

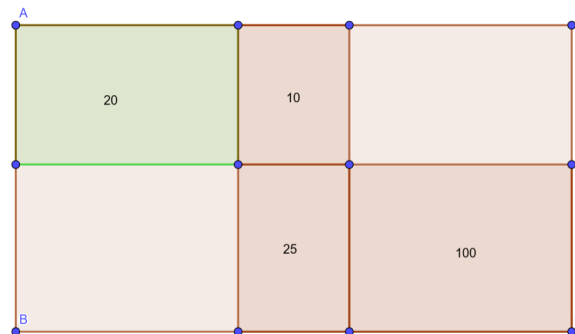
# ROOTS 2025

Cube Roots

September 22, 2025

## Answers

1. Students from Mr. Ashwin's class are standing in a circle. The space between any two students standing next to each other is the same and they are numbered 1, 2, 3, ... and so on. The student with number 3 is standing directly opposite to the student with the number 17. How many students are there in Mr. Ashwin's class?  
**Answer:** 28
2. The base of a right angled triangle is 5 units, and its height is 12 units. A rectangle of width 10 units is constructed whose area is equal to the area of the triangle. Find the perimeter of the rectangle.  
**Answer:** 26
3. A number line starts at  $-55$  and ends at  $55$ . If we start at  $-55$ , and color all the way to number  $5.5$ , what percentage of the number line is colored?  
**Answer:** 55
4. Consider the six-digit multiples of three with at least one of each of the digits 0, 1 and 2, and no other digits. What is the difference between the largest and the smallest number that can be formed using this condition?  
**Answer:** 12208
5. Saeed broke her necklace. She found one-quarter of the beads on the floor, one-sixth in her pocket, one-third on the table, while one-fifth remained on the necklace; six beads were still missing. How many beads were there to start with?  
**Answer:** 120
6. Given areas of these four rectangles  $[20, 10, 25, 100]$ , find area of big rectangle  $ABCD$ .



**Answer:** 245 .

7. The numbers 1 through 8 are written in a circle. You start by deleting the 1 and in each subsequent turn, go two steps clockwise and delete the number you land at. If the numbers you end up deleting are 1, 2, 3, 4, 5, 6, 7, 8 in that order, which number is one step in the clockwise direction away from 2?

**Answer:** 7

8. A digital clock shows times from 00:00 to 23:59. How many times in a day are all digits even?

**Answer:** 105

9. Alice starts with a sequence of natural numbers of her choice; for example (3, 4, 1, 2) (which we will call the original sequence) and generates new sequences using the following procedure:

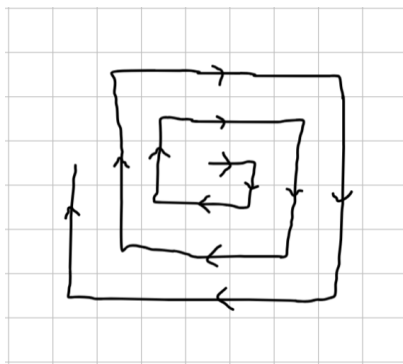
- since the first number in the original sequence is 3, the first number of every new sequence will be the 3<sup>rd</sup> number in the previous one - so 1 in this case
- the second number in the original sequence is 4, so the second number in every new sequence will be the 4<sup>th</sup> number in the previous one - so 2 in this case
- the third number in the original sequence is 1, so the third number in every new sequence will be the 1<sup>st</sup> number in the previous one - so 3 in this case
- the fourth number in the original sequence is 2, so the fourth number in every new sequence will be the 2<sup>nd</sup> number in the previous one - so 4 in this case

Thus, the new sequence obtained is (1, 2, 3, 4). Again, keeping the original sequence the same and repeating the procedure, we see that the next sequence we get is (3, 4, 1, 2).

If Alice starts with (6, 1, 4, 5, 7, 2, 3) as the original sequence, find out how many times the procedure needs to be repeated until her sequence is back to the same as she started with.

**Answer:** 12

10. You start in the middle of a  $2025 \times 2025$  square. You go in a spiral as shown in the following image. Which corner do you end up in if the first step you take is to the right?



- (a) top left    (b) top right    (c) bottom left    (d) bottom right

**Answer:** (b)

11. On a distant planet there are two types of animals - borts and zorgs. The borts always tell the truth whereas the zorgs always lie. You meet three of them - Alice, Bob and Charlie - and you don't know what species they belong to. The three of them make the following statements:

- Alice states that Bob is not the same species as I am, and Bob is a bort.
- Charlie claims that Alice has not spoken the truth.
- Bob follows up by claiming that Charlie has lied.

How many of the three of zorgs?

**Answer:** 2 .

12. Alice has some cards. She distributes them equally into two piles, and one extra card remains. Out of the two, she takes one and splits it into 3 further equal piles - and 1 extra card is left again! She takes one of the smallest piles and splits it into 4 further equal piles, which leaves 3 extra cards and 5 cards in each pile. How many cards did she start with?

**Answer:** 141

13. If

$$\begin{array}{r} abc \\ + cba \\ \hline mnxy0 \end{array}$$

and  $x \neq y$ , find  $y - x$ .

**Answer:** 1

14.  $\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \dots + \frac{1}{90} = \frac{x+1}{x}$ , find the value of  $-x$ .

**Answer:** 10

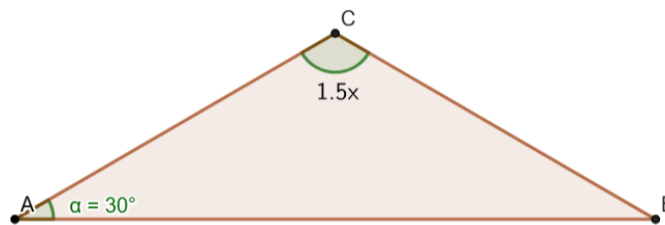
15. If  $0.037037037\dots = \frac{a}{b}$ , then find the minimum possible value of  $a + b$ .

**Answer:** 28

16. If  $6x48$  is divisible by 63, find the value of  $x + 1$ .

**Answer:** 1

17. If  $CA = CB$ . Find the value of  $x$ .



**Answer:** 80

18. In  $\triangle ABC$ ,  $AB = 5$  and  $BC = 6$ . If  $x < AC < y$  such that  $y$  is the smallest number possible and  $x$  is the largest number possible, find  $x + y$ .

**Answer:** 12

19. What is the 2025<sup>th</sup> digit after the decimal point in the expansion of  $3/7$ ?

**Answer:** 8

20. Find the total number of 3 digit numbers such that all 3 digits are distinct.

**Answer:** 648