An Unsolved Mystery: The Collatz Conjecture

A. Choose the correct option.

1. What is the first step in the Collatz Conjecture for an odd number?

a) Divide by 2 b) Multiply by 3 and add 1

c) Subtract 1 d) Multiply by 2

2. What will be the next number in the Collatz sequence starting from 6?

a) 3 b) 9

c) 5 d) 18

3. Which of the following numbers enters the loop 4 → 2 → 1 under Collatz Conjecture?

a) 5 b) 7

c) 11 d) All of the above

4. Which pattern is always followed in the Collatz Conjecture?

a) Number always increases

b) Number always decreases

c) Sequence ends in 4 → 2 → 1 loop

d) Sequence becomes zero eventually

5. The Collatz Conjecture is named after:

a) A Greek Mathematician b) A scientist from NASA

c) Lothar Collatz d) Isaac Newton

B. Write the Missing Terms to Complete the Sentences:

1. If the number is even, in Collatz Conjecture, we _____ it by 2.
2. If the number is odd, we multiply by _____ and add _____.
3. The Collatz Conjecture is sometimes called the _____ problem.
4. The sequence always ends in the loop _____ → _____ → _____.
5. The Collatz Conjecture helps develop skills in _____ and _____ thinking.

C. Figure out the answers to these questions:

1. Find the Collatz sequence starting from 7 and write all the steps till it reaches 1.

2. Create a flowchart that explains how the Collatz steps work for any given number.
3. Identify and explain the pattern in the sequence starting from 9.
4. Challenge your friend: Can you find a starting number between 10 and 20 that takes the longest to reach 1 using the Collatz steps? Write the steps.
5. Match the number with the number of steps it takes to reach 1 using Collatz:
   - **Numbers:** 5, 6, 11, 3
   - **Steps:** 5, 8, 14, 16
6. Write a short story or riddle describing the journey of a number in the Collatz world.
7. **Think and Predict:** If you start with 15, what kind of numbers do you mostly get in the sequence—odd or even?
8. **Do it Yourself:** Try to find a 2–digit number whose sequence takes more than 15 steps to reach 1.

D. Mark each sentence with a True (✓) or False (✗):

1. The Collatz Conjecture always leads to a result of 0. ☐
2. The number 1 is the end of every Collatz sequence. ☐
3. Every even number in the sequence is divided by 2. ☐
4. Collatz Conjecture has been fully proven for all natural numbers. ☐
5. The Collatz Conjecture helps us practice logical thinking. ☐

E. Challenge yourself with these questions:

1. **Code Puzzle:** Write a pseudo–code or steps in your own words to perform the Collatz operation on any number.
2. **Graph It Out:** Plot the sequence for number 13 on graph paper or digitally—use Y–axis for values and X–axis for steps.
3. **Team Game Idea:** Design a board game where players must follow Collatz steps to reach 1 the fastest!
4. **Art Integration:** Create a Collatz Sequence Art using colors for odd and even numbers in a spiral or grid.
5. **Math Debate:** "Is the Collatz Conjecture the most exciting mystery in math?" Prepare your views for or against.