

Paper 4-Fundamentals of Business Mathematics and Statistics

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Full Marks: 100

Time allowed: 3 Hours

Section – A
(Fundamentals of Business Mathematics)

I. Answer any two questions. Each question carries 5 marks [2 × 5 = 10]

- Two numbers are in the ratio of 3 : 5 and if 10 be subtracted from each of them, the remainders are in the ratio of 1 : 5, find the numbers.
- A sum of money invested at C.I payable yearly amounts to ₹10,816 at the end of the second year and to ₹ 11,248.64 at the end of the third year. Find the rate of interest and the sum.
- Show that $\log_3 \sqrt{3\sqrt{3\sqrt{3\cdots\infty}}} = 1$

Answer: I

- Let the numbers be x and y, so that $\frac{x}{y} = \frac{3}{5}$ or, $5x = 3y$(1)

Again $\frac{x - 10}{y - 10} = \frac{1}{5}$

or, $5x - y = 40$ (ii) , Solving (I) & (ii), $x = 12, y = 20$

∴ Required Numbers are 12 and 20.

- Let the sum be ₹ P and rate of interest be i%.

∴ $A_1 = 10,816$ (₹) $A_2 = ₹ 11,248.64,$ $n = 1$
 C.I. = $A_2 - A_1 = 11,248.64 - 10,816$
 = ₹ 432.64.

∴ C.I. = $P[(1+i)^n - 1]$
 $\Rightarrow 432.64 = 10,816 [(1+i)^n - 1]$
 $\Rightarrow 0.04 = (1+i)^1 - 1$
 $\Rightarrow 1 + i = 1.04$

$i = 1.04 - 1 = 0.04 \times 100 = 4\%$

∴ $A = P[(1+i)^n - 1]$
 $\Rightarrow 10,816 = P \left(1 + \frac{4}{100}\right)^2$
 $= P (1.04)^2$
 $= P (1.0816)$

$\therefore P = \frac{10816}{1.0816} = ₹ 10,000.$

- Let, $x = \sqrt{3\sqrt{3\sqrt{3\cdots\infty}}}$ or $x^2 = \sqrt{3\sqrt{3\sqrt{3\cdots\infty}}}$
 (Squaring both sides)
 or, $x^2 = 3x$ or, $x^2 - 3x = 0$ or, $x(x - 3) = 0$ or, $x - 3 = 0$ (as $x \neq 0$),
 $\therefore x = 3$
 \therefore given expression = $\log_3 x = \log_3 3 = 1$.

II. Answer any two questions. Each question carries 3 marks

[2 × 3 = 6]

4. If $y = \log (x + \sqrt{x^2 + a^2})$ then find $(a^2 + x^2) y_2 + xy_1$
5. What sum of money will produce ₹28,600 as an interest in 3 years and 3 months at 2.5% p.a. simple interest?
6. If $a = 2^{\frac{1}{3}} - 2^{-\frac{1}{3}}$ show that $2a^3 + 6a - 3 = 0$

Answer: II

4. Given $y = \log (x + \sqrt{x^2 + a^2})$

Diff w. r. to x .

$$\frac{dy}{dx} = \frac{1}{x + \sqrt{x^2 + a^2}} \times 1 + \frac{1}{\cancel{\sqrt{x^2 + a^2}}} \times \cancel{x}$$

$$= \frac{1}{x + \sqrt{x^2 + a^2}} \times \left(1 + \frac{x}{\sqrt{x^2 + a^2}} \right)$$

$$= \frac{1}{\cancel{(x + \sqrt{x^2 + a^2})}} \times \frac{\cancel{(x + \sqrt{x^2 + a^2})}}{\sqrt{x^2 + a^2}}$$

$$= \frac{1}{\sqrt{x^2 + a^2}}$$

$$y_1 \sqrt{x^2 + a^2} = 1$$

S.O.B.S.

$$y_1^2 (x^2 + a^2) = 1$$

$$y_1^2 (2x) + (a^2 + x^2) 2y_1 y_2 = 0$$

$$\Rightarrow 2y_1 [(a^2 + x^2)y_2 + xy_1] = 0$$

$$(a^2 + x^2)y_2 + xy_1 = 0$$

5. Let the sum be ₹ P.

Given S.I. = ₹ 28,600, $r = 2.5\%$ p.a. S.I.

$t = 3$ years 3 months

$$= 3 \frac{3}{12} = 3 \frac{1}{4} \text{ years}$$

$$\therefore \text{S.I.} = \frac{prt}{100}$$

$$\Rightarrow 28,600 = P \times \frac{2.5}{100} \times \frac{13}{4}$$

$$\therefore P = \frac{28,600 \times 100 \times 4}{13 \times 2.5} = ₹ 3,52,000.$$

\therefore The required sum be ₹ 3,52,000.

6. Given that $a = 2^{\frac{1}{3}} - 2^{-\frac{1}{3}}$

Taking cube of both sides

$$a^3 = 2 \cdot 2^{-1} - 3(2^{\frac{1}{3}} - 2^{-\frac{1}{3}}) = 2 - \frac{1}{2} - 3a = \frac{3}{2} - 3a$$

i.e., $3 \cdot 2a + 6a - 3 = 0$

III. Choose the correct answer

[5 × 1 = 5]

7. If $A = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$ then transpose of the transpose of A = ____

(a) $\begin{pmatrix} 2 & 5 \\ 4 & 3 \end{pmatrix}$

(b) $\begin{pmatrix} 2 & 5 \\ 3 & 4 \end{pmatrix}$

(c) $\begin{pmatrix} 2 & 4 \\ 3 & 5 \end{pmatrix}$

(d) $\begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$

8. Set of even positive integers less than equal to 6 by selector method.

(a) $\{x / < 6\}$

(b) $\{x/x = 6\}$

(c) $\{x/x \leq 6\}$

(d) None of these

9. $\left[\log \left(\frac{a^2}{bc} \right) + \log \left(\frac{b^2}{ac} \right) + \log \left(\frac{c^2}{ab} \right) \right]$ is equal to -

(a) 0

(b) 1

(c) 2

(d) abc

10. The ratio $\frac{5}{3} : 2\frac{1}{4}$ is -

(a) ratio of lesser inequality

(b) ratio of greater inequality

(c) 20 : 9

(d) 5 : 27

11. If the numerator is multiplied by it becomes equal to 1 however if 2 is deducted from denominator it becomes equal to 1. The number is ____

(a) 5/7

(b) 3/7

(c) 5/8

(d) 1/3

Answer: III

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

$$(A^T)^T = A = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix} \quad (\text{Option : d})$$

8. $\{x/x \leq 6\}$ (Option: c)

9.
$$\left[\log\left(\frac{a^2}{bc}\right) + \log\left(\frac{b^2}{ca}\right) + \log\left(\frac{c^2}{ab}\right) \right]$$

$$= \log\left(\frac{a^2}{bc}\right) \times \left(\frac{b^2}{ca}\right) \times \left(\frac{c^2}{ab}\right)$$

$$= \log\left(\frac{a^2 b^2 c^2}{a^2 b^2 c^2}\right)$$

$$= \log 1 = 0 \quad (\text{Option : a})$$

10. The ratio $\frac{5}{3} : 2\frac{1}{4}$

$$= \frac{5}{3} : \frac{9}{4}$$

$$= \frac{5}{3}(12) : \frac{9}{4}(12)$$

$$= 20 : 27$$

Here $20 < 27$
 \therefore Ratio of lesser inequality. (Option : a)

11. By verification (Option : d) is correct.

IV. Fill in the blanks

[5 × 1 = 5]

12. If A and B are two sets then $A \cap (B - A)$ is _____

Answer:

$$A \cap (B - A) = \emptyset$$

13. If A and B are two disjoint sets then $n(A \cup B)$ is equal to ____

Answer: Given A and B are two disjoint sets then
 $n(A \cup B) = n(A) + n(B) - n(A \cap B)$.

14. The C.I on a certain sum of money for 2 years at 8% p.a. compounded annually is ₹ 1040.
 The sum is _____

Answer:

Let the certain sum be ₹ P.
 $I = 8\%$ p.a. $n = 2$ years, C.I. = ₹ 1040.
 \therefore C.I. = $P[(1+i)^n - 1]$

$$\Rightarrow \text{C.I.} = P\left[\left(1 + \frac{8}{100}\right)^2 - 1\right]$$

$$= P[(1.08)^2 - 1]$$

$$= P(0.1664)$$

$$\therefore P = \frac{1040}{0.1664} = ₹ 6250$$

15. If $y = (\sqrt{x} + 1)^2$ then $\frac{dy}{dx} = \underline{\hspace{2cm}}$

Answer:

Given $y = (\sqrt{x} + 1)^2$

Diff. w.r. to x

$$\frac{dy}{dx} = 2(\sqrt{x} + 1) \cdot \frac{1}{2\sqrt{x}}$$

$$\frac{dy}{dx} = 1 + \frac{1}{\sqrt{x}}$$

16. There are 10 points in a plane and among them 4 are collinear. The total number of triangles formed by joining them is ____

Required No. of Triangle

$$\begin{aligned} &= {}^{10}C_3 - {}^4C_3 \\ &= \frac{|10}{|7|} \frac{|3}{|3|} - \frac{|4}{|3|} \frac{|1}{|1|} = \frac{10 \times 9 \times 8 \times \cancel{|7|}}{\cancel{|7|} |3|} - 4 \\ &= \frac{10 \times \cancel{9}^3 \times \cancel{8}^4}{\cancel{9} \cancel{8}} - 4 \\ &= 120 - 4 \\ &= 116. \end{aligned}$$

- V. State whether the following statements are true or false [5 × 1 = 5]

17. The number of different words that can be formed from the letters of the word "TRIANGLE" so that no two vowels come together is 36000.

Answer:

Given the word : TRIANGLE.

Total No. of arrangements = 8!.

No. of vowels come together = 6!3!

Required Permutation = 8! - 3!6!

$$= 40320 - 4320$$

$$= 36000. \quad (T)$$

18. The statement $\{2\} \otimes \{2, 3, 5\}$ is true or false.

Answer:

The statement $\{2\} \otimes \{2, 3, 5\}$ is False (F)

19. The decimal part of the value of logarithm of a number is called mantissa.

Answer:

The decimal part of the value of Logarithm of a number is called Mantissa (T)

20. If the ratio of two positive numbers is 4:5 and their L.C.M is 140 then the numbers are 35, 45.

Answer:

L.C.M. of 35, 45 is 315.

\therefore The statement is False. (F)

21. f and g are two continuous functions of their common domain D then f – g is continuous.

Answer:

According to properties of continuous function, f and g are two continuous function of their common domain D then, (f – g) is continuous. (T)

VI. Match the following

[5 × 1 = 5]

| | | | |
|-----|--|---|----------------------------------|
| 22. | If $\frac{A}{3} = \frac{B}{4} = \frac{C}{5}$ then A:B:C = ____ | A | 4 |
| 23. | $\log_{10000}X = -\frac{1}{4}$ then x = ____ | B | $\log_e\left(\frac{3}{2}\right)$ |
| 24. | If $(n + 1)! = 20(n - 1)!$ then n = ____ | C | $\frac{1}{10}$ |
| 25. | $\lim_{x \rightarrow 0} \frac{3^x - 2^x}{x} = \text{_____}$ | D | 1 |
| 26. | If $A = \begin{pmatrix} x-2 & 4 \\ 3 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 4 \\ 3 & 5 \end{pmatrix}$ and A = B then x = ____ | E | 3 : 4 : 5 |

Answer:

| | | | |
|-----|--|---|----------------------------------|
| 22. | Let $\frac{A}{3} = \frac{B}{4} = \frac{C}{5} \quad \therefore a \Rightarrow A : B : C = 3 : 4 : 5$ | E | 3 : 4 : 5 |
| 23. | $\Rightarrow \log_{10000}X = -\frac{1}{4}$ $x = \left(10^4\right)^{-\frac{1}{4}} = 10^{-1} = \frac{1}{10}$ | C | $\frac{1}{10}$ |
| 24. | Given $(n+1)! = 20(n-1)!$ $\Rightarrow (n+1)n(n-1)! = 20(n-1)!$ $\Rightarrow (n+1)(n) = 5 \times 4 \quad \therefore n = 4$ | A | 4 |
| 25. | $\lim_{x \rightarrow 0} \frac{3^x - 2^x - 1 + 1}{x}$ $= \lim_{x \rightarrow 0} \frac{(3^x - 1) - (2^x - 1)}{x}$ $= \lim_{x \rightarrow 0} \frac{3^x - 1}{x} - \lim_{x \rightarrow 0} \frac{2^x - 1}{x}$ $= \log_3 - \log_2$ $= \log_e\left(\frac{3}{2}\right)$ | B | $\log_e\left(\frac{3}{2}\right)$ |
| 26. | Given $A = \begin{pmatrix} x-2 & 4 \\ 3 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 4 \\ 3 & 5 \end{pmatrix}$ and $A = B$ $\Rightarrow x - 2 = -1$ $\Rightarrow x = 2 - 1$ $= 1$ | D | 1 |

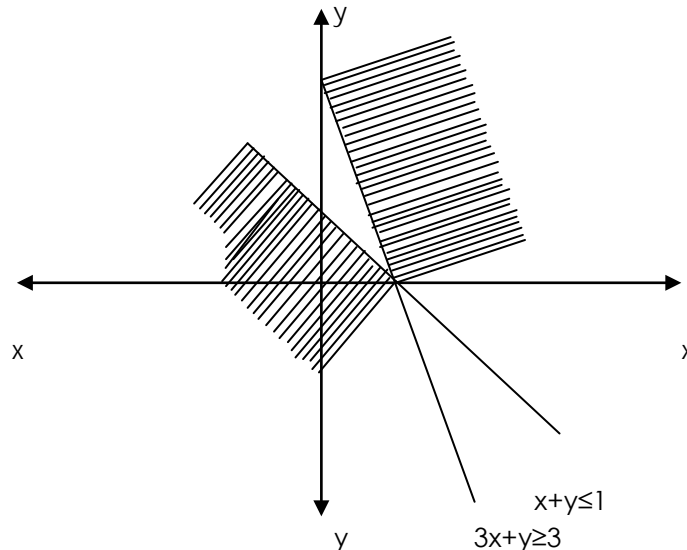
VII. Answer the following in one (or) two steps

[4 × 1 = 4]

27. Draw the graph of $x + y \leq 1$, $3x + y \geq 3$ $x \geq 0$, $y \geq 0$
28. Find the logarithm of 2025 to the base $3\sqrt{5}$.
29. Construct the truth table for " $p \rightarrow q$ ".
30. What sum of money will yield ₹1407 as interest in $1\frac{1}{2}$ year at 14% p. a. simple interest.

Answer:

27. Given in equations $x + y \leq 1$, $3x + y \geq 3$, $x \geq 0$, $y \geq 0$.



28. Let x be the required number; then $(3\sqrt{5})^x = 2020 = 3^4 \cdot 5^2 = (3\sqrt{5})^4 \therefore x = 4$.
 $\therefore 4$ is the required number.

29. The truth table for $p \rightarrow q$

| p | q | $p \rightarrow q$ |
|-----|-----|-------------------|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | T |

30. Here $A = 1380$, $n = 3$, $i = \frac{5}{100} = 0.05$, $P = ?$

From $A = P(1 + 0.05 \times 3)$ or, $1380 = P(1 + 0.15)$

Or, $1380 = P(1.15)$ or, $P = \frac{1380}{1.15} = 1200$.

\therefore Reqd. sum = ₹1200

Section – B
(Fundamentals of Business Statistics)

VIII. Answer any Nine questions of the following. Each question carries 2 marks

[9 × 2 = 18]

1. (Class frequency) / (Width of the class) is defined as
 - (a) Frequency density
 - (b) Frequency distribution
 - (c) Both
 - (d) None
2. The variables x and y are related by $5x+6y=70$ and median of x is 8. What is the median of y ?
 - (a) 4
 - (b) 4.5
 - (c) 6
 - (d) 5
3. If median = 12, $Q_1 = 6$, $Q_3 = 22$ then the coefficient of quartile deviation is
 - (a) 33.33
 - (b) 60
 - (c) 66.67
 - (d) 70
4. The variables x and y are related by $5x+6y=70$ and median of x is 8. What is the median of y ?
 - (a) 4
 - (b) 4.5
 - (c) 6
 - (d) 5
- (5) If the median of 5, 9, 11, 3, 4, x , 8 is 6, the value of x is equal to
 - (a) 6
 - (b) 5
 - (c) 4
 - (d) 3
- (6) In Ogive, abscissa corresponding to ordinate $N/2$ is
 - (a) Median
 - (b) 1st quartile
 - (c) 3rd quartile
 - (d) None
- (7) If a card is drawn at random from a pack of 52 cards, what is the chance of getting a Spade or an ace?
 - (a) $4/13$
 - (b) $5/13$
 - (c) 0.25
 - (d) 0.20
- (8) A, B and C are three mutually exclusive and exhaustive events such that $P(A)=2$ $P(B) = 3$ $P(C)$. What is $P(B)$?
 - (a) $6/11$
 - (b) $6/22$
 - (c) $1/6$
 - (d) $1/3$

- (9) If the coefficient of correlation between two variables is -0.2, then the coefficient of determination is
- (a) 0.4
 - (b) 0.02
 - (c) 0.04
 - (d) 0.16
- (10) The sum of the difference of rank is
- a) 1
 - b) -1
 - c) 0
 - d) None
- (11) The value of correlation coefficient lies between
- (a) -1 and +1
 - (b) -1 and 0
 - (c) 0 and 1
 - (d) None
- (12) What is the probability that a leap year selected at random would contain 53 Saturdays?
- (a) 1/7
 - (b) 2/7
 - (c) 1/12
 - (d) 1/4

Answer: VIII

- 1. a
- 2. d
- 3. b
- 4. d
- 5. a
- 6. a
- 7. a
- 8. a
- 9. c
- 10. c
- 11. a
- 12. b

IX. Answer any nine questions of the following. Each question carries 2 marks [9 × 2 = 18]

1. Given Mean = 50, C.V = 40%, Karl Pearson's Coefficient of Skewness = - 0.4. Find standard deviation and Mode

Answer:

Given $\bar{x} = 50$

C.V. = 40%

$S_{kp} = - 0.4$.

Now

$$C.V. = \frac{\sigma}{\bar{x}} \times 100$$

$$40 = \frac{\sigma}{50} \times 100$$

$$a = \frac{40 \times 50}{100}$$

$$a = 20.$$

Now

$$S_{kp} = \frac{\bar{x} - z}{\sigma}$$

$$-0.4 = \frac{50 - z}{20}$$

$$(-0.4)(20) = 50 - z$$

$$-8 = 50 - z$$

$$z = 58$$

2. If $\bar{X} = 56.2$, $Z = 55$; Find M

Answer:

$$\bar{x} = 56.2$$

$$Z = 55$$

We know that Mode = 3 median – 2 mean

$$\therefore \text{Median} = \frac{\text{Mode} + 2 \text{ Mean}}{3}$$

$$= \frac{55 + 2(56.2)}{3}$$

$$= \frac{55 + 112.4}{3}$$

$$= \frac{167.4}{3}$$

$$\text{Median} = 55.8$$

3. If three dice are thrown simultaneously, then the probability of getting a score of 5 is

Answer:

Three dices are rolled $\Rightarrow n(s) = 6^3 = 216$.

The probability of getting a score of 5 is P(A)

$$P(A) = \frac{6}{216}$$

$$P(A) = \frac{1}{36}$$

4. Calculate S.D. for first 10 natural nos.

Answer:

We know that S.D. of first n natural nos. is

$$\sqrt{\frac{1}{12}(n^2 - 1)}$$

\therefore Given n = 10.

$$= \sqrt{\frac{1}{12}(10^2 - 1)}$$

$$= \sqrt{\frac{1}{12}(99)}$$

$$= \sqrt{8.25}$$

$$= 2.87.$$

5. A class of 40 students has an average of 56 marks in Math exam. But later on it was found that terms 48, 54 and 67 were misread as 68, 45 and 87. Find correct mean.

Answer:

$$\text{Total of 40 terms} = 56 \times 40 = 2240$$

$$\text{Correct terms} = 48 + 54 + 67 = 169$$

$$\text{Incorrect terms} = 68 + 45 + 87 = 200$$

$$\begin{aligned} \therefore \text{Correct Total} &= \text{Incorrect total} + \text{correct terms} - \text{Incorrect terms} \\ &= 2240 + 169 - 200 \\ &= 2209. \end{aligned}$$

$$\begin{aligned} \text{Correct Mean} &= \frac{\text{Correct Total}}{\text{No. of terms}} \\ &= \frac{2209}{40} \\ &= 55.2225. \end{aligned}$$

6. In a Moderately Asymmetrical Distribution Compute M.D. and S.D. Given Q.D. = 50

Answer:

$$\text{Given Q.D.} = 50$$

$$\begin{aligned} \text{Now S.D.} &= \frac{3}{2}(\text{Q.D.}) \\ &= \frac{3}{2}(50) \\ &= 75 \end{aligned}$$

$$\begin{aligned} \text{M.D.} &= \frac{4}{5}(\text{S.D.}) \\ &= \frac{4}{5}(75) \\ &= 60. \end{aligned}$$

7. If the first quartile is 104 and quartile deviation is 18. Find the third quartile.

Answer:

$$\text{Given } Q_1 = 104$$

$$\text{Quartile deviation} = 18$$

$$\text{Now } \frac{Q_3 - Q_1}{2} = 18$$

$$\frac{Q_3 - 104}{2} = 18$$

$$Q_3 = 36 + 104$$

$$Q_3 = 140.$$

8. A dice is rolled. What is the probability that a number 1 or 6 may appear on the upper face?

Answer:

The probability of getting 1 on upper face of die is

$$P(1) = 1/6$$

The Probability of getting 6 on upper face of die is

$$P(6) = 1/6$$

Now probability of getting 1 or 6 on upper face of die

$$\begin{aligned} P(1 \cup 6) &= 1/6 + 1/6 \\ &= 2/6. \end{aligned}$$

9. If the median of 5, 9, 11, 3, 4, x, 8 is 6. Find the value of x.

Answer:

Given 5, 9, 11, 3, 4, x, 8

=> median = 6

Arranging in ascending order

3, 4, 5, x, 8, 9, 11

Median = $\left(\frac{N+1}{2}\right)^{\text{th}}$ term

$6 = \left(\frac{7+1}{2}\right)^{\text{th}}$ term

$6 = \left(\frac{8}{2}\right)^{\text{th}}$ term

$6 = (4)^{\text{th}}$ term

$6 = x$

$\therefore x = 6$

10. The probability that a number selected at random from the set of numbers {1,2,3,...,100} is a cube is:

Answer:

Given $\cap(s) = \{1, 2, 3, \dots, 100\}$

$\cap(s) = 100$

Now probability of getting selected number is a cube is P(A).

Now $\cap(A) = \{1^3, 2^3, 3^3, 4^3\}$

$\cap(A) = \{1, 8, 27, 64\}$

$\cap(A) = 4$

$$\begin{aligned}\therefore P(A) &= \frac{\cap(A)}{\cap(S)} \\ &= \frac{4}{100} \\ &= \frac{1}{25}\end{aligned}$$

11. In a Moderately Asymmetrical Distribution. Compute M.D. and Q.D. Given S.D. = 50

Answer:

Given S.D. = 50

We know that

$$\text{M.D.} = \frac{4}{5} (\text{S.D.})$$

$$= \frac{4}{5} (50)$$

M.D. = 40.

We know that

$$\text{Q.D.} = \frac{2}{3} (\text{S.D.})$$

$$= \frac{2}{3} (50)$$

Q.D. = 33.33.

12. 4 coins are tossed. Find the probability that at least one head turns up.

Answer:

When 4 coins are tossed.

$$n(s) = 2^4 = 16$$

Probability of getting all: tails is

$$P(TTTT) = 1/16$$

Probability of getting atleast one head is P(A)

$$P(A) = 1 - 1/16$$

$$= 15/16.$$

- X. Answer any FOUR of the following questions

[4 × 6 = 24]

1. Draw Pie diagram to represent the data

| Item | Food | Rent | Clothing | Fuel | Education | Miscellanies |
|-------------|------|------|----------|------|-----------|--------------|
| Expenditure | 240 | 125 | 66 | 57 | 42 | 198 |

2. Find mode

| Class interval | below 10 | 10-15 | 15-20 | 20-25 | 25-30 | above 30 |
|----------------|----------|-------|-------|-------|-------|----------|
| Frequency | 21 | 47 | 67 | 89 | 55 | 21 |

3. Compute rank correlation from the following table

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| X | 415 | 434 | 420 | 430 | 424 | 428 |
| Y | 330 | 332 | 328 | 331 | 327 | 325 |

4. Find Quantity Index No. from following data i) Laspeyre's, ii) Paasche's iii) Dorbish and Bowley's

| Commodity | 2001 | | 2005 | |
|-----------|----------|-------|----------|-------|
| | Quantity | Value | Quantity | Value |
| A | 5 | 40 | 6 | 60 |
| B | 5 | 30 | 5 | 40 |
| C | 6 | 24 | 6 | 30 |
| D | 5 | 10 | 10 | 40 |

5. Fit a straight line trend to the following data and estimate the likely profit for the year 2012. Also calculate the trend values.

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------|------|------|------|------|------|------|------|
| Profit (in lakhs of ₹) | 60 | 72 | 75 | 65 | 80 | 85 | 95 |

6. What is the chance that a leap year, selected at random will contain 53 Sundays?

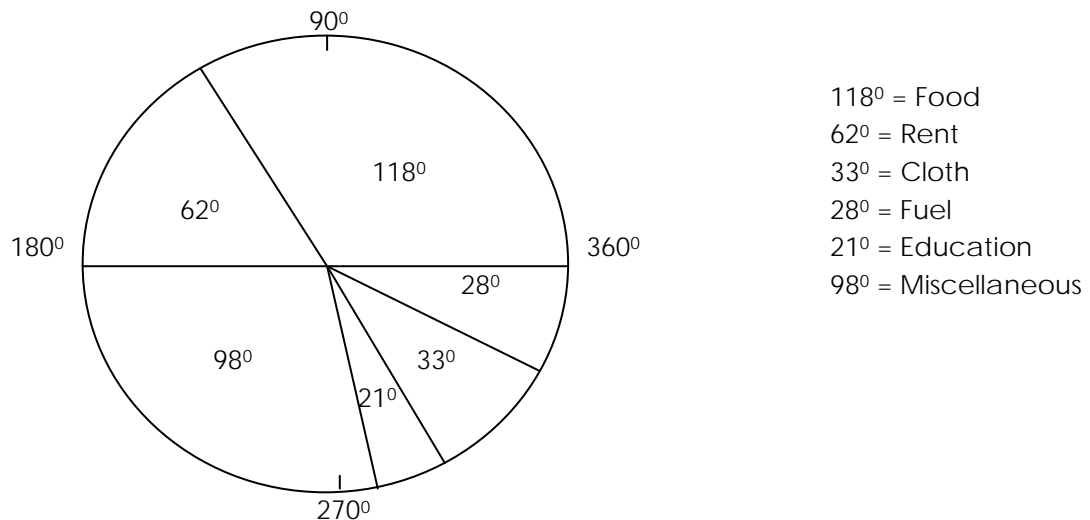
Answer: X

1. Food : 240 => angles = $240/728 \times 360 = 118^\circ$ (app)
 Rent : 125 => angles = $125/728 \times 360 = 62^\circ$ (app)
 Clothing : 66 => angles = $66/728 \times 360 = 33^\circ$ (app)

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Fuel : 57 \Rightarrow angles = $57/728 \times 360 = 28^\circ$ (app)
 Education : 42 \Rightarrow angles = $42/728 \times 360 = 21^\circ$ (app)
 Miscellaneous : 198 \Rightarrow angles = $198/728 \times 360 = 98^\circ$ (app)
728

PIE CHART:



2. GROUPING TABLE:

| Class Interval | I | II | III | IV | V | VI |
|----------------|----------|-------|-------|-------|-------|-------|
| 5 - 10 | 2 | | | | | |
| 10 - 15 | 47 | 49 | | 116 | | |
| 15 - 20 | 67 f_0 | (156) | 114 | | (203) | |
| 20 - 25 | 89 f_1 | | (144) | | | (211) |
| 25 - 30 | 55 f_2 | | | (165) | | |
| 30 - 35 | 21 | 76 | | | | |

ANALYSIS TABLE:

| Class Interval | I | II | III | IV | V | VI | Total |
|----------------|---|----|-----|----|---|----|-------|
| 5 - 10 | | | | | | | 0 |
| 10 - 15 | | | | | X | | 1 |
| 15 - 20 | | X | | | X | X | 3 |
| 20 - 25 | x | x | X | X | x | X | 6 |
| 25 - 30 | | | x | X | | x | 3 |
| 30 - 35 | | | | x | | | 1 |

$l = 20,$ $c = 5,$ $f_1 = 89,$ $f_0 = 67,$ $f_2 = 55$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times c$$

$$= 20 + \frac{89-67}{178-67-55} \times 5$$

$$= 21.964.$$

3.

| X | R ₁ | Y | R ₂ | (R ₁ - RR ₂) =D | D ² |
|-----|----------------|-----|----------------|--|----------------|
| 415 | 6 | 330 | 3 | 3 | 9 |
| 434 | 1 | 332 | 1 | 0 | 0 |
| 420 | 5 | 328 | 4 | 1 | 1 |
| 430 | 2 | 331 | 2 | 0 | 0 |
| 424 | 4 | 327 | 5 | -1 | 1 |
| 428 | 3 | 325 | 6 | -3 | 9 |

$$r_k = 1 - \frac{6\sum D^2}{N(N^2 - 1)}$$

$$= 1 - \frac{1(20)}{6(6^2 - 1)} = 1 - \frac{120}{210} = \frac{210-120}{210} = \frac{90}{210} = \frac{3}{7} = 0.429$$

4. Quantity Index

| p ₀ | q ₀ | v | p ₁ | q ₁ | v | p ₀ q ₁ | p ₁ q ₀ |
|----------------|----------------|-----|----------------|----------------|-----|-------------------------------|-------------------------------|
| 8 | 5 | 40 | 10 | 6 | 60 | 48 | 50 |
| 6 | 5 | 30 | 8 | 5 | 40 | 30 | 40 |
| 4 | 6 | 24 | 5 | 6 | 30 | 24 | 30 |
| 2 | 5 | 10 | 4 | 10 | 40 | 20 | 20 |
| | | 104 | | | 170 | 122 | 140 |

$$\text{Laspeyre's} = \frac{\sum p_0 q_1}{\sum p_0 q_0} \times 100$$

$$= \frac{122}{104} \times 100$$

$$= 117.31$$

$$\text{Pasche's} = \frac{\sum p_1 q_1}{\sum p_1 q_0} \times 100$$

$$= \frac{170}{140} \times 100$$

$$= 121.43$$

$$\text{Dorbish \& Bowley's} = \frac{L+P}{2}$$

$$= \frac{117.31+121.43}{2}$$

$$= \frac{238.74}{2}$$

$$= 119.37.$$

5. Table : Calculation of trend and Trend values

| Year | Profit | Deviation from 2006 | X ² | XY | Trend Values (Y _c = a + bX) |
|------|--------|---------------------|----------------|------|--|
| | | X | | | [Y _c = 76 + 4.85X] |
| 2003 | 60 | -3 | 9 | -180 | 76 + 4.85 (-3) = 61.45 |
| 2004 | 70 | -2 | 4 | -144 | 76 + 4.85 (-2) = 66.30 |

| | | | | | |
|------|------------------|----|-------------------|-------------------|--------------------------|
| 2005 | 75 | -1 | 1 | -75 | $76 + 4.85 (-1) = 70.15$ |
| 2006 | 65 | 0 | 0 | 0 | $76 + 4.85 (0) = 76$ |
| 2007 | 80 | 1 | 1 | 80 | $76 + 4.85 (1) = 80.85$ |
| 2008 | 85 | 2 | 4 | 170 | $76 + 4.85 (2) = 85.70$ |
| 2009 | 95 | 3 | 9 | 285 | $76 + 4.85 (3) = 90.55$ |
| | $\Sigma y = 532$ | | $\Sigma X^2 = 28$ | $\Sigma XY = 136$ | |

$$N = 7$$

The equation for starlight line trend is $Y_c = a + bx$

Where

$$\Sigma x = 0; \quad a = \frac{\Sigma Y}{N} = \frac{532}{7} = 76$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = \frac{136}{28} = 4.85$$

$$Y_c = 76 + 4.85X$$

For 2012, $x = 6$ (2012 - 2006)

$$Y_c = 76 + 4.85 (6) = 76 + 29.10$$

$$= 105.10$$

The estimated profit for the year 2012 is rs.105.10 lakhs.

6. As a leap year consist of 366 days it contains 52 complete weeks and two more days. The two consecutive days make the following combinations:

- (a) Monday and Tuesday
- (b) Tuesday and Wednesday
- (c) Wednesday and Thursday
- (d) Thursday and Friday
- (e) Friday and Saturday
- (f) Saturday and Sunday, and
- (g) Sunday and Monday

If (f) or (g) occur, then the year consists of 53 Sundays.

Therefore the number of favourable cases = 2

Total number of cases = 7

$$\text{The probability} = \frac{2}{7}$$