mathleague.org – Relay Round 11003.1

(1-1) Three marbles are in a bag, each of which is equally likely to be black or white. A white marble is added to the bag. If a marble is removed from the bag, what is the probability that it is black?

(1-2) Let T=TNYWR. Evaluate cos(Arctan(2T)).

(1-3) Let T=TNYWR. What is the sum of the squares of the roots of $x^3 + 4x^2 + 6x + T$?

mathleague.org – Relay Round 11003.2

(2-1) What is the area of the largest square that can be inscribed in a circle of area 100π?

(2-2) Let T=TNYWR. What is the area of an equilateral triangle with side length T?

(2-3) Let T=TNYWR. Define the "Tribonacci Sequence" as T_1 =1, T_2 =1, T_3=2, and for n > 3, $T_n = T_{n-1} + T_{n-2} + T_{n-3}$. Within every subsequence consisting of eight consecutive terms of the Tribonacci sequence, there are exactly x terms divisible by T. Find x.

mathleague.org – Relay Round 11003.3

(3-1) Eight people sit in a row of chairs, but the oldest three must sit in three consecutive seats. How many such seating arrangements are possible?

(3-2) Let T=TNYWR., and let R = T/36. R is the sum of the first *n* triangular numbers (i.e. R is the *n*th tetrahedral number). What is *n*?

(3-3) Let T=TNYWR. Find the Tth digit after the decimal point in the decimal expansion of π.

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(4-1) Let n be a 24-digit base-2 number with all digits equal to 1. Find $\log_8 (n+1)$.

(4-2) Let T=TNYWR and let S be the cube of T. Compute the smallest divisor of S-1 that is greater than 1.

(4-3) Let T=TNYWR. If k= $\frac{a}{T} + \frac{T}{a}$,and a and T are relatively prime integers, compute the smallest possible value of k.

mathleague.org – Relay Round 11003.5

(5-1) Find the sum of the first three triangular numbers.

(5-2) Let T=TNYWR. Convert the base T number 22 into a base ten representation.

(5-3) Let T=TNYWR. What is the smallest positive integer that has exactly T factors?

Relay Test – Round 11003
(Solutions)

Answers for Question 3 must be exact and simplified.

(1-1)	3/8	(1-2)	4/5	(1-3)	**4**
(2-1)	200	(2-2)	$10000\sqrt{3}$	(2-3)	**0**
(3-1)	4320	(3-2)	8*	(3-3)	**5**
(4-1)	8	(4-2)	7	(4-3)	**113/56**
(5-1)	10	(5-2)	22	(5-3)	**3072**

* Knowledge of tetrahedral numbers is fair game for future contests.