Problems of the Month

October 2017

General Problem:

In Pokémon Go, the base chance to catch an Entei is 2%. However, this is modified by many "multipliers" as given in the formula below. What is the best possible chance of catching an Entei on a single ball?

$$\text{Catch Chance} = 1 - \left(1 - \frac{0.02}{1.58}\right)^{[\text{Ball}]\cdot[\text{Curve}]\cdot[\text{Berry}]\cdot[\text{Metal}]}$$

Ball	Value
Normal	1
Great	1.5
Ultra	2

Curve	Value
None	1
Curve Ball	1.7

Berry	Value
None	1
Razz	1.5
Golden Razz	2.5

Metal	Value
None	1
Bronze	1.1
Silver	1.2
Gold	1.3

Calculus Problem:

Again in Pokémon Go, people usually call the values in the exponent *multipliers* and approximate the catch rate by saying that the chance to catch an Entei is:

$$\text{Approximate Catch Chance} = 0.012 * [\text{Ball}] \cdot [\text{Curve}] \cdot [\text{Berry}] \cdot [\text{Metal}]$$

In this case, for instance one would say that a Razz Berry increases the catch rate by 50%.

Use the Taylor series of the actual catch rate formula to calculate the maximum error in the approximate catch chance formula.

Challenge Problem:

Continuing the study of catching Entei, calculate the rate of convergence of your Taylor series in the Calculus problem to the actual catch chance given in the general problem.