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OM TUTORIALS

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ALGEBRA FORMULA SET FOR SSC STUDENTS

School Section

Nursery to 10th

(State / CBSE / ICSE Board)

College Section

XIth / XIIth

(Commerce)

General Formula

$$1. (a+b)^2 = a^2 + b^2 + 2ab$$

$$2. a^2 + b^2 = (a+b)^2 - 2ab$$

$$3. (a-b)^2 = a^2 + b^2 - 2ab$$

$$4. a^2 + b^2 = (a-b)^2 + 2ab$$

$$5. (a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$

$$6. (a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$7. (a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$8. a^3 + b^3 = (a+b)^3 - 3ab(a+b)$$

$$9. a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$10. (a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

$$11. (a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$$12. a^3 - b^3 = (a-b)^3 + 3ab(a-b)$$

$$13. a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$14. a^2 - b^2 = (a+b)(a-b)$$

$$15. a^m \cdot a^n = a^{m+n}$$

$$16. \frac{a^m}{a^n} = a^{m-n}$$

$$17. (a^m)^n = a^{m \times n}$$

$$18. (ab)^n = a^n \times b^n$$

$$19. \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$$20. a^0 = 1$$

$$21. a^{-n} = \frac{1}{a^n}$$

$$22. a^n = \frac{1}{a^{-n}}$$

Chapter 1- Linear equations in Two variables

1. An equation which contains two variables and the degree of each term containing variable is one is called a linear equation in two variables.
2. General form of linear equation is $(ax+by+c=0)$.In which a,b,c, are real numbers and a,b are not equal to zero.
Eg. $3x+4y-12=0$

3. Determinant

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

eg. $\begin{vmatrix} 2 & 6 \\ 4 & 3 \end{vmatrix} = 2 \times 3 - 6 \times 4$
 $= 6 - 24$
 $= -18$

4. Cramer's Rule [Determinant Method]

Step 1: Write given equations in the form $ax + by = c$

Step 2: Find Value of determinants D , Dx and Dy

Step 3: Value of x = $\frac{Dx}{D}$ and

$$\text{Value of } y = \frac{Dy}{D}$$

Chapter 2 - Quadratic Equations

1. If degree of polynomial is 2 . It is called a quadratic polynomial.
2. General form of quadratic equation :- $ax^2+bx+c=0$ where a, b ,c are real numbers and a is non zero.
3. The values of variable which satisfy the equation are called solutions or roots of the equation.
4. If product of two numbers is zero then at least one of them is zero.

5. Solution of quadratic equation by completing square

When equation is in the form $x^2+bx+c=0$, it can be written as $x^2+bx+(b/2)^2-(b/2)^2+c=0$
i.e $(x+b/2)^2 = (b/2)^2-c$

6. Value of discriminant

$$\text{Value of discriminant } (\Delta) = b^2 - 4ac$$

Chapter 2 - Quadratic Equations

7. Nature of roots of quadratic equation

We know that $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ are roots of quadratic equation $ax^2 + bx + c = 0$.

- (I) If $b^2 - 4ac = 0$ then roots of quadratic equation are real and equal.
- (ii) If $b^2 - 4ac > 0$ then roots of the quadratic equation are real and unequal.
- (iii) If $b^2 - 4ac < 0$ then roots of quadratic equation are not real.

8. Relation between roots of the quadratic equation and coefficients

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

(i) $\left[\alpha + \beta = -\frac{b}{a} \right]$ and $\left[\alpha\beta = \frac{c}{a} \right]$

(ii) $\alpha = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $\beta = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$

(iii) The quadratic equation, whose roots are α and β is $x^2 - (\alpha + \beta)x + \alpha\beta = 0$.

Chapter 3 - Arithmetic Progression

1. A set of numbers where the numbers are arranged in a definite order, like the natural numbers, is called sequence.

2. If the difference between two consecutive terms ($t_{(n+1)} - t_n$) is constant then sequence is called Arithmetic Progression(A.P.)

3. Common difference (d) in AP = $t_{(n+1)} - t_n$

4. AP having first term as a and common difference as d then the terms in the sequence are $a, (a + d), (a + 2d), (a + 3d) \dots$

5. Difference (d) can be positive, negative or zero.

6. $t_n = a + (n - 1)d$

7. $S_n = \frac{n}{2} [2a + (n - 1)d]$

8. $S_n = na + \frac{n(n-1)}{2} d$

Chapter 4 - Financial Planning

1. CGST = SGST
2. Rate of CGST = rate of SGST
3. Total GST = CGST + SGST
4. GST = 2 X CGST
5. GST = 2 X SGST
6. Rate of GST = 2 X rate of CGST
7. Rate of GST = 2 X rate of SGST
8. **Input Tax** : When trader pays GST at the time of purchase, it is called 'input tax'.
9. **Output Tax** : When trader collects GST at the time of sale, it is called 'output tax'.
10. **GST Payable** : output tax – Input tax credit
11. **Share** : A share is the smallest unit of the capital.
12. **Share Certificate** : The value of a share is printed on the company's certificate with other details is called as share certificate.
13. **Share Holder** : A person who owns the share is called share holder.
14. **Stock Exchange** : It is a place where buying and selling of shares take place. It is also known as share market or stock market
15. **Face Value (F.V.)** : The value printed on share certificate is called the Face Value of the share. It is also called **Nominal Value** or **printed value** or **par value**.
16. **Market Value (M.V.)** : The price at which the share are sold or purchased in the stock market is called market value of the share.
17. **Dividend** : The part of annual profit of a company which is distributed per share among shareholders is called dividend.
18. **Comparison of FV and MV**
 - (i). If M.V. > F.V. then share is at premium
 - (ii). If M.V. = F.V. then share is at par
 - (iii). If M.V. < F.V. then share is at discount
19. Sum invested = Number of shares X MV

Chapter 4 - Financial Planning

20. $MV = FV + \text{Premium}$

21. Number of shares = $\frac{\text{Total investment}}{MV}$

22. Rate of return (ROR) = $\frac{\text{Dividend income}}{\text{Sum invested}} \times 100$

23. Brokerage is always calculated on market value of shares.

24. Buying price of per share = $MV + \text{Brokerage}$

25. Selling price per share = $MV - \text{Brokerage}$

26. Net asset value (NAV) per unit = $\frac{\text{total value}}{\text{No. of units}}$

27. Number of units = $\frac{\text{sum invested}}{\text{NAV}}$

28. Total value of mutual fund = $NAV \times \text{No. of units}$.

Chapter 5 - Probability

1. The sample space for a coin tossed twice is the same as that of two coins tossed simultaneously. The same is true for three coins.

2. The sample space for a die rolled twice is the same as two dice rolled simultaneously

3. **Event:** A set of favourable outcomes of a given sample space is an 'Event'.

4. Event is the subset of the sample space.

5. **Probability:** When possibility of an expected event is expressed in numbers it is called "Probability".

6. Probability is always expressed as a fraction or a percentage.

7. $P(A) = \frac{n(A)}{n(S)}$ where S is sample Space and A is event.

8. The probability of any event is from 0 to 1 or 0% to 100%. Probability can never be greater than 1.

9. Probability of $\frac{1}{4}$ is written as 25%.

Chapter 6 - Statistics

MEAN

1. For ungrouped data :-

Mean of data = $\frac{\text{sum of observations}}{\text{Total Numbers of observation}}$

$$(\bar{x}) = \frac{\sum x_i}{N}$$

2. Mean from classified frequency distribution

A) Direct Method

$$\text{Mean } (\bar{x}) = \frac{\sum x_i f_i}{N}$$

B) Assumed mean method

Steps :- i) Choose assumed mean (A) from table

ii) Write classes in first column

iii) Write class mark in second column

iv) find Value of $d_i = x_i - A$ and write in third column

v) Write given frequency in fourth column and write their sum as $\sum f_i$

vi) Write product ($f_i \times d_i$) in fifth column and write their sum as $\sum f_i d_i$

vii) Calculate \bar{d} and \bar{X} using formula :- $\bar{d} = \frac{\sum f_i d_i}{\sum f_i}$ and $\bar{x} = A + \bar{d}$

C) Step deviation method

Steps :- i) Write the classes of table in first column.

ii) Write the value of x in second column.

iii) Write value of $d_i = x_i - A$ in third column.

iv) Represent the G.C.D of all value of d_i as $g = u_i = \frac{d_i}{g}$

v) Write corresponding frequencies in fifth column.

vi) Write the product $f_i \times u_i$ for each class in sixth column .

vii) Find the mean of u_i by following formula :- $\bar{u} = \frac{\sum f_i u_i}{\sum f_i}$ and $\bar{x} = A + \bar{u} \cdot g$.

MEDIAN

A) Median for ungrouped data

- I) If the numbers are arranged in the ascending order, the number at the middle position is called the median of the data.
- II) The median divides the array of numbers in two equal parts , that is the number of scores below and above the median is equal
- III) If the number of the scores is odd then $(\frac{n+1}{2})^{\text{th}}$ term is the median of the data.
- IV) If the number of the score is even, then the mean of middle two terms is the median.

Chapter 6 - Statistics

B. Median for grouped data

- I) Find N , Where $N = \sum f_i$
- ii) Find $\frac{N}{2}$
- iii) Value of $(\frac{N}{2})^{\text{th}}$ number will be the approximate median.
- iv) Find cumulative frequency less than upper limit
- v) From the table , the $(\frac{N}{2})^{\text{th}}$ score which contains the median is called median class.
- vi) Identify the lower value of median class
- vii) Frequency of the median class is frequency of the table

Formula :-

$$\text{Median} = L + \left[\frac{\frac{N}{2} - c.f}{f} \right] \times h$$

Where , L = Lower class limit of median class

N = Sum of frequencies

f = Frequency of median class

cf = Cumulative frequency of the class preceding the median class

h = Class interval of the median class

MODE

A. Mode for ungrouped data :-

Score repeating maximum number of the times in a data is called the mode of the data.

Eg. If given data is 5,9,3,7,5,4,5,1

In above data 5 is repeated maximum time i.e 3 times , so mode is 5.

B. Mode for grouped frequency distribution :-

$$\text{Formula : Mode} = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h$$

Where ,

L = Lower class limit of the modal class

f_1 = Frequency of Modal class

f_0 = Frequency of the class preceding the modal class

f_2 = Frequency of the class succeeding the modal class

h = Class interval of the modal class

PIE DIAGRAM

The measure of central angle of sector (θ)

$$= \frac{\text{Number of scores in the components}}{\text{Total number of scores}} \times 360$$



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