FORMULA BOOK

MATHS

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FORMULA MARATHON MATHS SESSION LINK:

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Formula 1	If a quantity increases or decreases in the ratio a:b then new quantity = b/a times of original quantity
Formula 2	Inverse Ratio of a:b is b:a
Formula 3	Ratio compounded of the two ratios a:b and c:d is ac : bd
Formula 4	• $a^2 : b^2$ is the duplicate ratio of a:b • $a^3 : b^3$ is the triplicate ratio of a:b
Formula 5	• $\sqrt{a} : \sqrt{b}$ is the sub-duplicate ratio of a:b • $\sqrt[3]{a} : \sqrt[3]{b}$ is the sub-triplicate ratio a:b
Formula 6	Continued Ratio: Two different ratios can be put into continued if there common term is same. If given ratios are a:b and b:c, we can make the continued ratio a:b:c if we make term b as same in both ratios
Formula 7	Continuous Proportion: $\frac{a}{b}=\frac{b}{c}\Rightarrow b^2=ac$ here, a = first proportional, c = third proportional and b is mean proportional (because b is GM of a and c)
Formula 8	Invertendo: If a:b = c:d, then b:a = d:c
Formula 9	Alternendo: If a:b = c:d, then a:c = b:d
Formula 10	Componendo: If a:b = c:d, then (a+b):b = (c+d):d
Formula 11	Dividendo: If a:b = c:d, then (a-b):b = (c-d):d
Formula 12	Componendo and Dividendo: If a:b = c:d, then $\frac{a+b}{a-b}=\frac{c+d}{c-d}$ and $\frac{a-b}{a+b}=\frac{c-d}{c+d}$
Formula 13	Addendo: if $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}=k$, then $\frac{a+c+e+\ldots}{b+d+f+\ldots}=k$
Formula 14	Subtrahendo: if $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}=k$, then $\frac{a-c-e-\ldots}{b-d-f-\ldots}=k$
Formula 15	Indices - Standard Results • Any base raised to the power zero is defined to be 1 i.e. $a^0=1$ • Roots can also be expressed in the form of power i.e. $\sqrt[r]{a}=a^{\frac{1}{r}}$
Formula 16	Law of Indices 1: (sum of powers) $a^m \times a^n = a^{m+n}$
Formula 17	Law of Indices 2: (difference of powers) $\frac{a^m}{a^n}=a^{m-n}$
Formula 18	Law of Indices 3: (power of power) $\left(a^m\right)^n = a^{m\times n}$
Formula 19	Law of Indices 4: $\left(a\times b\right)^n = a^n \times b^n$
Formula 20	Calculator Trick for Power (Integer) of any number: Base[×][=][=][=][=][=][=][=][=]..
Formula 21	Calculator Trick for Reciprocal of any number: Number[÷][=]

Formula 22	Calculator Trick for n^{th} root of a number Base $\sqrt{}$ $\sqrt{}$ ...12times -1 $\div$ n $+1$ $\times$ $=$ $\times$ $=$ ...12times
Formula 23	Calculator Trick for Power (also non-integer) Base $\sqrt{}$ $\sqrt{}$ ...12times -1 $\times$ n $+1$ $\times$ $=$ $\times$ $=$ ...12times
Formula 24	Basic Logarithm: if $a^x = n$ then $\log_a n = x$ Conditions: $n > 0, a > 0, a \neq 1$
Formula 25	Log Standard Results: • Log of a number with same base as number is equal to 1 i.e. $\log_a a = 1$ • Log of 1 (one) for any base is equal to zero i.e. $\log_a 1 = 0$
Formula 26	Law of Log 1: Log of product of two numbers $\log_a mn = \log_a m + \log_a n$
Formula 27	Law of Log 2: Log of product of two numbers $\log_a \frac{m}{n} = \log_a m - \log_a n$
Formula 28	Law of Log 3: Log of Number with Power $\log_a m^n = n\log_a m$
Formula 29	Change of Base Theorem: $\log_b m = \frac{\log m}{\log b} = \frac{\log_a m}{\log_a b}$
Formula 30	Form of Quadratic Equation: $ax^2 + bx + c = 0$
Formula 31	Solution of Quadratic Equation: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ where, a is coefficient of x^2, b is coefficient of x, c is constant, a ≠ 0
Formula 32	Sum of Roots $\alpha + \beta = -\frac{b}{a}$
Formula 33	Product of Roots $\alpha\beta = \frac{c}{a}$
Formula 34	Construction of Quadratic Equation $x^2 - (\alpha + \beta)x + \alpha\beta = 0$
Formula 35	Discriminant $d = b^2 - 4ac$
Formula 36	Conjugate Pairs: if one root of the equation is $m + \sqrt{n}$ then other is $m - \sqrt{n}$
Formula 37	Form of Simple Equation (One Variable) $ax + b = 0$ where, a is coefficient of x, b is constant, a ≠ 0
Formula 38	Form of Simultaneous Linear Equations $a_1x + b_1y + c_1 = 0$ & $a_2x + b_2y + c_2 = 0$ where, a is coefficient of x, b is coefficient of y, c is constant, a ≠ 0
Formula 39	Cross Multiplication Method of solving Simultaneous Linear Equations $\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$
Formula 40	Form of Cubic Equation, $ax^3 + bx^2 + cx + d = 0$
Formula 41	Simple Interest: $SI = \frac{P.r.t}{100}$ where P = principal value, r = rate of interest p.a., t = time in years

Formula 42

Amount under Simple Interest: $A = P + SI = P + \frac{P.r.t}{100} = P(1 + \frac{rt}{100})$

Formula 43

Number of Conversion Period per year

Conversion Period	Description	Number of Conversion Period in a year
1 day	Compounded Daily	365
1 month	Compounded Monthly	12
3 months	Compounded Quarterly	4
6 months	Compounded semi annually	2
12 months	Compounded Annually	1

Formula 44

Amount under Compound Interest: $A = P(1+i)^n$

where, P = Initial Principal, i = adjusted interest rate, n = no. of periods

$i = \frac{r\%}{nocppy}$ and $n = t \times noccpy$

Formula 45

Calculator Tricks for Amount under CI: P + i % + i % ...n times

Formula 46

Compound Interest: $CI = A - P = P[(1+i)^n - 1]$

Formula 47

Effective Interest Rate: $E = [(1+i)^n - 1]$

Formula 48

Future Value of a single cashflow: $FV = CF(1+i)^n$

where CF means Cashflow/ Sum for which future value is to be calculated

Formula 49

Future Value – Annuity Regular: $FVAR = A_i \times FVAF(n,i)$

$$FVAR = A_i \times \left\{\frac{[(1+i)^n - 1]}{i}\right\}$$

where, A_i = Annuity (Installment), FVAF = Future Value Annuity Factor/ Multiplier

i = adjusted interest rate, n = no. of periods

Formula 50

Future Value – Annuity Due: $FVAD = A_i \times FVAF(n,i) \times (1+i)$

$$FVAD = A_i \times \left\{\frac{[(1+i)^n - 1]}{i}\right\} \times (1+i)$$

Formula 51

Present Value of a single cashflow: $PV = \frac{CF}{(1+i)^n}$

where CF means Cashflow/ Sum for which present value is to be calculated

Formula 52

Compounding Factor is $\times(1+i)^n$ and Discounting Factor is $\times\frac{1}{(1+i)^n}$

Formula 53

Present Value – Annuity Regular: $PVAR = A_i \times PVAF(n,i)$

$$PVAR = A_i \times \left[\frac{1}{i} \times \left\{1 - \frac{1}{(1+i)^n}\right\}\right]$$

where, PVAF is Present Value Annuity Factor/ Multiplier

Formula 54

Calculator Trick for PVAF 1 + i ÷ = = ...n – times GT

Formula 55

Present Value of Annuity Due $PVAD = \left[A_i \times PVAF\{(n-1), i\}\right] + A_i$

(since first installment is already in present we need to discount second onwards)

Formula 56

Present Value of Perpetuity $PVP = \frac{A_i}{i}$

Formula 57	Present Value of Growing Perpetuity $PVGP = \frac{A_1}{i-g}$ where A_1 is the first installment
Formula 58	Net Present Value: NPV = Present Value of Cash Inflows – Present Value of Cash Outflows
Formula 59	Real Rate of Return = Nominal Rate of Return – Rate of Inflation
Formula 60	CAGR = annual rate used in compound interest
Formula 61	Multiplication (AND) Addition (OR) Rules If one thing can be done in m ways and another thing can be done in n ways Number of ways of doing both things simultaneously/ together: m × n ways Number of ways of doing either of the jobs: m + n ways
Formula 62	Factorial $n! = n(n-1)(n-2)\ldots 3.2.1$ also, $n! = 1.2.3\ldots(n-2)(n-1)n$
Formula 63	Special Formula in Factorial: $n! = n(n-1)!$ $n! = n(n-1)(n-2)!$ $0! = 1$
Formula 64	Permutation Theorem: Number of Permutations when r objects are chosen out of n different objects $^nP_r = \frac{n!}{(n-r)!}$ also, you can use $^nP_r = n(n-1)(n-2)\ldots$ for r factors where n and r are always positive and $n \geq r$
Formula 65	Number of Permutations all objects are chosen out of n different objects $^nP_n = n!$
Formula 66	Special Formula: $(n+1)! - n! = n.n!$
Formula 67	Number of Circular permutations when all objects are chosen out of n different objects $(n-1)!$
Formula 68	Number of Circular permutations when all objects are chosen out of n different objects such that no two persons have same two neighbours $\frac{(n-1)!}{2}$
Formula 69	Permutation with Restrictions (Theorem 1) Number of permutations of n distinct objects taken r at a time when a particular object is not taken in any arrangement is $^{n-1}P_r$
Formula 70	Number of permutations of r objects out of n distinct objects when a particular object is always included in any arrangement is $r.^{n-1}P_{r-1}$
Formula 71	$^{n-1}P_r$ (one thing always included) + $r.^{n-1}P_{r-1}$ (one thing always excluded) = ^nP_r (total)
Formula 72	Number of ways when a group of objects are never together = Total ways – Number of ways when objects are always together
Formula 73	Number of Combinations when r objects are chosen out of n different objects $^nC_r = \frac{n!}{(n-r)!r!}$ where n and r are always positive and $n \geq r$
Formula 74	Linkage of Permutation and Combination Theorem: $^nC_r = \frac{^nP_r}{r!}$

Formula 75	Standard Result of Combinations: ${}^{n}C_0 = 1 \quad {}^{n}C_n = 1$
Formula 76	Complimentary Combinations: ${}^{n}C_r = {}^{n}C_{n-r}$
Formula 77	${}^{n+1}C_r = {}^{n}C_r + {}^{n}C_{r-1}$ (Special Formula)
Formula 78	Combinations of one or more out of n things (when there are two choices) = $2^n - 1$ Combinations of one or more out of n things (when there are three choices) = $3^n - 1$
Formula 79	Formulas in Geometry using Combinations Number of Straight Lines with the given n points: ${}^{n}C_2$ Number of Triangles with n given points: ${}^{n}C_3$ Number of Triangles with n given points where m points are collinear: ${}^{n}C_3 - {}^{m}C_3$ Number of Parallelograms with given two sets of m and n parallel lines: ${}^{n}C_2 \times {}^{m}C_2$ Number of Diagonals out of n lines of a polygon: ${}^{n}C_2 - n$
Formula 80	Common Difference in AP: $d = t_2 - t_1 = t_3 - t_2 = \ldots = t_n - t_{n-1}$
Formula 81	General term of an AP: $t_n = a + (n-1)d$ where, a = first term, d = common difference, n = term number
Formula 82	Calculator Trick of General Term of an AP: $\boxed{a}\boxed{\pm}\boxed{d}\boxed{=}\boxed{=}\boxed{=}\ldots\boxed{=}$ (First equal press will give you 2nd term and so on)
Formula 83	Sum of first n terms of an AP $S_n = \frac{n}{2}(a + t_n)$ or $S_n = \frac{n}{2}\{2a + (n-1)d\}$
Formula 84	Calculator Trick for Sum of n terms of an AP: $\boxed{a}\boxed{\pm}\boxed{d}\boxed{=}\boxed{=}\boxed{=}\ldots\boxed{=}\boxed{GT}\boxed{+}\boxed{a}$
Formula 85	Sum of first n natural or counting numbers: $S = \frac{n(n+1)}{2}$
Formula 86	Sum of first n odd numbers: $S = n^2$
Formula 87	Sum of the squares of first n natural numbers: $S = \frac{n(n+1)(2n+1)}{6}$
Formula 88	Sum of the cubes of first n natural numbers: $S = \left\{\frac{n(n+1)}{2}\right\}^2$
Formula 89	Common Ratio of GP: $r = \frac{t_2}{t_1} = \frac{t_3}{t_2} = \frac{t_n}{t_{n-1}}$
Formula 90	General Term of an GP: $t_n = ar^{n-1}$ where, a = first term, r = common ratio, n = term number
Formula 91	Calculator Trick for General Term of GP: $\boxed{r}\boxed{\times}\boxed{a}\boxed{=}\boxed{=}\boxed{=}\ldots\boxed{=}$ (First equal press will give you 2nd term and so on)
Formula 92	Sum of first n terms of a GP when r<1, $S_n = \frac{a(1-r^n)}{1-r}$ and when r>1 $S_n = \frac{a(r^n-1)}{r-1}$
Formula 93	Calculator Trick for n terms of GP $\boxed{r}\boxed{\times}\boxed{a}\boxed{=}\boxed{=}\boxed{=}\ldots\boxed{=}\boxed{GT}\boxed{+}\boxed{a}$

Formula 94	Sum of Infinite Geometric Series (only applicable if $-1<r<1$) $S_\infty = \frac{a}{1-r}$
Formula 95	Number of subsets of a set containing n elements = 2^n Number of proper subsets of a set containing n elements = $2^n - 1$
Formula 96	De Morgan's Law $(P \cup Q)' = P' \cap Q'$ and $(P \cap Q)' = P' \cup Q'$
Formula 97	2 Sets Operations Formula $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
Formula 98	$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$
Formula 99	Composite Functions $fog = fog(x) = f[g(x)]$ and $gof = gof(x) = g[f(x)]$

About CA. Pranav Popat Sir

- He is a Chartered Accountant (Inter and Final Both Groups in First Attempt) with 6+ years of experience.
- He is an Educator by Passion and his Choice (Dil Se ❤️)
- Taught 10k + students
- He teaches subjects of Maths, LR and Stats (Paper 3) at CA Foundation Level and Cost & Management Accounting (Paper 3) at CA Intermediate Level.

Hope this formula book helps you in revising all formulas and become helpful to you during exam time, I made this with my whole heart, make best use of it and I just want one thing in return - share these notes to every student who really needs this.

Wishing you ALL THE BEST for upcoming examinations, see you soon in Inter Costing!!!

Ab mushkil nahi kuch bhi, nahi kuch bhi!!!

With Lots of Love

CA. Pranav Popat (P^2 SIR)