Problems of the Month

April 2017

General Problem:

In Pokémon Go, the chance of a Magikarp being shiny has not yet been released, but data collected by players points to a chance of about 1 in 350. The chance of a wild Pokémon being appraised with highest marks is 5%. What is the chance of a wild Magikarp being both shiny and appraised with the highest marks?

Calculus Problem:

Human blood type is expressed in four different ways: A, B, O, and AB. However, there are only three alleles that control these blood types: A, B, and O. Assume the proportion of these alleles among all people is p, q, and r respectively. In particular, $p + q + r = 1$. Furthermore, in biology the Hardy-Weinberg Principle tells us that the portion of people with two different alleles is:

$$P = 2pq + 2pr + 2rq$$

Show that $P \leq \frac{2}{3}$.

Challenge Problem:

Suppose 5 dots all start moving with constant speed 5 meters per second along the same horizontal line, and, whenever two dots meet, those two instantly switch directions. If the two end dots initially move toward each other, and if the last change of direction is 10 seconds later, what is the average initial separation for consecutive dots?