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VIPNET NEWS

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National Mathematical Year 2012

Inside
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Rendezvous with Venus

Dear VIPNET Members,

People Watching Transit of Venus at Vigyan Prasar Campus (NOIDA) on 06th June, 2012

We have been flooded with reports on viewing of Transit of Venus on 6 June 2012. The reports are still pouring in from different clubs, organisations and individual communications by post and e-mail. A detailed analysis of these reports will be published soon in VIPNET News. This time the enthusiasm amongst students and the general public was phenomenal. The large gathering of people at all the places where public viewing of the transit was organised is evidence of the fact. People started gathering in the campus of Vigyan Prasar even before sunrise on 6 June. The experience was the same at all other places where special arrangements were made by different groups, agencies or individuals to facilitate the public viewing of the transit. This time the majority of VIPNET Clubs across the country, and almost all observatories, science centres, planetaria, educational institutions, State councils, even individuals made special arrangements to help the people observe the transit. It was unfortunate that the Sun was clouded out in many parts of northern and central regions of India, disappointing thousands who had gathered to observe the rarest of rare celestial drama of the century.

As per the reports received, the event was witnessed directly by millions using safe solar viewers provided by VP through science clubs, S&T Councils, and other S&T based agencies. At many places special arrangements were made for viewing of the transit directly though telescopes using filters along with other methods like projecting the image of Sun, etc. What was most remarkable was the response of media, both electronic and print, to this celestial event. Throughout the country, wide publicity was given to the event by publishing articles, stories, features, reports, etc., before the event. In electronic media, special panel discussions, interview with scientists, preparations undertaken by various institutes to facilitate public viewing of the transit were widely covered. On the day of the transit, many national channels directly telecast the entire event along with reactions of the public and interviews with eminent astronomers and scientists. The direct telecast/webcast really proved a boon for millions who could not watch this event directly due to clouds.

As you know, the viewing of transits became possible only after the invention of the telescope. In earlier days, telescopes were not available commercially as they are today when we can purchase a telescope even from a toy shop. We really are blessed people, being born in the present century, when all the tools and techniques of viewing the Sun directly in a safe manner are available to us. Today we have various options to view transits or solar eclipses directly using

All our knowledge has its origins in our perceptions.

... Leonardo da Vinci

solar filters or through telescopes. The other method through which we can see the event is by projecting the image of the Sun with a telescope or a pair of binoculars. If we go a little back into history (18-19th Century), it was just unimaginable for common people to watch the transits; it was only a few fortunate scientists who could observe the transit with the help of telescope.

Along with other institutes and agencies, the role of Vigyan Prasar in engaging a large number of students, institutes, planetaria, and amateur astronomers in observing this last transit of the century was noteworthy. Many students even recorded observations with scientific precision. A number of such reports have been pouring in at Vigyan Prasar from various science clubs. Unfortunately, at some places like Leh (Ladakh) where all the students had gathered at the Shanti Stupa, the transit could not be seen due to bad weather. However, the overall experience of Vigyan Prasar in creating the curiosity and mobilising students and general public to watch the transit was quite successful.

The success of the transit of Venus 2012 Campaign was the result of hard work of the entire team of Vigyan Prasar and other partner organisations, which started the work a year before this event. The planning of the campaign was started with a brainstorming session with a group of research scientists, planetaria directors and institutions like Inter-University Centre for Astronomy and Astrophysics, Pune; Indian Institute of Astrophysics, Bengaluru; Aryabhata Research Institute of Observational Sciences, Nainital, and the University of Delhi. To design the outreach activities, a few prominent science communicators were also part of this brainstorming.

For this campaign VP produced a variety of software on Transit of Venus, including a series of resource articles in VIPNET News and Dream 2047, a book of compiled resource articles, slide shows, TV programmes, films, books, and a kit. The activity kit

Children in Camp at LEH on June 5th preparing to Watch Transit of Venus

Children Waiting for Sun at LEH on 06th June, 2012

Master Resource Persons' Training Workshops *with National Council of Science and Technology Communication (NCSTC) :*

Sr No.	Places of MRPs workshops (state covered)	Dates of Workshop
01	Punjab State Council for Science and Technology and Environment, Chandigarh (J&K, Himachal Pradesh, Punjab, Haryana, Bihar, Delhi, Uttarakhand, UP, Chandigarh)	09 & 10 April 2012
02	Tamil Nadu Science & Technology Centre, Chennai (AP, Karnataka, Tamil Nadu, Kerala, Lakshadweep, A&N Islands, Pondicherry)	24 & 25 April 2012
03	Nehru Science Centre, Mumbai (Maharashtra, Rajasthan, Gujrat, Goa, Diu & Daman, Dadara & Nagar Haveli)	30 April and 01 May 2012
04	State council of Science, Technology & Environment, Shillong (WB, Assam, Meghalaya, Arucachal Pradesh, Nagaland, Manipur, Tripura, Mizoram, Sikkim)	08 & 09 May 2012
05	MP Council of S &T, Bhopal (MP, Chattisgarh, Orissa, Jharkhand)	14 & 15 May 2012

Orientation Workshops on Transit of Venus-2012:

Vigyan Prasar in association with various State/Central as well as non-government agencies organized the National level workshops at following places:

Sr No	Place of Workshop	Dates of workshop
01	**Jawahar Planetarium,** Anand Bhawan, Allahabad U. P.	26, 27 & 28 April 2012
02	**Department of Physics** Mohan Lal Sukhadia University Udaipur, Rajasthan	26, 27 & 28 April 2012
03	**Department of Astronomy,** Osmania University, Hydrabad, Andra Pradesh	07, 08 & 09 May 2012
04	**Guwahati Planetarium**, Uzan Bazar, M G Road Guwahati, Assam	07, 08 & 09 May 2012
05	**Pushpa Gujral Science City,** Jalandhar-Kapurtala Road Kapurtala , Punjab	09, 10 & 11 May 2012
06	**MGMs Centre for Astronomy and Space Technology** MGM Campus, Nanded, Maharashtra	12, 13 & 14 May 2012
07	**State Council of Educational Research** and Training Shankarnagar, Raipur, Chhattisgarh	18, 19 & 20 May 2012
08	**M P Birla Institute of Fundamental Research,** Bharatiya Vidya Bhavan Campus, Bangalore, Karnataka	21, 22 & 23 May 2012
09	**Anna Science Center- Planetarium,** Pudukkottai Road Tiruchirappalli, Tamilnadu	25, 26 & 27 May 2012
10	**Nehru Planetarium**, Teen Murty Bhavan, New Delhi	23 April, 30 April & 07 May 2012

People Watching Transit of Venus Using Solar Filters at RAICHUR (Karnataka)

and 2,000 telescopes were distributed throughout the country. More than 5,000 kits, posters and solar filters were also sent to science clubs. All the State Councils and some prominent S&T based science popularisation agencies were also contacted and resource material was made available to them.

To train resource persons for the campaign, different types of workshops like assembling telescopes and Master Resource Person training programmes were organised in different parts of the country. These workshops were organised either by Vigyan Prasar directly or in collaboration with National Council for Science and Technology Communication, DST, New Delhi. Three National and two State-level workshops were also organised on telescope assembling. In these workshops more than 2,000 resource persons were trained to create awareness, mobilise the media, and facilitate safe viewing of the transit by the general public. Many trained resource persons also translated the resource material produced by VP into different regional languages.

There is no gainsaying the fact that the concerted, coordinated and collaborative efforts of Vigyan Prasar have really shown result. Despite the fact that transits are not visually as spectacular as a solar eclipse, the people were curious and came out in the early hours of the morning to observe the transit. They were not only watching Venus as a small black dot moving across the disc of Sun; they had full understanding of its scientific significance and they knew that what they were watching was a rare celestial event that would recur only after a gap of more than a century. A role reversal was also seen as far as media is concerned. Instead of talking about the effect on transit of Venus on humans, they were focusing more on the scientific aspect of this rare phenomenon. The pro-active role of the media was quite supportive in creating awareness about the rarity and the scientific significance of this event among the people. ❑

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Carl Friedrich Gauss

One of the Greatest Mathematicians of All Time

"Mathematics is the queen of sciences and arithmetic the queen of mathematics. She often condescends to render service to astronomy and other natural sciences, but in all relations she is entitled to the first rank."

Gauss

"Almost everything, which the mathematics of our century has brought forth in the way of original scientific ideas, attaches to the name of Gauss."

Leopold Kronecker (1823-1891), the German mathematician

"If we except the great name of Newton (and the exception is one which Gauss himself would have been delighted to make) it is probable that no mathematician of any age or country has ever surpassed Gauss in the combination of an abundant fertility of invention with an absolute righteousness in demonstration, which the ancient Greeks themselves might have envied."

Henry Smith(1826-1883), the British mathematician

"Gauss' contributions to mathematics were profound and they have affected almost every area of mathematics and mathematical physics. In addition to being a brilliant and original theoretician he was a practical experimentalist and a very accurate observer. His influence was naturally very great, but it would have been very much greater had he published all his discoveries. Many of his major results had to be rediscovered by some of the best mathematicians of the 19th century, although the extent to which this was the case was revealed after Gauss' death."

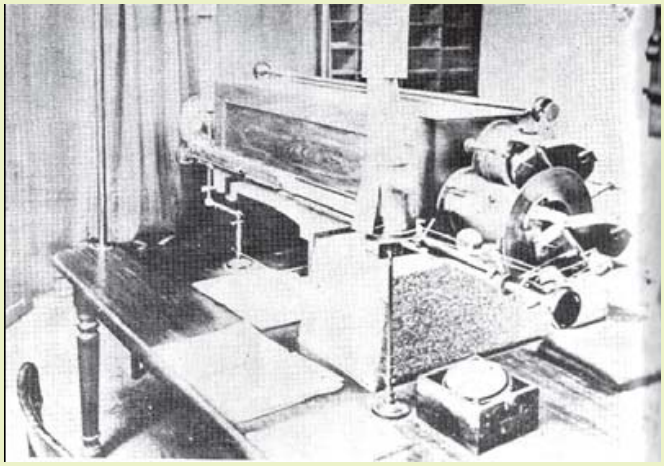
A Dictionary of Scientists, Oxford University Press (1999)

Carl Friedrich is regarded as one of the greatest mathematicians of all time. His biographer G. Waldo Dunnington wrote: "No other name in nineteenth-century mathematics has received recognition equal that of Gauss. His standing in physics and astronomy was perhaps slightly less. Contemporary scholars recognised his unconditional intellectual superiority in his own field. Gauss enjoyed an almost superhuman respect and admiration at the hands of those competent to judge him…Laplace is said to have urged Napoleon to spare Gottingen because "the foremost mathematician of his time lives there."…Gauss' career does not show a gradual rise, as in the case of most scientists; it begins at a high point and continues at that level…In 1805, when the King of Prussia requested Humboldt to enter the Berlin Academy of Sciences in order to lend it the splendour of his name, acquired on the American tour, Humboldt informed the King that his appearance would not be of importance; the only man who could give the Berlin academy new splendour, he wrote, was Carl Friedrich Gauss."

Gauss in 1854

Gauss's work virtually transformed all areas of mathematics. He contributed to almost all branches of mathematics and to number theory in particular. As a mathematician, he was of the stature of Archimedes and Newton. However, in range of interests he exceeded both Archimedes and Newton. In mathematics his chief interest was in the theory of numbers. His monumental work Disquisitiones arithmetica *(Arithmatica Investigations)* was the first attempt to organise the theory of numbers. This was published in 1801. Before Gauss' work the theory of numbers was little more than a collection of isolated results. Gauss made important contributions in other areas of mathematics—algebra, analysis, geometry, mechanic, celestial mechanics, probability, the theory of errors, and actuarial science. It was Gauss who gave the first genuine proof of the fundamental theorem of algebra—that every algebraic equation with complex coeeficients has at least one root that is a complex number. He also worked in observational astronomy, surveying, geodesy, capillarity, geomagnetism, electromagnetism, optics and the design of scientific instruments. He discovered the Gaussian error curve and also the method of least squares, which he used in his geodesic work.

Gauss was an excellent experimentalist. He invented the heliotrope, (a sextant-like instrument that uses reflected sunlight for geodetic measurements) for trigono-



Gauss' personal laboratory in the Gottingen Observatory as he left it

metric determination of the Earth's shape and with Wilhelm Weber (1804-1891), the electromagnetic telegraph. His interest in magnetism also led to the invention of the bifilar magnetometer (in which two silk threads are used for measuring geomagnetic force). Gauss worked on topology and the geometry associated with functions of a complex variables. His researches in mathematical astronomy resulted in many valuable innovations. Gauss obtained a formula for calculating parallax in 1799. In 1808, he published a work on planetary motion. Gauss believed that physical units should be assembled from a few absolute units (mainly length, mass and time), an idea basic to the presently followed SI system.

Gauss discovered the possibility of non-Euclidean geometry but he never published it. He discussed this possibility at length with Farkas Bolayi and in his correspondence with Gerling and Schumacher. It is said that Gauss believed that his reputation would suffer if he publicly admitted the existence of such geometry.

Gauss had a very keen interest in language and at one stage he hesitated between a career in mathematics and one in philology. His linguistics ability was such that he was able to teach himself fluent Russian in less than two years. He also had a lively interest in world affairs. However, his views in politics as in literature were somewhat conservative.

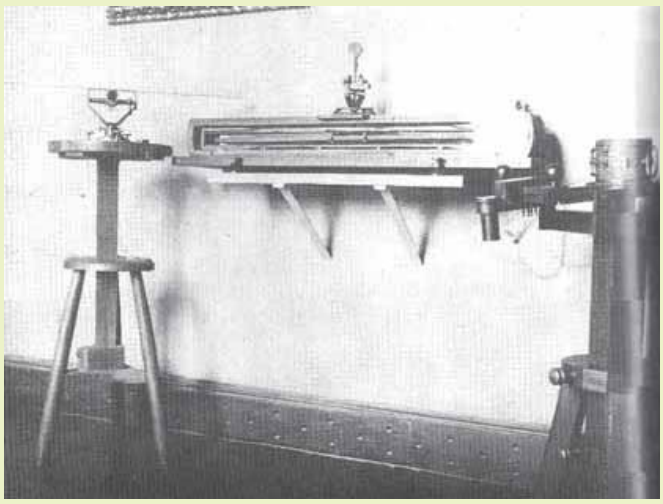
Gauss was never a professor of mathematics. However, many of his students turned out to be influential mathematicians. He disliked formal teaching. In a letter to Heinrich Olbers (1758-1840), Gauss wrote: "I have a true aversion to teaching. The perennial business of a professor of mathematics is only to teach the ABC of his science; most of the few pupils who go a step further, and usually, to keep the metaphor, remain in the process of gathering information, become only Halbwisser (one who has superficial knowledge of a subject), for the rarer talents do not want to have themselves educated by lecture cources, but train themselves. And with this thankless work the professor loses his precious time…..Experience also seems to corroborate this. I know of no professor who really would have done much for science, other than the great Tobias Mayer, and in his time he rated as a bad professor.

Gauss had a reputation of being aloof. He possessed the precious gift of being able to make friend with the young. Among his students included Moritz Cantor (1829-1920), Richard Dedekind (1831-1916) and Ferdinand Gotthold Maximillian Eisenstein (1823-1852), Johann Benedikt Listing, August Fardinand Mobius, Bernhard Riemann and Karl von Staudt.

Gauss is best described as a mathematical scientist or, in the terms common in his day, as a pure and applied mathematician. However, Gauss considered himself nothing but a mathematician. Dunnington wrote: "Gauss used to say that he was entirely a mathematician, and he rejected the desire to be anything different at the cost of mathematics. It is true that the research in physical science offered him a type of recreation. He called mathematics the queen of the sciences, and the theory of numbers the queen of mathematics, saying that she often condescended to serve astronomy and other sciences, but that under all circumstances top rank belonged to her. Gauss regarded mathematics as the principal means of educating the human mind." Whatever he did in science he did as a mathematician, motivated by mathematics and utilizing every experience for mathematical inspiration. Clemens Schäfer one of his scientific biographers wrote in Nature (1931): "He was not really a physicist in the sense of searching for new phenomena, but rather always a mathematician who attempted to formulate in exact mathematical terms the experimental results obtained by others."

Gauss' prinicipal instrument, the Repsold meridian circle

The name of Gauss appears in so many places in mathematics and other branches of science. There is hardly any other scientist who can match Gauss on this account. The most common examples are: Gause's principle, Gauss-A position, Gauss B position, Gauss-Bonnet theorem, Gauss-Codazzi equations, gauss (unit), Gauss' error curve, Gauss eye piece, Gauss formulas, Gauss' hypergeometric equation, Gaussian beam, Gaussian complex integers, Gaussian constant, Gaussian curvature, Gaussian curve, Gaussian distribution, Gaussian elimination, Gaussian error, Gaussian integer, Gaussian noise, Gaussian noise generator, Gaussian



The Gauss-weber telegraph (Easten, 1833)

optics, Gaussian pulse, Gaussian reduction, Gaussian system, Gaussian units, Gaussian weighing method, Gaussian year, Gauss image point, Gauss-Jordan elimination, Gauss' law of flux, Gauss' law of the arithmetic mean, Gauss-Legendre rule, Gauss lens system, Gauss' mean value theorem, gaussmeter, Gauss objective lens, Gauss point, Gauss positions, Gauss' principle of least constant, Gauss-Seidel method, Gauss test, Gauss' theorem.

Gauss was deeply religious and conservative. He was deeply preoccupied with the metaphysical issue of immortality. Gauss was a believer of life after death. He was a staunch supporter of the monarchy. He did not like the ascendancy of Napoleon, who he considered as an outgrowth of the revolution. Gauss lived a modest life. Dunnington wrote: "As the son of poor parents Gauss was not accustmed to the luxury of refinements of more modern times. The limited means of his early years were sufficient for his simple needs…Gauss was slow to accept financial aid from others. Throughout his life he remained true to his feelings of humour and intellectual independence…His wants were simple, and material possessions were sometimes regarded by him as exerting a disturbing influence on scientific work."

Gauss was born on April 30, 1777 in Brauschweig, Duchy of Brunswick-Luneburg (now part of Germany) in a lower middle-class family. Gauss' mother was the semiliterate daughter of a peasant stonemason. But she was a highly intelligent woman. She worked as a maid before becoming the second wife of Gauss' father. Gauss' father was a gardener, a labourer at various trades, a foreman, assistant to a merchant and treasurer of a small insurance fund. Gauss described his father as "worthy of esteem," but "domineering, uncouth, and unrefined." Gauss' mother was her son's only devoted support.

Gauss' extraordinary talent for mathematics showed itself at a very early age. It is said, that without any help, Gauss was able to calculate before he could even talk. According to a well-authenticated story, Gauss when he was 3 years old, corrected his father's arithmetic. Eric Temple Bell in his book *Men Of Mathematics* , (Simon Schuster, Inc., New York, 1937) described the incident in this way: "One Saturday Gerhardt Gauss (Gauss's father) was making out the weekly payroll for the laborers under his charge, unaware that his young son was following the proceedings with critical attention. Coming to the end of his long computations, Gerhardt was startled to hear the little boy pipe up, 'Father, the reckoning is wrong, it should be ...' A check of the account showed that the figure named by the young Gauss was correct."

In school, when he was in the third grade, he developed a formula for finding the sum of any arithmetic progression. Gauss was ten years old. In his arithmetic class, his teacher had given the class a difficult summation problem in order to keep them busy. Gauss took one look at the problem, invented the shortcut formula on the spot, and immediately wrote down the correct answer. Herr Buttner was so astonished by the feat achieved by young Gauss that he was transformed into a champion for this young boy. Out of his own pocket he paid for the best textbook on arithmetic obtainable and presented it to Gauss. Buttner realised that he could teach this young genius no more and he recommend Gauss to the Duke of Brunswick, Karl Wilhem Ferdinand. The Duke granted him financial assistance to continue his education into secondary school and finally into the University of Gottingen.

In 1792, Gauss entered the Brunswick Collegium Carolinum. Gauss possessed a scientific and classical education far beyond that usual for his age at the time. He was familiar with elementary geometry, algebra, and analysis.

Gauss spent three years at the Collegium, in which he continued his empirical arithmetic, once finding a square root in two different ways to fifty decimal places by ingenious expansions and interpolations. He formulated the principle of least squares, apparently while adjusting unequal approximations and searching for regularity in the distribution of prime numbers. Before entering the University of Göttingen in 1795, he had rediscovered the law of quadratic reciprocity (conjectured by Lagrange in 1785), related the arithmetic-geometric mean to infinite series expansions, and conjectured the prime number theorem (first proved by J. Hadamard in 1896).

Gauss studied at the Gottingen University during 1795 to 1798. At the Gottingen University he had the opportunity to study the mathematics classics and he realized that many of his earlier discoveries were not actually new discoveries. In 1799, Gauss got his doctorate; his dissertation was a brilliant proof of the fundamental theorem of algebra.

In 1801, Gauss published his famous work Disquisitiones Arithmeticae *(Researches in Arithmatic)*, which consisted almost wholly of original work and marked the beginning of modern number theory, an area of math-

ematics that Gauss always considered to be the most beautiful. In his *Disquisitiones arithmeticae*, Gauss summarized previous works in a systematic way, solved some of the most difficult outstanding questions, and formulated concepts and questions that set the pattern of research that is still in effect today. He introduced congruence of integers with respect to a modulus, the first significant algebraic example of the now ubiquitous concept of equivalence relation. He proved the law of quadratic reciprocity, developed the theory of composition of quadratic forms, and completely analyzed the cyclotomic equation. *Disquisitiones arithmeticae* almost instantly won Gauss recognition by mathematicians as their prince, but readership was small. G. B. Mathew in his *Theory of Numbers* (Cambridge, 1892) wrote: "It may fairly be said that the germs of the modern algebra of linear substitutions and concomitants are to be found in the fifth section of the *Disquisitiones Arithmeticae*; and inversely, every advance in the algebraic theory of forms is an acquisition to the arithmetical theory."

The courtyard of the Gottinge observatory as it appeared in Gauss time

In this work Gauss led the way to many new areas of mathematics, including the use of imaginary numbers and his theory of congruent numbers.

Immediately following this abstract work in pure mathematics, Gauss plunged into the realm of applied mathematics — in particular, astronomy. The newly discovered asteroid Ceres had been observed by many astronomers for 40 days, but none of them could get a correct computation for its orbit. Gauss was able to accurately compute the orbit after only three observations. This he did by inventing the method of least squares.

The birthplace of C.F. Gauss in Brunswick (picture taken 1884) which was destroyed in World War II

The most obvious course, to become a teacher of mathematics, repelled him because at this time it meant drilling ill-prepared and unmotivated students in the most elementary manipulations. Moreover, he felt that mathematics itself might not be sufficiently useful. When the duke raised his stipend in 1801, Gauss told Zimmermann: "But I have not earned it. I haven't yet done anything for the nation." Astronomy offered an attractive alternative. A strong interest in celestial mechanics dated from reading Newton, Gauss had begun observing while a student in Göttingen. The ingenuity on Ceres demonstrated both his ability and the public interest, the latter being far greater than he could expect in mathematical achievements. Moreover, the professional astronomer had light teaching duties and more time for research. Gauss decided on a career in astronomy and began to groom himself for the directorship of the Göttingen observatory.

In 1807, Gauss was appointed director of the Gottingen observatory, a post he held till his death.

Gauss made significant contributions in the area of differential geometry.His major findings in the field was included in his renowned work, *Dis quisitiones generales circa superficies curva (1828)*, which included such geometrical ideas as Gausian curvature and Gauss' famous eregrium theorem. His geodesic interests led him to differential geometry.

In 1828, Alexander von Humboldt persuaded Gauss to attend the only scientific convention of his career, the Naturforscherversammlung (Nature Research Collection) in Berlin. Humboldt first heard of Gauss from the leading mathematicians in Paris in 1802. Humboldt had been trying to bring Gauss to Berlin as the leading figure of a great academy he hoped to build there. Humboldt had no success in luring Gauss from his Göttingen hermitage. Gauss was repelled by the Berlin convention. However, the visit was a turning point. It inspired him to develop his long standing interest in earth magnetism. During this Berlin visit Gauss met Wilhelm Weber, a young and brilliant experimental physicist whose collaboration was essential for Gauss' work on magnetism. With Weber Gauss established a magnetic observatory. In 1834, Gauss organized the Magnetic Association to conduct Europe-wide geomagnetic observation. This was the first major scientific project based on international co-operation. Later Humboldt expanded the Magnetic Association into a worldwide network.

Gauss undertook the task of reorganisation of the fund for professors' Widows at the Gottingen University. Dunnington wrote: "Beginning in 1845 the academic senate at Gottingen entrusted Gauss with a gigantic task, a study and reorganisation of the fund for professors' widows. He devoted himself to it with his usual vigor; here his mathematical ability and knowledge of financial operations linked up with his practical talent in organising. This job took much of his time as late as 1851, and his work saved the fund from ruin…Gauss received recognition for his achievement, and widows as well as orphans were grateful to him."

Gauss made his last astronomical observation in 1851, at the age of 74, and later the same year approved Riemann's doctoral thesis on the foundations of complex analysis. The following year he was still working on minor mathematical problems and on an improved Foucault pendu-

lum. During 1853-4, Riemann wrote his great *Habilitationsschrift* on the foundations of geometry, a topic chosen by Gauss. Gauss' last scientific exchange was with Gerling, with whom he discussed a modified Foucalt pendulum in 1854.

Gauss had an intense dislike of controversy. He often remained silent when others announced results that he found decades before. Gauss avoided all noncompulsory ceremonies and formalities. He attended only those ceremonies where royalty was to be present. He hardly collaborated with other mathematicians. He was considered aloof and austere by many. After the Berlin visit, Humboldt wrote Shumacher (October 18, 1828) that Gauss was "glacially cold" to unknowns and unconcerned with things outside his immediate circle.

The observatory of the University of Gottingen

Commenting on the style of Gauss, W. W. R. Ball in his *History of Mathematics* (London, 1901) wrote: "The great masters of modern analysis are Lagrange, Laplace, and Gauss, who were contemporaries. It is interesting to note the marked contrast in their styles. Lagrange is perfect both in form and matter, he is careful to explain his procedure, and though his arguments are general they are easy to follow. Laplace on the other hand explains nothing, is indifferent to style, and, if satisfied that his results are correct, is content to leave them either with no proof or with a faulty one. Gauss is as exact and elegant as Lagrange, but even more difficult to follow than Laplace, for he removes every trace of the analysis by which he reached his results, and studies to give a proof which while rigorous shall be as concise and synthetical as possible."

From 1989 until the end of 2001, Gauss' portrait and a normal distribution curve were featured on the German tenmark bank note.

Gauss died on February 23, 1855 in Gottingen, Hanover. He was cremated in the cemetery Albanifriedhof.

Gauss worked in mathematics for his own curiosity. He did not publish anything unless complete and perfect. His motto was "*pauca sed matura*—few, but ripe." The notebook and Gauss's papers (unpublished ones) show that he anticipated non-Euclidean geometry as a boy, 30 years before J Bolai (1802-60, son of Wolfgang) and Lobachevsky; that he found Cauchy's fundamental theorem of complex analysis 14 years earlier; that he discovered quaternions before Hamilton and anticipated A-M Legendre (1752-1833), Abel, and Jacobi in much of their important work. If he had published, Gauss would have set mathematics half a century further along its line of progress." According to an exact mathematics historian Gauss had precisely 404 ideas, 178 of which he discussed in print.

Commenting on Gauss' philosophy of life Dunnington wrote: "Gauss' mature philosophy of life was closely connected with his strongly religious nature, which was characterized by tranquility, peace, and confidence. All pretence was especially repugnant to him, and he treated all charlatanism, especially on the scientific side, with disdain and often with bitter irony. He once said that the most despicable human being is the one who persists in his errors after he has recognized them. A thirst for truth connected with an urge for justice was the leading element in his character. The principle of least compulsion was the mathematical embodiment of that basic ethical thought which he recognized as binding on the universe.

All philosophical studies possessed a powerful charm for Gauss' mind, although he often disliked the ways by which scholars arrived at certain viewpoints. He once said to a friend: 'There are questions on whose answers I would place an infinitely higher value than on the mathematical, for example, concerning ethics, concerning our relationship to God, concerning our destiny and our future; but their solution lies quite unattainable above us and quite outside the area of science.'"

We end this article by quoting Gauss. "It is not knowledge, but the act of learning, not possession but the act of getting there, which grants the greatest enjoyment. When I have clarified and exhausted a subject, then I turn away from it, in order to go into darkness again; the never satisfied man is so strange—if he has completed a structure, then it is not in order to dwell in it peacefully, but in order to begin another. I imagine the world conqueror must feel thus, who, after one kingdom is scarcely conquered, stretches out his arms again for others.

References

1) Dunnington, G. Waldo. Carl Friedrich Gauss: Titan of Science. This book was originally published by Hafner Publishing, New York in 1955. A reprint of the original version with additional material by Jeremy Gray and Fritz-Egbert Dohse was brought out by the Mathematical Association of America in 2004. There are five other biographies of Gauss by E. Worbs (1955), T. Hall (1970), H. Wussing (1976), K.Reich (1977), and W.K. Buhler (1981). However, as Jeremy Gary has mentioned, Dunnington's biography of Gauss "remains unrivalled for its combined breadth, depth, and accuracy."

2) James, Ioan. Remarkable Mathematicians: From Euler to von Neumann, Cambridge: Cambridge University Press, 2002.

3) Ian, David et al. The Cambridge Dictionary of Scientists, Cambridge: Cambridge University Press, 2002.

Acknowledgement : The photographs/illustrations have been reproduced from Dunnington's biography of Gauss.❑

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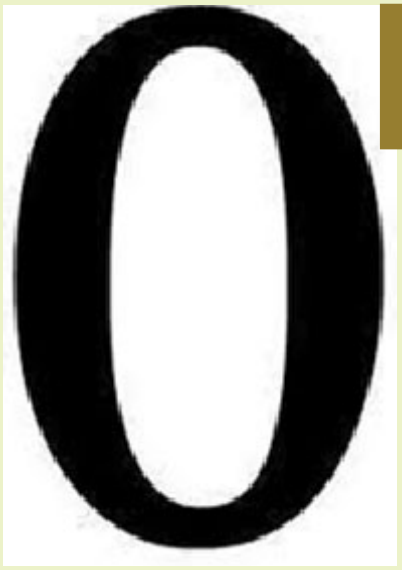
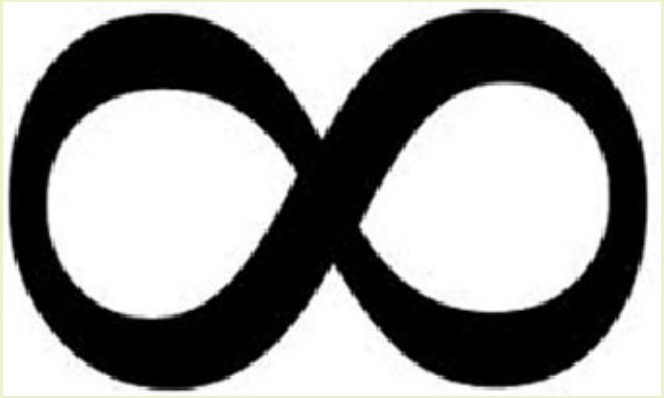


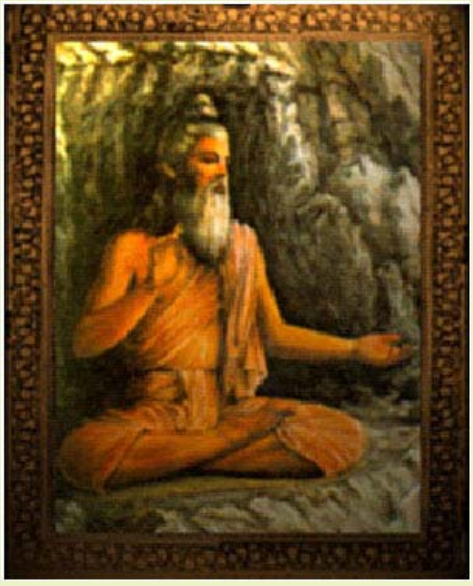
शून्य और अनन्त की कहानी



गणित का आम जीवन में महत्व अतुलनीय है। शहरों-देशों के बीच की दूरी, पदार्थों की नाप-तोल, विभिन्न भवनों, पुलों, रेलवे स्टेशनों आदि के निर्माण में गणित के तमाम सिद्धांत बहुत काम आते हैं। सोचिये, अगर गणित का विकास नहीं हुआ होता तो हम अपने आस-पास उन ढेर सारी चीजों को नहीं देख पाते जिनकी नींव गणित के सिद्धांतों पर टिकी है।

भारत में आर्यभट्ट, भाष्कर, ब्रह्मगुप्त से लेकर रामानुजन तक महान गणितज्ञों की एक शृंखला रही है। श्रीनिवासन रामानुजन (1887-1920) 20वीं शताब्दी के महान गणितज्ञों में से एक हैं। गणित में उनके योगदान को यादगार बनाने के लिए भारत सरकार ने रामानुजन के जन्म दिन को प्रत्येक वर्ष राष्ट्रीय गणित दिवस के रुप में मनाने का निर्णय लिया और वर्ष 2012 को 'राष्ट्रीय गणित वर्ष' घोषित किया है।

अधिकांश बच्चे अपने स्कूली दिनों में गणित से बहुत घबराते हैं मगर जब हम गणितीय स्थिरांकों, सूत्रों और सिद्धांतों के अतीत में झांकते हैं तब इनके विकास की रोचक दास्तान पढ़कर हमारा इनसे सहज लगाव हो जाता है। यहाँ पर हम इलेक्ट्रॉनिकी के सुधी पाठकों के लिए गणित के दो महत्वपूर्ण स्थिरांकों शून्य, और अनंत के इतिहास पर संक्षेप में प्रकाश डालेंगे।



ब्रह्मगुपत

परीक्षा में जिस संख्या को पाने से सभी घबराते हैं, उस संख्या का गणित और आम जीवन में बहुत अधिक महत्व है। जी हाँ, यहाँ बात हो रही है 'शून्य' की। आरम्भ में पाश्चात्य गणितज्ञों ने शून्य के अस्तित्व पर ध्यान नहीं दिया था। भारत में सर्वप्रथम शून्य का आविष्कार हुआ था और इसके विकास की कहानी बड़ी रोचक है। भारत में गणित का अस्तित्व मोहनजोदड़ो और हडप्पा के काल (करीब ईसा पूर्व 3000 साल पहले) से था। इस काल की एक समान आकार की प्रयुक्त ईंटें, सटीक भार, माप और सुव्यवस्थित नगर योजना, प्राचीन भारत में गणित के अस्तित्व को सच ठहराती है। हिंदू धर्म के पवित्र ग्रन्थ वेदों में गणित को समस्त विज्ञानों में सर्वश्रेष्ठ विज्ञान का दर्जा प्राप्त है। यदि आप से पूछा जाए कि पहले कौन-सी संख्या अस्तित्व में आयी 0 अथवा 1, तब हो सकता है कि, कुछ लोग असमंजस में पड़ जाए। यदि हम इतिहास देखें, तो पता चलता है कि, सर्वप्रथम प्राकृतिक संख्या '1' है। प्रथम प्राकृतिक संख्या '1' के बाद आने वाली संख्याएं 2, 3, 4, 5, 6, 7, 8, 9 इत्यादि हैं तथा इनका कोई अन्त नहीं है। यदि इन प्राकृतिक संख्याओं को आपस में जोड़े तो इससे बड़ी संख्या प्राप्त होती है जो निम्न है:-

1+1=2 2+1=3

3+1=4 4+1=5

योग की विपरीत क्रिया को व्यवकलन (घटाव) कहते हैं। अत: यदि 5 में से 1 व्यवकलन करते हैं तो 4 प्राप्त होता है, क्रमश: निम्नलिखित हैं।

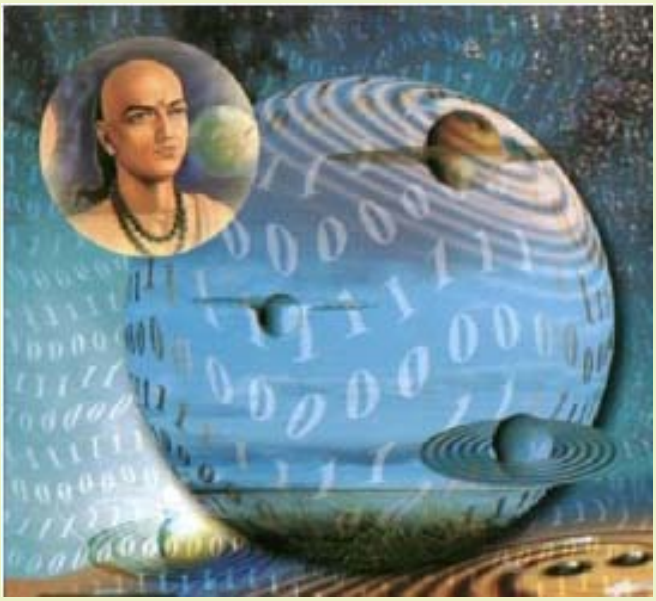
4-1=3 3-2=1

2-1=1 1-1=?

यह पहले पता नहीं था कि 1 में से 1 घटाने पर क्या प्राप्त होगा।

शून्य :- प्रश्न उठता है कि 1 में से 1 घटाने अथवा व्यवकलन करने पर शेष क्या प्राप्त होगा। विश्व भर में इस तरह का प्रश्न सबसे पहले भारतीय मनीषियों के मस्तिष्क में उत्पन्न हुआ। 1 में से 1 घटाने पर जो शेष प्राप्त होता है वह 'रिक्तता' है। रिक्तता को '0' लिखा जाता है। यदि यह पूछा जाय कि, शून्य का प्रयोग सबसे पहले किसने किया, तो इसका उत्तर देना कठिन है परन्तु यदि हम इतिहास पर नज़र डाले तो पता चलता है कि, ई.पू. की दूसरी शताब्दी में ज्योतिष शास्त्र में यूनान के लोग '0' का प्रयोग करते थे, यह एक यूनानी अक्षर 'ओमीक्रान' है। परन्तु दुर्भाग्यवश यूनानी लोग भी इसका प्रयोग उसी तरह करते थे, जिस तरह से बेबीलोन के निवासी करते थे। आचार्य पिंगल के छन्द: सूत्र में '0' का प्रयोग (200 ई. पूर्व) मिलता है। '0' का प्रयोग 300 ई. के दौरान भक्षाली पाण्डुलिपि में भी किया गया है।

भारतीय गणितज्ञ 'भास्कर' ने 629 ई. में स्थानमानयुक्त शून्य सहित अंक का प्रयोग आर्यभटीयं की टीका में किया। शून्य का प्रयोग प्राचीनतम रघोली पट्टों के पुरा लेख में भी किया गया है, जिसकी स्थापना आठवी



आर्यभट्ठ

शताब्दी में जयवर्धन द्वितीय ने की थी। इस लेख में शून्य का चिह्न वृत्ताकार है।

ब्रह्मगुप्त पहले भारतीय गणितज्ञ हैं, जिन्होंने बीजगणित में शून्य का उपयोग किया। जैसे:-

अ-0=अ,	-अ-0=-अ,
0-0=0	अ x 0=0
0 x 0=0	0÷0=0

अब यहां पर फिर असमंजस होता है, कि क्या शून्य में शून्य से भाग देने पर भागफल शून्य रहेगा? ऐसी परिकल्पना सर्वप्रथम ब्रह्मगुप्त ने की और उन्होंने कहा कि 0 ÷ 0=0 सही नहीं है।

खहर अथवा अनन्त (∞) : ब्रह्मगुप्त के अनुसार यदि हम किसी संख्या में शून्य से भाग देते हैं, तो जो भागफल प्राप्त होता उसे 'तच्छेद' कहते हैं। 'तच्छेद' का अर्थ है 'ख छेद'।

भारतीय गणितज्ञ भास्कराचार्य ने 'तच्छेद' को 'खहर' नाम दिया है। भास्कराचार्य के अनुसार यदि 'खहर' राशि में कोई भी राशि जोड दी जाए या घटा दी जाए तो खहर राशि में किसी भी तरह से कोई बदलाव नहीं होता है, 'खहर' राशि पहले की ही तरह 'खहर' राशि ही बनी रहती है। यद्यपि इस खहर राशि में कोई अंक जोड़ने आदि से उसके स्वरुप में विकार पड़ जाता है, तब भी उसका अनन्तत्व नष्ट नहीं होता है।

1, 3, 5, 7, 9 ..... और 2, 4, 6, 8..... संख्या समूह पर यदि हम ध्यान पूर्वक विचार करें तो देखते है कि दोनों ही वर्गों में एक-एक प्रथम पद है, परन्तु यदि अन्तिम पद के बारे में सोचे तो पाते हैं कि, इसमें कोई अन्तिम पद नहीं है। अत: यदि कोई पूछे कि, किस समूह में सर्वाधिक संख्याएं हैं तब इसका उत्तर असम्भव है। हम यह भी नहीं कह सकते कि दोनों समूह में बराबर संख्याएं हैं और यह भी नहीं कह सकते कि किस समूह में कम संख्याएं हैं।

ऐसे समूहों को 'अनन्त वर्ग' कहा जाता है। इस प्रकार के किसी भी समूह में पदों की संख्या का अन्त नहीं होता है, ये अन्तहीन होती है।

दो अनन्त वर्गों की तुलना करने का काम सबसे कठिन काम है। यदि हम उपरोक्त दोनों संख्या समूहों में से एक, दो या तीन पद निकाल भी लेते हैं, तो भी यदि पूछा कि अब कितने पद हैं? तब भी उत्तर होगा 'अनन्त'। यदि उपरोक्त पद में से चाहे जितना पद निकाल लिया जाए तब भी शेष पद 'अनन्त' ही रहेगा।

बेबीलोनियन गणितीय टेबलेट

प्राकृतिक संख्याओं के समुच्चय 1, 2, 3, 4 ,5.....में से यदि हम समस्त संख्याओं 2, 4, 6, 8.....निकाल ले, तो कितनी संख्याएं बचेगी? इसका भी उत्तर 'अनन्त' होगा क्योंकि इस वर्ग में पदों की संख्या अनन्त है। यदि हम लोग 6 के अपवर्त्य जो कि 6, 12, 18, 24, 30, 36, 43..... को निकाल लेते हैं तब कितनी संख्याएं बचेगी। इसका भी उत्तर वहीं 'अनन्त' ही होगा। आज के समय में हम इस शून्य के बगैर किसी भी वैज्ञानिक मापन की कल्पना भी नहीं कर सकते। आधुनिक भौतिकी में पदार्थ और प्रति-पदार्थ का आधार यही शून्य है। शून्य सहित कई भारतीय मूल की संख्याओं ने ब्लेज पास्कल और चार्ल्स बेबेज जैसे यूरोपीय वैज्ञानिकों को संगणन मशीनों जैसे कम्प्यूटर के आवष्किार के लिए प्रेरित किया। कम्प्यूटर की भाषा में बाईनरी सिस्टम का बहुत महत्व है और इसमें 0 और 1 का प्रयोग किया जाता है।

अत: यदि हम इस चीज को संक्षिप्त रुप तथा जन सामान्य की भाषा में कहना चाहे तो कहेंगे कि 'अनन्त' में से 'अनन्त' निकालने पर शेष भी 'अनन्त' रहता है। ❑

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National Mathematical Year 2012

चित्र पहेली-72 / Photo Quiz-72

This year the photo quiz will be based on Mathematical as part of **National Mathematical Year 2012**

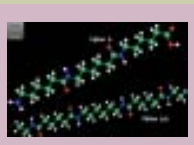
Brain Teaser / जुगत लगाओं

- **On the coast there are three lighthouse.**
  - The first light shines for 3 seconds, then is off for 3 seconds.
  - The second light shines for 4 seconds, then is off for 4 seconds.
  - The third light shines for 5 seconds, then is off for 5 seconds.
  - All three lights have just come on together,
  - When is the first time that all three light will be off?
  - When is the next time that all three light will come on at the same moment?

- **समुद्र के किनारे पर तीन प्रकाश घर हैं।**
  - पहले का प्रकाश 3 सेकंड चमकता है फिर 3 सेकंड के लिए बंद हो जाता है।
  - दूसरे का प्रकाश 4 सेकंड चमकता है फिर 4 सेकंड के लिए बंद हो जाता है।
  - तीसरे का प्रकाश 5 सेकंड चमकता है फिर 5 सेकंड के लिए बंद हो जाता है।
  - सभी तीनों का प्रकाश एक साथ शुरु होता है।
  - तीनों का प्रकाश पहली बार एक साथ कब बंद होगा?
  - तीनों का प्रकाश दूसरी बार कब एक साथ फिर इसी प्रक्रम में आएगा ।
- उत्तर प्राप्त करने की अंतिम तिथि: 15, सितम्बर, 2012
- ड्रॉ द्वारा चयनित विजेताओं को पुरस्कार स्वरूप विज्ञान प्रसार के प्रकाशन भेजे जाएँगे।
- अपने जवाब इस पते पर भेजें : **विपनेट चित्र पहेली - 72, विज्ञान प्रसार, ए-50, सेक्टर 62, नोएडा-201 309 (उत्तर प्रदेश)**
- Last date of receiving correct entries: 15 Sep., 2012
- Send Quiz Ans. to desk : VIPNET Photo Quiz 72, VIGYAN PRASAR, A-50, Sec. 62, Noida-201 309 (U.P.)

Correct Answer of Photo Quiz 67

Nylon



Nylon is the first commercially successful synthetic polymer and one of the most commonly used polymers today. Chemically, nylon is a generic name for a synthetic linear polymer with repeating amide groups (-NHCO-). It is a polyamide which is used in the manufacture of textile fibres. It is a thermoplastic material, first used commercially in nylon-bristled toothbrush in 1938. It replaced silk in military applications such as parachutes and vests, and it is used as reinforcement in many types of vehicle types. Solid nylon is used for mechanical parts such as machine screws, gears and other components previously cast in metal.

NAME OF THE WINNERS: -

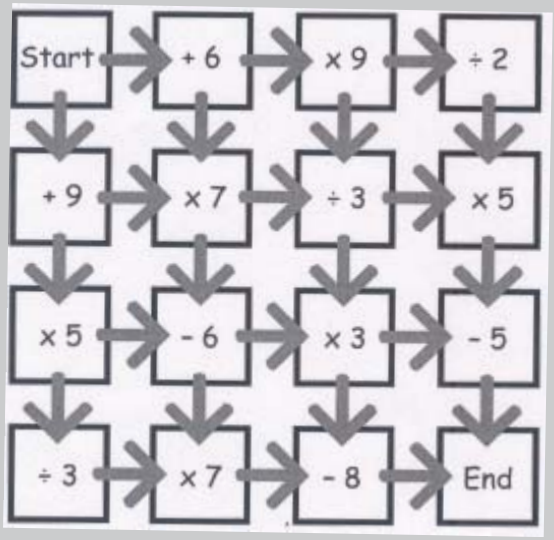
1- Shubham Mittal (Haldwani)

2- Md. Khalid Ansari (Bhagalpur, Bihar)

3- S.S. Hanmwgasundram (Tamil Nadu)

Mathemitical Puzzle 26,

- **Start with zero**
  - Find a route from 'Start' to 'end' that totals 100 exactly.
  - Which route has the highest total?
  - Which route has the lowest total?



- **शून्य से शुरु कीजिए**
  - वह कौन-कौन रास्ते हैं, जिसके द्वारा 'शुरु' से आरम्भ करके और 'समाप्त' पर समाप्त करके कुल 100 प्राप्त हो।
  - किस रास्ते के द्वारा सबसे अधिक प्राप्त होगा।
  - किस रास्ते के द्वारा सबसे कम प्राप्त होगा।

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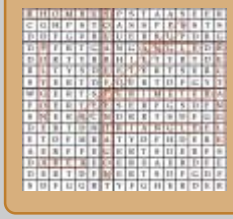
- Last date of receiving correct entries: 15 Sep., 2012.
- Winners will get activity kit/ books as a prize.
- **Please send your entries to**:-

Mathematical Puzzle-26 , VIPNET News, Vigyan Prasar, A-50, Sector 62, Noida-201 309 (U.P.)

The puzzle has been Designed as part of National Mathematical Year-2012

Chemicals Terminology Puzzle- 22



Name of the winners:

1- Sabita Devi (Sitamadhi Bihar)

2- Debmalya Gharai (West Bengal)

3- Nim Doma Tamang (Sikkim)

Club speak

शुक्र पारगमन पर आलेख का वाचन

डॉ. ए.पी.जे. अब्दुल क्लाम विपनेट क्लब, पूर्व माध्यमिकशाला, भिलाई द्वारा क्लब की मासिक बैठक के दौरान शुक्र पारगमन 06 जून, 2012 की जानकारी आलेख वाचन करके दी गई। छत्तीसगढ़ में शुक्र को 'सुकुना' के नाम से जाना जाता है। वाचन के द्वारा शुक्र पारगमन कब-कब होता है, शुक्र पारगमन से संबंधित एवं अन्य वैज्ञानिक जानकारी बच्चों को दी गई। आलेख वाचन को बच्चों ने रोचक ढंग से ग्रहण किया।

राष्ट्रीय गणित वर्ष-2012: जागरुकता गोष्ठी

समाधान विकास समिति विपनेट क्लब, पीलीभीत द्वारा राष्ट्रीय गणित वर्ष-2012 के उपलक्ष्य में गोष्ठी, प्रश्नोत्तरी व जादुई वर्ग प्रतियोगिता का आयोजन किया गया तथा इसी के माध्यम से बच्चों में गणित के प्रति उत्साह उत्पन्न किया गया। गोष्ठी के दौरान शून्य पर तथा रामानुजन की उपलब्धियों पर प्रकाश डाला गया। प्रतियोगिता में प्रथम एवं द्वितीय स्थान पाने वाले प्रतिभागियों को पुरस्कृत किया गया। गोष्ठी के अन्त में प्रतिभागियों को गणित के प्रचार-प्रसार तथा गणित में कैरियर संवारने के लिए प्रेरित किया गया।

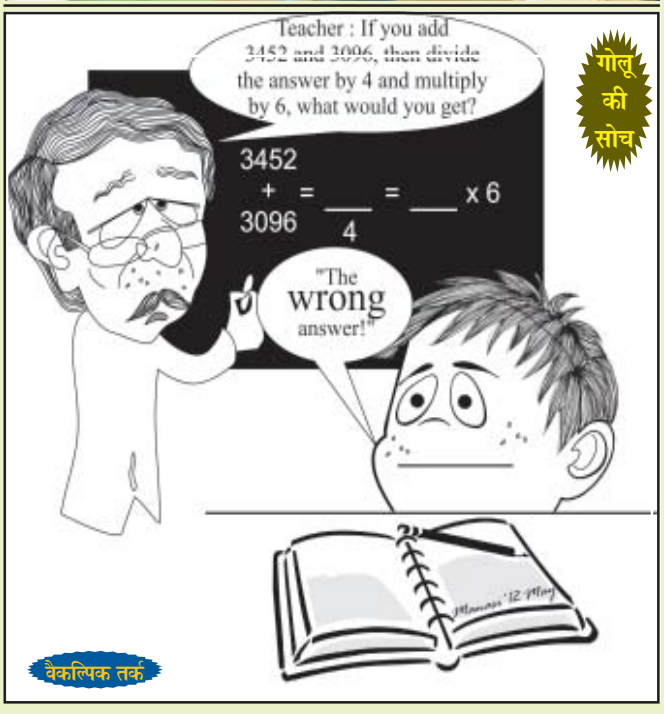
Chemistry & Miracles: Experiments

Eureka Science Club (Delhi Public School), NFL Township, Vijaypur, Guna (M.P,) conducted chemistry & miracles experiments on August 03, 2011. Approximately 50 peoples participated in this activity. During the programme different groups of student carried out various experiments as guided in VIPNET News.

It was an eye opener to the participant to understand science specially chemistry, behind the so called miracles.

Seminar on 'Understanding the origin of universe'

Chandrayan VIPNET Club (Hans Raj Mahila Vidyalaya) Mahatma Hans Raj Marg, Jalandhar organised a seminar on the topic 'Understanding the Origin of Universe' on November 05, 2011. Approximately 250 students attended this seminar. All the participants in the seminar took keen interest and asked very interesting questions, which were answered by the speakers.



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