MATHSTICKS

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A Newsletter dedicated to Mathematics teachers (all level)
Mathematics Education Department, SCERT, Haryana

इस **Newsletter** की ख़ास विशेषताएं हैं –

• रिसर्च से सीख **(Learnings from the Research)**
आपकी गणित अधिगम सम्बन्धी समझ को गहरा करने के लिए, प्रत्येक अंश में, रिसर्च के नए-नए पहलू

• कक्षा-कक्ष में करने के लिए
प्रत्येक अंश में आपकी गणित अधिगम प्रक्रिया को बेहतर करने के लिए रिसर्च पर आधारित कुछ सुझाव

• **Take the challenge**
चुनौतीपूर्ण कार्य/समस्या/ **Puzzle** जिसे किसी भी स्तर के शिक्षक या शिक्षार्थी कर सकते हैं I इसके हल व करने की प्रक्रिया आप हमसे **mathsedu.scert@gmail.com** पर साझा कर सकते हैं I

• आपके अनुभव **(Learning from the classroom experiences)**
आप अपने सुझाव, टिप्पणी,अनुभव हमें इस लिंक **https://forms.gle/Xdq7zP4UYz2kFBgV7** या **mathsedu.scert@gmail.com** पर साझा कर सकते हैं I

महत्वपूर्ण निर्देश

हर सप्ताह, कम से कम एक चुनौती / पज़ल अपने स्कूल के नोटिस बोर्ड पर लगायें।
बच्चों को इन्हें करने के लिए प्रोत्साहित करें। उन्हें स्वयं से जूझने दें।
हल बता कर उनकी brain growth को न रोकें।

आप या आपके विद्यार्थी जब इन टास्क पर काम करें तो इन्हें अपने ब्लाक के BRP/ABRC/डाइट Mentor से अवश्य सांझा करें।

यहाँ सही उत्तर मायने नही रखता, मायने रखता है कि आपने कैसे किया ? आपकी समस्या समाधान की यात्रा कैसी थी ? क्या स्ट्रेटेजीज प्रयोग की ?

MINDSET WORKS !!

Settings In Life :

Growth Mindset

Give up

Self Love

Fixed Mindset

Keep Trying

Fear of Failure

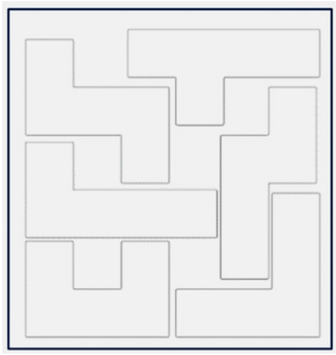
Learning from Mistakes

I can't Do This

Take The Challenge (चुनौती)

Task:

For this task we need one page and cutouts which are given in link below. You need to place the cutouts in such a way that only "Shubh Deepawali" and "Shubh Navratri" are visible on the page, and no other content is displayed. Additionally, no cutouts should overlap with each other. One is done for you. You can only see “Shubh Dussehra” in the solution image.



Why this challenge ?

The purpose of this challenge is to develop visualization Skills. Working with cut-out puzzles fosters creativity as students explore different ways to combine or manipulate shapes to achieve specific results. This creativity supports mathematical thinking, encouraging students to think outside the box and discover new solutions or patterns. Unlike traditional rote learning methods, cut-out puzzles allow for interactive learning. This hands-on approach makes abstract mathematical concepts more tangible and relatable.

Major Questions ?

Is there more than one possible solution to this puzzle? If so, how many solutions does this challenge have?

https://drive.google.com/file/d/1iUul4L2ymYukiomjbcjXuK7itpM0V51g/view?usp=drive_link

Puzzle

Given a circle and Six straight lines. What is the maximum number of pieces that one can cut the circle using these six straight lines? For example, using one line, circle can be divided into two parts (fig. 1) and when we use two lines, we get four parts (fig. 2). Similarly, when we use three lines, we will find circle is divided into seven parts (fig. 3).

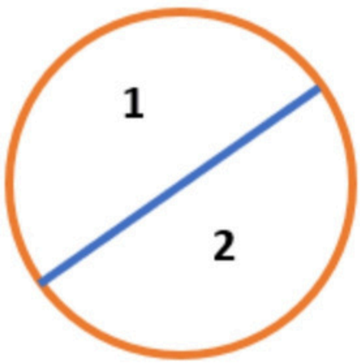


fig. 1

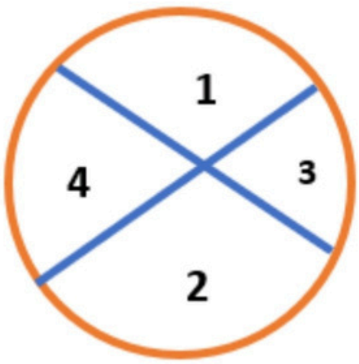


fig. 2

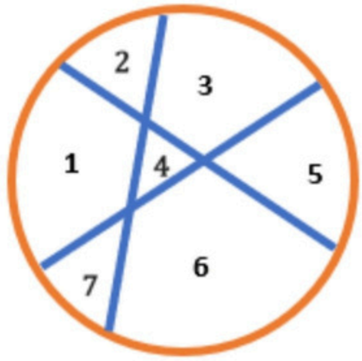
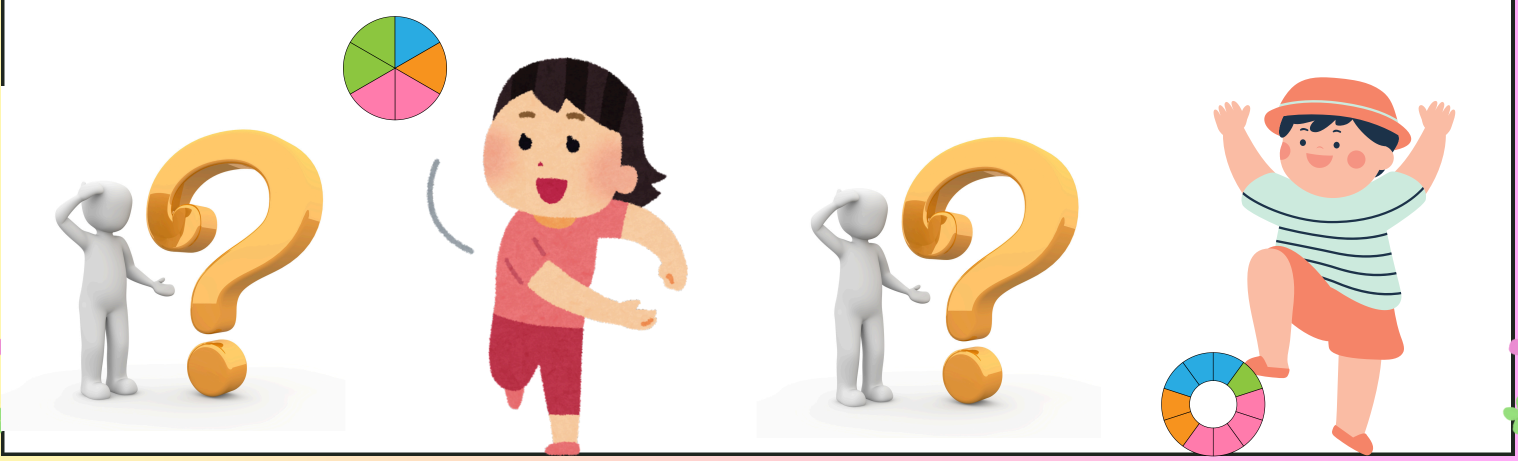
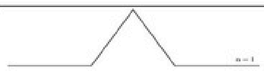
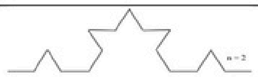
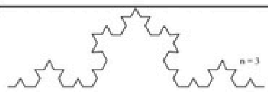
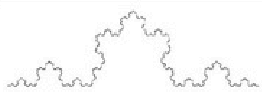


fig. 3



A teacher's exploration
Koch Curve

Koch curve is a mathematical curve that exhibits self-similarity, meaning each part of the curve resembles the whole structure. It starts with a simple pattern made from a line that is divided into three equal parts. First, erase the middle segment and replace it with an upside down "V" shape. Now the pattern is made up of four-line segments. Repeating this process indefinitely, we obtain the Koch Curve. The Koch Curve is a famous example of a fractal, discovered by the Swedish mathematician Helge Von Koch in 1904.

level	*Formation of Koch Curve*		*Number of Segments*	*Total Length of Curve*
0	Initial straight line		1	$L_0 = 1$
1	After 1st iteration		4	$L_1 = \frac{4}{3} = \left(\frac{4}{3}\right)^1$
2	After 2nd iteration		16	$L_2 = \frac{16}{9} = \left(\frac{4}{3}\right)^2$
3	After 3rd iteration		64	$L_3 = \frac{64}{27} = \left(\frac{4}{3}\right)^3$
	After infinite Iterations		continues to grow	Length $= \lim_{n \to \infty} \left(\frac{4}{3}\right)^n \to \infty$

As we have already read in previous article in Mathsticks newsletter for self-similar fractals like the Koch curve, the fractal dimension D is given by the formula:

$$D = \frac{\log N}{\log r} \text{ or } \frac{\log(\text{number of self-similar pieces})}{\log(\text{magnification factor})}$$

Where:

- **N is the number of self-similar pieces (in the case of the Koch curve second iteration, N=4).**
- **r is the scaling factor (in this case, r=3 because each new segment is 1/3 the length of the previous segment).**

Using the formula:

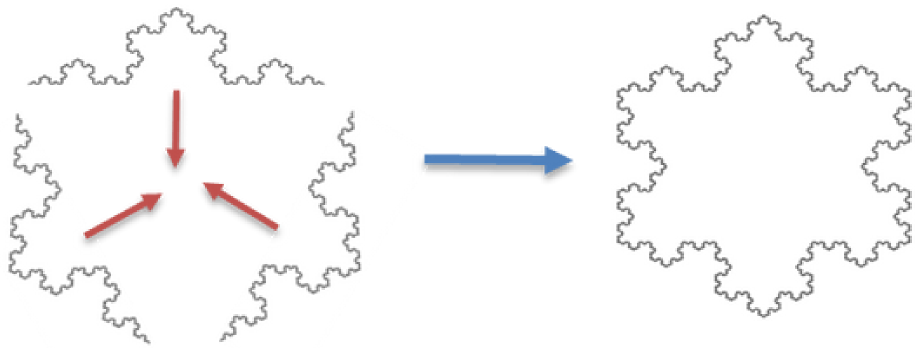
$$D = \frac{\log 4}{\log 3} = \frac{2 \log 2}{\log 3} \approx 1.2619$$

Interpretation:

The fractal dimension of the Koch Curve is approximately 1.2619.

- **This value is greater than 1, indicating that the Koch curve is more complex than a simple 1-dimensional line.**
- **The value is less than 2, meaning the curve doesn't completely fill a 2-dimensional plane**

What do snowflakes and Koch Curves have in common? If you take three copies of the Koch Curve, rotate them and combine them as shown below, you end up with a six-fold symmetric object that looks like a snowflake which sometimes called as Koch snowflake. In both cases, as the recursion depth increases, the total perimeter approaches infinity, even though they are bounded within a finite space.

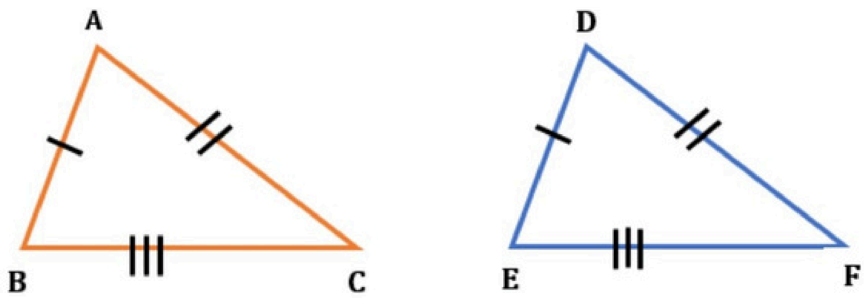


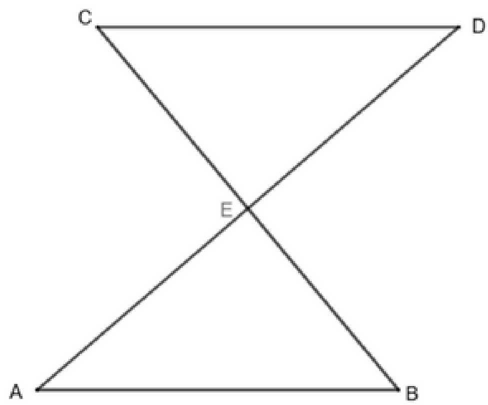
Can you find the fractal dimension of Menger Sponge?

contd.

Learnings From The Classroom

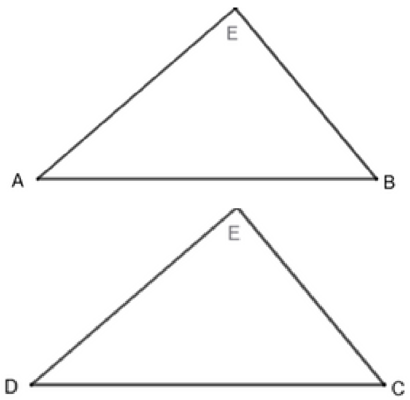
While introducing the concept of congruency, I noticed that students understand it more easily with coins i.e. concrete objects, but they find it difficult when it comes to triangles. In the case of triangles, if the figure is simple, as shown below, students can easily interpret which sides are congruent.





In the classroom, when I drew the figure on the board like this, students couldn't directly identify which sides were congruent. After looking at the figure, the students had difficulty in interpreting the congruent parts, and they said

AE is congruent to CE
BE is congruent to DE
AB is congruent to CD



Then, I experienced that the paper cutting method could be used to explain it practically very well. After that, I cut the above figure in two triangles and overlapped them. Now, the students were quite able to easily recognize the congruent parts. They said

AE is congruent to DE
BE is congruent to CE
AB is congruent to CD

Further, I found that this method turned out to be very effective, and the students learned about congruency in an excellent, fruitful way.