MATH:1260 Pokémath
The Mathematics of Pokémon Go®

Week 3 Wednesday, Spring 24

Popular curve:

Growlithe-like curve

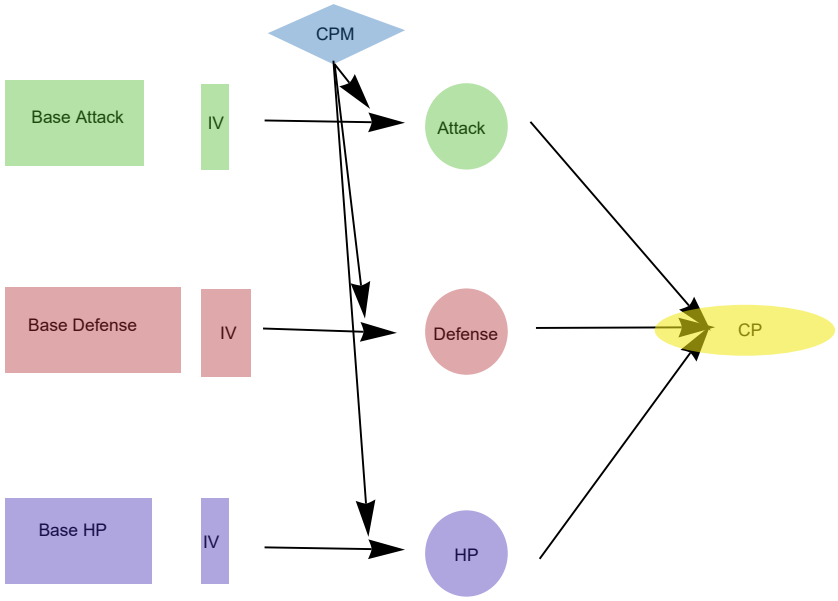
Plan for Today

- Pokémon® stats continued
  - Attack, Defense, HP
  - IVs
- More functions
  - Graphing functions
  - Piecewise defined functions

Class Reminders

- GW3 in discussion tomorrow.
- HW2 is due tonight at midnight.
- HW3 is due by Wednesday January 31 at midnight.
- IV stands for “Individual Value!”

How are the stats computed?



Functions

Definition

A function consist of a set of inputs called the domain, a set of outputs called the range and a rule by which each input determines exactly one output.

Meditite

https://bulbapedia.bulbagarden.net/wiki/List_of_Pokémon_by_base_stats_(GO)

307		Meditite	102	78	107

Compute Attack stat

The Base Attack for Meditite is 78. We got this from our bulbapedia chart.

This Meditite has an Attack IV of 11. We'll talk about how to get this from appraisal.

This Meditite is level 20. So he has a CPM of 0.5974. This is more tricky, stay tuned.

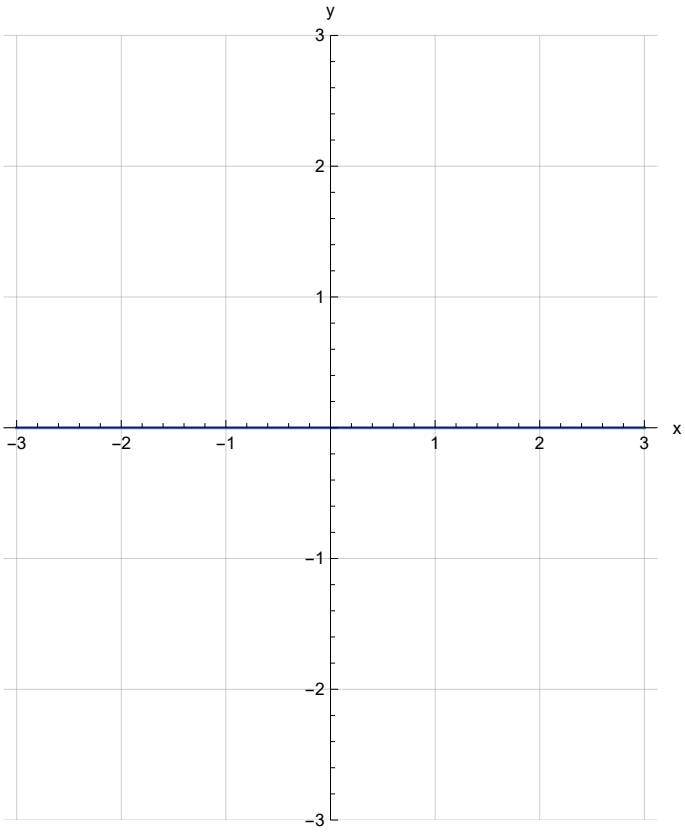
Description of the Function

The Attack stat is computed by adding the Base Attack to the Attack IV and then multiplying by the CPM. This result is then rounded up to 10 if it is less than 10.

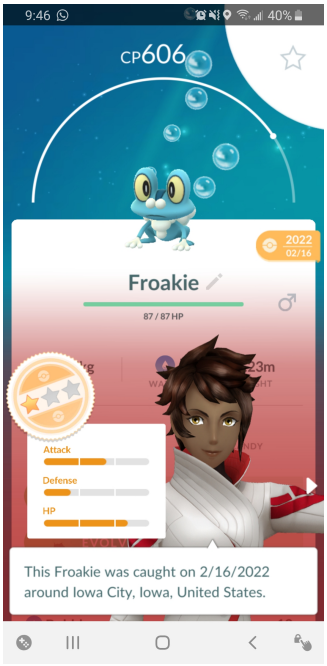
Y’all remember graphing?

Graph f(x) = 3x - 2

If you don’t remember the shortcuts, just make a table!



IVs in Appraisal: A type of graph!



Attack IV: 9

Defense IV: 4

HP IV: 12

Function: IVs to Picture (this is what the computer does)

Domain?

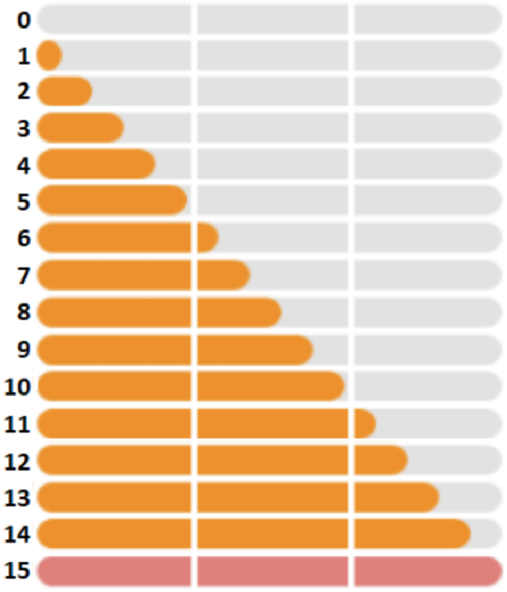
Range?

Function: Picture to IVs (this is what we trainers do)

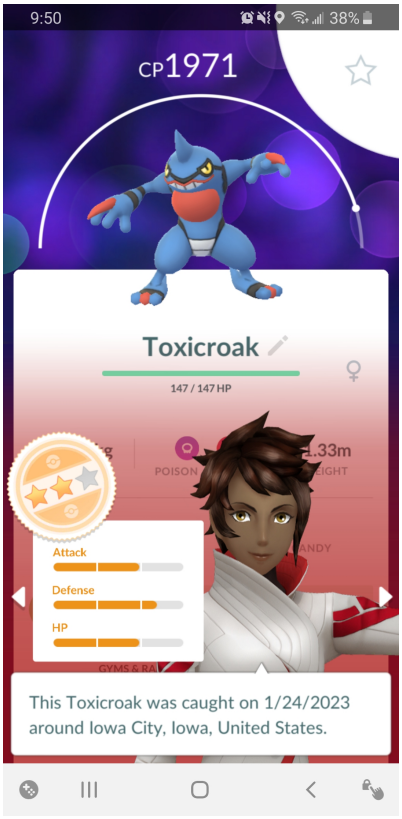
Domain?

Range?

The IV Chart Interpreter



Appraisal bars as IVs



Check your favorite Pokemon!

An Aside

Why 0-15?

The original games must store everything in the cartridge. 512 kB.

32 kB were set aside for your save

Of that 16 kB are for stored pokemon. Only about 30 Bytes per pokemon.

(species, ivs, level, HP, status, moves, PP, name, original trainer)

Only 2 bytes (16 bits) available for all IVs. So each stat IV (Attack, Defense, Speed, Special) had only 4 bits to be stored. So: 0-15 is all they had.

https://bulbapedia.bulbagarden.net/wiki/Save_data_structure_(Generation_I)

The original Pokemon Red takes up less storage space than an Instagram profile picture.

Stars ***

The number of stars you get on your appraisal is also a function! It takes as input the **sum** of the Pokemon's IVs. So the domain is {0, 1, ..., 45}. The range is {0,1,2,3,4} for the number of stars. This is an example of a piecewise defined function.

$$\text{Number of Stars} = \begin{cases} 0 & 0 \le \text{IVs} \le 22 \\ 1 & 23 \le \text{IVs} \le 29 \\ 2 & 30 \le \text{IVs} \le 36 \\ 3 & 37 \le \text{IVs} \le 44 \\ 4 & \text{IVs} = 45 \end{cases}$$

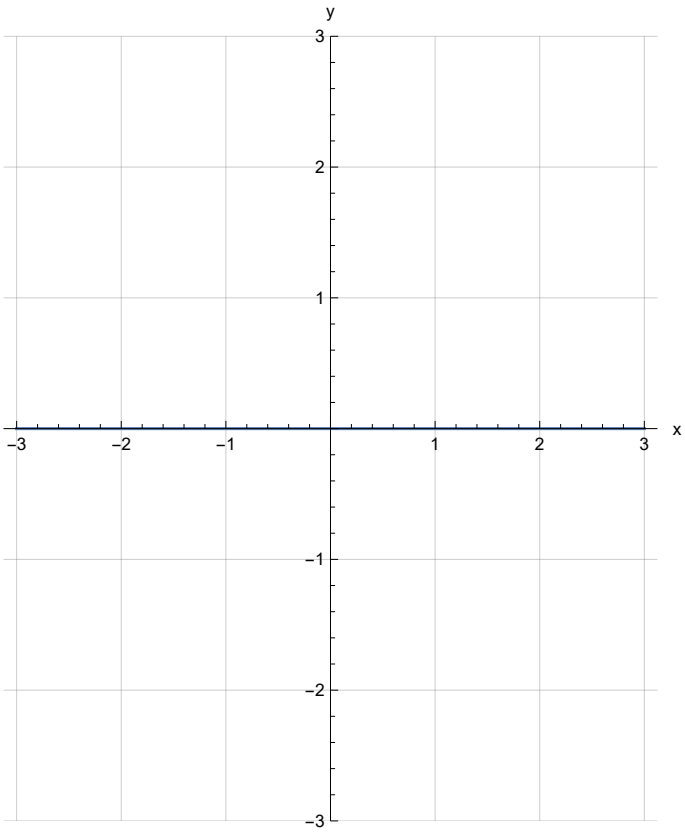
Piecewise defined functions

A function that is defined differently on different subsets of the domain.

We can also graph piecewise defined functions

$$g(x) = \begin{cases} x & x \le 1 \\ -x + 1 & x > 1 \end{cases}$$

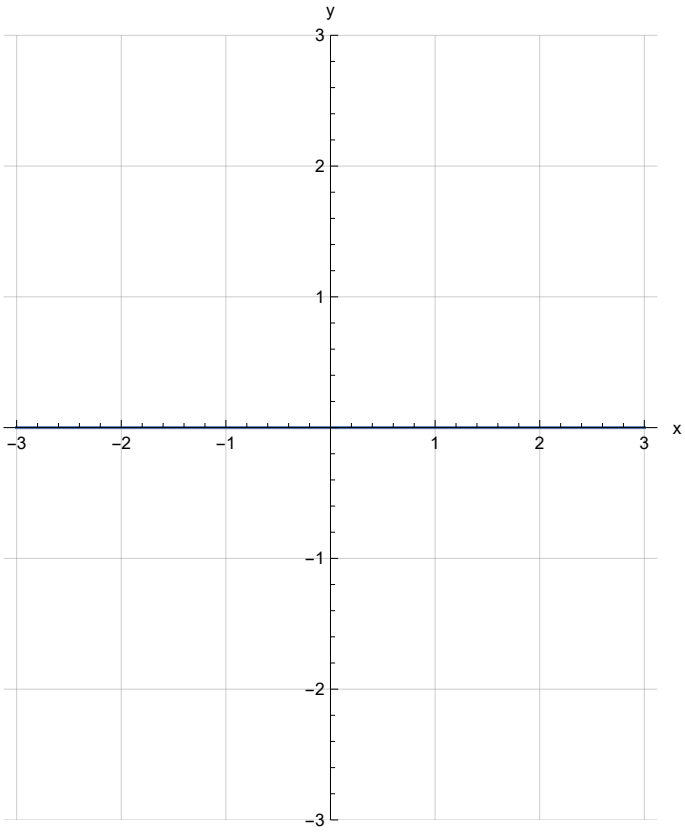
For clarity, include the “split point” in your table!



Another Example

$$g(x) = \begin{cases} \frac{1}{2}x - 2 & x \le -1 \\ 2 & x > -1 \end{cases}$$

For clarity, include the “split point” in your table!



My Growlithe

Base Stats

058		Growlithe	146	136	93

Compute Attack stat

Description of the function:

The attack stat is computed by adding the base attack and attack IV and then multiplying by the CPM. If the result is less than ten it is rounded to ten.

Domain for the function?

Range for the function?

Growlithe?

Attack

The base Attack for Growlithe is 136.

This Growlithe has an attack IV of 9.

This Growlithe is level 19. So he has a CPM of 0.582

Defense

The base defense for Growlithe is 93.

This Growlithe has a defense IV of 8.

CPM is still 0.582

HP? Something is different...

The base HP for Growlithe is 146.

This Growlithe has an HP IV of 11.

CPM is still 0.582

After the initial calculation HP is “rounded”

Description of the function:

The Unrdd HP stat is computed by adding the base HP and HP IV and then multiplying by the CPM. This is how we find Attack and Defense.
However, with HP, This result is then rounded down to the nearest integer or up to 10 if it is less than 10.

Formula for HP?

Floor or “greatest-integer function”

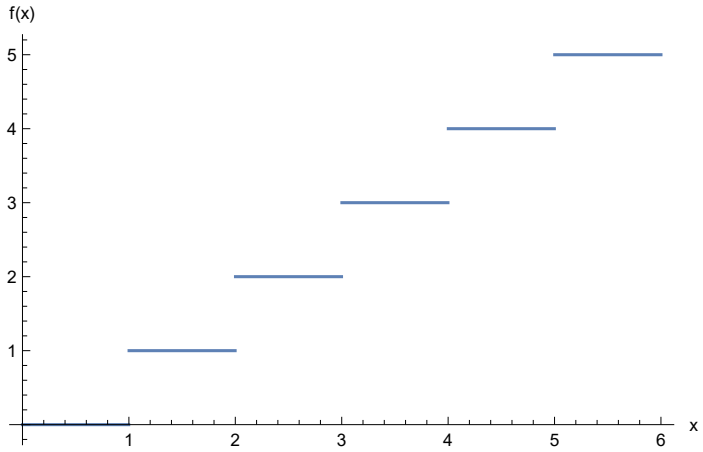
The book calls this the “greatest-integer function.”

Most everyone else calls it the “floor function.”

The rule is round down. The domain is , the range is .

Notation

Visualization f(x)=⌊x⌋



Smallest possible value is 10 for HP