1 Let \( x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{\ldots}}}} \). Find the value of \( x \).

2 Given that \( x + \frac{1}{x} = 5 \), find \( x^2 + \frac{1}{x^2} \).

3 Suppose that the roots of \( x^2 + 7x + 8 = 0 \) are \( r \) and \( s \). Find \( r^2s + rs^2 \).

4 When three numbers are added two at a time, the sums are 29, 46, and 53. What are the three numbers?

5 Betty has 180mL of solution that is 20% acid and a plentiful supply of 100% acid solution. How much 100% acid solution must be added to her original 180mL so that she can have a 30% acid solution?

6 Cassandra sets her watch to the correct time at noon. At the actual time of 1:00PM, she notices that her watch reads 12:57 and 36 seconds. Assuming that her watch loses time at a constant rate, what will be the actual time when her watch first reads 10:00?

7 If I pick a random 4-digit number, what is the probability that all of its digits are distinct?

8 In a 3 by 3 square made up of 9 unit squares, how many rectangles are formed by lines parallel to the sides of the rectangle?

9 An ant starts at the point (0, 0) on a coordinate system. Every second, the ant either moves one unit to the right or one unit up. How many ways can the ant get to (5, 7)?

10 Twenty couples are at a party. Every man shakes hands with everyone except himself and his spouse. Half of the women refuse to shake hands with any other women. The other 10 women all shake hands with each other (but not with themselves). How many handshakes are there at the party?

11 What is the probability that I flip 6 coins and get exactly 4 heads?

12 How many three digit numbers have exactly one zero?

13 If a set, \( S \), contains the first 8 counting numbers, how many subsets of \( S \) can represent the side lengths of a non-degenerate triangle?

14 An equilateral triangle and a regular hexagon have equal perimeters. If the area of the triangle is 2, what is the area of the hexagon?

15 Pipe A can fill a pool in 5 hours, while pipe B can fill it in 4 hours. If both pipes operate at the same time, how long will it take to fill up the pool?

16 If it takes 3 days for 4 people to paint 5 hours, how long will it take 2 people to paint 6 houses?

17 Yan is somewhere between his home and the stadium. To get to the stadium he can walk directly to the stadium, or else he can walk home and then ride his bicycle to the stadium. He rides 7 times as fast as he walks, and both choices require the same amount of time. What is the ratio of Yan's distance from his home to his distance from the stadium?