This year's theme:

Using Maths to Fight COVID-19

1. A certain vaccine requires two 3ml doses for a person to become immune from COVID-19. With 2100ml of this vaccine, what is the maximum number of people which could become immune to COVID-19?
2. A normal school day starts at 8 am and ends at 3 pm. However, sick students are required to self-quarantine at home for 2 weeks (10 school days). Taking into account the 1 hour and 30 minutes of break a student gets per day, how many hours of learning would be missed by a sick student?
3. A COVID-safe sofa must have a perimeter of 15 meters, be a scalene triangle and have integer side lengths. How many different shapes of COVID-safe sofas are there? Note that two sofas are identical if they have the same side lengths.
4. During the pandemic, Jimmy and his friends discovered some very interesting sequences. One of their lists has five numbers in it. The mean of the first three numbers is -2. The mean of the first four numbers is 3. The mean of the first five numbers is -4. What is the difference between the fourth number and the fifth number?
5. There are 170 people standing around in a perfect circle. Due to social distancing rules, each person is exactly one metre apart along the circumference from the person on either side of them. George is the 171^{th} person who is standing at a place such that he is exactly $\frac{d}{\pi}$ meters away from each of the 170 people. What is the value of d?
6. A classroom ABC is in the shape of a right triangle where $AB = 48$ and $BC = 42$. COVID regulates that the side AC is more than 32, and it is expressed in the form of $p\sqrt{q}$, where p and q are relatively prime integers. What is the value of $q - p$?
7. Due to new COVID regulations, there have to be fewer than 33 people in a classroom. Mr. Gaudet is trying to come up with a seating plan on which the students will be grouped in pairs. If the total number of ways to do so is odd, what is the maximum number of students in the class?
8. A pharmaceutical company is producing at a rate of 10 thousand vaccines per half annum and increases its supply at a simple rate of 25% per half annum. Given that the company has to produce 30 thousand vaccines per half annum, how many years would it take to reach the quota?
9. COVID-19 spreads fast on the island of Izlando. On day 1, one person was tested positive for COVID-19. Every day after that, the number of infected patients doubles, then exactly one more person becomes infected. If the population of Izlando is 2048, on what day will every single person on the island be infected?
10. There are 7.5 billion people in the world. Every day, 1 million people get infected with COVID-19, 700 thousand people recover, and 2 million get vaccinated. How many people will still be infected on the day when the last non-infected person is vaccinated? Note that recovered people don't get vaccinated, and people who recovered on the day does not count as "still infected". Give your answer in millions.