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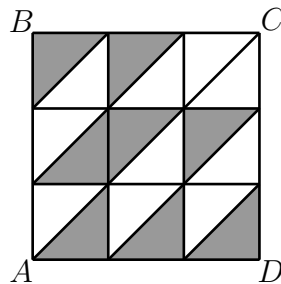## 2023 Canadian Team Mathematics Contest

Relay Problem #1 (Seat a)

A square garden has an area of 9 square metres. The perimeter of the garden is N metres. What is the value of N?

Relay Problem #1 (Seat b)

Let t be TNYWR.

In the diagram, square $ABCD$ has side-length t. Two vertical lines and two horizontal lines divide square $ABCD$ into nine equal smaller squares, and each of these smaller squares is cut in half by a diagonal, as shown. Some of the triangular regions defined by these lines are shaded. What is the total area of the shaded parts of the square?

Relay Problem #1 (Seat c)

Let t be TNYWR.

If $t = n(n-1)(n+1) + n$, what is the value of n?

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Relay Problem #2 (Seat a)

How many integers n with $n > 0$ satisfy $\dfrac{1}{n+1} > \dfrac{4}{29}$?
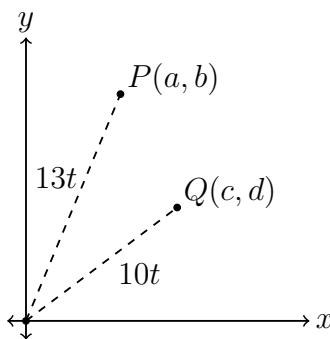
Relay Problem #2 (Seat b)

Let t be TNYWR.

A water tank initially contains x litres of water. Pablo adds $\dfrac{t}{2}$ litres of water to the tank, making the tank 20% full. After Pablo adds water to the tank, Chloe then adds $\dfrac{t^2}{4}$ litres of water to the tank, making the tank 50% full. What is the value of x?

Relay Problem #2 (Seat c)

Let t be TNYWR.

Point O is at the origin and points $P(a, b)$ and $Q(c, d)$ are in the first quadrant, as shown. The slope of OP is $\dfrac{12}{5}$ and the length of OP is $13t$. The slope of OQ is $\dfrac{3}{4}$ and the length of OQ is $10t$. What is $a + c$?

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Relay Problem #3 (Seat a)

Three of the positive divisors of 24 are 1, 8, and 24. What is the sum of all of the positive divisors of 24?

Relay Problem #3 (Seat b)

Let t be TNYWR.

The numbers a and b satisfy both of the following equations.

$$a - \frac{t}{6}b = 20$$

$$a - \frac{t}{5}b = -10$$

What is the value of b?

Relay Problem #3 (Seat c)

Let t be TNYWR.

The parabola with equation $y = ax^2 + bx + c$ passes through $(4, 0)$, $\left(\frac{t}{3}, 0\right)$, and $(0, 60)$. What is the value of a?