Functions Come to Life with Funville Adventures!

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MAA MathFest 2023 – My Favorite Adapted Math Circle Topic

A math-inspired fantasy adventure!

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Introduces children to the concept of functions.

Can be used to introduce functions in a classroom or math circle setting.

Why Functions in a Math Circle?

- The topic is accessible
- Functions are a core concept underlying any further STEM education
- If kids build intuition before they encounter it more formally, it can alleviate the confusion and stress they often experience later.
- Functions can be fun! (Pun intended.)

Why A (math-inspired) Fantasy Adventure?

- *Historical Reason*: Inspired by the Sasha's older daughter who loved turning everything into stories.
- A format that many kids love and are not intimidated by.
- Can appeal to a wider audience that may not have yet connected with mathematics in other forms.
- The math is subtle, but it is very much there!
- Allows the math to come alive.

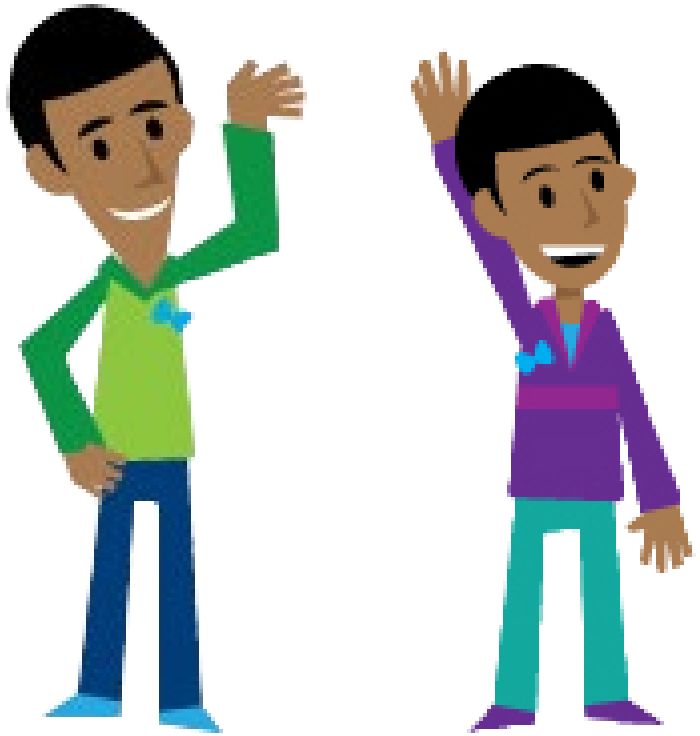
something

something

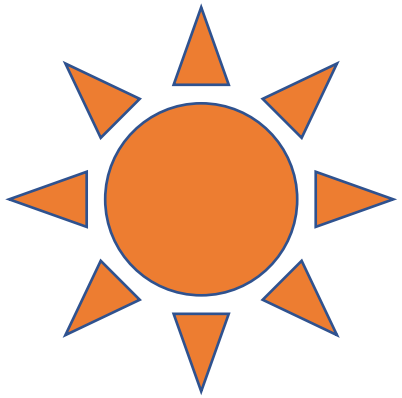
something

WELCOME
TO
FUNVILLE

The Cast of Characters



Harvey and Doug

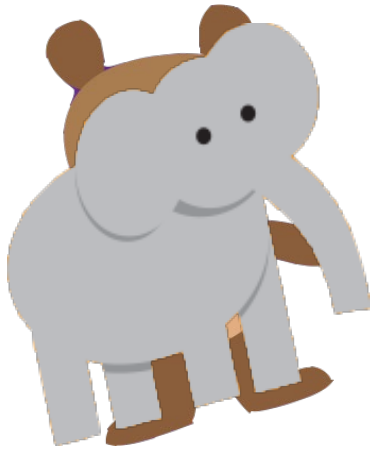


Harvey can make things shrink down to half size

Doug can make things double in size

The Cast of Characters

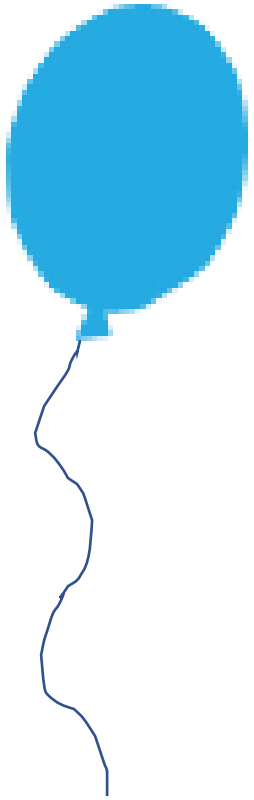
Constance



Constance can turn any object into a gray elephant

The Cast of Characters

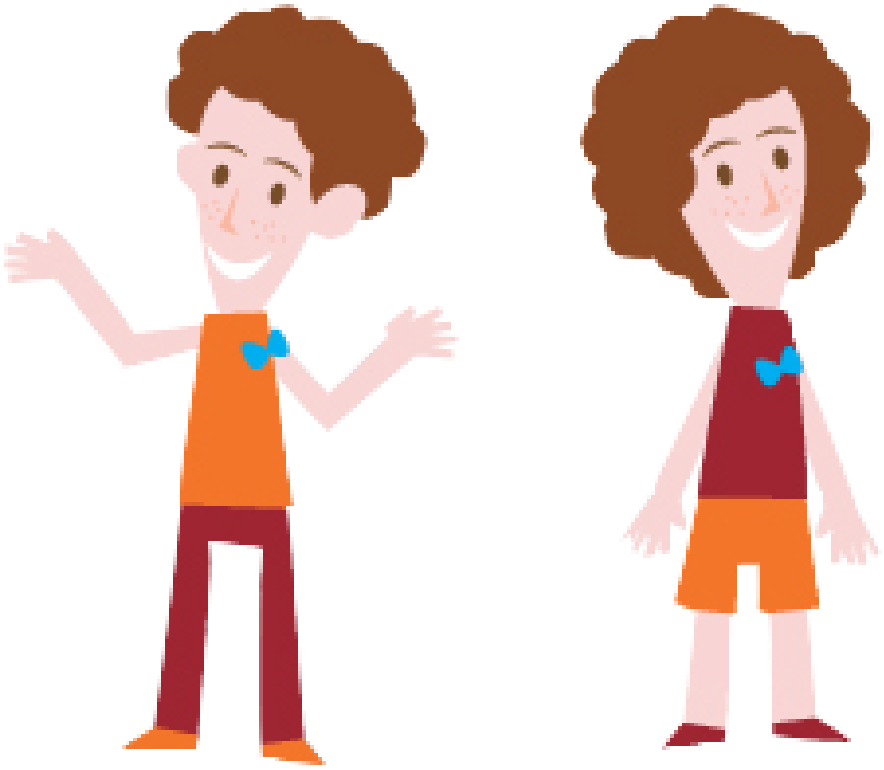
Liza and Heather



Liza can make things light

Heather can make things heavy

The Cast of Characters



Cory and Marge

Marge can merge two copies back into one

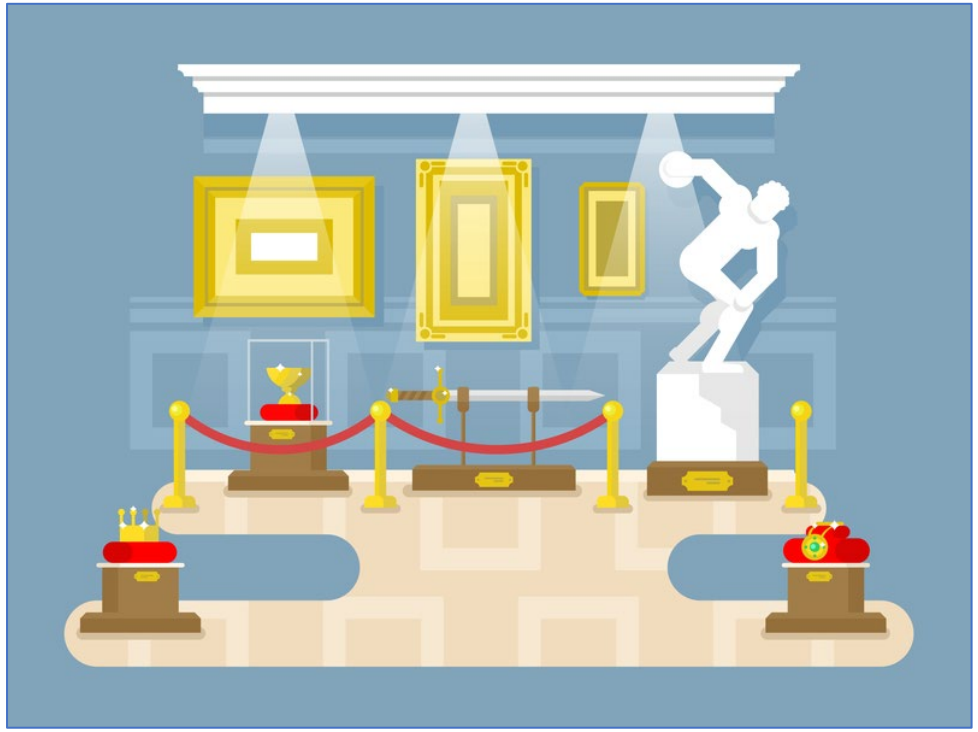
Cory can copy the object

Example of a Mystery . . .

At the Funville Museum, there are lots of exhibits.

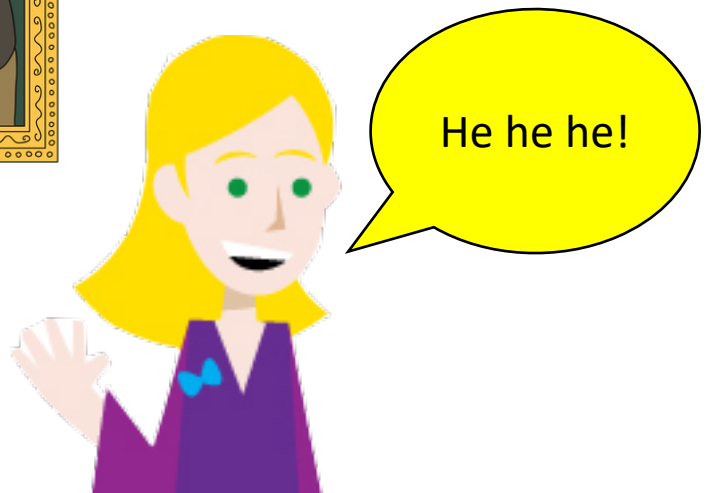
But after seeing the exhibits many times, some Funvillians decide to change them a bit to make things more interesting.

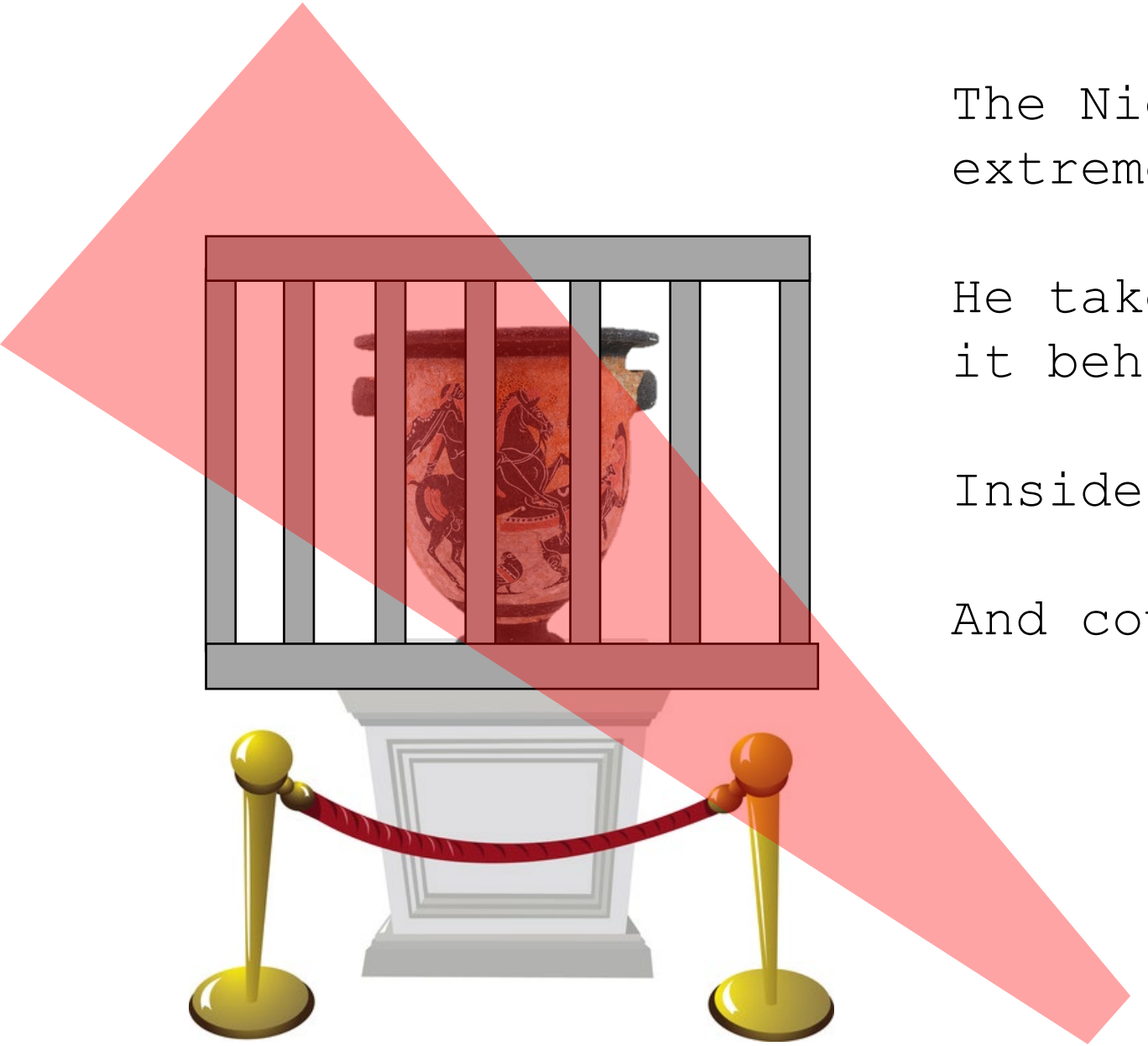
But there is a night watchman at the Funville Museum, who does not like things to change.



He doesn’t like it when statues are copied.

He doesn’t like it when paintings float!





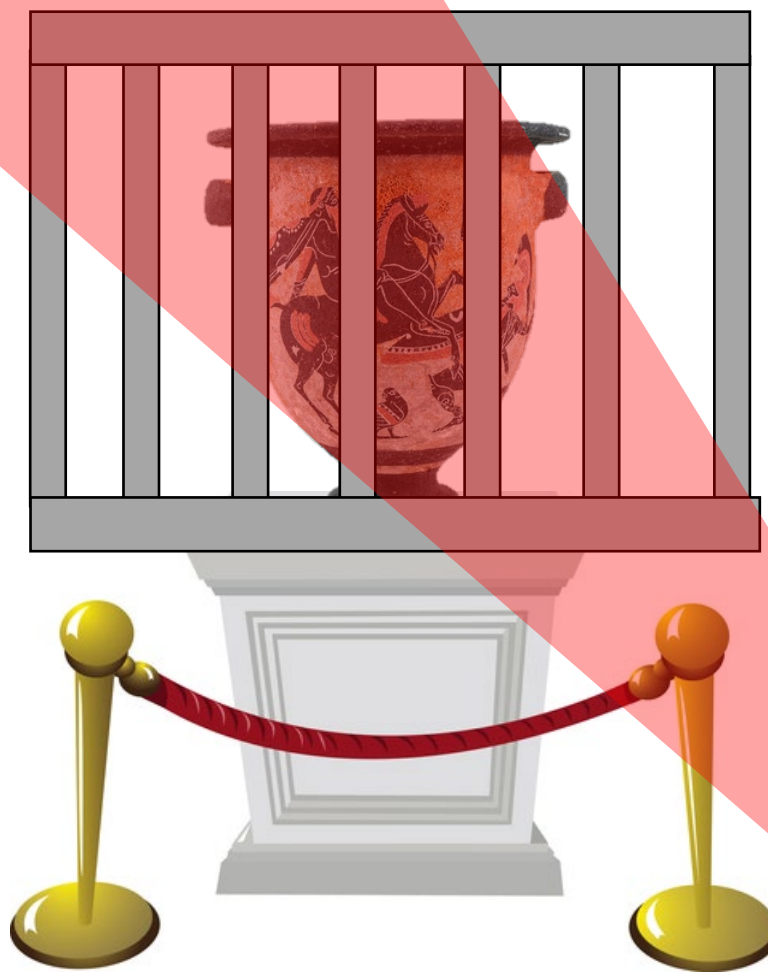
The Night Watchman resorts to extreme measures.

He takes the prize exhibit and puts it behind a rope,

Inside bars,

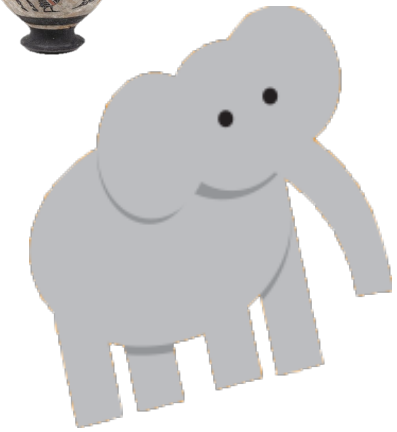
And covered by a motion detector.

Some Funvillians sneak into the museum.

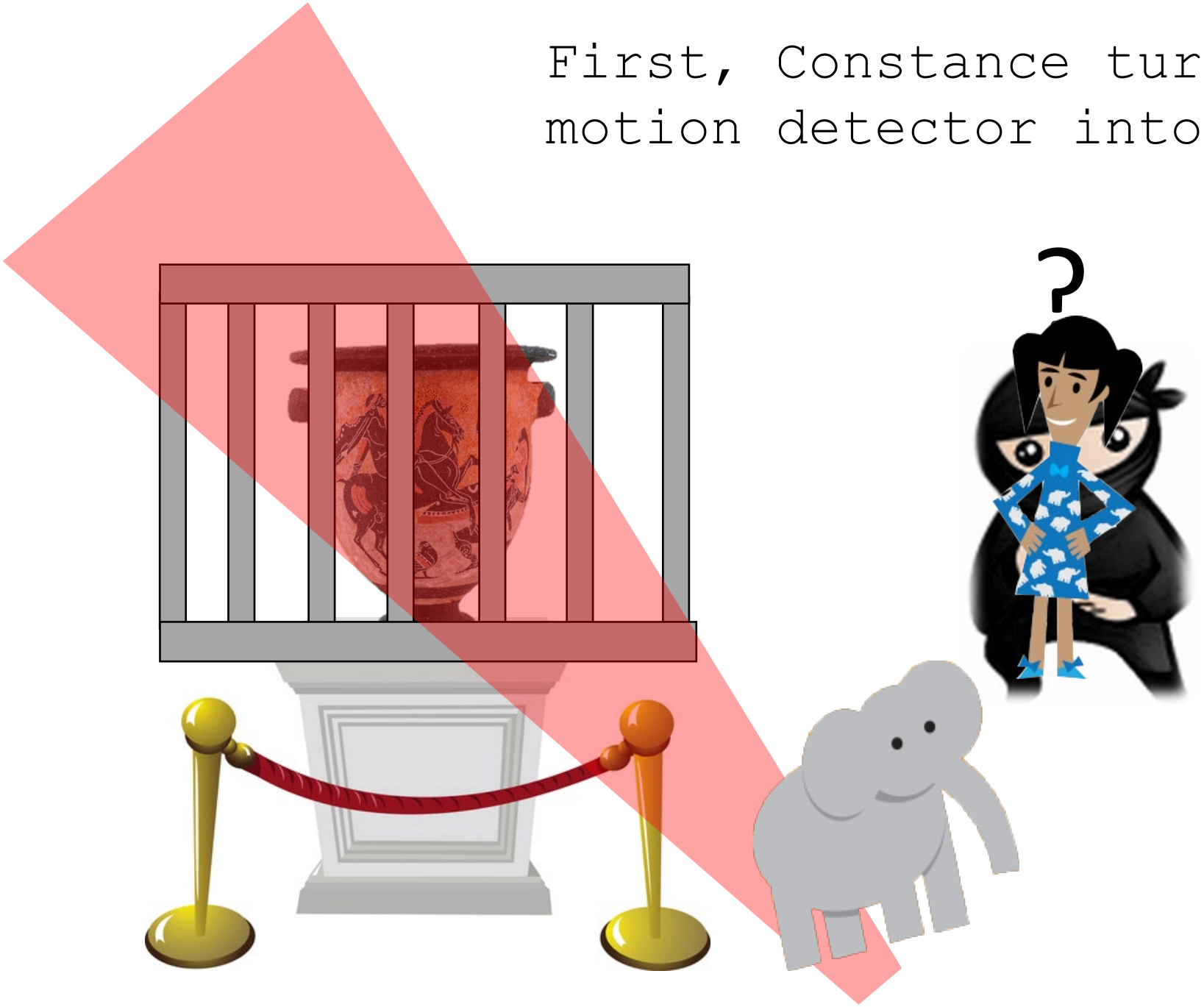


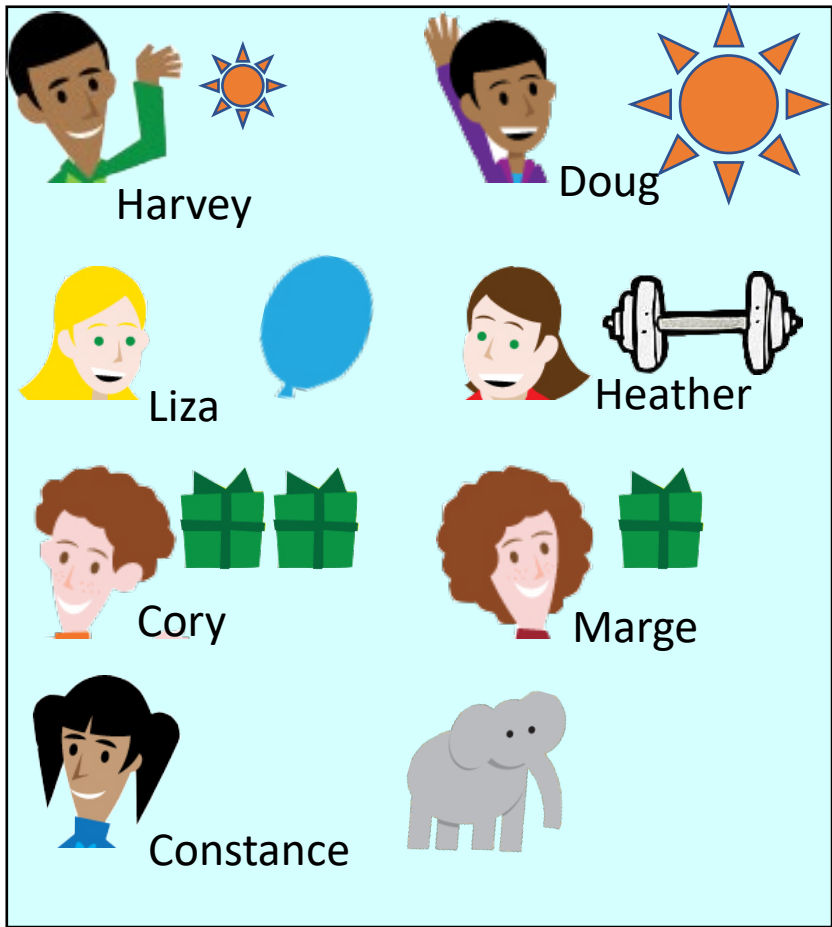
When the watchman returns, he finds . . .

The original vase appears undisturbed, but the motion detector is gone, there is a mysterious gray elephant, and now there are many vases of various sizes everywhere!

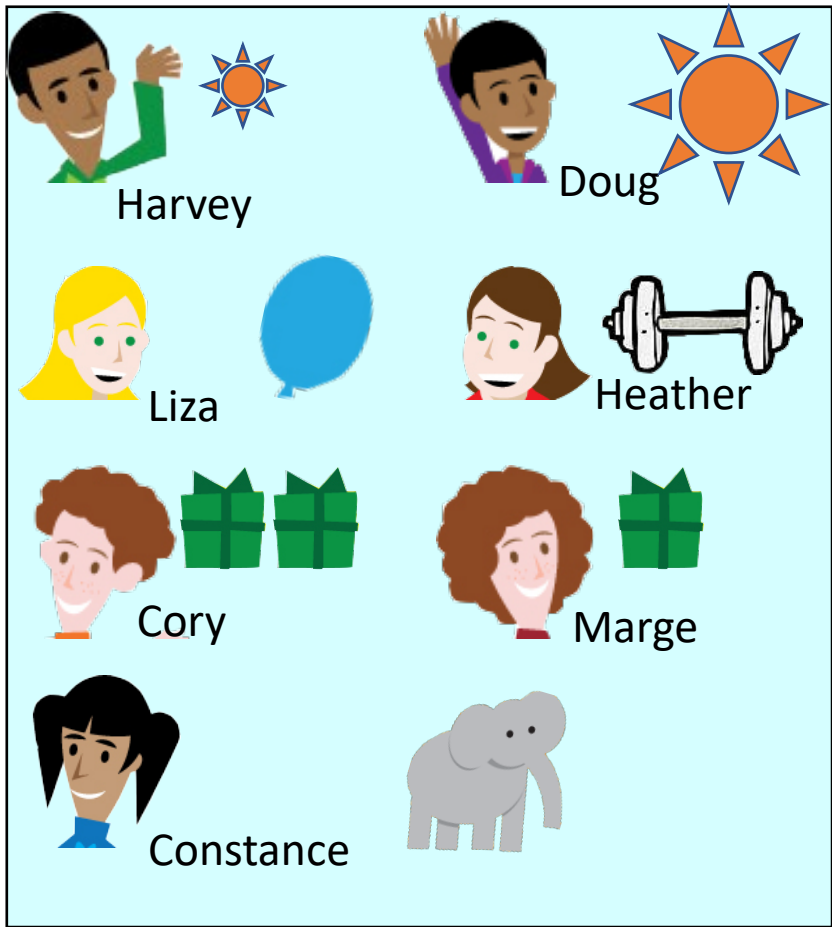


First, Constance turned the motion detector into a gray elephant.

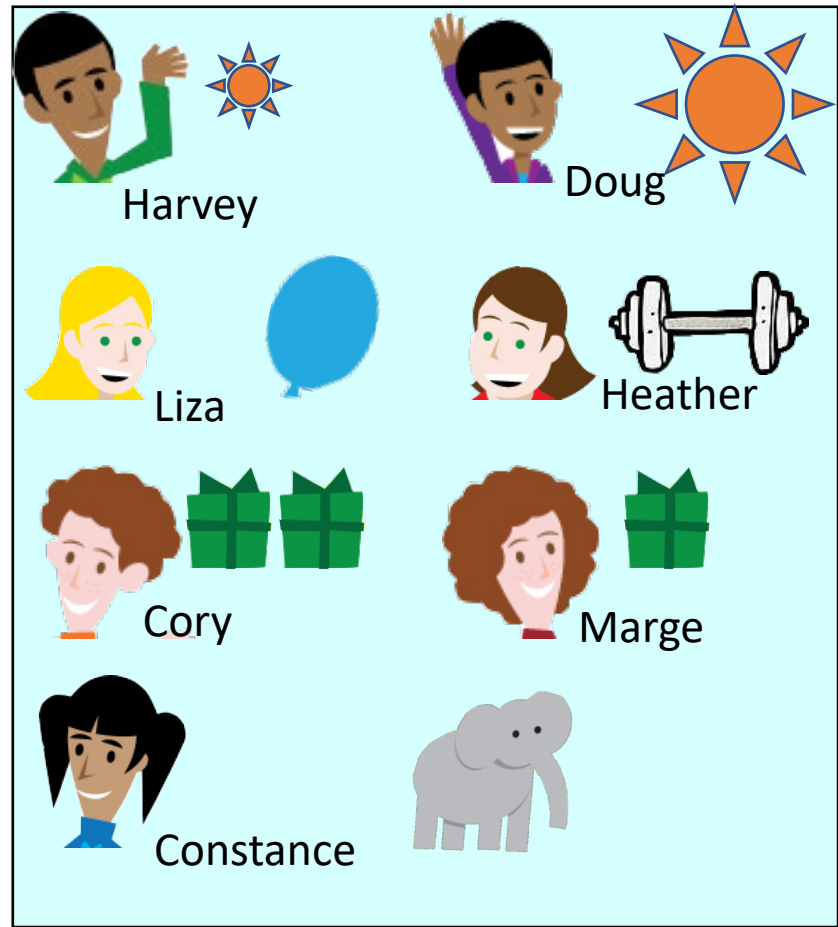




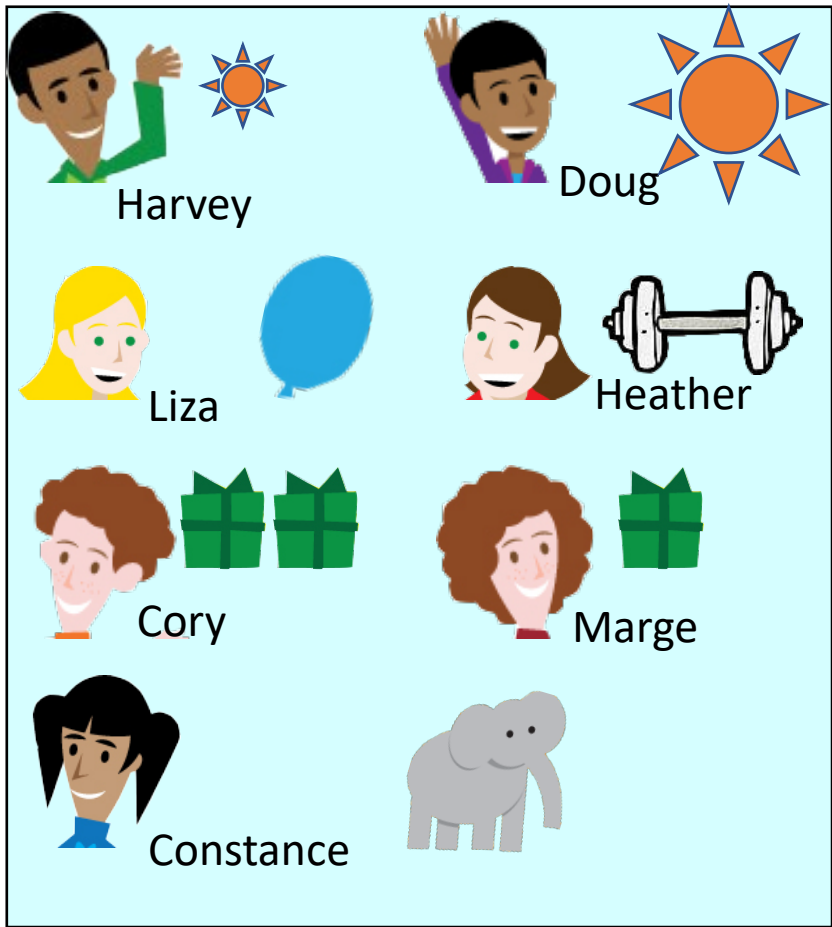
Then, Liza made the bars and vase light so they could be lifted off the pedestal.



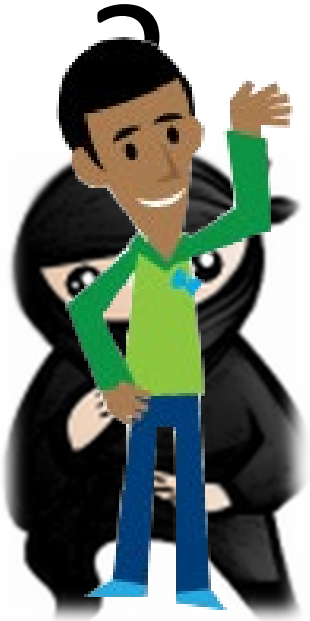
Next Doug made the bars big so the vase could fit through them.

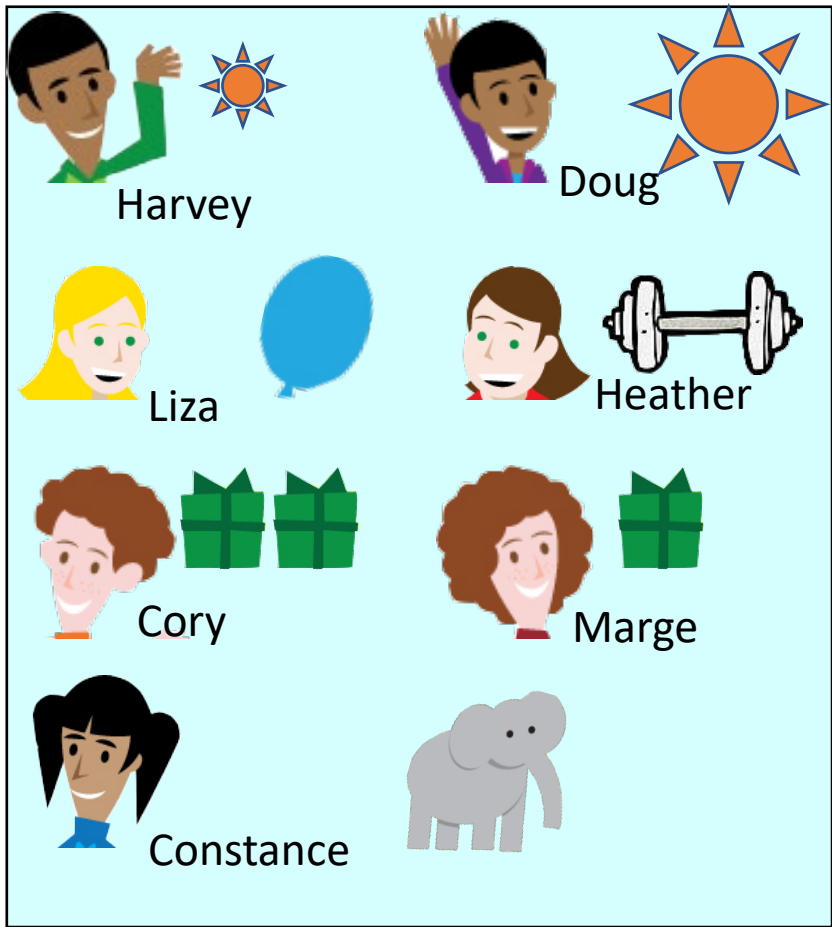


Then Cory copied the vase several times.



And Harvey shrunk some of the copies.

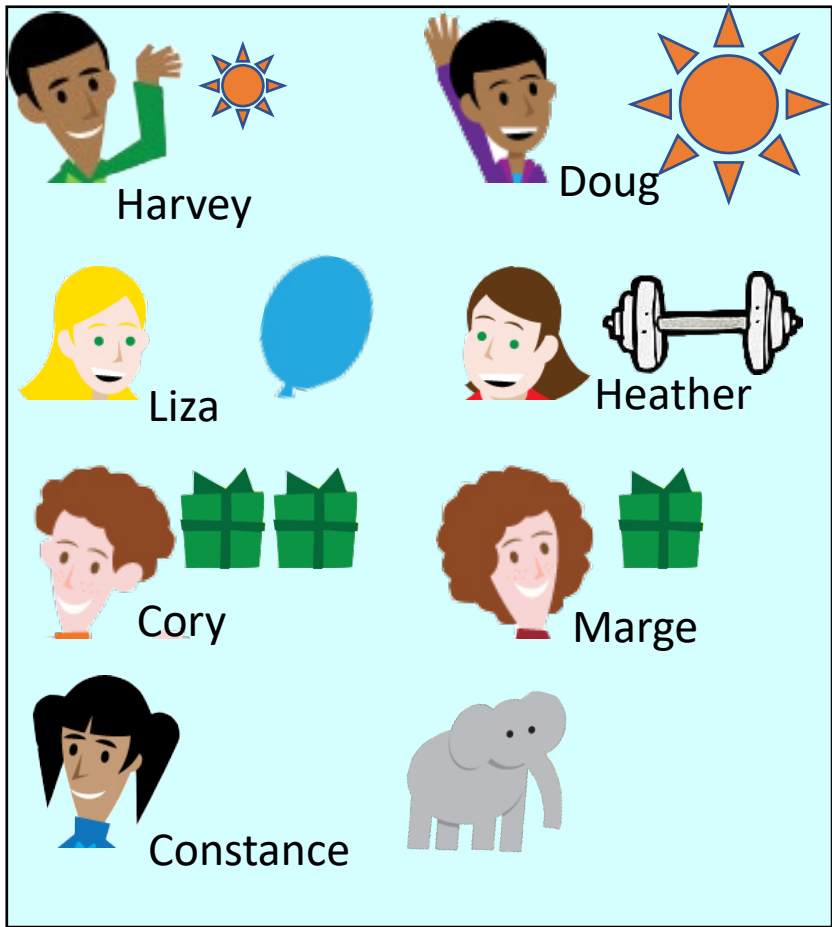




They put the original vase back in the bars. Then Harvey shrunk the bars back to their original size.

They put the vase and bars back on the pedestal.

Finally, Heather returned everything to its proper weight.

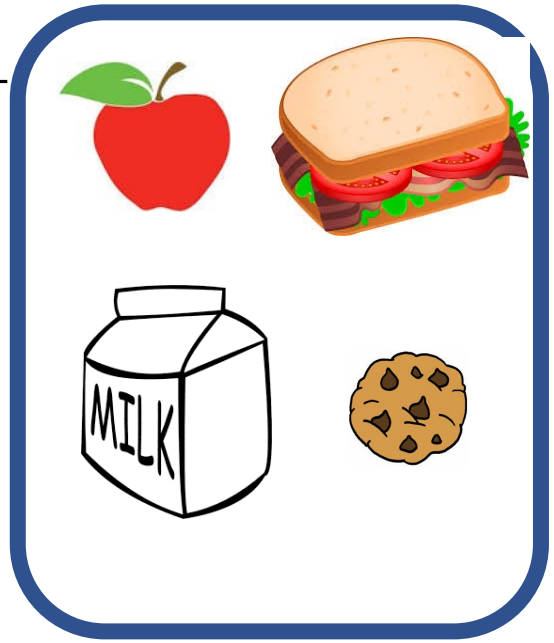


Some Examples of Who-dun-it Puzzles

1. Whose lunch is on each tray?

Original lunch:

- Apple
- Sandwich
- Milk
- Cookie



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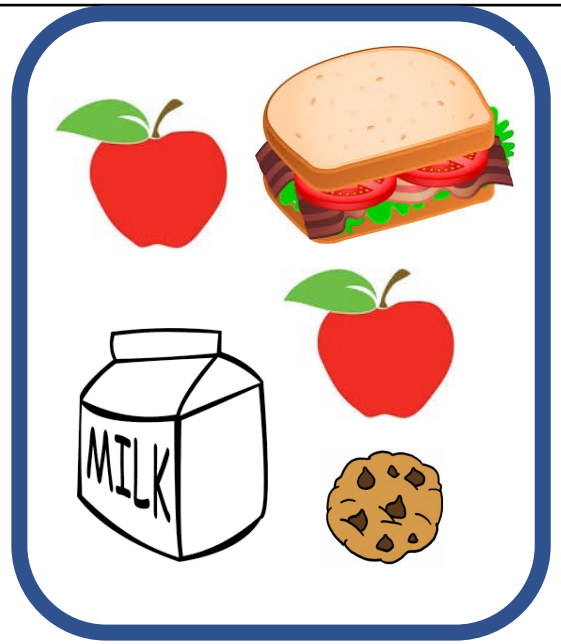

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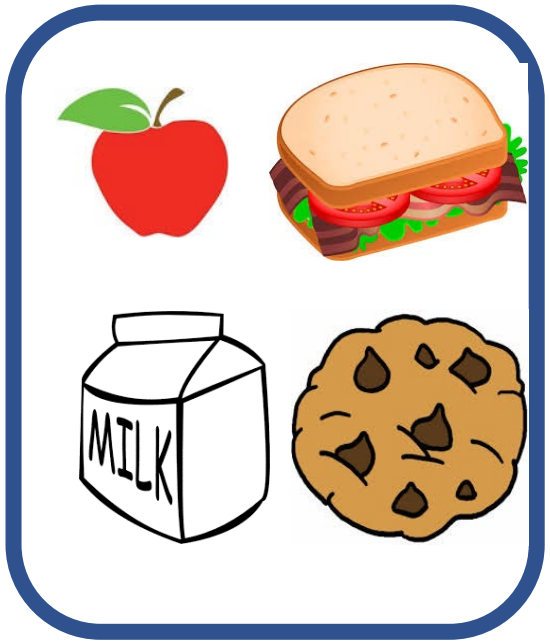

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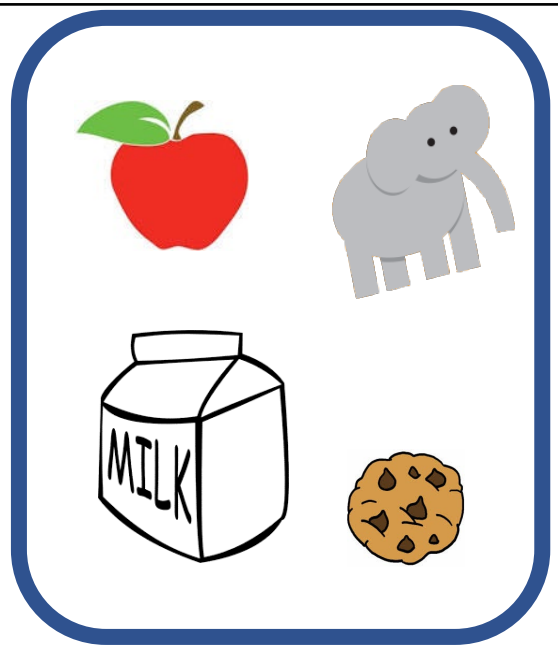
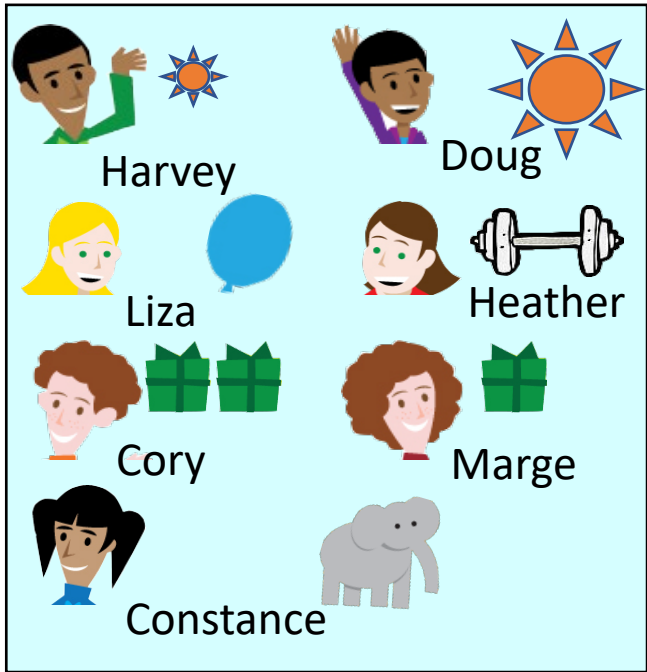
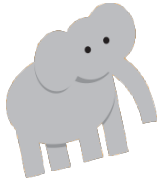




2. Who changed what letter in the word “WELCOME” on the sign?

Welcome to Funville	W e  c o mm e

W_____

E_____

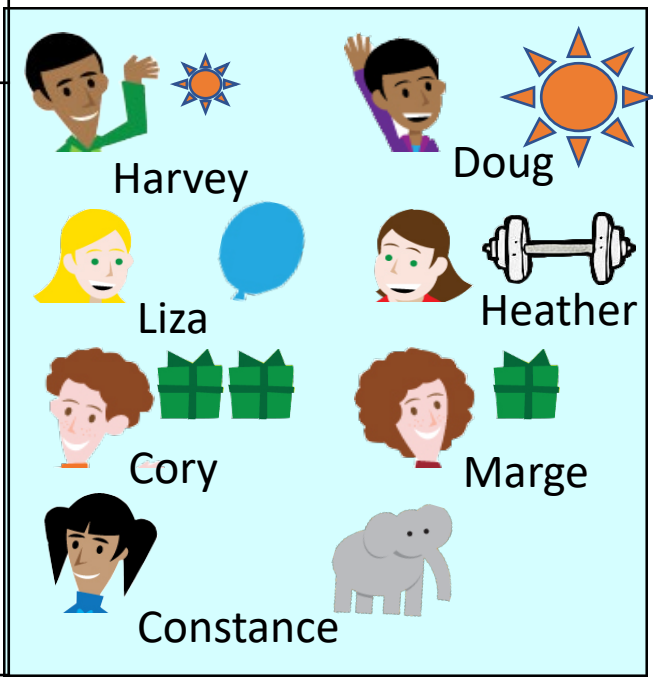
L_____

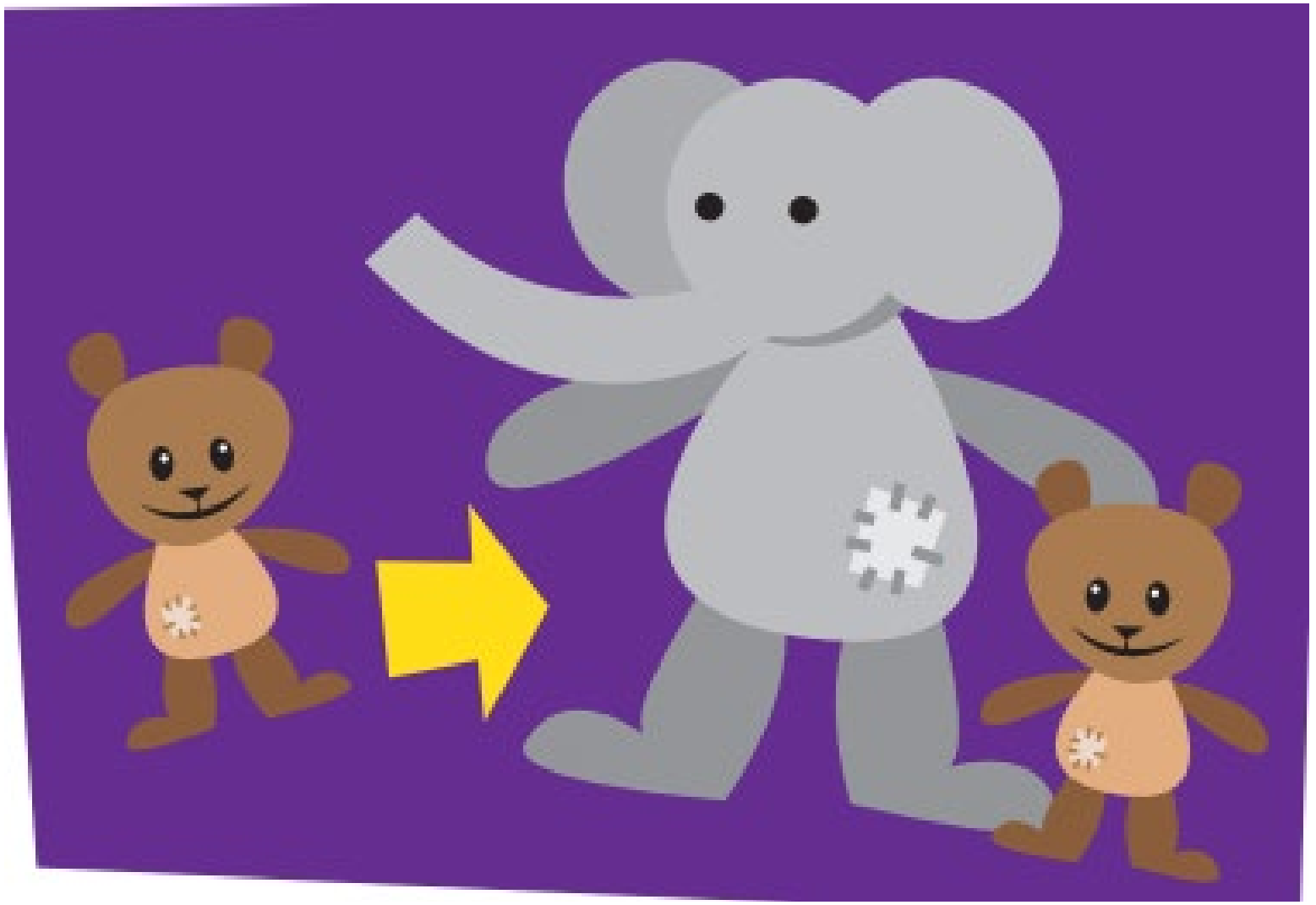
C_____

O_____

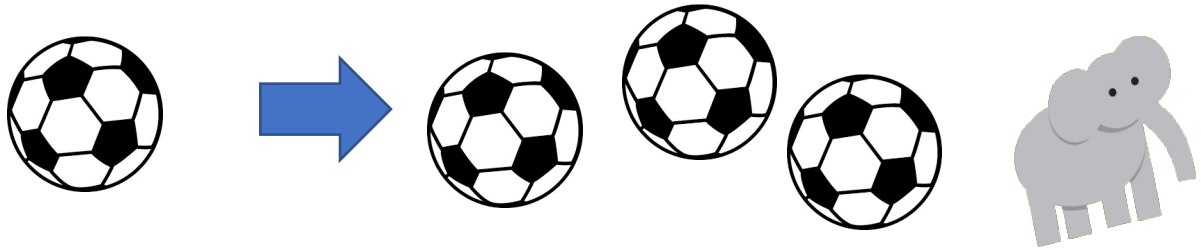
M_____

E_____





Can you tell in what order Ivy passed her teddy bear to Cory, Constance, and Doug?



Cory and Constance are on a soccer team together. They caused some chaos at the last game when, instead of one soccer ball, the team ended up with three balls and an elephant!

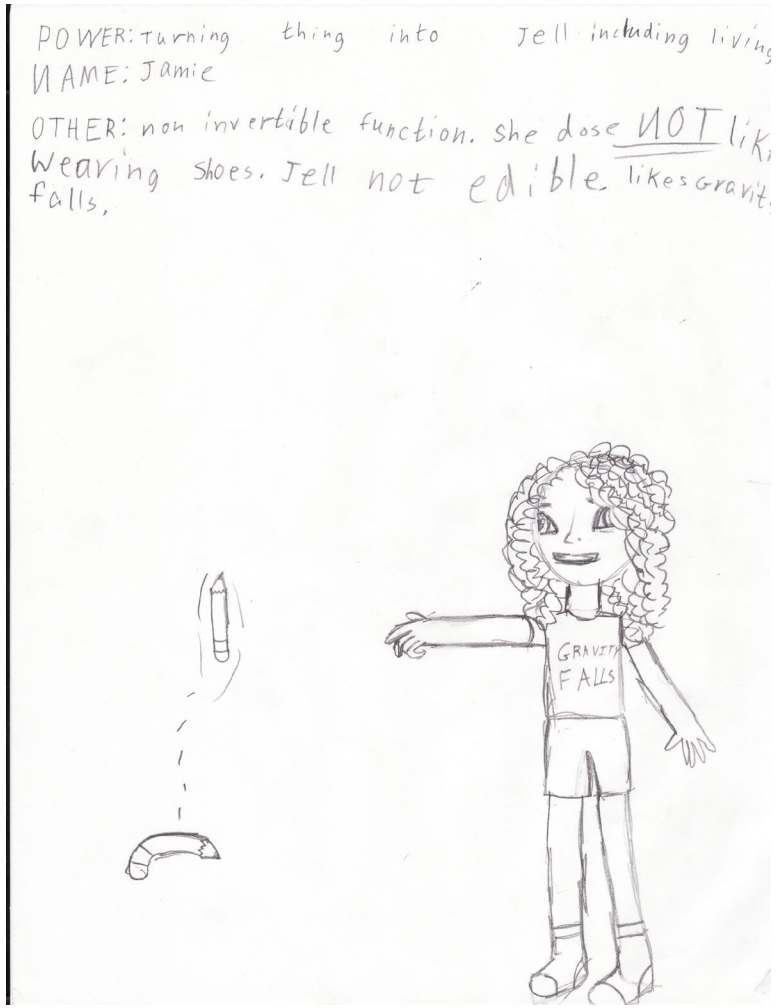
a. What happened at the game? How did Cory and Constance use their powers?

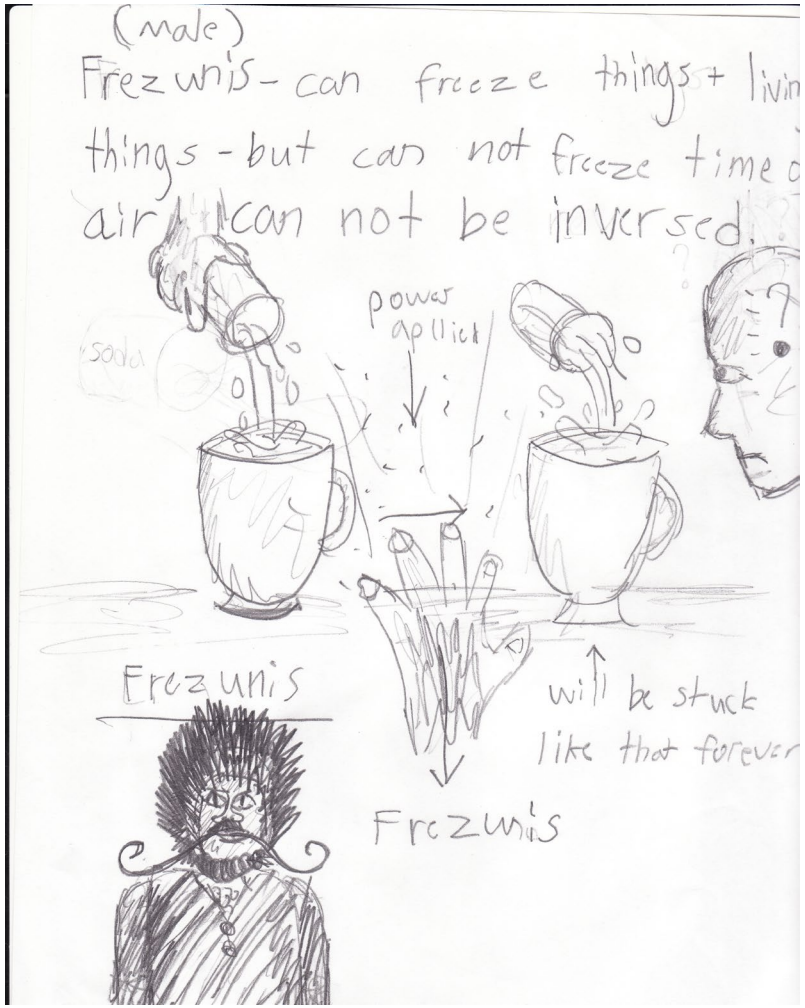
_____

b. Which friend could they call to get rid of the extra balls?

_____

Examples of student Funvillians

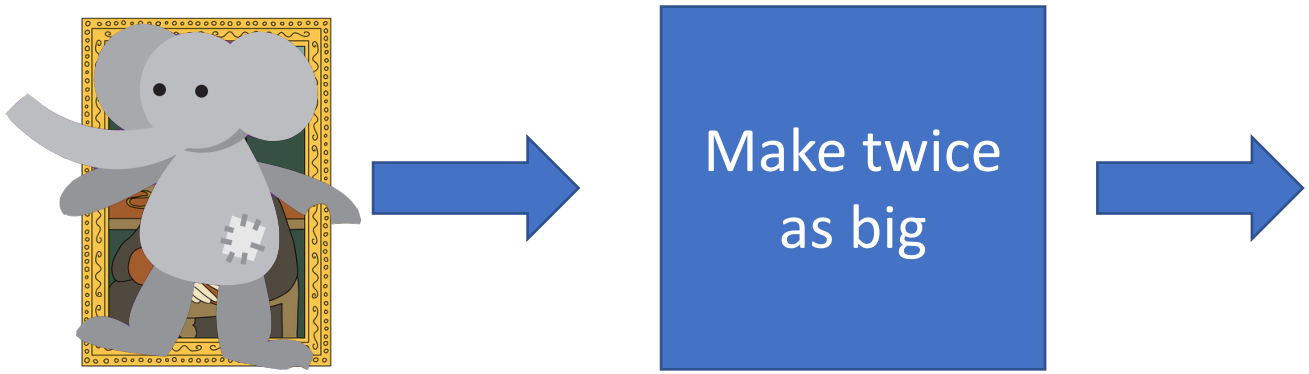




A brief look at the mathematics behind Funville Adventures

Functions

A function is a process that can be applied to certain objects:



Domain

The **domain** of a function is the set of objects it can be applied to.

Cory and Marge's powers only work on non-living things.

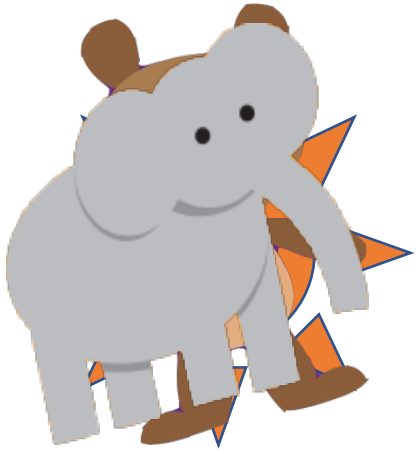
Merging two living copies would be scary!

Invertible and Non-invertible functions

A function is **invertible** if its effects can be reversed by another function, which is called its **inverse.**

Hanvey and Doug's powers are inverses

Constance's power is non-invertible



Once she turns something into an elephant, there is no way to tell what it was!

Commutativity

Sometimes it doesn't matter what order functions are applied in.
When this happens, we say the functions "commute."

If Harvey makes something small,
then Liza makes it light:

We get the same result if Liza makes it light,
then Harvey makes it small.

Lack of Commutativity

Sometimes order does matter!

If you put on your socks first, then your shoes,
You are ready to go!

But if you put on your shoes first, then your socks,
You get a different result!

In this case, we say these functions don’t commute.

Using Funville Characters and ideas in a math circle session

- Teacher creates a mystery for the students to solve
- Students come up with their own mystery
- Students create their own Funvillians and figure out their properties (Invertible? Domain and Range. Commutes with others?)
- Teachers create who-dun-it puzzles for students to solve
- Students create their who-dun-it puzzles

The book contains many more adventures and fun characters!