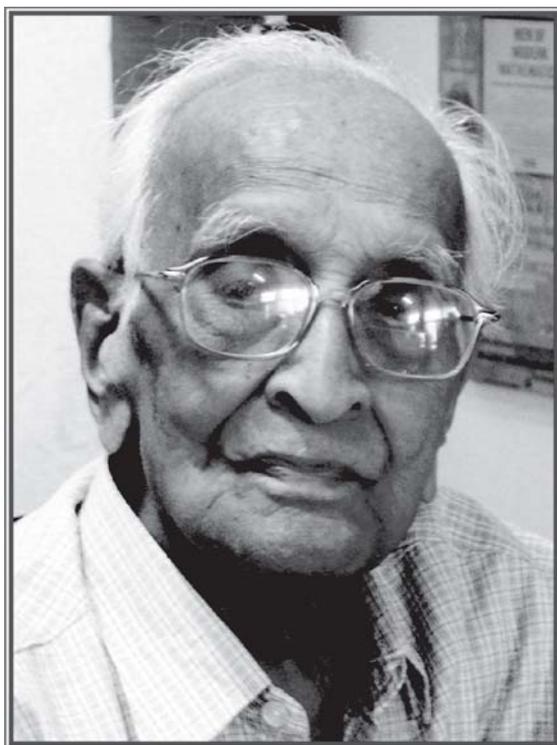# Glorious Innings

of

Prof. A. R. Rao

VIKRAM A SARABHAI
COMMUNITY SCIENCE CENTRE

PROF. A. R. RAO

Popularly known as Raosaheb, Prof. A.R.Rao is completing one hundred years of his active and fruitful life today - September 23, 2008. One of the leading mathematicians of the country, Raosaheb worked as a Professor of Mathematics, first in Bahauddin College, Junagadh- where he spent more than a quarter of a century- and then in various other colleges of Gujarat. After his retirement from active teaching in 1976, Raosaheb joined the Vikram A. Sarabhai Community Science Centre (VASCSC) at Ahmedabad, as Professor Emeritus, where he continues to offer his services till today. Considered to be the father of nonformal mathematics in Gujarat, Raosaheb has established a Mathematics Laboratory at VASCSC, which is unique of its kind in the whole country. The laboratory is replete with fascinating mathematical models, games and puzzles, which not only help the students to understand mathematics better but which also help kindle interest among masses in the subject, considered dry and dull otherwise. It is this innovative concept of Mathematical Laboratory that won Raosaheb a number of awards for popularizing mathematics from state and national level organizations. While Geometry is his first love, Raosaheb is also interested in Number theory and Combinatorics. His book titled 'Brain Sharpeners' is a treasure of mathematical puzzles which are both challenging and captivating.

On this auspicious day we all pray for his healthy, vigorous, dynamic and prolific life.

VASCSC Family
September 23, 2008

Glorious Innings

of

Prof. A. R. Rao

VIKRAM A SARABHAI
COMMUNITY SCIENCE CENTRE

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FOREWORD

It is a matter of great pleasure and privilege for Vikram A Sarabhai Community Science Centre (VASCSC) to bring out this booklet 'Glorious Innings' on this special day- Prof. A. R. Rao's 100th birthday. It is a modest attempt to give a glimpse of the life and work of a mathematical wizard. Of course, this booklet, or, for that matter, even volumes, cannot do justice to the person that he is. But with his long-standing association with the Centre, the least we could do is to pay our humble respects in this small way.

Prof. Rao has been associated with the Centre for the past 34 years. The Centre's Mathematics Laboratory, now a well-known and accepted concept, is his brainchild. He has, with his sustained effort and enthusiasm, nurtured the Mathematics lab, so much so that his name has become synonymous with it.

The concept of teaching mathematics through non-formal methods like using models and hands-on approaches, promoted by the Centre's Mathematics Laboratory, has helped make mathematics a less 'difficult and dreadful' subject for students. Many teachers have employed this approach in their classrooms for effective teaching. Mathematics has, indeed, become more popular with this approach.

For the past few years that I have known him, I have been overwhelmed to see a nonagenarian so active professionally. His love for mathematics brings him to the Centre regularly and he is constantly working on new ideas. Through his continued interaction with teachers and students, he has been a huge source of motivation.

We are proud to have Prof. A. R. Rao with us at the Centre. We hope and pray that we may continue to get his guidance for many more years to come.

Dilip Surkar
Executive Director, VASCSC
23 September 2008

A LIFE SKETCH

A stalwart personality completing 100 years of his exemplary life, an expert in problem solving, pioneer in the field of non-formal mathematics, the one to set an exellent mathematical laboratory at VASCSC, the first lab of its kind in India; who can it be? Only one man in India fits into this description; Prof. A. R. Rao (Annaswami Rangnath Rao) popularly known as 'Raosaheb'.

Prof. A. R. Rao was born in a small village named Jakka-samudram of Salem district, Tamilnadu. Had his schooling at Tanjore and Trichinapalli. Raosaheb graduated in chemistry with goldmedal from Madras (now Chennai) University and completed his post-graduation with first class, distinction, from Bombay University. Prof. Rao was a fellow at Wilson College.

Home

Maths Entertainment - College Picnic

On the completion of formal education, Prof. A. R. Rao joined Bahauddin College, Junagadh in 1933, as a Professor of Mathematics. He spent 27 years of his bright career there; after which, Gujarat College, Ahmedabad (1960-1963), Sir P. P. Institute of Science, Bhavnagar (1963-1967), C. U. Shah College, Ahmedabad (1967-1968) and Natwarsinhji College, Chota Udaipur (1968-1974) had the privilege of receiving his services in the capacity of Professor of Mathematics and Principal.

During this period, Prof. Rao held many prestigious positions such as membership or chairmanship of various academic committees within or outside the state.

As president GGM, 1974

Prof. Rao has to his credit many papers presented by him at several conferences and many research papers in the field of geometry, number theory, and combinatorics which have given him international recognition. Prof. Rao has also to his cedit several contributions in the Gujarati encyclopaedia - 'Vishwakosh'.

At VASCSC

After retirement he started his second innings in 1974 as a mathematician at VASCSC. The teacher of formal mathematics took up a new role of a teacher and an advocate of nonformal mathematics, as a means to popularize mathematics. Making mathematics enjoyable for students & masses was his dream. His innovative, creative thinking went hand in hand with his commitment and dedication to mathematics in designing new mathematical models, be they teaching aids, games or puzzles.

At VASCSC, Raosaheb's idea of a mathematics laboratory acquired a concrete shape. It is a first of its kind in India; and now with many laboratories coming up, it is the largest. To bring general awareness of the concept of non-formal mathematics and mathematics laboratory, he travelled far and wide to deliver talks and organize workshops and exhibitions. Prof. Rao has offered

At the Maths Lab with US Full Bright Team 2008

his services for workshops organized by N.C.E.R.T. also. Raosaheb has published books in English as well as in Gujarati to popularize mathematics.

At math workshop, STTI, Gandhinagar - 2007

Prof. Rao's marvellous problem-solving skill is yet another chapter in the volume of his merits. Raosaheb is considered to be an uncrowned king of problem-solving. His services are still sought for in training students for International Olympiad and he enjoys doing it.

Prof. Rao's other interests are also varied. He can discuss Philosophy, Geography, Chemistry, Biology, and even Linguistics in great details. Raosaheb knows eight languages! Besides academics, he is very good at sports. Young Prof. Rao was an excellent tennis player and to defeat him at chess, even today, would be an achievement.

With some Awards

To acknowledge his services to the society in popularizing mathematics and science he has been honoured with national award by the Central Government in 1997. He was also honoured by the state government in May 2008. Prof. A. R. Rao has been felicitated by many institutes of local and national standing.

Documentaries have been produced on Prof. Rao's life and work by the Department of Science and Technology, New Delhi, EMRC as well as by Gujarat Ganit Mandal. N.I.D., Ahmedabad, has produced video films on his lectures on 'Soap Bubbles' and 'Negative Numbers.There were Raosaheb's appearances in 'Surabhi', a well-known T.V. feature and in Ahemadabad Doordarshan's UGC programme.

And such a great, nationally acclaimed mathematician is so humble! So simple at heart! He is a RISHI in true sense of word. His family, friends, and students, they all have the same thing to say.

With Family Members

''શ્રી રાવ સાહેબને રાજયકી જો સેવા કી હે, વિજ્ઞાનકી જો સેવા કી હે, એક કર્મયોગી તપસ્વીકે રૂપમેં કી હે. મૈં નહીં માનતા હૂં કી આનેવાલી પીઢીયાં ઈસ પ્રકારકે જીવનકો ભૂલા સકતી હે. કોઈ ભી શિક્ષક કો ઈસસે બડા living inspirational example નહીં મિલ સકતા.''   - શ્રી નરેન્દ્ર મોદી, મુખ્ય મંત્રી, ગુજરાત રાજય

PROF. A. R. RAO ON MATHEMATICS EDUCATION

Prof. A.R.Rao is an eminent and popular teacher of mathematics. He taught at college and higher levels before retirement and after that, he devoted himself to reading, research and devising innovative methods of teaching in the subject, now especially in school mathematics. His vast and varied experience in the field is reflected in his ideas on Mathematics Education, expressed in his article on 'The Concept of a Mathematical Laboratory', from which we quote here:

"Although everyone concedes that without mathematics, modern science and technology can hardly make any progress, it is common knowledge that the students everywhere consider mathematics as a very difficult subject. Of the many reasons that can be found for this, perhaps, the most important are, some defective methods of teaching, over emphasis on exams and indiscriminate cramming of materials from the text books and the so-called guides. So what is really needed is inculcation of a power of understanding and a capacity of creative thinking."

A R Rao in action - 2007

This would call for some remedial measures, in supplementing the present system of teaching mathematics by some other methods, which may make mathematics easier to see, simpler to understand and interesting and enjoyable to make the student like it. There could be several ways of achieving this. One that Prof. Rao advocates for, is that of associating activities and experiments in the process of teaching, with the help of mathematical models in the form of teaching aids or puzzles. Besides serving the above purpose, this will also train the students, without their realizing it, to think logically.

An awareness of the advantages of this method seems to be coming up now and growing, and many School Boards are making it mandatory to use this method in schools and even to establish Mathematics Laboratory for the same.

If implemented properly, the experiment of experiments in school mathematics is bound to succeed and can be expected to make teaching more effective and learning more interesting.

> **It is important that the brain is used as an activity room and not a store room.**
> **- Prof. A. R. Rao**

NONFORMAL MATHEMATICS AND MATHEMATICS LABORATORY

> **I hear and I forget**
> **I see and I remember**
> **I do and I understand**

'Hands-On' is the 'in' term these days in the academic world. But it was half a century back that Prof. Rao first kindled the spark of 'Nonformal Mathematics', which is now catching up like wildfire. 'Hands-On' is only a part of it!

What is this nonformal mathematics, after all? Let us first see what formal mathematics is. Our teaching of mathematics is formal in two ways… defined and undefined terms, postulates and results proved very logically with their help, on one hand and the rigorous, syllabus-oriented and time-bound study on the other. This becomes difficult for the average student and boring for the bright ones. As a solution to this, together with the formal method of teaching mathematics, the presentation of mathematics with some nonformal methods which would make mathematics easy to understand, interesting to work with and which would make the student learn to think logically, is nonformal mathematics. Here, we may use mathematical teaching aids, do activities, solve problems and puzzles or play mathematical games; it may include a reference to some interesting mathematical history of the topic under consideration or an interesting story or inspiring anecdote from the lives of mathematicians; we may bring out the hidden characteristics of the results and point out the beauties in mathematics; we need not go strictly by syllabus here… we can talk about 'magic squares', always a very fascinating topic, or 'cryptography', the method of sending secret messages, or 'cycloid', the curve of quickest descent and such examples of varied interests and applications in everyday life. Besides, the practical work brings a change in the routine chalk-and-duster (or book-and-pen) theoretical study, not to mention its great advantage of putting the abstract in the concrete form, that is easy to visualise.

While entering the mathematics laboratory, two important things should be borne in mind, one, before an experiment, and the other, after. Before the experiment, one should remember that no result is acceptable in mathematics until it is proved and an experiment is only a verification, to help us see the result. The second thing to be done is after the experiment. One should try to find out the mathematics used in making the model or try to find out why the dissected pieces fit in the way they do and so on.

In nonformal mathematics, mathematical puzzles and games can play an important role. They fascinate one and all, age being no bar! One uses a lot of mathematical and logical thinking in solving them or in trying to find the winning strategy in games like the well-known one, 'number race', without even knowing or realising it. Here, too, after getting a solution, the student can be led to asking further questions... is there another solution? third one? or is the solution unique? Can there be variations in the problem?...

Our present teaching system is age-old! If we can supplement it by non-formal methods, may be, the students' scare for mathematics will disappear and they may learn mathematics with excitement and enjoy it. This is the dream of visionary Raosaheb.

(Based on the paper presented by Prof. A. R. Rao at the All India Science Teachers' Conference, at Trivendrum, December 1978.)

''હિમાલય કે તાજમહાલના સૌંદર્યનો સાચો ખ્યાલ કોઈ નિષ્ણાત ભોમિયો કરાવે તોજ આવે. રાવ સાહેબે એક અચ્છા માર્ગદર્શક બનીને ગણિતના અને વિશેષતઃ ભૂમિતિના આંતરિક સૌંદર્યનું દર્શન કરાવ્યું.''
— ડૉ. એમ. એચ. વસાવડા (ભૂતપૂર્વ વિદ્યાર્થી)

My coming to Ahmedabad has enriched my life through my association and interaction with two towering personalities (વિભૂતિઓ) Prof. A. R. Rao and another is Prof. P. C. Vaidya.
- Dr. Madhukar Mehta, Ex-Director, VASCSC Ahmedabad

Amazing Lab! Beyond the wildest imagination when VASCSC was conceived.
- Shri S. S. Patel (connected with VASCSC at its inception)

To spend even one hour with Raosahib is an education in itself
- Shri Sadanand B. Kumta, Retd. Principal, Polytechnic College, Bhavnagar

PROF. A. R. RAO AND HIS CREATIONS - TEACHING AIDS

Prof. A. R. Rao has been consistently and continuously working on methods for helping students get interested in Mathematics and understand it easily.

Naturally one learns best by doing things like constructing, touching, moving, investigating, and experimenting. With this in mind to explain some abstract concepts, Prof. A. R. Rao has developed as many as about 15 interesting teaching-learning aids in topics like Algebra, Geometry, Solid Geometry, Graph theory, Number systems, Number theory, Combinatorics etc. These can help in teaching-learning process and can be effectively used in a classroom. Some are known teaching aids and some are his own innovations.

Putting an abstract idea or mathematical result in a concrete form is quite difficult, and it may take anything from two days to six months in conceiving, conceptualizing, designing, and making it.

To give a flair of his ingenuity, given below are the glimpses of some the teaching aids designed by him.

1. Result : $a^2 - b^2 = (a+b)(a-b)$

To demonstrate the above identity, we have a model with three pieces as shown. The bigger length is considered as 'a' units. The smaller square has sides of length 'b' units. The two congruent trapeziums will have parallel sides of lengths a and b units and the distance between them is a-b units.
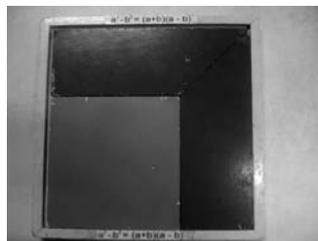

This is how it works: we can see that the total area is a^2. Now remove the square piece (b^2 sq. units). We are then left with a^2-b^2, the quantity we are looking for, in the form of the two trapeziums. We can rearrange the trapeziums to form a rectangle whose sides will be 'a+b' and 'a-b', the area hence being $(a+b)(a-b)$. But this was a^2-b^2. Hence the result is verified.
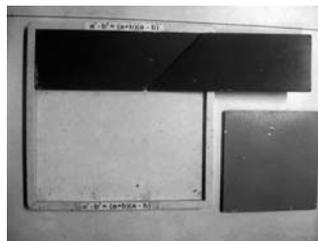
2. Result: $AD^2 = BD \times DC$

If the altitude AD is drawn on the hypotenuse BC of a right triangle ABC, right angled at A, then the length of the altitude is the geometric mean of the lengths of the segments of the hypotenuse formed by the altitude.

To understand this theorem Prof. Rao has given a beautiful model. By just seeing the arrangement and rearrangement of the pieces the proof can be seen and it becomes self explanatory.

figure (i)

figure (ii)
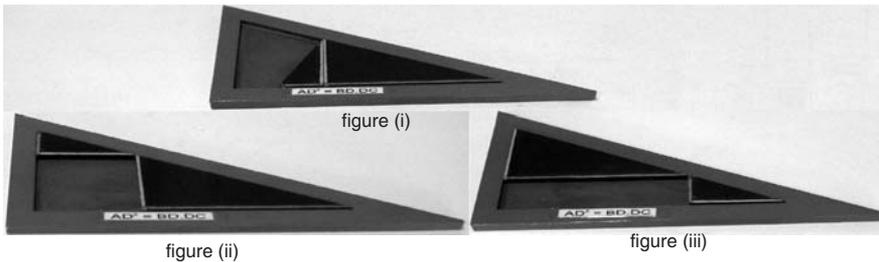
figure (iii)

There are two pieces arranged in a tray. In [figure (i)] the pieces are arranged in a tray to form a right triangle ABC. Angle A is 90° and AD is the altitude on BC. Arrange the two pieces [figure (ii)] in such a way that ABD fits in the upper corner of the tray.

If we remove the two pieces, what remains is a square, whose area is AD^2.

Now look at the [figure (iii)]. The two triangular pieces have been interchanged. If we remove the two pieces what remains is a rectangle whose area is BD x DC.

Since equals - equals = equals, we have $AD^2 = BD \times DC$.

## 3. Property of Intersecting Chords of a Circle

If two chords of a circle intersect, then the products of the segments formed on each chord are equal.

Prof. A. R. Rao has designed two models to show this result. The first one is similar to the one just discussed and the result is obvious.

8
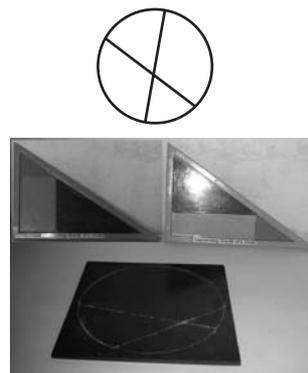
In the second model, two rectangles are taken in such a way that the sides of the two rectangles are precisely the lengths of the segments of the two chords.

One of the rectangles has been dissected in such a way that the pieces would fit on the other rectangle, thus demonstrating that the two areas are equal. But this means that the products are equal.
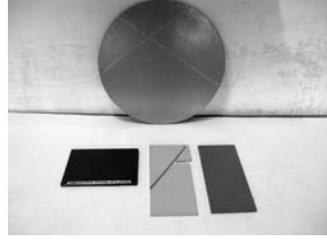
4. Desargue's Theorem

If in two triangles, the lines joining the corresponding vertices are concurrent then the points of intersections of the corresponding sides are collinear.

Obviously this means that we have ten lines and ten points. This configuration is also known as Desargue's configuration.

This theorem is true not only on a plane but also in space. To visualize such a configuration in space and to make a model for it, can be done by none other than Prof. Rao. If we draw the figure, we can see the property in two different ways, but it will be really amazing to find that we can realize the property in ten different ways by visualizing in space from the model by taking different pairs of triangles having the first property.
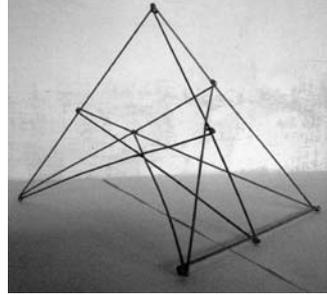
No attempt is made to prove the theorem through the model. It can be seen and needs no words.

"પ્રખર બુધ્ધિ, કુશાગ્ર રમૂજવૃત્તિ, સૌજન્યપૂર્ણ વ્યવહાર, વિનયપૂર્ણ વાણી, વિનમ્ર વર્તન અને દિલના ઔદાર્યને લીધે રાવ સાહેબ લગભગ સંપૂર્ણ માનવ છે.''
- ડૉ. એમ. એચ. વસાવડા, નિવૃત્ત હેડ, ગણિત વિભાગ, સરદાર પટેલ યુનિર્વસિટી, વલ્લભ વિદ્યાનગર

PROF. A. R. RAO AND HIS CREATIONS - MATHEMATICAL GAMES

You must have enjoyed playing games during your school days, but have you also enjoyed playing a mathematical game? Try playing such a game with Prof. A. R. Rao and experience the joy and excitement for yourself. Prof. Rao loved, and still loves, to play mathematical games with school children and even parents.

"Mathematical games", as Raosaheb says, "are excellent tools to catch the attention of the learner. They not only generate the learner's interest in the learning of mathematics but also help in sustaining this interest."

As mentioned by Raosaheb on several occasions, mathematical games can make mathematics very enjoyable, exciting, and interesting. Such a game keeps the student actively involved and at the same time it allows students to experience the joy of success and the satisfaction of finding the solution (or winning strategy), thereby building their enthusiasm and self-confidence.

It is Prof. Rao's way of playing a game - he will definitely win, but the charm is he will also encourage you to play again and again, and try to win the game. Of course you have to find the winning strategy for that. Don't worry; Prof. Rao will give you plenty of time to think over it. If not he will provide some hint towards the solution. This way he always encourages the learners to find the solution themselves.

Now hold on! Prof. Rao doesn't stop here. Once you know how to win a particular game, he then encourages you to generalize the game for *n* players or *n* numbers, or he will ask you to play the game with new rules, whatever the case may be.

''આજીવન ગણિતસેવી રાવ સાહેબ, આ જૈફ ઉંમરે પણ એટલા જ ઉત્કટ જોમ અને ઉત્સાહથી ગણિત વ્યાપારમાં ગળાડૂબ છે. ગણિત સાથેનો નાભિનાતો આજેય એવો સાબૂત છે. ગણિત તેમનો શ્વાસ-પ્રાણ છે. ગણિત તેઓ શ્વસે છે.''   - શ્રી એ. કે. વીરાણી, સૌરાષ્ટ્ર એજ્યુકેશન ફાઉન્ડેશન


''અમે મિત્રો મજાકમાં કહેતા આપણી નસ કાપો તો લોહી નીકળે, રાવ સાહેબની નસ કાપો તો પ્રવાહી સ્વરૂપે ગણિત વહે.''   - શ્રી વિક્રમ બી. બુચ, નિવૃત્ત રીડર, ભાવનગર યુનિવર્સિટી

We illustrate here some of the games that Prof. Rao enjoys playing with the students or the visitors at VASCSC:

■ **Number race**: This is very interesting game in which two players take turn to speak numbers, but each can say a number by adding not more than 10 to the previous number. The goal is to reach 100. Whoever reaches 100 first, is the winner.

Well, if you are playing this game with Prof. Rao and after playing few more times, you may get to know the winning strategy, be prepared for a slight change and a new challenge! Because Prof. Rao will then ask you to play the same game with new goal to reach, say 120, and new difference, say 13.

■ **Number trick 1 to 80:** The mathematical details of this game are too long for this space. It is the creativity of Prof. Rao that he keeps devising new games continuously. He devised a simpler one and after some years he improvised on it and made the one shown in the photograph.
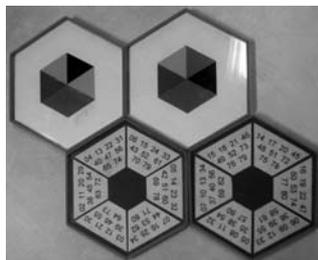
Number Game 1 to 80

Here you have to choose a number from 1 to 80, then from the given four cards (in the improvised one) find out on which side (along the sides of the hexagons) is the chosen number. That can be announced only by looking at the colours on back of the cards.

■ **Number Shift*:** You may have seen the simpler and linear model of this game, but the circular model [figure (i)], which Prof. A. R. Rao devised, may be quite intriguing but the details will require quite a good space. We would give here the details regarding linear form of the game [figure (ii)]. Prof Rao can go on playing this game till you find out how the chosen number is detected.

figure (i) - Number Shift - Circular

figure (ii) - Number Shift - Linear

Choose a number between 1 to 11 and shift as many counters from one end to the other end in the absence of the performer. The performer will then announce the chosen number, by doing some simple arithmetic.

*Taken from 'A Manual of Mathematical Models & Teaching Aids' by Prof. A. R. Rao

PUZZLES AND PROBLEMS

You must have heard about the famous 'Milkman's problem'. It goes like this,...

Problem*: A milkman has an eight litre can full of milk and two empty cans of capacities three and five litres only. How can he divide the milk between two customers equally (four litres each)?

How would we solve this puzzle? By trial and error. After trying one would get the solution as shown in the table below:

This is how the transfer of milk takes place .i.e. to begin with, milk is in the eight litre can, and then we pour three litres of milk in the three litre can. From three litres can, we pour all the milk (3 litres) in five litres can and so on. Thus in eight steps we will able to divide the milk in two equal parts.

8	5	3
8	-	-
5	-	3
5	3	-
2	3	3
2	5	1
7	-	1
7	1	-
4	1	3
4	4	-

But Prof. A. R. Rao comes up with a neat graphical solution as shown below:
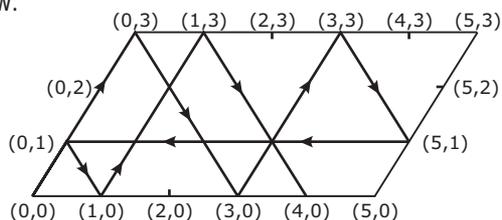
Draw a parallelogram whose sides are of three and five units and one of the angles is 60°. Mark the points as shown in the figure, each with the number as in oblique coordinate system. Imagine a ray of light starting from (0,0), travelling towards (0,1) and getting reflected and re-reflected as shown in the figure.

When you reach 4 for the first time, stop. You will observe that the points of reflections in between are exactly the numbers shown in column two and three of the above table.

* Taken from 'Brain Sharpeners' by Prof. A. R. Rao

Here is another example of Prof. Rao's way of handling a problem.

Problem*: There are 12 balls, all looking exactly alike. The weights of all the balls are perfectly equal except for one ball whose weight differs very slightly from any of the others. It is not known whether the defective ball is slightly heavier or lighter. Using a balance only three times, show how to find the defective ball.
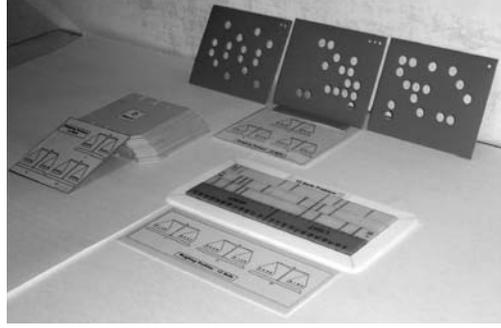
Now the entire solution is highly logical and is not within our scope here. It would be easier to try first, a similar problem with only eight balls, in two weighings. This 12 ball problem will have many more cases and sub-cases. Prof. Rao put all the logical reasoning to work and has finally come up with three different mechanical models for the same problem. (The photographs of the mechanical models devised by Prof. A. R. Rao are given above.)

It is amazing to see how such a highly logical problem can be converted into a totally mechanical device! That is Prof. A. R. Rao!

Not only is he himself not satisfied with a single solution, but he believes in and encourages others in looking for other solutions, if any, and if not, then to prove its uniqueness and to minimize the number of moves required in any particular solution.

Problems illustrated above may be known. But the way they are solved are unique.

Prof. Rao himself created several mathematical puzzles and problem.

According to Prof. A. R. Rao, 'Problem or puzzle-solving, besides being an enjoyable timepass, it provides opportunity to stimulate interest in mathematical and logical reasoning.' And anything that enhances mathematical understanding is Prof. Rao's passion.

* Taken from 'Brain Sharpeners' by Prof. A. R. Rao

''રાવ સાહેબે તેમના તન-મન-ધનથી ગુજરાતમાં ગણિતની સેવા કરી છે. કાકાસાહેબ કાલેલકરની જેમ તેઓ સવાઈ ગુજરાતી થયા છે.''
                                                                      - શ્રી સુરેન્દ્ર માહેશ્વર શુકલ

AWARDS AND ACHIEVEMENTS

Yes, you guessed it right. A plenty of them have come his way. Still with so many feathers in his cap, Prof. Rao continues his endeavour to popularize mathematics amongst the masses.

Post-retirement, in 1974, Prof. Rao started his next innings. After joining the Vikram A. Sarabhai Community Science Centre at Ahmedabad, Prof. Rao surged ahead with new zeal and enthusiasm and started giving shape to his ideas on making mathematics education lucid, interesting, and exciting.

To honour his services he has been rendering, Prof. Rao has been felicitated at many functions, in particular:

a. By the Gujarat Ganit Mandal at the Conference at Visnagar in 1974.

b. By the Mathematics Association of India at Delhi (1987) in the programme of "A Date with Mathematicans".

c. By Homi Bhabha Centre for Science Education, Mumbai.

d. By Gujarat Ganit Mandal at Anand in 1998.

e. By Gujarat Science Academy in Gujarat Science Congress at Ahmedabad in 2001.

f. By the National Board of Higher Mathematics, on his 90th birthday during a week-long Mathematics workshop at Lucknow for training resource persons for the Olympiad trainees.

g. At Bahauddin College, Junagadh on the January 25, 2004, a felicitation on a grand scale as reminiscences of a long and memorable service in the college.

h. A special issue of the bimonthly 'Suganitam' was brought out in his name in October 2007 and presented in a grand felicitation function at Ahmedabad attended by more than two hundred guests.

i.   At a felicitation function at Vadodara during the 44ᵗʰ Gujarat Ganit Mandal Conference.

j.   Felicitated by the organisation - Society for Research & Initiatives for Sustainable Technologies and Institutions (SRISHTI), Ahmedabad, on February 29, 2008.

Felicitation by SRISHTI

k.   Felicitated by the Government of Gujarat at Science City on May 4, 2008.

Felicitation by Govt. of Gujarat

Although Prof. Rao has received many awards, the one that needs special mention is:

National Award Citation →

■   The National Award of 1997, awarded to him for the best effort in the country for popularization in Science and Mathematics, given by the National Council of Science and Technology Communication (DST), Government of India.

National Award

His work and contributions to the society have been noted by many institutions. Here is a glimpse of that:

■   There was an appearance in the well known TV feature 'Surabhi'.

■   The National Institute of Design, Ahmedabad had produced two video films on the topics 'Soap Bubbles' and 'Negative Numbers'.

■   Ahmedabad Doordarshan had telecast a half-hour programme on Mathematical activities in nonformal education in their weekly programme for schools.

■   Gujarat Ganit Mandal has taken a documentary film on his life & his work in popularization of Mathematics.

■   On an assignment from the Department of Science and Technology, New Delhi, Education Media Research Center (EMRC) has produced a documentary on the life and work of Prof. Rao for telecasting by Doordarshan in their feature 'Countrywide Classroom'.

SOME OF THE MODELS DESIGNED BY PROF. A. R. RAO

1.   Divisible by 7 - Circular
2.   Divisible by 7 - Rectangular
3.   Divisible by 13
4.   Divisible by 17
5.   Divisible by 19
6.   Number game 1 to 80
7.   12 balls problem strip model
8.   12 balls problem window reader model
9.   12 balls problem punch card model
10. Model to demonstrate Ramanujan's number
11. 4 x 4 colour square
12. 5 x 5 colour square
13. Binary Converter
14. Square and Rectangle
15. Perpetual Calendar
16. 17 Dominoes
17. Tap-tap
18. $AD^2 = BD.DC$
19. Use of same model to explain other formula; $(a+b)^3$, $(a+b+c)^2$
20. Model to demonstrate a^2-b^2
21. $(a+b)^2 + (a-b)^2$ model 1
22. $(a+b)^2 + (a-b)^2$ model 2
23. Two Intersecting Chords of a Circle model 1
24. Two Intersecting Chords of a Circle model 2
25. Desargue's Configuration
26. Mobius Tetrahedra
27. Conic Sections glass model
28. Ptolemy's Theorem
29. Pythagoras Theorem
30. Continuous path on a Cube
31. Binary Punch Cards
32. Parking Puzzle
33. Number Shift Circular
34. $a^3 + b^3$
35. $a^3 - b^3$

(Some of these models are available at Centre's Science Shop)

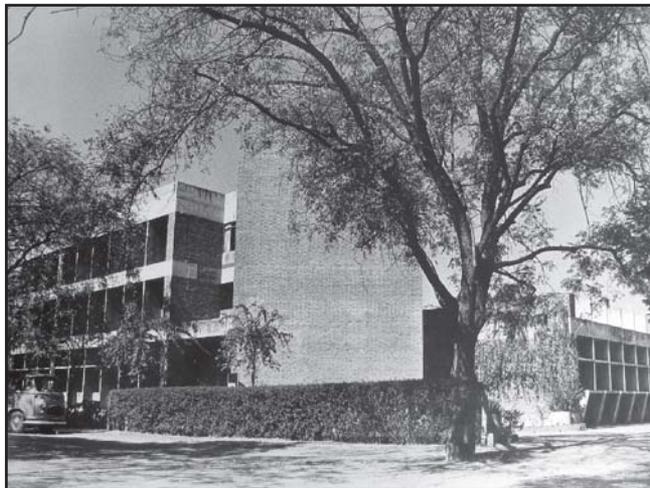# PUBLICATIONS OF PROF. A. R. RAO

1. A Manual of Mathematical Models and Teaching Aids (English)

2. Brain Sharpeners (English)

3. Buddhi Kaso (Gujarati)

4. Ganitma Prayogo (Gujarati) jointly with Prof. I. M. Pandya

5. Ganit Atlun Majhanu Chhe (Gujarati)

6. Several Articles in Magazines and Papers in Journals

Publications
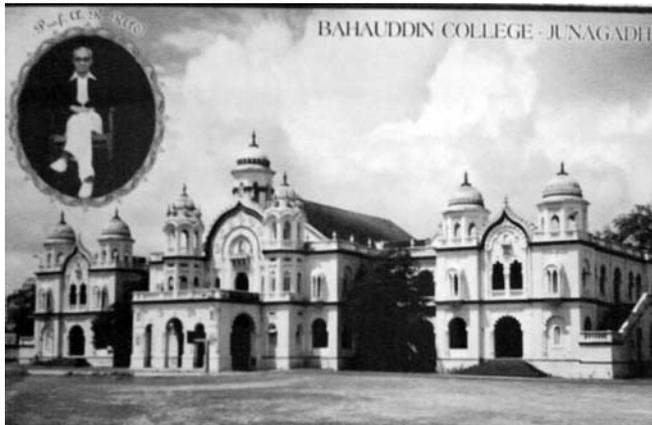
Karmabhumi - Bahauddin College, Junagadh

Vikram A Sarabhai Community Science Centre (VASCSC)

VASCSC is a pioneering institution in the field of science education, founded by Dr. Vikram Sarabhai in 1966. It was created as a facility where people concerned about the quality of science education could come together to try out new ideas and methods of teaching science and mathematics. Its mandate is to stimulate interest, encourage and expose the principles of science and scientific method to the community. VASCSC has well-equipped laboratories in Biology, Chemistry, Computers, Electronics, Mathematics and Physics as well as a Workshop, Library and Science Playground. It is open to everyone interested in science and technology.

VIKRAM A SARABHAI
COMMUNITY SCIENCE CENTRE

Multifarious Aspects of Prof. A. R. Rao

With Dr. P. C. Vaidya - 1964

With Maharaja of Bhavnagar

Interacting With Kids - 2007

Training Parents - 2006

Delivering one of his popular talks

Felicitation by Gujarat Ganit Mandal - 2007

With Dr. Abdul Kalam at VASCSC

With Dr. P. C. Vaidya - 2008