11	0.06
	C	0.14	0.09	0.06	0.08

43. Find P (B/D).
A. 0.18
B. 0.29
C. 0.37
D. 0.52 (2 marks)

44. Find P (D or E).
A. 0.17
B. 0.24
C. 0.41
D. 0.58 (2 marks)

45. Find P (A or F).
A. 0.21
B. 0.28
C. 0.45
D. 0.49 (2 marks)

46. The probability of rolling a six on a six-sided die is one divided by six. This inclusion is obtained on the basis of _____.
A. personalistic approach
B. priori approach
C. relative approach
D. subjective approach (2 marks)

47. Find the integral equation of $y = 3x^2 - 2x + 5$.
A. $x^3 - x^2 + 5 + c$
B. $6x - 2$
C. $3x^3 - 2x^2 + 5x + c$
D. $3x - 2x + 5$ (2 marks)

Use the following information to answer Question 48 to Question 50:

Naomi Makena sold 15 oranges and 7 mangoes for Sh.815. She later sold 11 oranges and 20 mangoes for Sh.895.

48. Determine the price of an orange.
A. Sh.20
B. Sh.25
C. Sh.45
D. Sh.65 (2 marks)

49. Determine the price of a mango.
A. Sh.20
B. Sh.25
C. Sh.45
D. Sh.65 (2 marks)

50. If Naomi makes a profit of 25% on the cost of oranges and mangoes, calculate the total profit she made upon selling 5 oranges and a mango.
A. Sh.19
B. Sh.81
C. Sh.324
D. Sh.405 (2 marks)

……..

DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 20 August 2024. Morning Paper. **Time Allowed: 2 hours.**

This paper consists of fifty (50) Multiple Choice Questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks.

1. Which one of the following statements **BEST** describes the term "calculus"?
   A. The study of shapes and their properties
   B. The study of change and motions
   C. The study of numbers and their relationships
   D. The study of data and its anlalysis (2 marks)

2. What is the primary application of derivatives in finding maximum and minimum turning points?
   A. Finding the area under a curve
   B. Determining the rate of change
   C. Identifying points where the slope is zero
   D. Evaluating the antiderivative at the bounds (2 marks)

3. Which one of the following is an application of integration?
   A. Determining the slope of a tangent line
   B. Calculating the area under a curve
   C. Finding the derivative of a function
   D. Solving linear functions (2 marks)

4. Find the integral of $F(X) = 4X^3$ with respect to X.
   A. X^4
   B. X^3
   C. $X^4 + C$
   D. $12X^2$ (2 marks)

5. Find the integral of $F(X) = 3X^2$ from X = 0 to X = 2.
   A. 8
   B. 4
   C. 12
   D. 16 (2 marks)

6. Which one of the following rules would you use to find the derivative of $F(X) – (2X + 1)^3$?
   A. Product rule
   B. Quotient rule
   C. Chain rule
   D. Power rule (2 marks)

7. Using the quotient rule, find the derivative of $Q(x) = \frac{X^2+1}{X-1}$
   A. $\frac{2x(x-1)-(x^2+1)}{(x-1)^2}$
   B. $\frac{2x(x-1)+(x^2+1)}{}$

C. $\dfrac{(x-1)^2}{(x^2+1)(x-1)-2x}$

D. $\dfrac{(x-1)^2}{(x^2+1)(x-1)+2x}$ (2 marks)

8. Which one of the following statements **BEST** describes the term "experiments" in probability?
   A. The set of all possible outcomes
   B. A single result of a trial
   C. A process that produces outcomes
   D. The probability of an event (2 marks)

9. Which one of the following events is a simple event?
   A. Rolling an even number on a die
   B. Rolling a 3 on a die
   C. Rolling a number greater than 2 on a die
   D. Rolling a prime number on a die (2 marks)

10. Which one of the following events is a dependent event?
   A. Drawing a card from a deck and then drawing another card without replacement
   B. Flipping a coin twice
   C. Rolling a die then rolling it again
   D. Drawing a card from a deck and then drawing another card with replacement (2 marks)

11. The additional law of probability is used for calculating the probability of _____.
   A. dependent events
   B. mutually exclusive events
   C. independent events
   D. a single event (2 marks)

Use the information below to answer Question 21 to Question 26:

Given the data 10, 12, 15, 15, 18 and 20.

12. Calculate the arithmetic mean.
   A. 10
   B. 12
   C. 15
   D. 18 (2 marks)

13. Calculate the mean absolute deviation.
   A. 10
   B. 1.67
   C. 3
   D. 2.67 (2 marks)

14. Calculate the variance for the data.
   A. 10
   B. 11.33
   C. 68
   D. 100 (2 marks)

15. Calculate the standard deviation for the data.
   A. 8.25
   B. 3.16
   C. 10
   D. 3.37 (2 marks)

16. Calculate the coefficient of variation.
   A. 22.47%
   B. 66.67%

C. 26.33%
D. 33.7% (2 marks)

17. In a contingency table with rows for different age groups and columns for different types of insurance plans, which cell would represent the probability of a specific age group choosing a specific insurance plan?
A. Marginal probability cell
B. Joint probability cell
C. Conditional probability cell
D. Total probability cell (2 marks)

Use the information below to answer Question 18 to Question 22:

In a contingency table showing the relationship between smoking status (smoker and non-smoker) and long disease status (disease and no disease), the following data is provided:
Out of 100 smokers 50 have no lung disease and out of 80 respondents with lung diseases 30 are known to be non-smokers. The total number of respondents was 200.

18. Determine the probability of a respondent being a smoker.
A. 0.25
B. 0.4
C. 0.6
D. 0.5 (2 marks)

19. Determine the probability of being a smoker and having a lung disease.
A. 0.25
B. 0.5
C. 0.625
D. 0.4 (2 marks)

20. Determine the probability that a respondent selected at random is a non-smoker given that they have a lung disease.
A. 0.3
B. 0.15
C. 0.375
D. 0.35 (2 marks)

21. Find the probability that a respondent has no lung disease on condition that they are non-smokers.
A. 0.7
B. 0.3
C. 0.58
D. 0.35 (2 marks)

22. Find the probability of being a non-smoker or having a lung disease.
A. 0.9
B. 0.5
C. 0.75
D. 0.40 (2 marks)

Use the information below to answer Question 23 to Question 27:

A company is conducting a survey to understand the preferences of its employees for two types of benefits; health insurance and retirement plan. In the first stage, employees are asked if they prefer health insurance or not. In the second stage, those who prefer health insurance are asked if they also want dental coverage and those who do not prefer health insurance are asked if they want a retirement plan. The following probabilities are provided:
(i) The probability that an employee prefers health insurance is 0.6.
(ii) The probability that an employee who prefers health insurance will also want dental coverage is 0.7.
(iii) The probability that an employee who does not prefer health insurance will want a retirement plan is 0.8.

23. Find the probability that an employee prefers health insurance and also wants dental coverage?
A. 0.50
B. 0.70

C. 0.42
D. 0.30 (2 marks)

24. Find the probability that an employee does not prefer health insurance but wants a retirement plan.
A. 0.08
B. 0.80
C. 0.20
D. 0.32 (2 marks)

25. Find the probability that an employee prefers health insurance but does not want dental coverage.
A. 0.42
B. 0.18
C. 0.30
D. 0.60 (2 marks)

26. Find the probability that an employee does not prefer health insurance and does not want a retirement plan.
A. 0.08
B. 0.20
C. 0.40
D. 0.32 (2 marks)

27. Find the probability that an employee prefers health insurance or wants a retirement plan.
A. 0.42
B. 0.18
C. 0.92
D. 0.32 (2 marks)

28. Convenience sampling is characterised by _____.
A. equal probability of selection for all population members
B. random selection from a population
C. selection based on ease of access to participants
D. selection of participants in proportion to their occurrence in the population (2 marks)

29. When constructing a histogram, the horizontal axis typically represents _____.
A. frequency of occurrence
B. categories of data
C. intervals of the variable
D. cummulative frequency (2 marks)

30. Which sampling method involves dividing the population into sub-groups and randomly selecting from each sub-group?
A. Sample random sampling
B. Systematic sampling
C. Stratified sampling
D. Convenience sampling (2 marks)

31. Which one of the following characteristics distinguishes probalistic sampling from other sampling methods?
A. The researcher uses personal judgment to select participants
B. Every member of the population has a known chance of being selected
C. Participants are selected based on convenience
D. Sampling is done in a non-random manner (2 marks)

32. Which one of the following is an example of a non-probabilistic sampling method?
A. Systematic sampling
B. Stratified sampling
C. Cluster sampling
D. Judgemental sampling (2 marks)

33. Which one of the following statements is **TRUE** about range?
A. It provides information about the central tendency of the data
B. It is the same as standard deviation of a certain dataset

C. It measures variability of the data
D. It is unaffected by extreme values (2 marks)

34. What does a high standard deviation indicate about a data set?
A. The data points are close to the mean
B. The data points are spread out over a wide range
C. There are no outliers in the data set
D. The data set has low variability and confidence interval (2 marks)

Use the information below to answer Question 35 and Question 36:

The equation of line A is y = 5x + 7. Line A and line B are perpendicular. Line B passes through the coordinate point (3, 8).

35. Find the gradient of line B.
A. $^1/_5$
B. -5
C. $-^1/_5$
D. -1 (2 marks)

36. Find the equation of line B.
A. 5y = x + 37
B. y = 23 – 5x
C. 5y = 43 – x
D. y = 11 – x (2 marks)

Use the information below to answer Question 37 and Question 38:

Given that A = $\begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} 5 & 1 \\ 2 & 0 \end{pmatrix}$ and x = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and that AB = 2x

37. Find the value of a.
A. 7
B. 1.5
C. 9.5
D. 0.5 (2 marks)

38. Find the value of b.
A. 7
B. 1.5
C. 9.5
D. 0.5 (2 marks)

Use the data below to answer Question 39 to Question 42:

The monthly income of workers in a certain company is analysed below:

Monthly income Sh. "000"	**Number of workers**
5 – 15	3
15 – 25	X
25 – 35	15
35 – 45	7
45 – 55	2

Given that the median income of the workers is Sh.29,000.

39. Find the value of x.
A. 4
B. 5
C. 8
D. 9 (2 marks)

40. Determine the upper quartile value.
    A. Sh.27,000
    B. Sh.35,000
    C. Sh.9,000
    D. Sh.15,000 (2 marks)

41. Determine the lower quartile value.
    A. Sh.9,000
    B. Sh.21,677
    C. Sh.20,000
    D. Sh.15,333 (2 marks)

42. Determine the interquartile deviation.
    A. Sh.6,666.5
    B. Sh.3,333.25
    C. Sh.13,333
    D. Sh.9,000

Use the information below to answer Question 43 to Question 46:

The cost of producing Q units of a certain commodity is $TC = 3Q^2 + 2Q + 9$ shillings. If the demand function in shillings per unit is $Q = 15 – P$.

43. Determine the revenue function.
    A. $R = Q^2 – 15Q$
    B. $R = -Q^2 + 15Q$
    C. $R = 15Q$
    D. $R = 15Q + Q^2$ (2 marks)

44. Determine the total function.
    A. $\Pi = 4Q^2 – 13Q + 9$
    B. $\Pi = 4Q^2 + 13Q + 9$
    C. $\Pi = -4Q^2 + 13Q – 9$
    D. $\Pi = 4Q^2 – 13Q – 9$ (2 marks)

45. Determine the level of production that maximises profit.
    A. $Q = 8$
    B. $Q = 6$
    C. $Q = 14$
    D. $Q = 1.625$ (2 marks)

46. Determine the price charged at maximum profit.
    A. Sh.1
    B. Sh.13.375
    C. Sh.7
    D. Sh.9 (2 marks)

47. The function $y = ax^4 + 8x^2 + 2$ has a gradient 192, when $x = 2$. Find the value of a.
    A. 5
    B. -2
    C. 3
    D. -6 (2 marks)

Use the following information to answer Question 48 to Question 50:

Given two lines A and B, line A passes through points (2, 5) and (4, 3) while line B passes through points (1, 2) and (2, 3).

48. Find the equation of line A.
    A. $3y – 2x = 11$
    B. $3y – 5x = 1$

C. $y + x = 7$
D. $y - x = 1$

(2 marks)

49. Find the equation of line B.
A. $3y - 5x = 1$
B. $y - x = 1$
C. $3y - 2x = 11$
D. $y + x = 7$ (2 marks)

50. Find the coordinates of the point of intersection of lines A and B.
A. (-4, -3)
B. (-3, -4)
C. (3, 4)
D. (4, 3) (2 marks)

……..

DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 23 April 2024. Morning Paper. **Time Allowed: 2 hours.**

Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. This paper is made up of fifty (50) Multiple Choice Questions. Each question is allocated two (2) marks.

1. Two lines L1: $2y - 3x = 6$ and L2: $3y + x = 20$. Intersect at point A.

   What are the coordinates of point A?
   A. (-2, -6)
   B. (-6, -2)
   C. (2, 6)
   D. (6, 2) (2 marks)

2. Given matrix A = $\begin{pmatrix} 5 & 7 \\ 3 & 4 \end{pmatrix}$. Find $5A^2$.

   A. $\begin{pmatrix} 50 & 70 \\ 30 & 40 \end{pmatrix}$

   B. $\begin{pmatrix} 230 & 315 \\ 135 & 185 \end{pmatrix}$

   C. $\begin{pmatrix} 125 & 245 \\ 45 & 80 \end{pmatrix}$

   D. $\begin{pmatrix} 150 & 95 \\ 45 & 70 \end{pmatrix}$ (2 marks)

3. A carpenter sold 8 beds and 3 chairs for Sh.31,600. He later sold 5 beds and 7 chairs for Sh.25,900.

   Determine the price of a bed and a chair.
   A. Sh.141 and Sh.4,003
   B. Sh.237 and Sh.4,226
   C. Sh.350 and Sh.120
   D. Sh.3,500 and Sh.1,200 (2 marks)

4. A straight line passes through points A (7,11) and B (10, 17). What is the equation of the straight line?
   A. $y = {}^{x}/_{2} - 7.5$
   B. $y = {}^{x}/_{2} + 7.5$
   C. $y= 2x - 3$
   D. $y = 2x + 3$ (2 marks)

5. Given that P = 5a + 2b where; a = $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and b = $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$. Find the column vector P.

A. $\begin{pmatrix} 14 \\ 1 \end{pmatrix}$

B. $\begin{pmatrix} 23 \\ 12 \end{pmatrix}$

C. $\begin{pmatrix} 7 \\ 8 \end{pmatrix}$

D. $\begin{pmatrix} 26 \\ 9 \end{pmatrix}$ (2 marks)

6. Point (3, 4) lies on the graph of the equation 3y = Kx + 7. The value of K is _____.
A. 3
B. $^4/_3$
C. $^7/_3$
D. $^5/_3$ (2 marks)

7. The graph of linear equation 3x + 5y = 10 cuts through the y - axis at point _____.
A. (2, 0)
B. (0, 2)
C. (10, 0)
D. (0, 10) (2 marks)

Use the data provided below to answer question 8 to question 11.

Given A = $\begin{pmatrix} 4 & 6 \\ -2 & 2 \end{pmatrix}$, B = $\begin{pmatrix} -2 & -2 \\ 3 & 3 \end{pmatrix}$, X= $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and that A = Bx + x.

8. Find the value of a.
A. -10
B. 14
C. -5
D. 6 (2 marks)

9. Find the value of b.
A. 6
B. -5
C. 14
D. -10 (2 marks)

10. Find the value of c.
A. -5
B. -10
C. 6
D. 14 (2 marks)

11. Find the value of d.
A. -10
B. 6
C. 14
D. -5 (2 marks)

12. In the equation y = mx + c, m represents _____.
A. Y intercept
B. Slope of the line
C. Solution of the equation
D. X intercept (2 marks)

13. Solve the matrix AX = B. Given that: A = $\begin{pmatrix} 1 & 2 \\ 1 & 5 \end{pmatrix}$ and B = $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$.

A. $\begin{pmatrix} -25/3 & 8/3 \end{pmatrix}$

B. $\begin{pmatrix} -25/3 \\ 8/3 \end{pmatrix}$

C. $\begin{pmatrix} 8/3 & -25/3 \end{pmatrix}$

D. $\begin{pmatrix} 8/3 \\ -25/3 \end{pmatrix}$ (2 marks)

14. To find the product matrix AB the number of _____ of A must be same as the number of _____ of B.
A. Rows and rows
B. Rows and columns
C. Columns and rows
D. Columns and columns (2 marks)

15. The product of matrix AB has the same number of _____ as A and the same number of _____as B.
A. Rows and columns
B. Rows and rows
C. Columns and columns
D. Columns and rows (2 marks)

16. Calculate the gradient of a straight line passing through the following points:

(-5, -10) and (0, 20).

A. -6
B. -2
C. 2
D. 6 (2 marks)

17. The function $y = ax^3 - 3x^2 - 2x + 1$ has a gradient of 7 when x = 1.

Find the value of a.
A. 1
B. 2
C. 4
D. 5 (2 marks)

18. Integrate the following functions; $y = 6x^3 + 5x^2 + 7x + 2$.
A. $24x^4 + 15x^3 + 14x^2 + 2x + C$
B. $18x^2 + 10x + 7$
C. $18x^4 + 10x^3 + 7x^2 + 2x + C$
D. $3/2\ x^4 + 5/3\ x^3 + 7/2\ x^2 + 2x + C$ (2 marks)

Use the information provided below to answer question 19 to question 24.

The cost of producing q units of a certain commodity is $C(q) = q^2 + 4q + 7$ shillings. If the price is $P(q) = (48 - q)$ shillings per unit.

19. Determine the total revenue function.
A. $R = 48 - q^2$
B. $R = 48q - q^2$
C. $R = 48 - q$
D. $R = \frac{(48 - q)}{q}$ (2 marks)

20. Determine the total profit function.
A. $\Pi = 44q - 2q^2 - 7$
B. $\Pi = 52q - 2q^2 - 7$
C. $\Pi = 52q - 2q^2 + 7$
D. $\Pi = 44q - 2q^2 + 7$ (2 marks)

21. Determine the level of production that maximises profit.
A. $q = 13$
B. $q = 22$
C. $q = 11$
D. $q = 26$ (2 marks)

22. Determine the price charged at maximum profit.
A. Sh.25.5
B. Sh.35
C. Sh.22
D. Sh.37 (2 marks)

23. Given that $y = -3n^4 + 40n^3 - 126n^2 + 15$.

Find dy/dn.
A. $-3/5\, n^5 + 10n^4 - 42n^4 + 15n$
B. $-12n^4 + 120n^3 - 252n^2 + 15$
C. $-12n^3 + 120n^2 - 252n + 15n$
D. $-12n^3 + 120n^2 - 252n$ (2 marks)

24. Given that $y = (x + 2)(x + 3)$.

Find dy/dx.
A. $2x + 5$
B. $x^2 + 5x + 6$
C. $2x$
D. 5 (2 marks)

25. Find $\int_0^2 (x^2 + 3)\, dx$.
A. $24/3$
B. $25/3$
C. $26/3$
D. 9 (2 marks)

26. The probability based on prior events happening is called _____.
A. Conditional
B. Empirical
C. Independent
D. Subjective (2 marks)

27. A die is thrown twice, what is the probability of getting odd numbers?
A. 0.12
B. 0.25
C. 0.5
D. 1 (2 marks)

28. The expression $P(AUB) = P(A) + P(B) - P(A \cap B)$ describes _____ law of probability.
A. Addictive
B. Conditional
C. Empirical
D. Multiplicative (2 marks)

Use the data provided below to answer question 29 to question 32.

A company has tendered for two contracts namely; X and Y.
The probability of winning contract X is $^{3}/_{5}$ and the probability of winning contract Y is $^{2}/_{3}$.

29. What is the probability of winning no contract?
    A. $^{11}/_{5}$
    B. $^{1}/_{5}$
    C. $^{2}/_{15}$
    D. $^{4}/_{15}$ (2 marks)

30. What is the probability of winning at least one contract?
    A. $^{13}/_{15}$
    B. $^{7}/_{15}$
    C. $^{2}/_{5}$
    D. $^{4}/_{75}$ (2 marks)

31. What is the probability of winning contract X or Y?
    A. $^{7}/_{15}$
    B. $^{1}/_{15}$
    C. $^{4}/_{15}$
    D. $^{13}/_{15}$ (2 marks)

32. What is the probability of winning contract X and Y?
    A. $^{13}/_{15}$
    B. $^{7}/_{15}$
    C. $^{4}/_{75}$
    D. $^{2}/_{5}$ (2 marks)

Use the information provided below to answer question 33 to question 38.

A recent survey of Kenyans in employment showed that majority believe that when they retire, their retirement income from National Social Security Fund (NSSF) and employer's retirement plan will be inadequate. A breakdown of the percentages in each category is shown in the table below:

Category	**Primary type of retirement support**			
	NSSF	**Job security**	**Personal pensions**	**Other savings**
Adequate	24	7	9	5
Inadequate	35	8	5	7

The following are some events:

A - A person believes that his or her retirement income will be inadequate.
B - The major source of retirement income will be NSSF pension.
C - The major source of retirement income will be on employment pension

33. Determine the probability that event A occurs.
    A. $^{35}/_{100}$
    B. $^{45}/_{100}$
    C. $^{55}/_{100}$
    D. $^{59}/_{100}$ (2 marks)

34. Determine the probability that event B occurs.
    A. $^{59}/_{100}$
    B. $^{15}/_{100}$
    C. $^{45}/_{100}$
    D. $^{55}/_{100}$ (2 marks)

35. Determine the probability that event C occurs.
A. $^{7}/_{100}$
B. $^{8}/_{100}$
C. $^{15}/_{100}$
D. $^{14}/_{100}$ (2 marks)

36. Determine the probability that both event A and B occur.
A. $^{35}/_{59}$
B. $^{649}/_{2000}$
C. $^{55}/_{100}$
D. $^{35}/_{100}$ (2 marks)

37. Determine the probability that either event A or B or both occur.
A. $^{57}/_{50}$
B. $^{79}/_{100}$
C. $^{35}/_{100}$
D. $^{35}/_{55}$ (2 marks)

38. Determine the probability that event B or A occur.
A. $^{35}/_{59}$
B. $^{79}/_{100}$
C. $^{35}/_{55}$
D. $^{35}/_{100}$ (2 marks)

Use the data given below to answer question 39 to question 41.

Profit	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25
Frequency	6	10	12	X	4

39. Given that the arithmetic mean of the data is 12.25.

Find the value of X.
A. 4
B. 5
C. 8
D. 12.1667 (2 marks)

40. What is the upper quartile value of the class?
A. 4.625
B. 7.5
C. 9.25
D. 16.75 (2 marks)

41. What is the interquartile deviation of the data?
A. 4.625
B. 7.5
C. 9.25
D. 16.25 (2 marks)

Use the data provided below to answer question 42 to question 46.

A mobile phone service provider is studying the number of minutes used monthly by clients in their post paid plan. A random of eight clients enrolled in this plan showed the following number of minutes used last month:

900, 770, 940, 890, 1,190, 1,120, 910, 1,100.

42. What is the arithmetic mean number of minutes?
A. 925
B. 910
C. 977.5
D. 940 (2 marks)

43. What is the median number of minutes?
    A. 925
    B. 1,040
    C. 910
    D. 940 (2 marks)

44. What is the mean deviation number of minutes?
    A. 52.5
    B. 105
    C. 420
    D. 119.375 (2 marks)

45. What is the variance number of minutes?
    A. 176,400
    B. 420
    C. 17,893.75
    D. 133.768 (2 marks)

46. What is the coefficient of variation?
    A. 5.46%
    B. 13.68%
    C. 7.30%
    D. 42.97% (2 marks)

47. Which of the following variables is discrete?
    A. Distance travelled by student to class
    B. Students scores on the first statistics test
    C. Number of hours students study per week
    D. The number of students in each level (2 marks)

48. What is the level of measurement for a classification of students by county of birth?
    A. Ordinal
    B. Ratio
    C. Interval
    D. Nominal (2 marks)

49. What is the level of measurement for student's intelligence quotient (IQ) ratings?
    A. Ordinal
    B. Ratio
    C. Interval
    D. Nominal (2 marks)

50. Which one of the following measures of central tendency should be used for a data set with outliers to get a representative value?
    A. Mode
    B. Median
    C. Mean
    D. Variance (2 marks)

……..

DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 5 December 2023. Morning Paper. **Time Allowed: 2 hours.**

Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. This paper is made up of fifty (50) Multiple Choice Questions. Each question is allocated two (2) marks.

Use the data to answer question 1 to question 3.

Celine Kemunto scored 10,11,12,12,13, and 14 points in her last six basketball games.

1. What was the arithmetic mean of her score?
   A. 12
   B. 10
   C. 13
   D. 11 (2 marks)

2. What was the mean absolute deviation of her score?
   A. 3
   B. 2
   C. 1
   D. 12 (2 marks)

3. What was the variance of her score?
   A. 1.29
   B. 1.67
   C. 2.5
   D. 4 (2 marks)

The data below shows the CAT marks score for Mathematical Concepts in Data Science students at Alpham College.

Use the data to answer question 4 to question 8.

Score	**Number of students**
50 - 59	64
60 - 69	128
70 - 79	80
80 - 89	32
90 - 100	16

4. What percentage of students scored 75 marks and below?
   A. 85%
   B. 60%
   C. 72.5%
   D. 80% (2 marks)

5. Determine the score X, such that 40% of the total number of students scored above X marks.
   A. 65
   B. 40
   C. 70
   D. 60 (2 marks)

6. Determine the lower quartile (Q_1) of score.
   A. 80
   B. 60.75
   C. 60
   D. 192 (2 marks)

7. Determine the upper quartile (Q_3) of score.
   A. 70.5
   B. 240
   C. 272
   D. 75.5 (2 marks)

8. Determine the quartile deviation of the score.
   A. 7. 375
   B. 14.75
   C. 10
   D. 5 (2 marks)

The table below relates to the monthly earnings of 100 employees of Lantex company Limited.

Earnings (Sh.“000”)	**Number of employees**
25 - 50	3
50 - 75	19
75 - 100	**x**
100 - 125	**y**
125 - 150	13
150 - 175	6
175 - 200	5
200 - 225	4

The arithmetic mean earnings is known to be Sh.107.75 (Sh.“000”)

Use the data above to answer question 9 to question 12.

9. Determine the value of x.
   A. 87.5
   B. 24
   C. 28
   D. 22 (2 marks)

10. Determine the value of y.
   A. 24
   B. 22
   C. 112.5
   D. 26 (2 marks)100

11. Calculate the median.
   A. 100
   B. 125
   C. 112.5
   D. 137.5 (2 marks)

12. Calculate the mode.
   A. 28
   B. 75
   C. 90
   D. 100 (2 marks)

13. A matrix which does not have an inverse is called _____.
    A. A scalar
    B. Diagonal matrix
    C. Singular matrix
    D. Identity matrix (2 marks)

14. When each outcome in an experiment is just as likely to occur as any other outcome, then we say we are working with _____.
    A. Equally likely outcomes
    B. Equivalent events
    C. Dependent events
    D. Company events (2 marks)

Use the data below to answer question 15 to question 19.

A college class that started the semester with 36 students obtained the following grades at the end of the semester.

Grade	**Men**	**Women**
Pass	4	5
Supplementary	6	7
Fail	8	6

What is the probability that a student selected at random from the class:

15. Is female.
    A. ¼
    B. $^1/_3$
    C. ½
    D. $^1/_6$ (2 marks)

16. Is male and failed the exam.
    A. $^4/_7$
    B. $^4/_9$
    C. $^2/_9$
    D. $^7/_9$ (2 marks)

17. Is female given that she got a supplementary.
    A. $^7/_{13}$
    B. $^7/_{18}$
    C. $^7/_{36}$
    D. $^8/_9$ (2 marks)

18. Is male or passed exam.
    A. $^3/_4$
    B. $^1/_2$
    C. $^1/_4$
    D. $^{23}/_{36}$ (2 marks)

19. Got a supplementary given that she is female.
    A. $^7/_{18}$
    B. $^7/_{13}$
    C. $^7/_{36}$
    D. $^1/_2$ (2 marks)

Use the data to answer question 20 to question 23.

A jar contains 4 white marbles, 6 black marbles and 2 red marbles. 2 marbles are drawn from the jar one after another with replacement.

Find the probability that:

20. Both marbles are white
A. $^1/_3$
B. $^1/_{11}$
C. $^2/_3$
D. $^1/_9$ (2 marks)

21. None of the marbles selected are white.
A. $^8/_9$
B. $^4/_9$
C. $^1/_9$
D. $^5/_9$ (2 marks)

22. The second marble selected is white.
A. $^1/_3$
B. $^1/_9$
C. $^1/_6$
D. $^1/_{18}$ (2 marks)

23. Both marbles will have different colours.
A. $^1/_6$
B. $^7/_{18}$
C. $^{11}/_{18}$
D. $^1/_2$ (2 marks)

Use the data below to answer question 24 and question 25.

If $\begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}\begin{pmatrix} x & 2 \\ 5 & y \end{pmatrix} = \begin{pmatrix} 7 & 10 \\ 23 & 30 \end{pmatrix}$

24. Find the value of x.
A. 6
B. 1
C. 9
D. 5 (2 marks)

25. Find the value of y.
A. 6
B. 34
C. 26
D. 14 (2 marks)

Use the following information to answer question 26 to question 30.

$P = \begin{pmatrix} 8 & 4 \\ 12 & 4 \end{pmatrix}$ $Q = \begin{pmatrix} 4 & 0 \\ 0 & 4 \end{pmatrix}$ $R = \begin{pmatrix} 0 & 4 \\ 4 & 0 \end{pmatrix}$ $S = \begin{pmatrix} 4 & -8 \\ -24 & 12 \end{pmatrix}$

Given that: $aP + bQ = S$

26. Find a
A. 2
B. 5
C. -2
D. 3 (2 marks)

27. Find b.
A. -5
B. 2
C. -6
D. 5 (2 marks)

28. Find the determinant of matrix S.

A. 144
B. 240
C. -144
D. -240 (2 marks)

29. Find the inverse of matrix S.

A. $\begin{pmatrix} -1/12 & 1/18 \\ 1/6 & -1/36 \end{pmatrix}$

B. $\begin{pmatrix} -1/12 & 1/18 \\ 1/6 & 1/36 \end{pmatrix}$

C. $\begin{pmatrix} -1/12 & -1/18 \\ -1/6 & -1/36 \end{pmatrix}$

D. $\begin{pmatrix} 1/12 & -1/18 \\ -1/6 & 1/36 \end{pmatrix}$

(2 marks)

30. Find $S.S^{-1}$.

A. $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

B. $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

C. $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

D. $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ (2 marks)

31. Solve the following pair of equations:
$3a + 4m = 0$
$a = 2m - 5$

A. a = 7.5
m = -5.625

B. a = -2
m = 1.5

C. a = 0
m = 0

D. a = 2
m = -1.5 (2 marks)

Use the data below to answer question 32 and question 33.

A curve passes through the point (-3, 7) and its gradient at any point is given by $6x^2 + 10x - 7$

32. Find the equation of the curve.

A. $y = 12x + 10 + C$
B. $y = 2x^3 + 5x^2 – 7x + C$
C. $y = 6x^2 + 10x – 7 + C$
D. $y= 6x^3 + 10x^2 – 7x + C$ (2 marks)

33. Find the value of the constant.
A. -7
B. 7
C. -5
D. 5 (2 marks)

34. Find the maximum value of y on the curve $y = 4x - x^2$.
A. 4
B. 2
C. -1
D. -4 (2 marks)

35. If $y = 3x^2 - 6x + 1$

Find y when x = -2.
A. 1
B. 25
C. -5
D. -23 (2 marks)

36. A categorical scale without any order or priority like gender, marital status or home town is called _____.
A. Normal scale
B. Ordinal scale
C. Interval scale
D. Ratio scale (2 marks)

37. With reference to measurement scale, students score in an exam is represented using _____.
A. Interval scale
B. Ratio scale
C. Ordinal scale
D. Normal scale (2 marks)

38. Which one of the following is an alternative name for identity matrix?
A. Elementary matrix
B. Singular matrix
C. Scalar matrix
D. Null matrix (2 marks)

39. If $y = 3x^2 + x$, find $\frac{dy}{dx}$ when x = 1.
A. 4
B. 6
C. 3
D. 7 (2 marks)

40. Find the slope of the line given by the equation; 7x + 4y = 8.
A. 7
B. 4
C. $-\frac{7}{4}$
D. $\frac{4}{7}$ (2 marks)

41. Find the y intercept of the line given by the equation; 7x + 4y = 8
A. 8
B. 2
C. 4
D. 7 (2 marks)

42. Find the equation of the line through the points (-2, 5) and (7, 1).
A. $y = -\frac{4}{9}x + \frac{37}{9}$
B. $y = \frac{4}{9}x - \frac{37}{9}$
C. $y = -\frac{4}{9}x + \frac{37}{9}$
D. $y = 5x + 6$ (2 marks)

43. Find the slope-intercept equation of the line through (1, 4) and rising 5 units for each unit increase in x.
A. $y = 5x + 4$
B. $y = 5x - 1$
C. $y = 5x + 1$
D. $y = 5x - 4$ (2 marks)

Use the following information to answer question 44 to question 46.

It has been determined that at a price of Sh.880, 2,000 units of a certain consumer product will be sold, while at a reduced price of Sh.380, 12,000 units will be sold.

44. Determine the linear demand function.
A. $P = 980 - 0.05q$
B. $P = 880 - 0.05q$
C. $P = 380 + 0.05q$
D. $P = 880 + 0.05q$ (2 marks)

45. Determine the quantity to be sold in order to minimise revenue.
A. 12,000
B. 9,800
C. 10,900
D. 2,000 (2 marks)

46. Determine the price to be charged at maximum revenue.
A. Sh.380
B. Sh.880
C. Sh.490
D. Sh.435 (2 marks)

47. If events cannot occur simultaneously, they are called _____.
A. Exhaustive events
B. Equally likely events
C. Independent events
D. Mutually exclusive events (2 marks)

48. In a statistical survey, you are asked to rate the performance of your member of National Assembly as poor, average, good or excellent.

What type of measurement scale is this?
A. Normal scale
B. Ordinal scale
C. Interval scale
D. Ratio scale (2 marks)

49. If an event consists of more than one single point of the sample space, then such an event is called _____.
A. Complementary events
B. Compound events
C. Simple events
D. Exhaustive events (2 marks)

50. The scale measurement that includes equal intervals between values but lacks a true zero is known as _____.
A. Nominal scale
B. Ordinal scale
C. Interval scale
D. Ratio scale (2 marks)

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DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 22 August 2023. Morning Paper. **Time Allowed: 2 hours.**

Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. This paper is made up of fifty (50) Multiple Choice Questions. Each question is allocated two (2) marks.

1. You are given the following matrices:

$B = \begin{pmatrix} 8 & 6 & 2 \\ 5 & 4 & 0 \end{pmatrix}$ $C = \begin{pmatrix} 3 & 11 \\ 2 & 0 \\ 7 & 4 \end{pmatrix}$

Evaluate $C + B^T$

A. $\begin{pmatrix} 11 & 17 \\ 7 & 4 \end{pmatrix}$

B. $\begin{pmatrix} 11 & 8 & 9 \\ 16 & 4 & 4 \end{pmatrix}$

C. $\begin{pmatrix} 11 & 16 \\ 8 & 4 \\ 9 & 4 \end{pmatrix}$

D. Incompatible (2 marks)

2. If $A = \begin{pmatrix} 2 & 4 \\ 8 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 5 \\ 4 & 3 \end{pmatrix}$. Find $3A - 4B$

A. $\begin{pmatrix} -2 & 8 \\ -8 & -6 \end{pmatrix}$

B. $\begin{pmatrix} 1 & -1 \\ 4 & 3 \end{pmatrix}$

C. $\begin{pmatrix} 2 & -8 \\ 8 & 6 \end{pmatrix}$

D. $\begin{pmatrix} -2 & 8 \\ -8 & -6 \end{pmatrix}$ (2 marks)

3. Find the inverse of $\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$

A. $2\begin{pmatrix} 3 & -1 \\ -4 & 2 \end{pmatrix}$

B. $\frac{1}{2}\begin{pmatrix} -2 & 4 \\ 1 & 3 \end{pmatrix}$

C. $^{1}/_{2}\begin{pmatrix} 3 & -1 \\ -4 & 2 \end{pmatrix}$

D. $^{1}/_{2}\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$ (2 marks)

Use the following information to answer question 4 and question 5.

The 2 x 2 matrices A, B and C are given below:

$A = \begin{pmatrix} x & 2 \\ 3 & 7 \end{pmatrix}$ $B = \begin{pmatrix} 2 & 4 \\ y & 2 \end{pmatrix}$ $C = \begin{pmatrix} -1 & -2 \\ 3 & 2 \end{pmatrix}$

Given that $2A - 3B = 4C$

4. Find the value of x.
   A. -1
   B. 1
   C. 3
   D. 6 (2 marks)

5. Find the value of y.
   A. -2
   B. 0
   C. 2
   D. 6 (2 marks)

6. Determine the equation of the straight line which passes through the points (10, 20) and has a gradient of -5.
   A. $y = -5x + 110$
   B. $y = -5x - 70$
   C. $y = -5x + 70$
   D. $y = -5x + 20$ (2 marks)

7. Find the equation for the line that passes through the points (30, 60) and (-90, -60).
   A. $y = -x + 30$
   B. $y = -90x - 60$
   C. $y = 30x - 60$
   D. $y = 30 + x$ (2 marks)

The following data is an extract of demand and supply pattern for product "Gloss" produced by a company during the month of July 2023:

Quantity (units)	200	600
Demand price (Sh.)	580	540
Supply price (Sh.)	205	215

Use the data to answer question 8 to question 11:

8. Determine the linear demand function.
   A. $P = 620 - 0.2q$
   B. $P = 660 - 0.2q$

C. $P = 540 - 0.9q$
D. $P = 600 - 0.1q$ (2 marks)

9. Determine the linear supply function.
A. $P = 200 + 0.025q$
B. $P = 201 + 0.02q$
C. $P = 203 + 0.02q$
D. $P = 201 - 0.02q$ (2 marks)

10. Determine the market equilibrium quantity.
A. 600
B. 6,400
C. 3,200
D. 200 (2 marks)

11. Determine the market equilibrium price.
A. 200
B. 280
C. 580
D. 600 (2 marks)

12. Find the derivative of the function:
$Y = 8x^2 - 4x^{-3}$

A. $16x - 12x^{-4}$
B. $16x + 12x^{-4}$
C. $16x - 12x^{-2}$
D. $16x + 12x^{-2}$ (2 marks)

The marginal revenue (MR) of a certain company is given by the function:

Where: $MR = 4x^3 + 3x^2 + x + 15$ within the production interval of $4 \leq x \leq 15$
MR = Marginal Revenue

Use the above information to answer question 13 and question 14:

13. Determine the total revenue function.
A. $x^4 + x^3 + {}^1/_2\, x^2 + 15x$
B. $12x^2 + 6x + 1$
C. $2x^2 + 3x + {}^1/_2 x + 15x$
D. $4x^4 + 3x^3 + x^2 + 15x$ (2 marks)

14. Determine the total revenue within the stated sales limit.
A. 404
B. 54,158.5
C. 54,562.5
D. 2,624 (2 marks)

A doctor collects data on his patients and notes whether or not patients were at risk of getting high blood pressure and whether or not the patient exercised regularly. Of all 112 patients that were at risk of getting high blood pressure, 78 did not exercise regularly. Of all the 127 patients that did not exercise regularly, 49 were not at risk of getting high blood pressure. The total number of patients examined was 246.

You are required to use the above information to answer question 15 to question 18:

15. Determine the probability that a patient was at risk of getting high blood pressure.
A. ${}^{34}/_{112}$
B. ${}^{78}/_{112}$
C. ${}^{112}/_{246}$
D. ${}^{134}/_{246}$ (2 marks)

16. Determine the probability that the selected patient neither had a risk of getting high blood pressure nor did not exercise regularly.
    A. $^{49}/_{134}$
    B. $^{49}/_{127}$
    C. $^{127}/_{246}$
    D. $^{49}/_{246}$ (2 marks)

17. Determine the probability that the selected patient was at risk of getting high blood pressure given that he exercised regularly.
    A. $^{34}/_{119}$
    B. $^{34}/_{112}$
    C. $^{34}/_{246}$
    D. $^{78}/_{246}$ (2 marks)

18. Determine the probability that a selected patient either was at risk of getting high blood pressure or exercised regularly.
    A. $^{112}/_{246}$
    B. $^{119}/_{246}$
    C. $^{231}/_{246}$
    D. $^{197}/_{246}$ (2 marks)

A Supermarket shelf contains 200 plates and cups of which 150 are white in colour, while the rest are blue. There are a total of 160 plates in the shelf of which 120 are white.

An item is picked at random from the shelf.

Use the above information to answer question 19 to question 22:

19. The probability that an item picked is white given that it is a plate.
    A. 0.25
    B. 0.60
    C. 0.75
    D. 0.9375 (2 marks)

20. The probability that the item picked is a cup which is blue in colour.
    A. 0.05
    B. 0.20
    C. 0.25
    D. 0.75 (2 marks)

21. The probability that the item picked is blue in colour given that it is a plate.
    A. 0.2
    B. 0.25
    C. 0.3125
    D. 0.75 (2 marks)

22. The probability that the item picked is a plate and white in colour.
    A. 0.25
    B. 0.6
    C. 0.75
    D. 0.9375 (2 marks)

23. Which one of the following statistical measures is highly affected by extreme values?
    A. Arithmetic mean
    B. Median
    C. Mode
    D. Harmonic mean (2 marks)

24. All possible outcomes of an experiment are referred to as _____.

A. Mutually inclusive events
B. Mutually exclusive events
C. Collectively exhaustive events
D. Independent events (2 marks)

The Arithmetic mean of 5 observations: -4, 0, x, 9 and 18 is found to be 6.

Use the above information to answer question 25 to question 28:

25. Determine the value of x.
A. 1
B. 5
C. 6
D. 7 (2 marks)

26. Compute the range for the data.
A. 4
B. 14
C. 18
D. 22 (2 marks)

27. Compute the standard deviation for the data.
A. 3.74
B. 4.69
C. 2.45
D. 7.62 (2 marks)

28. Compute the coefficient of variation for the data.
A. 21.26%
B. 27%
C. 78.74%
D. 127% (2 marks)

29. Which one of the following is a probabilistic sampling method?
A. Convenience sampling
B. Judgmental sampling
C. Quota sampling
D. Simple random sampling (2 marks)

30. Respective class frequencies expressed as a percentage of the total frequencies is known as _____?
A. Class marks
B. Cummulative frequencies
C. Frequency density
D. Relative frequencies (2 marks)

The data below is an extract of the electricity cost in thousands of shillings incurred by 80 coffee processing factories:

Electricity cost (Sh."000")	**Number of companies**
4 - 8	20
8 - 12	x
12 - 16	24
16 - 20	y

Use the above information to answer question 31 to question 35:

31. Determine the value of x given that the median cost is Sh.10,500.

A. 10
B. 30
C. 32
D. 36 (2 marks)

32. Determine the value of y.

A. 0
B. 4
C. 6
D. 26 (2 marks)

33. Determine the lower quartile value in Sh."000".
A. 4
B. 6
C. 8
D. 20 (2 marks)

34. Determine the 75^{th} percentile value in Sh."000".
A. 12
B. 13
C. 14
D. 16 (2 marks)

35. Determine the semi-interquartile range in Sh."000".
A. 2.5
B. 4
C. 5
D. 8 (2 marks)

36. The following are methods of primary data collection. Which one is **NOT**?
A. Corporate database
B. Experimentation
C. Observation
D. Survey method (2 marks)

37. Classification where data is arranged at regular time interval is called _____.
A. Chronological
B. Geographical
C. Quantitative
D. Qualitative (2 marks)

38. The graph which is formed when successive mid points in a histogram are connected by straight line is known as?
A. Cumulative frequency curve
B. Frequency curve
C. Frequency polygon
D. Ogive (2 marks)

39. Given that the mean of x, x+2, x+4, x+6 and x+8 is 12. Calculate the mean of the last 3 observations.
A. 11
B. 14
C. 15
D. 17 (2 marks)

40. Which of the following is **NOT** an advantage of median?
A. It is rigidly defined
B. It is least affected by extreme values
C. It is based on all values
D. It is easy to compute and understand (2 marks)

41. With reference to measurement scales, the temperature at any given day is represented using _____.
A. Interval scale
B. Nominal scale
C. Ordinal scale
D. Ratio scale (2 marks)

42. Which of the following variable is measured using ordinal scale?
A. Annual family income
B. Number of pairs of shoes owned
C. Students' excel skills
D. Students score in mathematics exam (2 marks)

43. A statistical results obtained from studying a fraction of the population are called?
A. Sample mean
B. Sample parameter
C. Sample statistics
D. Population parameters (2 marks)

44. Which of the following represents a continuous variable?
A. Number of cell phones in the household
B. Number of online purchase made in a month
C. Number of text books purchased
D. Time in hours spent surfing the internet per week (2 marks)

45. An event in probability that will never occur is known as?
A. Certain event
B. Uncertain event
C. Impossible event
D. Unlikely event (2 marks)

46. What is the probability of getting an even number if a dice is tossed?
A. $^1/_6$
B. $^1/_3$
C. $^1/_2$
D. 2 (2 marks)

47. The Head teacher of a school wishes to assess the overall efficiency of teachers by asking 1,000 students to rate the teachers' presentation skills. He selected 5 students from each of the 20 classes in the school. Which kind of sampling is this?
A. Cluster sampling
B. Simple random sampling
C. Stratified sampling
D. Systematic sampling (2 marks)

48. The Human Resource Manager of ABC Ltd. wants to find out the cause for low level motivation among workers. He selects all the employees from the ICT Department and administered questions to all of them. Which kind of sampling is it?
A. Cluster sampling
B. Quota sampling
C. Simple random sampling
D. Systematic sampling (2 marks)

49. A method of sampling where the investigator selects items that are easy and inexpensive to sample is referred to as?
A. Convenience sampling
B. Judgmental sampling
C. Quota sampling
D. Snowball sampling (2 marks)

50. A plot of the class frequencies on the vertical axis alongside the respective class size on the horizontal axis using vertical adjacent rectangle is called _____.
A. Component bar chart
B. Frequency histogram
C. Multiple bar chart
D. Simple bar chart (2 marks)

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DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 25 April 2023. Morning Paper. **Time Allowed: 2 hours.**

Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. This paper is made up of fifty (50) Multiple Choice Questions. Each question is allocated two (2) marks.

1. Solve the following pair of simultaneous equations:

$5x + 2y = 34$

$x + 3y = 25$

A. $x = -7, \quad y = 4$
B. $x = 2, \quad y = 12$
C. $x = 4, \quad y = 7$
D. $x = 7, \quad y = 6$

2. How many solutions does a linear equation have?
A. One
B. Two
C. Three
D. Four

3. Point (6,8) lies on the graph of the equation $9y = Kx + 24$. Find the value of K.
A. 3.75
B. 6
C. 8
D. 16

4. The graph of the linear function $3x + 6y = 6$ cuts the y axis at?
A. $^{-}½$
B. 1
C. 3
D. 6

5. The graph of $x = 4$ is a line
A. Parallel to the x - axis
B. Parallel to the y - axis
C. Has an intercept 4 on the x - axis
D. Has an intercept 4 on the y - axis

6. Expand the bracket and simplify the expression $(a + b)^2 - ab$
A. $a^2 + ab + b^2$
B. $a^2 + b^2 + 3ab$
C. $2a + 2b - ab$
D. $a^2 + b^2 - ab$

7. Find the equation for the straight line that has a slope of 8 and goes through the point $(2, {}^{2}/_{3})$
A. $y = 8x - {}^{46}/_{3}$
B. $y = {}^{46}/_{3} - 8x$
C. $y = 2 + {}^{2}/_{3x}$
D. $y = {}^{2}/_{3} - 2x$

8. Given the equation $16x + 12y - 28 = 0$. What is the slope?
   A. 16
   B. $^{-4}/_{3}$
   C. $^{7}/_{3}$
   D. 28

9. Find the inverse $\left(A^{-1}\right)$ of the Matrix A = $\begin{pmatrix} 10 & 38 \\ 2 & 8 \end{pmatrix}$
   A. $\begin{pmatrix} 2 & 9.5 \\ 0.5 & 2.5 \end{pmatrix}$
   B. $\begin{pmatrix} 2.5 & 9.5 \\ 0.5 & 2 \end{pmatrix}$
   C. $\begin{pmatrix} 2 & -9.5 \\ -0.5 & 2.5 \end{pmatrix}$
   D. $\begin{pmatrix} 10 & 2 \\ 38 & 8 \end{pmatrix}$

10. Given that A = $\begin{pmatrix} 3 & 5 \\ x & 7 \end{pmatrix}$ B = $\begin{pmatrix} 3 & 5 \\ 2 & 4 \end{pmatrix}$ and AB = $\begin{pmatrix} 19 & 35 \\ 20 & 38 \end{pmatrix}$

    Find the value of x.

    A. –2
    B. 2
    C. 10
    D. 18

11. The order of matrix A is (4 x 2) and that of matrix B is (2 x 3). Find the order of matrix AB
    A. 2 x 2
    B. 4 x 3
    C. 4 x 2
    D. 2 x 3

12. A matrix with self-transpose is referred to as _____.
    A. Diagonal matrix
    B. Square matrix
    C. Symmetric matrix
    D. Scalar matrix

13. The determinant of an identity matrix is _____.
    A. -1
    B. 0
    C. 1
    D. 2

14. If the determinant of a matrix **A** is zero, then
    A. A is a singular matrix
    B. A is a non-singular matrix
    C. A is an identity matrix
    D. A is a square matrix

15. Given that $A = \begin{pmatrix} 5 & Y \\ 3 & 4 \end{pmatrix}$ and $A^{-1} \begin{pmatrix} -4 & -7 \\ 3 & -5 \end{pmatrix}$

Find Y:

A. 3
B. 4
C. 5
D. 7

16. It has been observed that 3 out of every 10 customers approached will buy a product. The probability of a customer buying a product is therefore $^{3}/_{10}$.
This conclusion is obtained on the basis of:

A. Axiomatic approach
B. Priori approach
C. Relative frequency approach
D. Subjective approach

17. Peter Juma concludes that there is a 20% chance that it will rain tomorrow. This conclusion is obtained on the basis of:

A. Classical approach
B. Objective approach
C. Relative approach
D. Subjective approach

A poll was conducted of a sample of 400 voters to determine whether they were in favour of Candidate B who was contesting for the position of MCA in a particular county. The results were divided according to their ages.

The following results were obtained:

Opinion / Age	In favour of Candidate B	Not in favour of Candidate B	No Opinion
Below 30 years	70	30	2
Between 30 and 60 years	50	80	10
Above 60 years	94	60	4

Use the above data to answer question 18 to question 20:

A voter is selected in random.

18. What is the probability that a voter is below 30 years and in favour of Candidate B?

A. $^{70}/_{214}$
B. $^{70}/_{400}$
C. $^{70}/_{102}$
D. $^{102}/_{400}$

19. What is the probability that a voter is not in favour of Candidate B given that he is between 30 and 60 years?

A. $^{80}/_{140}$
B. $^{50}/_{214}$
C. $^{50}/_{400}$
D. $^{214}/_{400}$

20. What is the probability that a voter is above 60 years or had no opinion?

A. $^{4}/_{400}$
B. $^{188}/_{400}$
C. $^{170}/_{400}$
D. $^{174}/_{400}$

21. What is the total number of possible outcomes following a simultaneous tossing of 3 coins?
    A. 3
    B. 6
    C. 8
    D. 9

22. Two coins are tossed at the same time. Determine the sample space

A.	H	T	H	T
B.	HT	HT	HT	HT
C.	HH	TT	HH	TT
D.	HH	HT	TH	TT

A bag contains 5 red marbles and 2 blue marbles. 2 marbles are picked at random one after another without replacement.

Use the above information to answer Question 23 to Question 26.

23. What is the probability that the second marble selected is blue given that the first marble selected was red?
    A. $^1/_6$
    B. $^2/_6$
    C. $^5/_{21}$
    D. $^4/_6$

24. What is the probability of no red marble is selected?
    A. $^4/_{49}$
    B. $^5/_{21}$
    C. $^1/_{21}$
    D. $^{20}/_{21}$

25. What is the probability of getting at least one red marble?
    A. $^{45}/_{49}$
    B. $^5/_{21}$
    C. $^{20}/_{21}$
    D. $^{10}/_{21}$

26. What is the probability that one marble is red and the other marble is blue?
    A. $^{10}/_{21}$
    B. $^{11}/_{21}$
    C. $^5/_{21}$
    D. $^1/_{21}$

27. Find the following indefinite integral

$$\int (3 + 2x + 9x^2 - 4x^3)\,dx$$

    A. $2 + 18x - 12x^2 + C$
    B. $3x + x^2 + 3x^3 - x^4 + C$
    C. $3x + 2x^2 + 9x^3 - 4x^4 + C$
    D. $^3/_x + 2 + 9x - 4x^2 + C$

28. Differentiate $y = 20x^{-5} + 19$
    A. $100x^{-6}$
    B. $100x^{-4}$
    C. $-100x^{-6}$
    D. $-100x^{-4}$

29. Find $\int 6x\,(x^2 + 6)\,dx$

A. $\frac{3x^4}{2} + 18x + C$

B. $\frac{3x^4}{2} - 18x^2 + C$

C. $\frac{3x^4}{2} + 18x^2 + C$

D. $\frac{3x^4}{2} + x^2 + C$

A company's cost function is given as C = 45,000 + 10x while its revenue function is given as K = 25x

Use the above information to answer Question 30 to Question 32.

30. Determine the profit function

A. 35x - 45,000
B. 15x + 45,000
C. 35x + 45,000
D. 15x - 45,000

31. What is the break-even number of units?

A. 1,285
B. 1,800
C. 3,000
D. 4,500

32. What level of output is required to earn a profit of Sh.15,000?

A. 1,000
B. 2,000
C. 4,000
D. 4,500

33. If y = 40, Find dy/dx

A. -40
B. 0
C. 1
D. $^1/_{40}$

34. Given that $y = 24x^3 - 12x^2 + 40x - 200 + 12x^{-2}$

Find dy/dx

A. $72x^2 - 24 + 40x - 24x^{-1}$
B. $72x^2 - 24x + 40 - 24x^{-3}$
C. $72x^2 - 24x + 40 - 2x^{-1}$
D. $72x^2 - 24x + 40 - 200 - 12x^{-3}$

35. Observation method is _____.

A. When the researcher watches the group but does not ask any question
B. When the researcher watches the group and asks questions
C. When the researcher participates in the activities and asks questions
D. When the researcher asks questions but does not participate in the activities of the group

36. An unstructured interview is_____.

A. Rigid in its content
B. Flexible in the questions and how they are modeled
C. Predetermined in structure
D. Closed in question and question order

37. Which of the following aspects is an advantage of mailed questionnaires?
    A. Cost is lower
    B. High response rate
    C. Possibility of misinterpreting the question
    D. Responses are representative of the population

38. Which of the following is an advantage of a closed question?
    A. Easier to analyse
    B. Provides indepth information
    C. Respondents can be mechanical
    D. Respondents can express themselves

39. How much money do you spend on beer each week? This is an example of a(n) _____question.
    A. Double-barrelled
    B. Presumptuous
    C. Rhetorical
    D. Open-ended

40. Which of the following is affected by extreme values?
    A. Arithmetic mean
    B. Median
    C. Mode
    D. Quartile deviation

The time in seconds required to complete a specific task by a new machine is given as follows:

30, 27, 35, 40 and 38

Use the above data to answer Question 41 to Question 43.

41. Calculate the range for the data
    A. 8
    B. 13
    C. 34
    D. 40

42. Calculate the variance for the data
    A. 4.86
    B. 8
    C. 23.6
    D. 34

43. Calculate the co-efficient of variation for the data
    A. 4.85%
    B. 14.26%
    C. 34%
    D. 69.41%

Consider the following form of grouping for a certain frequency distribution table:

Class
10-14
15-19
20-24

Use the above data to answer question 44 to question 46

44. The form of grouping is known as _____.
    A. Exclusive
    B. Continuous
    C. Inclusive
    D. Definite

45. The class width for the second class is?
    A. 3.5
    B. 4
    C. 4.5
    D. 5

46. The lower limit for the second class is?
    A. 14.5
    B. 15
    C. 19
    D. 19.5

The following data relate to the scores of students in a mathematical concepts examination:

Scores	**Number of students**
20	4
30	5
40	16
55	12
60	8
75	5

Use the data to answer question 47 to question 50

47. Determine the median scores
    A. 30
    B. 40
    C. 47.5
    D. 55

48. Calculate the first quartile value
    A. 12.5
    B. 20
    C. 30
    D. 40

49. Determine the upper quartile value
    A. 37.5
    B. 55
    C. 60
    D. 75

50. Calculate the quartile deviation
    A. 12.5
    B. 10
    C. 25
    D. 30

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DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 6 December 2022. Morning Paper. **Time Allowed: 2 hours.**

Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. This paper is made up of fifty (50) Multiple Choice Questions. Each question is allocated two (2) marks.

1. A bookshop buys 100 pens. Some cost Sh.10 and others Sh.14. If the bookshop spent Sh.1,300 in total, how many pens costing Sh.10 did the bookshop buy?
   A. 25
   B. 46
   C. 54
   D. 75 (2 marks)

2. Find the equation of the straight line passing through the point A(3, 8) and with a gradient of –15.
   A. $Y = -15x - 53$
   B. $Y = -37 + 15x$
   C. $Y = -37 - 15x$
   D. $Y = 53 - 15x$ (2 marks)

3. Given the formula $Y = ax + 20x^2$, make "a" the subject of the formula.
   A. $a = {}^{y}/_{X} + 20x$
   B. $a = {}^{y}/_{X} - 20x$
   C. $a = -{}^{y}/_{X} - 20x$
   D. $a = {}^{y}/_{X} - 20$ (2 marks)

4. Using the data in question 3 above, determine the value of "a" when $Y = 500$ and $X = 2$.
   A. –270
   B. –210
   C. 230
   D. 290 (2 marks)

5. Find the value of X which satisfies the equation $2x - 2y = 10$ and $4x + 2y = 14$
   A. –4
   B. –2
   C. 2
   D. 4 (2 marks)

6. If, $A = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and $B = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$ Find X if, $A + X = 4B$

A. $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$

B. $\begin{pmatrix} -2 \\ 7 \end{pmatrix}$

C. $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$

D. $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$

(2 marks)

Use the data below to answer question 7 to 10.

Given that $A = \begin{pmatrix} 3 & -3 \\ 6 & -9 \end{pmatrix}$ $B = \begin{pmatrix} w & x \\ y & z \end{pmatrix}$ and $C = \begin{pmatrix} 9 & 3 \\ -6 & 3 \end{pmatrix}$

If, A X B = C

7. Find the value of w.
A. 8
B. 11
C. 1
D. 2

(2 marks)

8. Find the value of x.
A. 2
B. 8
C. 1
D. 11

(2 marks)

9. Find the value of y.
A. 5
B. 11
C. 2
D. 8

(2 marks)

10. Find the value of z.
A. 2
B. 8
C. 1
D. 11

(2 marks)

11. Find the area bound by the function $Y = 5x$.
A. 10
B. 15
C. 52.5
D. 62.5

(2 marks)

A company's cost function is given as $C = x^2 + 240x + 100$, while the revenue function is given by the equation $R = 500x - 4x^2$

Use the information to answer Question 12 to Question 15.

12. Determine the profit function for the company.
    A. $-5x^2 + 740x + 100$
    B. $-5x^2 + 740x - 100$
    C. $5x^2 - 260x - 100$
    D. $-5x^2 + 260x - 100$ (2 marks)

13. Determine the number of units to have a maximum profit.
    A. 26
    B. 52
    C. 74
    D. 148 (2 marks)

14. Determine the maximum profit for the company.
    A. 3, 280
    B. 3, 380
    C. 10, 296
    D. 27,280 (2 marks)

15. Determine the price charged at maximum profit.
    A. 204
    B. 292
    C. 396
    D. 500 (2 marks)

16. Given that $Y = u.V$ and both u and V are functions of x, then using product rule of differentiation, find dy/dx.

    A. $u.\frac{dV}{dx} - V.\frac{du}{dx}$

    B. $u.\frac{dV}{dx} + V.\frac{du}{dx}$

    C. $\frac{dV}{dx} \times \frac{du}{dx}$

    D. $V\frac{du}{dx} - u.\frac{dV}{dx}$ (2 marks)

17. Find the derivative of the function; $y = 120x + 300x^2 - 6x^3 + 12{,}000$
    A. $120 + 300x + 6x^2 + C$
    B. $120 + 600x - 18x^2 + C$
    C. $120 + 600x^3 - 18x^4 + C$
    D. $120x^2 + 100x^3 - 2x^2 + 12{,}000x + C$ (2 marks)

18. A coin is tossed twice and the outcomes noted. What is the probability that both outcomes are heads?
    A. ¼
    B. ½
    C. ¾
    D. 1 (2 marks)

19. Given that P(A) = 0.4, P(B) = 0.5 and P(A and B) = 0.2

Find P(A) or P(B)
A. 0.9
B. 0.2
C. 0.7
D. 0.1 (2 marks)

20. Three unbiased coins are tossed simultaneously.

Find the sample space
A. 3
B. 6
C. 8
D. 9 (2 marks)

John Barasa is independently working on two separate jobs. The probability that either of the jobs will be completed on time is 0.4.

Use the above information to answer Question 21 to Question 24.

21. Find the probability that both jobs will be completed on time.
A. 0.8
B. 0.16
C. 0.24
D. 0.36 (2 marks)

22. Find the probability that neither of the jobs will be completed on time.
A. 0.24
B. 0.36
C. 0.84
D. 0.48 (2 marks)

23. Find the probability that at least one of the jobs will be completed on time.
A. 0.36
B. 0.24
C. 0.48
D. 0.64 (2 marks)

24. Find the probability that exactly one of the jobs will be completed on time.
A. 0.16
B. 0.24
C. 0.48
D. 0.64 (2 marks)

In a period of 200 days, the following number of sales were recorded:

Number of sales (units)	0	1	2	3
Number of days	28	56	56	36

Use the data above to answer Question 25 to Question 27.

25. What is the probability that on any one day there will be no units sold?
A. 0.28
B. 0.14
C. 0.86
D. 0.72 (2 marks)

26. What is the probability that on any one day there will be more than 3 units sold?
A. 0.12
B. 0.18
C. 0.88
D. 0.82 (2 marks)

27. What is the probability that on any one day there will be less than 3 units sold?
A. 0.30
B. 0.70
C. 0.12
D. 0.88 (2 marks)

In a class of 140 students, 28 are female students and are studying information technology. There are 76 male students in the class out of which 44 do not study information technology. A student is selected at random.

Use the information above to answer Question 28 to Question 30.

28. Determine the probability that a student studies information technology given that the student is a male.
A. $^{32}/_{60}$
B. $^{32}/_{140}$
C. $^{32}/_{76}$
D. $^{104}/_{140}$ (2 marks)

29. Determine the probability that a student studies information technology or the student is a female.
A. $^{28}/_{140}$
B. $^{96}/_{140}$
C. $^{124}/_{140}$
D. $^{28}/_{64}$
(2 marks)

30. Determine the probability that the student is male and studies information technology.
A. $^{32}/_{140}$
B. $^{32}/_{76}$
C. $^{32}/_{60}$
D. $^{136}/_{140}$
(2 marks)

Use the information below to answer Question 31 to Question 35.

Given the observations: –10 –5 0 15 and 20.

31. Determine the range of the data.
A. –30
B. 10
C. 20
D. 30 (2 marks)

32. Determine the arithmetic mean for the data.
A. 0
B. 4
C. 5
D. 10 (2 marks)

33. What is the variance for the data?
A. 9.27
B. 11.58
C. 86
D. 134 (2 marks)

34. What is the coefficient of variation for the data?
    A. 2.99%
    B. 33.5%
    C. 34.54%
    D. 289.40% (2 marks)

35. Determine the quartile deviation for the data.
    A. 10
    B. 15
    C. 20
    D. 30 (2 marks)

The following table gives the distribution of ages of 50 workers in a certain factory.

Age (years)	**Frequency (Number of workers)**
20 – 25	12
25 – 30	X
30 – 35	8
35 – 40	Y

Use the data to answer Question 36 to Question 39.

36. Determine the value of X given that the mean is 29.1.
    A. 8
    B. 10
    C. 20
    D. 22 (2 marks)

37. Determine the value of Y.
    A. 8
    B. 10
    C. 22
    D. 32 (2 marks)

38. Determine the mode for the data.
    A. 20
    B. 25
    C. 27
    D. 30 (2 marks)

39. Determine the median for the data.
    A. 20.50
    B. 27.60
    C. 28.25
    D. 30 (2 marks)

40. Which one of the following graphs can be used to estimate the median of a distribution?
    A. Frequency polygon
    B. Lorenz curve
    C. Percentage ogive
    D. Frequency histogram (2 marks)

41. Which one of the following is not an advantage of median?
    A. It is rigidly defined.
    B. It works well with open-ended distributions.
    C. It is based on all distributions.
    D. It can be determined graphically.

42. The probability of an event occurring given that another event has already occurred is called_____.
A. Conditional probability
B. Joint probability
C. Marginal probability
D. Compound probability (2 marks)

43. The total of all possible outcomes of an experiment is referred to as_____.
A. Even
B. Outcomes
C. Sample space
D. Possibility space (2 marks)

44. Which one of the following sampling methods is a probabilistic sampling technique?
A. Convenience sampling
B. Quota sampling
C. Simple random sampling
D. Snowball sampling (2 marks)

45. The matrix $\begin{pmatrix} 0 & 8 \\ 8 & 0 \end{pmatrix}$ is a _____ matrix.

A. Diagonal matrix
B. Identity matrix
C. Scalar matrix
D. Symmetric sampling (2 marks)

46. The graph of X = – 10 is a line parallel to:
A. X - axis
B. Y - axis
C. The line x = 10
D. Both X and Y axis (2 marks)

47. A list of the entire population from which items are selected to form a sample is called?
A. Census
B. Statistics
C. Sampling frame
D. Parameters (2 marks)

48. A plot of cumulative frequency against lower class boundaries is known as?
A. Frequency curve
B. Frequency histogram
C. Less than ogive
D. More than ogive

(2 marks)

49. Which one of the following variables is discrete?
A. Weight of students in a class
B. Height of students in a class
C. Number of debtors sampled
D. Prices of shares sold at the stock exchange (2 marks)

50. Which one of the following is not a method of collecting primary data?

A. Abstraction from records
B. Telephone interview
C. Postal questionnaire
D. Questionnaire by enumerator

(2 marks)

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DIPLOMA IN DATA MANAGEMENT AND ANALYTICS (DDMA)

LEVEL II

MATHEMATICAL CONCEPTS IN DATA SCIENCE

TUESDAY: 2 August 2022. Morning paper. **Time Allowed: 3 hours.**

The paper is made up of fifty (50) multiple choice questions. Answer ALL questions by indicating the letter (A, B, C or D) that represents the correct answer. Each question is allocated two (2) marks.

1. A unit matrix is a _____.
   A. square matrix whose elements have value 0 except for those on the main diagonal which have value 1
   B. matrix have one column
   C. square matrix whose elements have value of 0 except for those in the secondary diagonal which have value 1
   D. matrix whose elements are all equal to one (2 marks)

2. The following matrix, gives the price of comparable articles by size and type in Sh.:

$$X = \begin{matrix} \\ A \\ B \end{matrix} \begin{pmatrix} P & Q \\ 4 & 3 \\ 7 & 11 \end{pmatrix}$$

   If all prices increased four times, what would be the new price matrix?

   A. $\begin{pmatrix} 8 & 7 \\ 11 & 15 \end{pmatrix}$ B. $\begin{pmatrix} 44 & 56 \\ 28 & 72 \end{pmatrix}$

   C. $\begin{pmatrix} 40 & 60 \\ 15 & 23 \end{pmatrix}$ D. $\begin{pmatrix} 16 & 120 \\ 28 & 44 \end{pmatrix}$ (2 marks)

3. Which of the following statements is **NOT** true about matrix?
   A. Matrix can consist of any number of complete row and column
   B. The value at the intersection of a row and column is referred to as a call
   C. A square matrix is one that has the same element in either row or column
   D. The value of a matrix are normally enclosed within a bracket (2 marks)

4. The inverse of a matrix is written as_____.
   A. A^{-1}
   B. A1
   C. Both A and B are correct
   D. None of the above (2 marks)

5. If $A = \begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 2 \\ 4 & -0 \end{pmatrix}$

Find AB

A. $\begin{pmatrix} 8 & 7 \\ 11 & 15 \end{pmatrix}$ B. $\begin{pmatrix} 44 & 56 \\ 28 & 72 \end{pmatrix}$

C. $\begin{pmatrix} 40 & 60 \\ 15 & 23 \end{pmatrix}$ D. $\begin{pmatrix} 16 & 120 \\ 28 & 44 \end{pmatrix}$ (2 marks)

6. ABC Ltd. has two branches A and B, each carrying stock of a particular item as follows:

$$A = \begin{matrix} \\ \text{Pink} \\ \text{Yellow} \end{matrix} \begin{matrix} \textbf{Medium} & \textbf{Small} \\ \end{matrix} \begin{pmatrix} 6 & 2 \\ 4 & 1 \end{pmatrix} \quad \text{and } B = \begin{matrix} \\ \text{Pink} \\ \text{Yellow} \end{matrix} \begin{matrix} \textbf{Medium} & \textbf{Small} \\ \end{matrix} \begin{pmatrix} 6 & 4 \\ 2 & 10 \end{pmatrix}$$

Determine the stock of the item for the company as a whole.

A. $\begin{pmatrix} 12 & 4 \\ 8 & 2 \end{pmatrix}$ B. $\begin{pmatrix} 15 & 6 \\ 9 & 7 \end{pmatrix}$

C. $\begin{pmatrix} 12 & 6 \\ 6 & 11 \end{pmatrix}$ D. $\begin{pmatrix} 0 & -2 \\ 2 & -11 \end{pmatrix}$ (2 marks)

7. Consider the function below for Zed Ltd.:

TR = $40q - 10q^2$

TC = $-2q^2 + 4q + 10$

Where TR is the total revenue
TC is the total cost
Q is the number of units produced and sold.

Determine the total profit function.

A. $40 - 20q - 10$
B. $-4q + 4 - 10$
C. $-44 - 16q - 10$
D. $-8q2 + 36q - 10$ (2 marks)

8. A wholesaler sold 15 cartons of washing detergents and 10 crates of soda for Sh.15,500. He later sold 20 cartons of washing detergents and 5 crates of soda for Sh.14,000.

Determine the price of a carton of washing detergent and a crate of soda.

A. Sh.1,000 and Sh.1,600
B. Sh.250 and Sh.400
C. Sh.500 and Sh.800
D. Sh.100 and Sh.160 (2 marks)

9. Gladys Osebe spent half of her salary on rent and ⅓ of the remainder on food. If she saved Sh.6,000 how much was her salary.

A. Sh.3,600
B. Sh.18,000
C. Sh.12,000
D. Sh.1,500 (2 marks)

10. Evaluate the following integral

$$\int_{3}^{4} 3x2 - 6x + 2)dx$$

A. 0
B. 24
C. 6
D. 18 (2 marks)

11. Differentiate $y = 9x4 + 6x3 + 3x2 + x$

A. $36x^3 + 18x^2 + 6x + 1$
B. $9x^3 + 6x^2 + 3x + 1$
C. $x^4 + x^3 + x^2 + x$
D. $9x^5 + 6x^4 + 3x^3 + x^2$ (2 marks)

12. Given the matrix;

$$A = \begin{pmatrix} 5 & 7 \\ 6 & 9 \end{pmatrix}$$ Determine A^{-1}

A. $3\begin{pmatrix} 9 & -2 \\ -6 & 5 \end{pmatrix}$

B. $\frac{1}{3}\begin{pmatrix} -5 & 7 \\ 6 & -5 \end{pmatrix}$

C. $\frac{1}{3}\begin{pmatrix} 9 & -7 \\ -6 & 5 \end{pmatrix}$

D. $3\begin{pmatrix} -5 & 7 \\ 6 & -9 \end{pmatrix}$ (2 marks)

13. The revenue function of Neema Company Ltd. is given by $TR = 25Q - 0.5q^2$ where q is the level of output sold. Determine the marginal revenue for Neema Company Ltd.

A. $\frac{25q^2}{2} - \frac{0.5q^3}{3}$

B. $25 - q$

C. $q\left(\frac{25q}{2} - \frac{0.5q^3}{3}\right)$

D. $-0.5q^2 + 25q + 0$ (2 marks)

14. The total revenue obtained (Sh."000) from selling x items in a particular month is given by R, which is a function of variable x. Given that

$\frac{dr}{dx} = 20 - 4x$, determine the total revenue function R.

A. $20x - 4x^2$
B. $20x - 4x$
C. $20x - 2x^2$
D. $20x - 2x$ (2 marks)

15. The second derivative on any function is given by;
A. $\frac{dy}{dx}$

B. $\frac{d^2y}{dx^2}$

C. $\frac{dy^2}{dx^2}$

D. $\frac{d^2y}{d2x}$ (2 marks)

16. Differentiate $y = 9x4 + 6x3 + 3x2 + x$
A. Cannot happen at the same time
B. Cannot affect one another
C. Cannot be protected
D. Their respective event sets overlap (2 marks)

17. A manufacturing company is independently working on two separate jobs. The probability that either job will be finished on time is 0.3. What is the probability that both jobs will be finished on time?
A. 0.49
B. 0.09
C. 0.42
D. 0.9 (2 marks)

18. Empirical probability is_____.
A. Probability that is calculated without an experiment being performed
B. Calculated based on the result of repeated performance of an experiment
C. Probability based on prior logical thinking
D. All of the above (2 marks)

19. Given that for event A and B $P(A) = 0.6$, $P(B) = 0.4$
Calculate $P(A/B)$
A. 0.625
B. 0.75
C. 0.25
D. 0.375 (2 marks)

20. The probability of an event must lie between _____.
A. 0 to 1
B. – 1 to 1
C. All of the above
D. None of the above (2 marks)

21. The general multiplication role for dependent events A and B is given as_____.
A. P(A and B) = P(A) x P(B)
B. P(A and B) = P(A) x P(B/A)
C. P(A and = P(A) x P(A/B)
D. All of the above. (2 marks)

22. The conditional probability that event A occurs given that event B has occurred is given by _____.

A. $P(A/B) = P(A) \times P(A/B)$

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

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

D. $P(A/B) = \frac{P(A/B)}{P(B)}$ (2 marks)

23. The following are sources of primary data **EXCEPT:**

A. Census
B. Observation
C. Interview
D. Journals (2 marks)

24. Which one of the following is not a source of secondary data?

A. Abstract of statistics
B. Financial statistics
C. Economic trends
D. Direct observation (2 marks)

25. For the following data set, determine the value of x given that the arithmetic mean for the data is 15.5:

10, x, 15 and 25

A. 14
B. 15
C. 12
D. 16 (2 marks)

26. Solve for x in the following equation:

$4(8x - 4) = 6(2x + 4)$

A. 2
B. – 0.4
C. 4
D. – 0.8 (2 marks)

27. Differentiate the following function;

$Z = 32y^{\frac{1}{2}} + \frac{2}{3}y^3 + 12$ with respect to y

A. $16y^{1\frac{1}{2}} + 2y^4$
B. $16y^{\frac{1}{2}} + \frac{2}{3}y^2$
C. $16y^{-\frac{1}{2}} + 2y^2 + 1$
D. $16y^{-\frac{1}{2}} + 2y^2$ (2 marks)

28. In which of the following sampling methods is personal bias likely to be introduced.

A. Simple random sampling
B. Quota sampling
C. Purposive sampling
D. Systematic sampling (2 marks)

29. Strategic sampling method is preferred where _____.

A. Population is heterogeneous
B. Population is homogenous
C. Large samples are required
D. None of the above (2 marks)

30. Which one of the following sampling methods is a non-probabilistic sampling technique?
A. Simple random sampling
B. Systematic sampling technique
C. Convenience sampling
D. Stratified sampling method (2 marks)

31. _____ method of sampling gives each item in the population an equal chance of being selected.
A. Quota sampling method
B. Snowball sampling method
C. Judgemental sampling method
D. Simple random sampling method (2 marks)

32. Given that matrix $C = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ Find C^T

A. $\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ B. $\begin{pmatrix} 4 & -2 \\ -3 & 1 \end{pmatrix}$

C. $\begin{pmatrix} 3 & 4 \\ 1 & 5 \end{pmatrix}$ D. $\begin{pmatrix} -1 & -2 \\ -3 & -4 \end{pmatrix}$ (2 marks)

33. A bag contains 4 white balls and 3 blue balls. Two balls are picked at random one after another with replacement. What is the probability that both balls are blue?
A. 16/49
B. 1/7
C. 9/49
D. 6/7 (2 marks)

34. Which one of the following describes the additional law of probability?
A. P(A and B) = P(A) x (B)
B. P(A or B) = P(A) + (B) + P(A∩B)
C. P(A or B) = P(A) + (B) – P(A∩B)
D. P(A or B) = P(A) + P(B) – P(A/B) (2 marks)

35. Which one of the following is TRUE about matrices?
A. $A.A^{-1} = A$
B. $A.A^{-1} = I$
C. $A.A^{-1} = A$
D. $A.A^{-1} = A^{-1}$ (2 marks)

36. A car bazaar has 800 cars comprising Toyota, Mazda and Mercedes models. The probability of selecting a Mercedes model from the lot is 0.0625. What is the number of Mercedes model in the lot?
A. 625
B. 600
C. 50
D. 750 (2 marks)

The following data relates to the sales made by 50 sales representatives of a commercial college:

Number of sales	0 – 5	5 – 10	10 – 15
Number of salesmen	15	25	10

Use the data to answer questions 37 – 39.

37. Calculate the mean number of sales.

A. 16.67
B. 7.5
C. 11.25
D. 7 (2 marks)

38. Calculate the median number of sales.
A. 7
B. 7.5
C. 5
D. 10 (2 marks)

39. Calculate the modal number of sales.
A. 10
B. 7
C. 25
D. 7.5 (2 marks

40. In probability theory what is $P(E^C)$ IF P(E) is 0.02.
A. 1
B. 0.80
C. 0.78
D. 0.98 (2 marks)

41. Two unbiased coins are tossed at the same time, what is the probability of getting two heads?
A. ¼
B. 2/4
C. 1
D. ¾ (2 marks)

42. Which one of the following is not a disadvantage of the arithmetic mean?
A. It is highly affected by extreme values
B. It does not work well with qualitative data
C. It is rigidly not defined
D. Difficult to compute for grouped data with open ended classes (2 marks)

Use the data below to answer Questions 43 – 46.

4, 5 and 12

43. What is the range for the data?

A. 1
B. 8
C. 7
D. – 7 (2 marks)

44. What is the variance for the data?
A. 64
B. 185
C. 12.67
D. 441 (2 marks)

45. What is the standard deviation for the data?
A. 3.55
B. 8
C. 13.60
D. 21 (2 marks)

46. What is the coefficient of variation for the data?

A. 4.77%
B. 12.5%
C. 28.01%
D. 50.84% (2 marks)

47. Use the following data to answer question 47 – 50.

x	2	4	6	8
f	14	20	18	10

A. 2
B. 4
C. 6
D. 8 (2 marks)

48. The arithmetic mean for the data set is_____.

A. 5
B. 4
C. 4.77
D. 6 (2 marks)

49. The median for the data set is_____.

A. 4
B. 5
C. 6
D. 8 (2 marks)

50. To calculate the _____, all the items of a series have to be arranged in size and order.

A. Arithmetic mean
B. Mode
C. Median
D. Range (2 marks)

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