

Exploring the Rise of Maths Circles: Enriching Mathematical Education in India

Maths Circle India Team

Maths circles are communities that encourage and nurture mathematical talent in children. The idea can be traced back to Bulgaria in the early 20th century and the Soviet Union in the 1930s. Over the years, maths circles have spread over the globe. Maths Circle India is an initiative of ICTS-TIFR, started in 2021. ICTS-TIFR coordinates as well as hosts the online Maths Circle India sessions as part of a pan-TIFR effort which is now joined by a number of institutions including CMI, HRI, IISER Bhopal, IISER Mohali, IISER Tirupati, IIT Tirupati, IIT BHU, ISI Bengaluru, TIFR-CAM and TIFR Mumbai. More recently, some in-person maths circles (Bengaluru, Bhopal, Chennai, Kolkata, Mumbai and Palakkad) have also appeared and a continuously updated list of them can be found at the link provided on the last page. This brief note describes the idea of a maths circle, to inform school students about the activity and offer encouragement and resources to those wanting to start their own maths circles.

Mathematics can be fun and engaging. The main purpose of a maths circle is to introduce children to the joy of solving mathematical puzzles. As with chess and music, mathematical talent often manifests very early. We hope to spot and nurture such talent in children of school-going age by having them interact with researchers in a friendly setting. The activity can be at any mathematical level, from simple problems involving numbers to the more abstract topics of mathematics. One does not need a PhD in mathematics to start a maths circle. The main qualification is a love of the subject and a desire to impart this love to children.

In maths circles, we engage children with games, puzzles and problems as a way of learning. For example, the rules of probability can be vividly brought out by playing a card game. In many board games, children are able to rapidly grasp complex rules and start applying them right away. The excitement of playing a game sharpens their senses and leads to subconscious learning.

The National Education Policy 2020 has recognized the importance of mathematics in establishing our nation's leadership role in science and technology and emphasized the need for developing innovative methods to make mathematical thinking more enjoyable and engaging. This is exactly in line with the philosophy of maths circles.

A typical maths circle session consists of guided problem-solving in a fun setting, with lots of discussion, collaboration and exchange of ideas. The facilitators will only help the discussion along, not teach and direct. They may provide occasional hints when the discussion stalls.

There are many initiatives (like the maths olympiad) which attract mathematically inclined children to competitions in mathematics. While these initiatives contribute to the growth of mathematical



Figure 1: Picture shows a scene at a ICTS-RRI Maths Circle session. On this day, our usual venue at the Raman Research Institute was not available. This session was conducted at Cubbon Park, Bangalore.



Figure 2: Picture shows a scene at a maths circle session at IISER Bhopal.



Figure 3: Picture shows a scene at a ICTS-RRI Maths Circle session at RRI.

excellence through competition, maths circles play a complementary role towards building a mathematical culture in our society. The emphasis in maths circles is on collaboration rather than competition. We are less concerned with speed and performance than with enjoyment and exploration.

While our online as well as in-person maths circles have received a very enthusiastic response from students overall, there is still a clear gender imbalance that is noticeable in our sessions. We would like to encourage more girls to solve the problems in our maths Challenge explorations so that we can set the gender imbalance straight. One of us (Disha Kushively) has started a Monthly maths challenge inviting people across age and gender to work out the Monthly Challenge. We hope that this will provide publicity to our maths circle activity and also encourage more girls to work out the maths circle explorations.

The larger objective of the Maths Circle India initiative is to spread the power of mathematical thinking as part of the social culture. Unlike some of the other mathematics enrichment activities which are either too specialized (such as olympiad training) or too generic (such as summer outreach camps), maths circles provide a refreshing middle ground where there's something for everyone. Designing mathematical explorations which engage, intrigue and challenge students is at the heart of a creative teaching and learning experience. Furthermore, as a scientist it is possible to become somewhat isolated or too specialized, and maths circles provide an excellent way to connect with the community.

A long term goal of the Maths Circle India initiative is to foster the creation of a network of maths circles across India, and to create and curate resources for these communities of mathematics students and teachers. We hope that interested people will start their own maths circles and that the movement will be a self sustaining one. If you wish to learn more about maths circles either as a participant, or a facilitator, or if you would like to start a maths circle in your own community, please consult the links below and get in touch with us.

Try this: If you think you may be interested, try the following problem: 10 cables were laid across the Zambezi river in a remote part of Africa. After laying the cables, the engineer realised that he had forgotten to label them, so he didn't know which of the 10 ends on one bank corresponded to the 10 ends on the other. He had at his disposal a multimeter to test continuity, some copper wire to connect the ends on each bank and a boat to cross the river with. As you may know, the Zambezi river has herds of hippos and these animals can be dangerous to crossing boats. It would be wise to minimise the number of river crossings. How would the engineer figure out the corresponding cables with a minimum number of crossings? If that was easy try changing 10 to N (other numbers). Is it easier for some numbers than others? Is it impossible for some values of N ?

Who can join: Students in the 6th-12th standard/grade age group who are passionate about mathematics can apply. Individuals who do not fall strictly within this age group may be considered in special cases.

How to join: Students wishing to apply are requested to fill out a form and to upload solutions to any two of the explorations/problems in the exploration set available on the website mentioned below.

For more details, please visit: <https://www.icts.res.in/form/maths-circle-india>

To start a new maths circle: please write to mathscircleindia@icts.res.in

For more maths Circle session pictures, please visit: <https://photos.app.goo.gl/vBsv9ht64NtNJYHW8>

Local maths circles: <https://www.icts.res.in/lmc>

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