



EPSILON INDIA 2026

Exploration Problems for Epsilon India 2026

- Please answer the questions below in a separate sheet. Make sure you write the question number and answers clearly.
- Please take your time to write down the steps as we are interested in your approach rather than just your answer. There is no time limit. This will help us to determine if you have the critical reasoning skills and mathematical foundation that will make you a good fit for the camp.
- Do make an attempt to try out all the questions! It is not a problem, if you are unable to solve all the questions correctly. Our reviewers will review your answers and will be able to determine your strength/and provide suggestions on topics to study prior to the camp, if you are selected.
- Remember, that answers to these questions may not be quick and easy like problems you see in your homework or even some mathematics competitions. You will have to spend time thinking about them deeply. Most of our students work on these problems over a few days and revisit the solutions to improve on them. This will greatly improve the chances of doing well on the test and getting selected. These questions are meant to exercise your cognitive skills, which will equip you to solve problems later in your career that require perseverance and critical thinking.
- The work has to be completed on your own. If you seek help, you will be at a huge disadvantage as you will be barred from attending Epsilon India permanently. On the off chance that a student gets through the admission process and attends the camp, we have noted such students really struggle through the camp and it affects their confidence negatively. Fees will not be refunded.
- We hope you struggle but enjoy the process of solving these problems!

Sending the forms to us:

Priority given to candidates applying before February 2nd, 2026. Registrations open till spots are left. Once you have completed the 'Algebra Assessment' and 'Exploration Problems':

- Please go to the 'How to Apply' section of www.epsilonindia.org and follow the instructions to complete the Application process on our student app. Parents can help with the Application process but the applicant has to work independently on the 'Algebra Assessment' and 'Exploration Problems'. Note that the completed tests must be scanned and uploaded as a single pdf into the student app.
- Please also send the scanned work on both the 'Algebra Assessment' and 'Exploration Problems' as attachments to an email to epsiloncampindia@gmail.com
- It is very important that you do not send us individual photos of the problems in the test. The Algebra Assessment must be scanned as one pdf and the Exploration problems have to be scanned as another pdf document and then emailed to us and also uploaded into the student app.



- 1) Natural numbers (a, b, c) that satisfy the condition $a^2 + b^2 = c^2$ are called Pythagorean Triples. 3,4,5 is a Pythagorean Triples because $3^2 + 4^2 = 5^2$. Natural numbers (a, b, c, d) that satisfy the condition $a^2 + b^2 + c^2 = d^2$ are called Pythagorean Quadruples.
 - a. Come up with a process to find Pythagorean Quadruples.
 - b. Can you come up with a process to find natural numbers a, b, c, d, e such that $a^2 + b^2 + c^2 + d^2 = e^2$?
 - c. Do you think you can take it further and come up with a way to find 5, 6 or 7 such natural numbers whose squares add up to the square of some other natural number?
- 2) There is a machine that takes any number as input and gives an output after going through a particular *function*. What the *function* does is - it counts the number of 0's first, then the 1's, then the 2's, and so on up to the 9's and returns the count first followed by the digit that it is counting. E.g. If the input is 1032, the output will be 10111213. This means, there will be 1 zero, 1 one, 1 two and 1 three. We will represent this as $f(1032) = 10111213$ where 1032 is the input, $f()$ will represent the function and 10111213 represents the output. This is the first iteration (step). In the second iteration, 10111213 will be the input and the output will be 10511213. In the third iteration, 10511213 will be the input and we will get some other output. This process will continue. If you continue this process for $f(1)$ for a few steps (say, 10 or 15 steps), you will see that you will land up in a number and get stuck at it. We will call this number a *constant*.

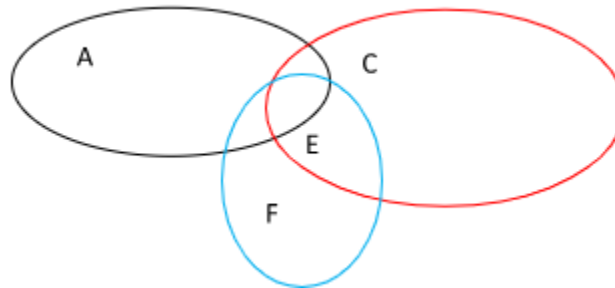
The questions that you need to explore are:

- i. What will happen if you do the process for $f(2)$? Will it also reach a constant? Why do you think it will reach *that* particular constant? Give at least 5 other numbers which when given as the input will reach the same constant that you get for $f(2)$.
- ii. At most, how many such constants do you think can exist? We don't expect you to calculate for every number and get the constants for every input, that would be impossible. What we expect is, can you give a logical argument as to *how many* constants *can* exist? E.g. You may feel that there can be 10 to 15 different constants for various inputs. In that case, you need to give a *reason* as to why you feel there cannot be more than 15 constants.



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- 3) The black circle is the set of numbers from 400 to 800, that are divisible by 5, the red one represents the set of numbers that are divisible by 7 and blue represents the ones that are NOT divisible by 11. Based on this information, answer the following questions:



- Which alphabet will have maximum numbers and why?
 - Give three numbers that will come under:
 - B, G and E.
 - Will there be numbers that will not come under any of these sets? In other words, will there be numbers from 400 to 800 that are not represented by any of these alphabets?
- 4) Pentominoes are 2D shapes obtained by joining 5 squares.



The squares must be joined along the edges entirely. The edges should not be joined partially and the squares should not be joined only at the corners. The following two ways of joining are not allowed.

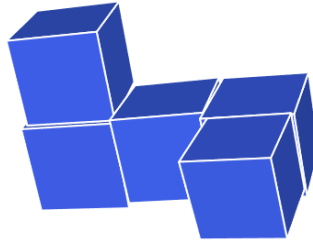


Draw all the possible pentominoes which can be made this way.

Suppose we had 5 cubes instead of 5 squares. We now have to join the cubes such that their faces overlap entirely. Here is an example.

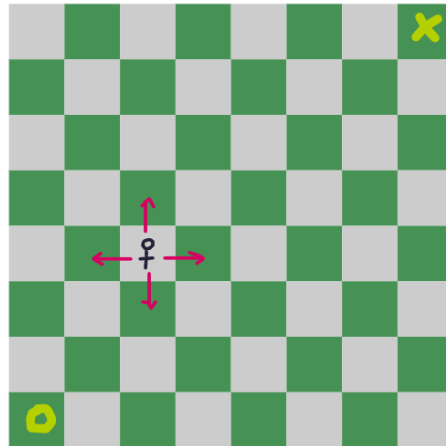


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What are all the possible shapes we can get? Draw the shapes and describe how you got them.

- 5) Suppose we have a new piece on the chessboard called Prince. This piece can move only one step at a time in four directions: up, down, left, or right. It cannot move diagonally.

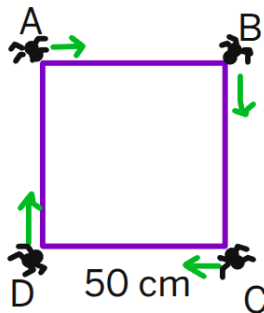


- (a) Starting from the bottom left corner of the board, how many steps will the Prince take to reach the top right corner of the chessboard? Assume that the Prince wants to make the journey in the fewest number of steps.
- (b) There are many paths which the Prince can take from the bottom left corner to the top right corner using the minimum number of steps. How many such paths are there?
- 6) Seven thieves steal a certain number of diamonds. On the way back home, they all decide to take a nap under a tree. While the others are asleep, two



of them wake up and decide to divide the loot amongst just the two of them equally. At the end of the division process, they find that there is one diamond left. By that time, one more thief wakes up. On his demand for his share, all three of them try to divide the loot equally amongst them. They find two diamonds extra after each one gets equal share. The fourth thief wakes up and they do the division once again. Now there are three diamonds left. With the fifth thief also waking up, there are four diamonds left after the division. The sixth thief also wakes up and they do the same process only to find that there are five diamonds left. Finally, when the seventh thief woke up, they were able to divide the loot among themselves equally. Can you find the number of diamonds? How many solutions exist for this problem, and why?

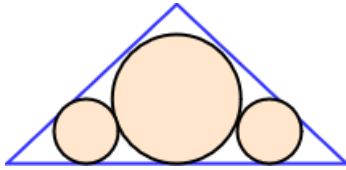
- 7) Four spiders are at the corners of a square ABCD. The side of the square is 50 cm. Each spider moves towards the spider in the adjacent corner: Spider at A moves towards the spider at B, spider at B moves towards the spider at C and so on. Note that the spiders always move towards the fellow spider, and not the corner of the square. The spiders move at a constant speed of 5 cm/s.



- Will the spiders ever catch each other? If so, after how long? If not, why?
 - What will be the path taken by the spiders?
 - What happens if three spiders started from the corners of an equilateral triangle of 50 cm and started following each other in the same way?
- 8) In the example below, we have packed three circles within a triangle in such a way that the circles touch the sides of the triangle, and each other, without any overlap. All three circles are enclosed within the triangle.



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Given any triangle, how can we pack three circles in a similar way so that the circles occupy the largest possible area? The circles can be of different sizes.