

Making Maths Digestible to Billions Through Distance Mode

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Introduction

Great strides have been in the area of imparting education through distance learning mode. [Reddy, V.V., & Manjulika, S (2002)] The basic pillar for success of this mode of learning is development of Self-Instructional Materials (SIMS). We utilize this path to solve one of the major problem in getting education reach one and all in the country! The minimum entry level background for a learner to enter any Open University system being 8th std or 10th std level of awareness. To reach the un-reached we need to examine how to enhance success rate at 8th/10th level. In this context we note a major fall out of learners is in the area of Maths. Whence, we present a way of making maths digestible to Millions by empowering every learner the strategy of problem solving through out school years in a simple manner.

Maths Sight Words and Phrases :

Our objective is to facilitate every learner to experience success. Why learners find [Prakash, S (2002), Komal, G (2001)] topics other than maths easy and or interesting? When we look at prescribed books of other subjects and maths, one notes a significant factor-that strikes all immediately namely, the vocabulary and language of maths versus the English language.

In the English language, there exists literature [McNally, J & Murray, W (1984), Cobuild (1993)], which have analyzed most important or commonly used words. List like first 100 words, first 300 words and even first 2000 words that a student at the SSC level need to be familiar with are available.

However, when it comes to finding a similar list for Maths words/terms for students up to SSC level, there appears to be none. An analysis of maths words used in typical Std. 5 to std. 10 textbooks was undertaken by this author and the results are described below :

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Up to 4thstd. Only = Beginning of 5th Std.

Standard	Number of words At the beginning	New words learnt in this class	Total number of Sight Words (CAP)
5th Std	112	62	174
6th Std	174	94	268
7th Std	268	76	344
8th Std	344	64	408
9th Std	408	117	525
10th Std	525	119	644

Quite interestingly we note that only about 650 Maths words/phrases that every learner need to understand use them effectively in problem solving!

The word list arranged through 5th to 10th std level is too big to print them here and hence all interested can get an e-mail copy of the same from the author at bssudhindra@vsnl.net. However, only the fresh sight words & phrases encountered in standards 8, 9 & 10 are given in Tables 1, 2, & 3 respectively, so that learners can get a feel of the efforts they need to put in.

FOLK-CAP for Success in Maths

Based on this author's experience in application of maths to diversified areas as quantum chemistry [Sudhindra et al (1981, 1984)] molecular modeling in drug design [Sudhindra, B.S. (1987, 1990)] and writing computer programs able to run on various platforms, a simple approach to cultivate the Joy of Solving Maths Problems was developed and is described below: This is labeled as "FOLK-CAP" procedure. The acronym stands for "*Figure Out the Logic with Knowledge of Current And Previous*".

The basic tenet of the whole approach is the emphasis on logic, which fortunately, Every human being has "in-built" logic software! One has to be proud/confident of it and make extensive use of it. As one grows up, he/she only needs to enlarge that database. — Cases or situations! eg. A child's cry for food or attention, ability to mimic etc. Acquired Logic includes rules of multiplication, division rules of addition,

subtraction, ..w.r.t sequence of operation of these {last [second (first...)...]} left to right with-in a sequence etc. (BODMAS is also an acronym which is seen in many text books)

The **Folk-cap** procedure involves following 5 Steps :

1. Step 1: Be aware of previous chapters/years maths data w.r.t. Definitions. Theorems and properties of figures, relations etc. Tables 1-3 and discussions in the previous sections provides the necessary help.
2. Step 2: Read the text/unit and spend some time in "Figuring Out the Logic" used in "solved example" in the Text/Unit. Add to your collection the newly read topics, important results & new vocabulary learnt.
3. Step 3: For any given problem, note down
 - data already given
 - what is to be found/determined clearly.
 - wherever possible draw a sketch/diagram indicating the above for better clarity of the problem.
 - be careful about signs, degrees or radians or pi etc While solving problems in physics, chemistry, engineering and allied fields be careful about units and dimensions employed (all should be in the same scale!)

Half the problem is solved if this is done!

4. Step 4: Try to Figure Out the Logic/steps with Knowledge of Current (data given) and Previous chapters to solve the problem.
 - Stretch/strain your mind and imagination to arrive at the solution in stages.
 - If you cannot "figure-out" at the first go, put it aside.
 - Keep thinking about it and come back to it.
 - Review again the steps/logic used in the solved problems in the text.
 - Try again!
5. Step 5: If you can finally solve it on your own, isn't the feeling great? Even solving the problem by discussing the difficult point with a friend or a family member is still a good effort for at least know you will have understood the logic

involved. Experience the Joy of Success in Maths! [Pawar, N.S. (2000), Bhamburkar, G, (2001), Sudhindra, B.S. (2001)]

Learner's Success Centered Format for Problem Solving :

The discussion in previous section leads us to having a “Learner Success Centered Instructional format “for Maths problem solving as given under:”

<p>1. Statement of the problem <i>Left column (CAP)</i></p>	<p><i>Right column (steps to result)</i></p>
<p>2. Data given</p> <p>a)</p> <p>b)</p> <p>c)</p>	<p>What to find/prove</p> <p>i)</p> <p>ii)</p>
<p>3. Logical deductions.</p> <p>Logic : Reason-1 We know that.....</p> <p>Logic : Reason-2 We know that..... As, because, for</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>Intermediate Result-1</p> <p>.....</p> <p>Intermediate Result-2</p> <p>.....</p> <p>.....</p>
<p>4. Therefore</p> <p>(left side : First reasons then)</p>	<p>Final result=Answer!</p> <p>(right side : steps leading to result)</p>

It may look one has to *repeatedly write reasons* at every step for every problem. This is necessary to prove to the reader (evaluator of your work) that you know how exactly to solve the problem! It will also help the learner to master the important results and speeds up his/her ability to tackle newer problems confidently.

Some Facilitating Self check Exercises :

To get a feel of what is being discussed the learner may try the examples given below and self check their position!

Conclusion :

A simple and uniform problem solving procedure valid across all the academic years was outlined to overcome *maths phobia*, which in turn enables a significant number of people to join the OUS.

We fervently hope that learners get used the approach presented here and future textbooks emphasize the **FOLK-CAP** procedure, so that all learners experience the art and joy of problem solving. Thereby facilitating a maths-literate society/nation.

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TABLE - 1 : Class - 8 Words, CAP-8 = Current (This Table) + Previous (CAP-7)

AAA test for similarity	fixed deposit account	reflection angle/reflection line
angular measure of arc	fourth-quadrant	reflection point
area of a circle	frequency	SAS test
Aryabhata	growth/increase	savings account
axis of symmetry	half-yearly interest	secant
bank transactions	heron formula	second quadrant
circumference	identities expansion	sector of a circle
class	intercept	similarity
class interval	irrational numbers	simultaneous equation
class mark	irregular polygon	sphere
compound interest	length of an arc	SSS test for similarity
cone	major arc	statistics
co-ordinate geometry	mean	sum or difference of two cubes
cubes and cube roots	mid-point of class	surface area
cubic expression	minor arc	surveyor's method
current account	passbook	symmetry
cylinder	plotting a point	tangent
depreciation/reduction	Quadrants	third quadrant
division of segments	quadratic equation	triangulation method
first quadrant	quadratic expression	withdrawal/deposit
first time coordinate geometry appears 8th	quarterly interest	X-axis
first time statistics appears in 8th	real numbers	Y-axis

TABLE - 2 : Class - 9 Words, CAP-9 = Current (This Table) + Previous (CAP-8)

absolute value	exterior of a triangle	rational algebraic expression
altitudes of a triangle	finite sets	rationalisation of surds
angle addition property	flat plane axiom	remainder theorem
angle construction property	geometric inequalities	roster method
angle measure axiom	half-plane	rule form
antilogarithm	HCF of polynomials	rules for equivalent form
ASA test	hypotenuse-side theorem	SAA test
associating one number with other	infinite sets	set
axiom of parallel lines	interior of a triangle	set builder
axioms= self evident truths	intersection of two sets	side of a line
binomial quadratic surd	laws of indices	solution set
Cantor G	LCM of polynomials	subsets
characteristic of a number >1	length of a segment	surds
characteristic of a number >1	linear equations in one unknown	synthetic division method
coefficient form of polynomial	linear pair axiom	terminating type
collection of objects	listing method	theorem -alternate angle test
comparison of angles	loci	theorem for converse of corresponding angle
complement of a set	locus	theorem for corresponding angles test
complementary angle	logarithms	Theorem for remote interior angle
condition for parallelism	logical reasoning	theorem of angle bisector
congruent segment	mantissa of a number	theorem of isosceles triangle
constant polynomial	medians of triangle	theorem of midpoints of 2 sides of triangle
converse of linear pair axiom	member	theorem of perpendicular bisector
converse theorem of isosceles triangle	midpoint of a segment	theorem-converse of alternate angle test
convex sets	mixed surd	theorem-converse of interior angle test
coplanar	Napier J	theorem-interior angle test
degree of a polynomial	non-coplanar	theorem-sum of angles in a triangle=180
depreciation value	objects	theorem-sum of angles in quadri=360
disjoint sets	operation on sets	union of two sets
domain of a function	pi	universal set
domain of a variable	plane separation axiom	value of a polynomial
element	point plotting axiom	venn diagram
empty set	population growth	word problems
equal sets finite sets	proof	zero polynomial
equality of polynomial	pure surd	

TABLE - 3 : Class - 10 Words, CAP-10 = Current (This Table) + Previous (CAP-9)

abscissa = x-coordinate	GIS group savings linked insurance policy	recurring deposit cumulative account
account holder	GPF	repair expenses
annual income	HCF * LCM of 2 polys= first poly * 2nd poly	RH-Sin congruency in right triangles
areas of paths	HCF of polynomials	right circular cone
at par, above par, below par	hemisphere area/volume	right circular cylinder areas/volumes
bank (banking)	HRA house rent allowance	same segment angles=
bank account	inadequacy of rational numbers	secant
basic proportionality theorem	indirect tax, sales tax, entertainment tax, road	secant theta
brokerage, broker	inequalities in triangle	shares
capital	inscribed angle	shortest distance
capital	instalments	simple proportion
cartesian plane	insured, insurance amount	sine theta
cash discount on early payment	intercept theorem	special product $(x+y)(x^2-xy+y^2)$
central angle	interior of a circle	special product $(x+y)(x-y)$
central angle	irreducible polynomial x^2+xy+y^2	special product cubes of binomials
circular region	irreducible polynomials x^2+x+1	special products $(x+y)^2$
commission	irregular polygon	standard deductions
compound proportion	isosceles triangle theorems	statistics
concydic points	LCM of polynomials	sum of roots of quadratic eqn
congruency of circles and arcs	LCM of polynomials	sum or difference of two cubes
CONSTRUCTIONS 25 experiments MUST	lends money	surcharge
converse of pythagoras theorem	life policy	surface area/volume of sphere
coordinate plane	loss percent	tan theta
coordinate plane	Measurement of areas in triangles	tangent
cos theta	measure of arc	taxable income
cosecant theta	measurement of areas in quadrilaterals	taxation
cotangent theta	measurement of areas in quadrilaterals in circle, portions of	term deposit
credit	measurement of areas in quadrilaterals in solids, surfaces	Thales theorem basic proportionality
debentures	measurement of volumes in solids	theorems-isosceles triangles
debit	mid-point theorem	third party insurance
degree of constant = 0	NOS	time and distance
degree of the equation	n-th root of +real a= +real b then $b^n=a$	time and work
deposits money	ordinate y=coordinate	transactions(dealings)
depreciation and growth	overhead charges added to cp	transportation charges added to cp
division by 0 not defined	partnership	trigonometric applications heights/distances
discount on marked price	premium =fixed amount paid regularly	trigonometric identities
edowment assurance policy	product of the roots of quadratic eqn	trigonometric ratios at angle 30 deg
exterior of a circle	profit percent	trigonometric ratios at angle 45 deg
factorisation by completing the square	proportion	trigonometric ratios at angle 60 deg
factorisation by splitting the middle term	PRT=simple interest/repair expenses	trigonometric ratios for $(90-\theta)$'s
factorisation of difference of two squares	quadratic eqn from given roots	trigonometric ratios for angle 0 deg (zero)
factorisation of perfect cubes	radical of a number	trigonometric ratios for angle 90 deg
factorisation of perfect square trinomial	ratio	trigonometry
gain% # discount%	rational expression=quotient of 2 polynoms	wealth tax
general insurance	real numbers	withdrawal slip & cheque
gift tax	rebate on donations	work and wage