Problem 1. Let \( f(x) = \frac{3x^3 + 7x^2 - 12x + 2}{x^2 + 2x - 3} \). Find all integers \( n \) such that \( f(n) \) is an integer.

Problem 2. How many ways are there to arrange 10 trees in a line where every tree is either a yew or an oak and no two oak trees are adjacent?

Problem 3. 20 students sit in a circle in a math class. The teacher randomly selects three students to give a presentation. What is the probability that none of these three students sit next to each other?

Problem 4. Let \( f_0(x) = x + |x - 10| - |x + 10| \), and for \( n \geq 1 \), let \( f_n(x) = |f_{n-1}(x)| - 1 \). For how many values of \( x \) is \( f_{10}(x) = 0 \)?

Problem 5. 2 red balls, 2 blue balls, and 6 yellow balls are in a jar. Zion picks 4 balls from the jar at random. What is the probability that Zion picks at least 1 red ball and 1 blue ball?

Problem 6. Let \( \triangle ABC \) be a right-angled triangle with \( \angle ABC = 90^\circ \) and \( AB = 4 \). Let \( D \) on \( AB \) such that \( AD = 3DB \) and \( \sin \angle ACD = \frac{3}{5} \). What is the length of \( BC \)?

Problem 7. Find the value of \( \frac{1}{1 + \frac{1}{2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{1 + \cdots}}}}} \).

Problem 8. Consider all possible quadrilaterals \( \square ABCD \) that have the following properties; \( \square ABCD \) has integer side lengths with \( AB || CD \), the distance between \( AB \) and \( CD \) is 20, and \( AB = 18 \). What is the maximum area among all these quadrilaterals, minus the minimum area?

Problem 9. How many perfect cubes exist in the set \( \{1^{2018}, 2^{2017}, 3^{2016}, \ldots, 2017^2, 2018^1\} \)?

Problem 10. Let \( n \) be the number of ways you can fill a \( 2018 \times 2018 \) array with the digits 1 through 9 such that for every \( 11 \times 3 \) rectangle (not necessarily for every \( 3 \times 11 \) rectangle), the sum of the 33 integers in the rectangle is divisible by 9. Compute \( \log_3 n \).