

1. New Quantity = $\frac{b}{a} \times$ Original Quantity (Ratio a:b)
 Factor multiplying Ratio
 b-antecedant, a- consequent

2. Inverse Ratio $\rightarrow a:b \Rightarrow b:a$ $4:3 \Rightarrow 3:4$

3. Compounded Ratio \rightarrow $\underbrace{a:b}_{\text{Antecedant}} \& \underbrace{c:d}_{\text{Consequent}} = ac:bd$ $4:5, 3:7 = 12:35$

4. Duplicate Ratio = $a:b \Rightarrow a^2:b^2$ ($a:b \times a:b$)

5. Triplicate Ratio = $a:b \Rightarrow a^3:b^3$

6. Sub-duplicate = $a:b \Rightarrow \sqrt{a}:\sqrt{b}$

7. Sub-triplicate = $a:b \Rightarrow \sqrt[3]{a}:\sqrt[3]{b}$

8. Continued Ratio = $a, b, c, d \Rightarrow a:b:c:d$ - Partnership Ratio
 $a:b = 2:5$ $b:c = 4:7$ $a:b:c = ?$

$\underline{a:b:c = 8:20:35}$ $\frac{a}{b} = \frac{2}{5} \times \frac{4}{4} = \frac{8}{20}$ $\frac{b}{c} = \frac{4}{7} \times \frac{5}{5} = \frac{20}{35}$

9. Continuous Proportion = $\boxed{\frac{a}{b} = \frac{b}{c} \Rightarrow ac = b^2}$; $b = \sqrt{ac}$ = G.M of a & c

10. Cross Prod. Rule
 Prod. of Means = $\rightarrow \frac{2}{6} = \frac{3}{x} = 2x = 18 \Rightarrow x = 9$

Pro d. of extremes $\frac{2}{6} = \frac{3}{9}$ ✓

11. Invertendo \rightarrow If $a:b = c:d$ then $b:a = d:c$
 $1:2 = 4:8$ then $2:1 = 8:4$

12. Alternendo $\rightarrow a:b = c:d$ then $a:c = b:d$
 $5:7 = 10:14$ then $5:10 = 7:14$

13. Componendo \rightarrow If $a:b = c:d$; then $a+b:b = c+d:d$

14. Dividendo \rightarrow If $a:b = c:d$; then $a-b:b = c-d:d$

15. 13 & 14 \rightarrow If $a+b = c:d$ then $a+b:a-b = c+d:c-d$
 $a-b:a+b = c-d:c+d$

16. Addendo \rightarrow If $2:3 = 4:6 = 6:9 = 10:15 = k(0.66666)$
 $= 2+4+6+10 : 3+6 : 9+15$
 $= 22:33 = 0.6666(k)$

17. Subtrahendo $\rightarrow \frac{2-4-6-10}{3-6-9-15} = \frac{-18}{-27} = 0.6666(k)$

18. $a^0 = 1$

23. $(a \times b)^n = a^n \times b^n$

19. $\sqrt[n]{a} = a^{1/n}$

24. Base x $\begin{matrix} 2 & 3 & 4 & 5 \\ \hline & \hline & \hline & \hline \end{matrix}$
 $\downarrow \quad \downarrow$
 $92 \quad 60$

20. $a^m \times a^n = a^{m+n}$

$2^2 \times 4 = 8 = 16$

21. $a^m \div a^n = a^{m-n}$

25: Reciprocal / Negative Power

22. $(a^m)^n = a^{mn}$

$60000 = 6 \times 10^4$

$(2^3)^4 = 2^{3 \times 4} = 2^{12} = 8^4 = 4096$

$10.73 \div 6 = 60000 = 5591.7986$

$\frac{1}{3^4} = \frac{1}{81}$

109. $A = \{2, 5, 7\}$

$\{2\} \{5\} \{7\}$

$\{2, 5\} \{5, 7\} \{2, 7\}$

$\{2, 5, 7\} \phi$

(8)

Total Subsets = 2^n

110. Proper Subsets = $2^n - 1$

111. De Morgan's Law

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

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

112. $n(A \cup B) = n(A) + n(B)$

$- n(A \cap B)$



113. $n(A \cup B \cup C) = n(A) + n(B) + n(C)$

$- n(A \cap B) - n(A \cap C) -$

$n(B \cap C) + n(A \cap B \cap C)$

3 set operations



121. $\frac{d}{dx} (\log x) = \frac{1}{x}$

114. $f \circ g = f \circ g(x) = f[g(x)]$

$f(x) = x^2, g(x) = (2x - 1)$

$f \circ g = f(g(x))$

$g \circ f = g(f(x))$

$= 2x^2 - 1$

115. $f(x) = 2x + 1$

$y = 2x + 1 \Rightarrow 2x = y - 1$

$x = \frac{y - 1}{2}$

$y = \frac{x - 1}{2} = f^{-1}(x)$

Calculus

116. $\frac{d(x^n)}{dx} = n x^{n-1}$

117. $\frac{d e^x}{dx} = e^x$

118. $\frac{d a^x}{dx} = a^x \log_e a$

119. $\frac{d k}{dx} = 0$

120. $\frac{d e^{ax}}{dx} = a e^{ax}$

$$37. \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$38. \text{Sum of roots} = \frac{-b}{a}$$

$$\alpha + \beta = \frac{-b}{a}$$

$$39. \text{Prod. of roots} = \frac{c}{a}$$

$$\alpha\beta = \frac{c}{a}$$

$$40. x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

Construction of Qd. Eq.

$$41. b^2 - 4ac = 0 \text{ Real \& Equal}$$

$$42. b^2 - 4ac < 0 \text{ Imaginary}$$

$$43. b^2 - 4ac > 0 \text{ Real \& Unequal}$$

$$44. b^2 - 4ac > 0 \text{ Real, Unequal}$$

& per. sq. & Rational

$$45. b^2 - 4ac > 0 \text{ Real, Unequal}$$

& not per. sq. & Irrational

$$46. m + \sqrt{n} \text{ other will be } m - \sqrt{n}$$

Conjugate pair

$$47. ax + b = 0 \text{ Simple equation}$$

$$3x - 5 = 13 \rightarrow 3x = 18$$

$$3x = 5 + 13 \rightarrow x = 6$$

$$48. a_1x + b_1y + c_1 = 0 \text{ - Simultan}$$

$$a_2x + b_2y + c_2 = 0$$

$$49. ax^3 + bx^2 + cx + d = 0$$

Trial

m, \dots

$$S0. A + B = B + A$$

$$S1. (A + B) + C = A + (B + C)$$

$$S2. k(A + B) = kA + kB$$

$$S3. A_{m \times p} \times B_{p \times n} = AB_{m \times n}$$

$$S4. A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

$$\det A \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

$$S5. A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

$$a_{11} \begin{bmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{bmatrix} - a_{12} \begin{bmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{bmatrix}$$

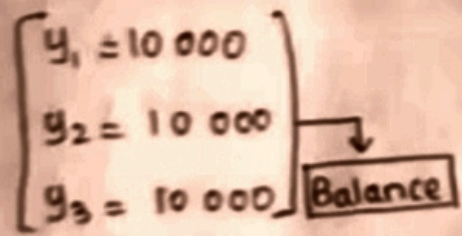
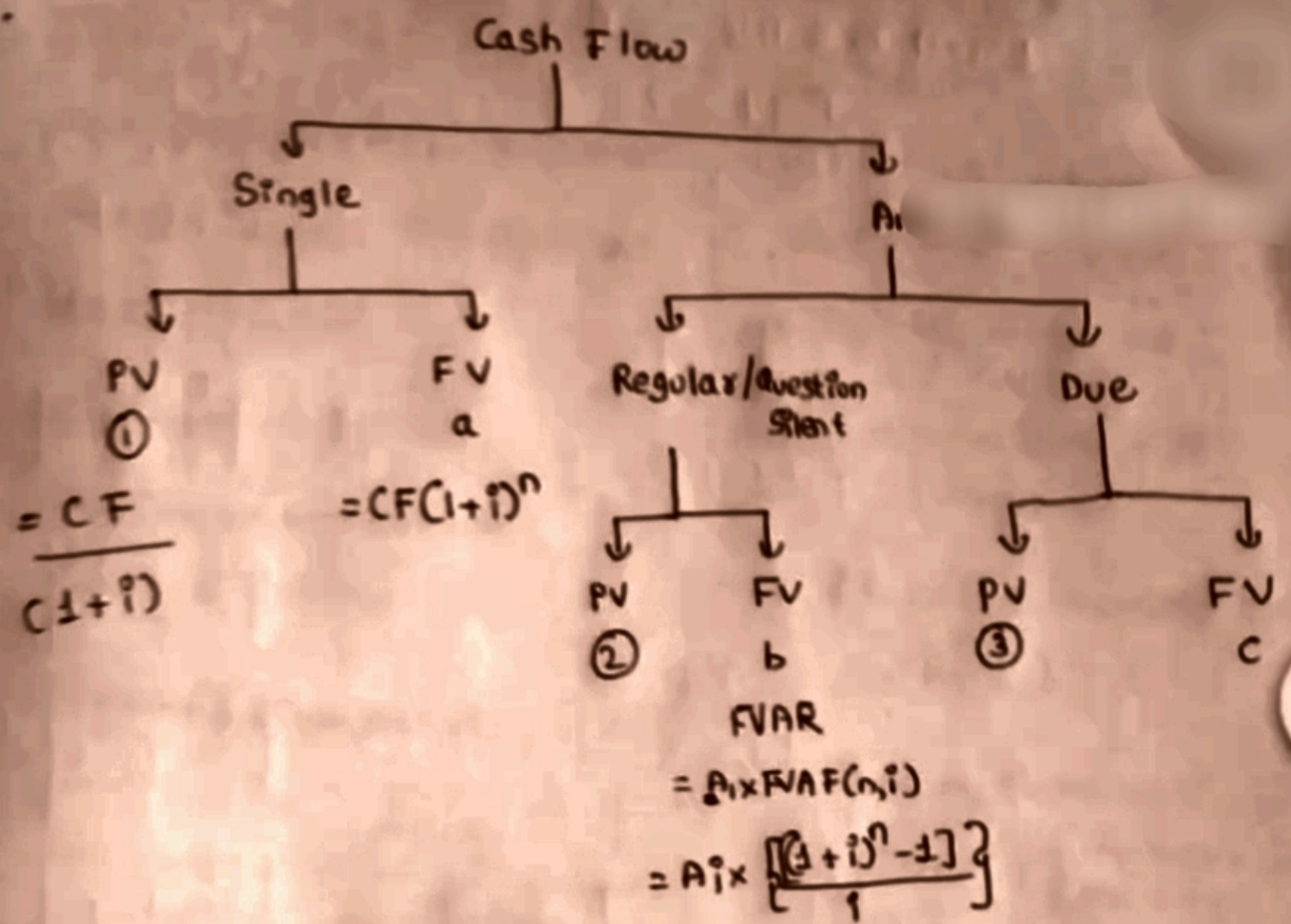
$$+ a_{13} \begin{bmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{bmatrix}$$

$$S6. B_{ij} = (-1)^{i+j} M_{ij}$$

$$S7. A^{-1} = \frac{1}{\det A} \times \text{adj } A$$

Inverse of A; $\det A \neq 0$

65.



$= 10000 \times [3 + \text{Something}]$

↗ Fut. Val. Ann. Fac.

69. $PVP = \frac{Ai}{i}$

70. Growing Perpetuity

$PVGIP = \frac{Ai}{i - g}$

66. $FVA\ Due = Ai \times FVAF(n, i)$

67. $PVA\ Reg = Ai \times \frac{1 - (1+i)^{-n}}{i}$

$1+i = \dots n \text{ times } \boxed{GT}$

69. 3000, 3000, 3000
10% p.a

$PVP = \frac{3000}{10\%} = 30000$

68. PVA Due

70. 1000, 1050, 1102.5

$PVGIP = \frac{1000}{0.10 - 0.05} = 20000$

$$96. S_n = \frac{n}{2} (a + t_n)$$

$$97. S_n = \frac{n}{2} [2a + (n-1)d]$$

$$98. a + d = \dots = \text{upto } n \text{ terms } G_n T + a$$

$$t_2 \quad t_3$$

$$99. S_{10} = \frac{10}{2} [2 \times 20 + 9 \times (-4)]$$

$$= 5(40 - 36) = 20$$

$$20 - 4 = \dots = t_n G_n T + 20$$

$$99. \frac{n(n+1)}{2}$$

$$100. S = n^2$$

$$101. S = n(n+1)(2n+1)$$

$$102. S = [n(n+1)^2]$$

$$103. r = \frac{t_2}{t_1} = \frac{t_n}{t_{n-1}} = \frac{t_3}{t_2}$$

$$104. t_n = ar^{n-1}$$

$$r \times a = \dots =$$

$$t_2 \quad t_3 \quad t_4 \dots t_n$$

$$2, 6, 18, 54$$

$$a = 2, r = 3$$

$$t_8 = a r^7 = 2 \times 3^7 = 4374$$

$$3 \times 2 = \dots = \text{upto } 8 \text{ times}$$

$$= 4374$$

G.P

$$105. S_n = a \frac{(1-r^n)}{1-r}$$

$$r < 1$$

$$106. S_n = \dots$$

$$r > 1$$

$$107. r \times a = \dots = G_n T + a$$

$$t_2 \quad t_3 \quad t_4 \dots t_n$$

$$20, 10, 5, 5/2$$

$$S_5 = \frac{a(r^5 - 1)}{r - 1}$$

$$= \frac{20(0.5^5 - 1)}{0.5 - 1}$$

$$0.5 - 1$$

$$= 20 \times \frac{1 - 0.96875}{1 - 0.5}$$

$$= 30.75$$

$$0.5 \times 20 = \dots = G_n T + 20$$

$$t^2 \quad t^3 \quad t^4 \quad t^5$$

$$108. S_\infty = \frac{a}{1-r}$$

83. ${}^n C_r = \frac{{}^n P_r}{r!}$

${}^n C_r = \frac{n!}{r!(n-r)!}$

${}^{10} C_4 = \frac{{}^{10} P_4}{4!}$
 $= \frac{10 \times 9 \times 8 \times 7}{24}$
 $= 210$

84. ${}^n C_0 = 1, {}^n C_n = 1$

85. ${}^{10} C_8 = {}^{10} C_2$

Complimentary
Combina bion

${}^{14} C_{11} = {}^{14} C_3$

${}^n C_r = {}^n C_{n-r}$

${}^{14} C_7 = {}^{14} C_{14-7}$

${}^{14} C_{11} = {}^{14} C_3$

5, 6, 11, 16, ...

$a=6, d=+5$

$6+5 = 11$

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

86. Special Combination Formula

${}^n C_r + {}^n C_{r-1} = {}^{n+1} C_r$

${}^{600} C_8 + {}^{600} C_9 = {}^{601} C_9$

87. Combinat.

$2^n - 1$

5 - One or more

${}^5 C_0 + {}^5 C_1 + {}^5 C_2 + {}^5 C_3 + {}^5 C_4 + {}^5 C_5 = 32 = 2^5$
 \rightarrow
 $= 2^5 - 1$

88. No. of straight lines = ${}^n C_2$

89. No. of triangles = ${}^n C_3$

90. No. of Collinear = Linear - Collinear

91. No. of parallelogram = ${}^n C_2 \times {}^m C_2$

92. No. of Diagonals = ${}^n C_2 - n$

93. AP, GP

$d = t_2 - t_1 = t_3 - t_2 = t_n - t_{n-1}$

Common diff. of AP

94. $t_n = a + (n-1)d$ (Gen. Term of AP)

95. $a \pm d = \dots n \text{ times}$

$t_2 \quad t_3 \quad t_4 \quad t_n$

Shortcut Trick

Cramer's Rule

$$58. \quad 2x + 3y - 4z = 10$$

$$7x + y + 2z = 19$$

$$-2x - 5y + 3z = 8$$

$$\Delta, \Delta_x, \Delta_y, \Delta_z$$

$$\Delta = \begin{vmatrix} 2 & 3 & -4 \\ 7 & 1 & 2 \\ -2 & -5 & 3 \end{vmatrix}$$

$$\Delta_x = \begin{vmatrix} 10 & 3 & -4 \\ 19 & 1 & 2 \\ 8 & -5 & 3 \end{vmatrix}$$

$$\Delta_y = \begin{vmatrix} 2 & 10 & -4 \\ 7 & 19 & 2 \\ -2 & 8 & 3 \end{vmatrix}$$

$$\Delta_z = \begin{vmatrix} 2 & 3 & 10 \\ 7 & 1 & 19 \\ -2 & -5 & 8 \end{vmatrix}$$

$$x = \Delta_x / \Delta$$

$$y = \Delta_y / \Delta$$

$$z = \Delta_z / \Delta$$

$$63. \text{ Amt. as per CI} = ?$$

$$P = 20000 \quad t = 3 \text{ years}$$

$$r = 8\% \text{ for first 2 yrs}$$

$$r = 12\% \text{ for last yr.}$$

$$20000 + 8\% + 8\% + 12\%$$

$$= 26127.36$$

$$CI = 6127.36$$

Time Value of Money

$$59. \quad SI = \frac{PRT}{100}$$

$$60. \quad A = P + SI$$

$$= P + \frac{PRT}{100}$$

$$= P \left(1 + \frac{RT}{100} \right)$$

$$61. \quad A = P(1+i)^n$$

$$i = \frac{8\%}{100}$$

$$n = t \times \text{no comp yr}$$

$$n = 3 \times 4 = 12$$

$$62. \quad P = 1000, i = 10\%, n = 3$$

$$1000 + 10\% + 10\% + 10\%$$

$$A = 1331$$

$$CI = 1331 - 1000 = 331$$

$$64. \quad E = [(1+i)^n - 1]$$

$$PNB = 8\% \text{ pa. Semi Annually}$$

$$i = \frac{8}{2} = 4\%$$

$$= [(1.04)^2 - 1] \times 100$$

$$= 8.16\%$$