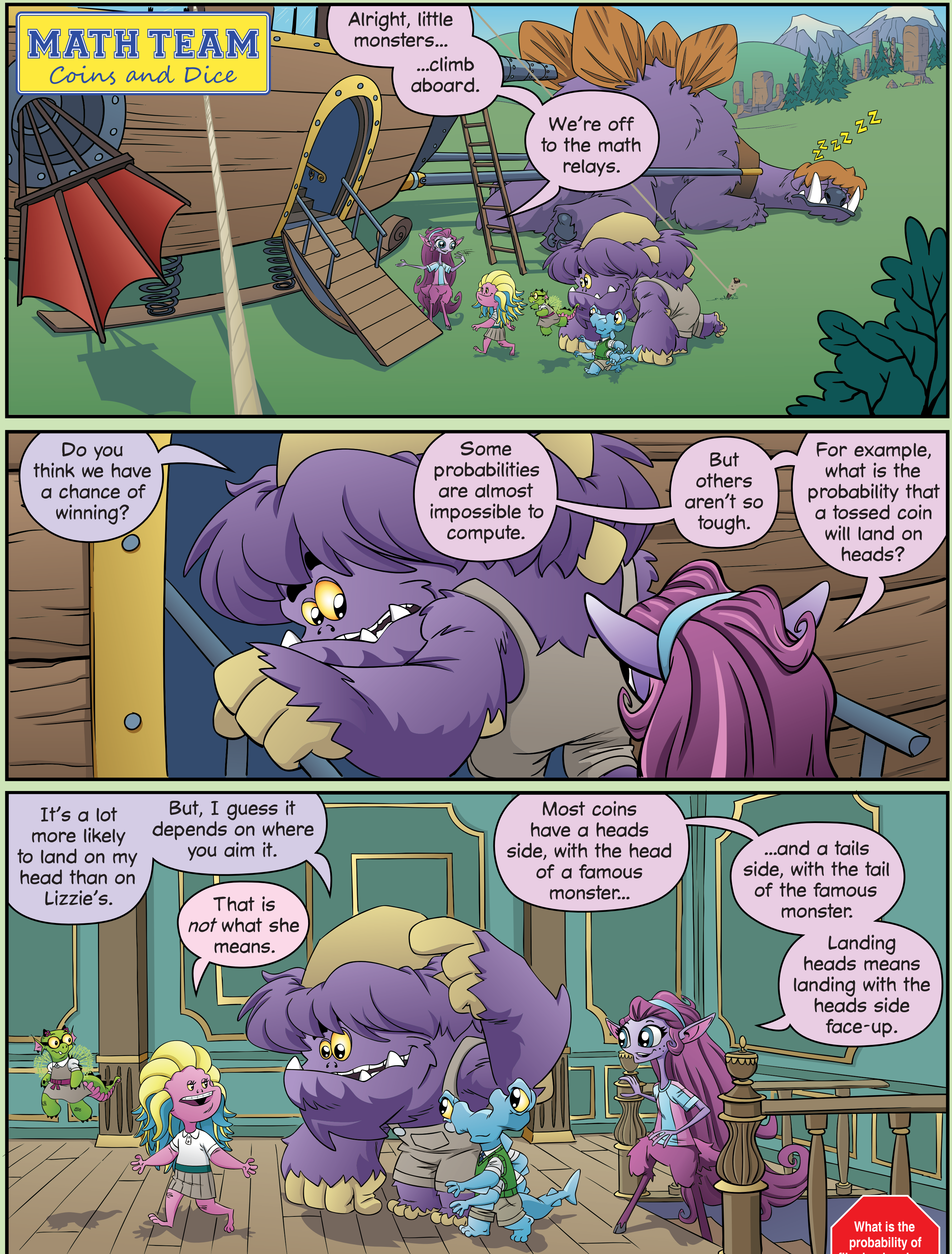
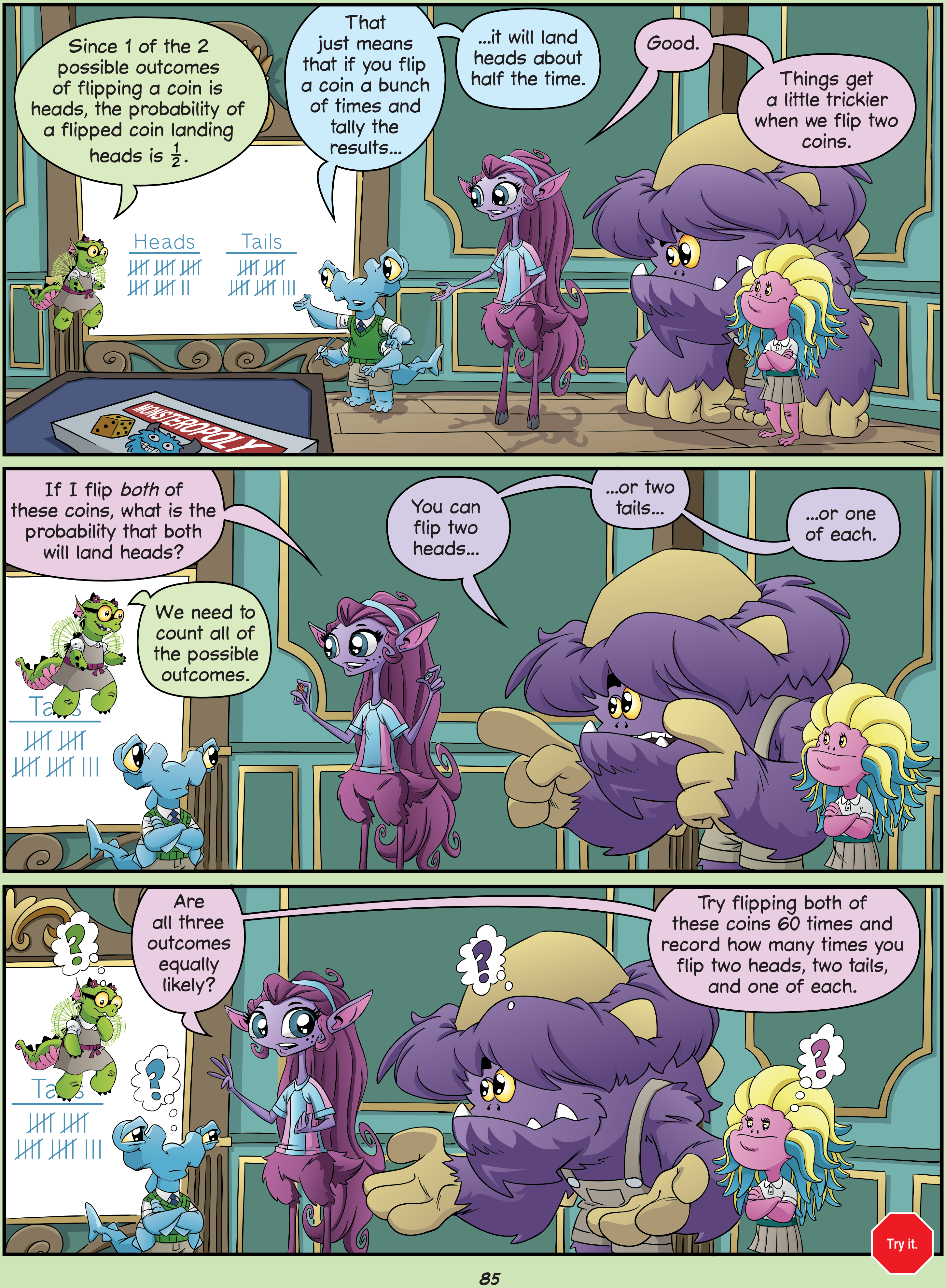
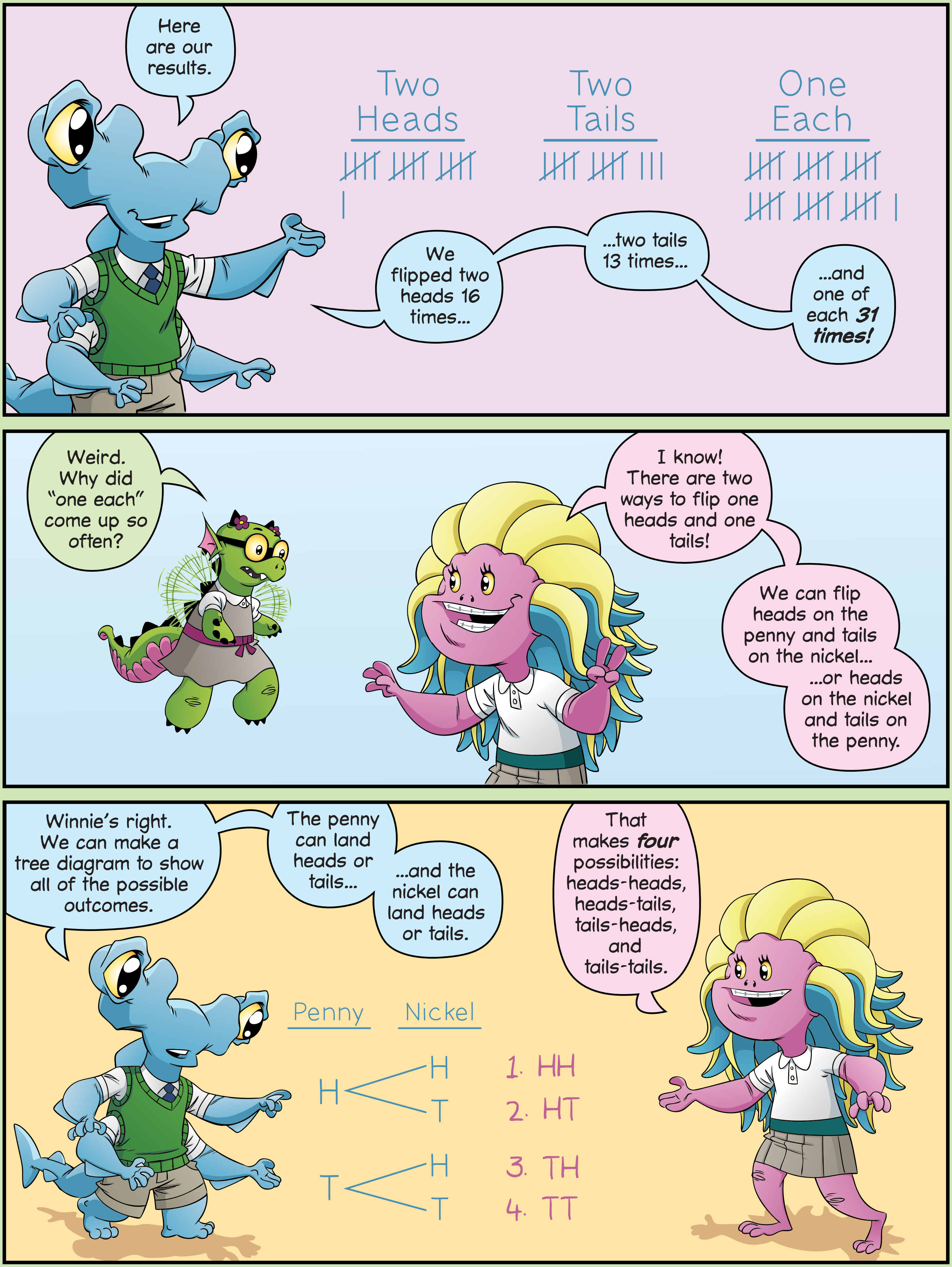
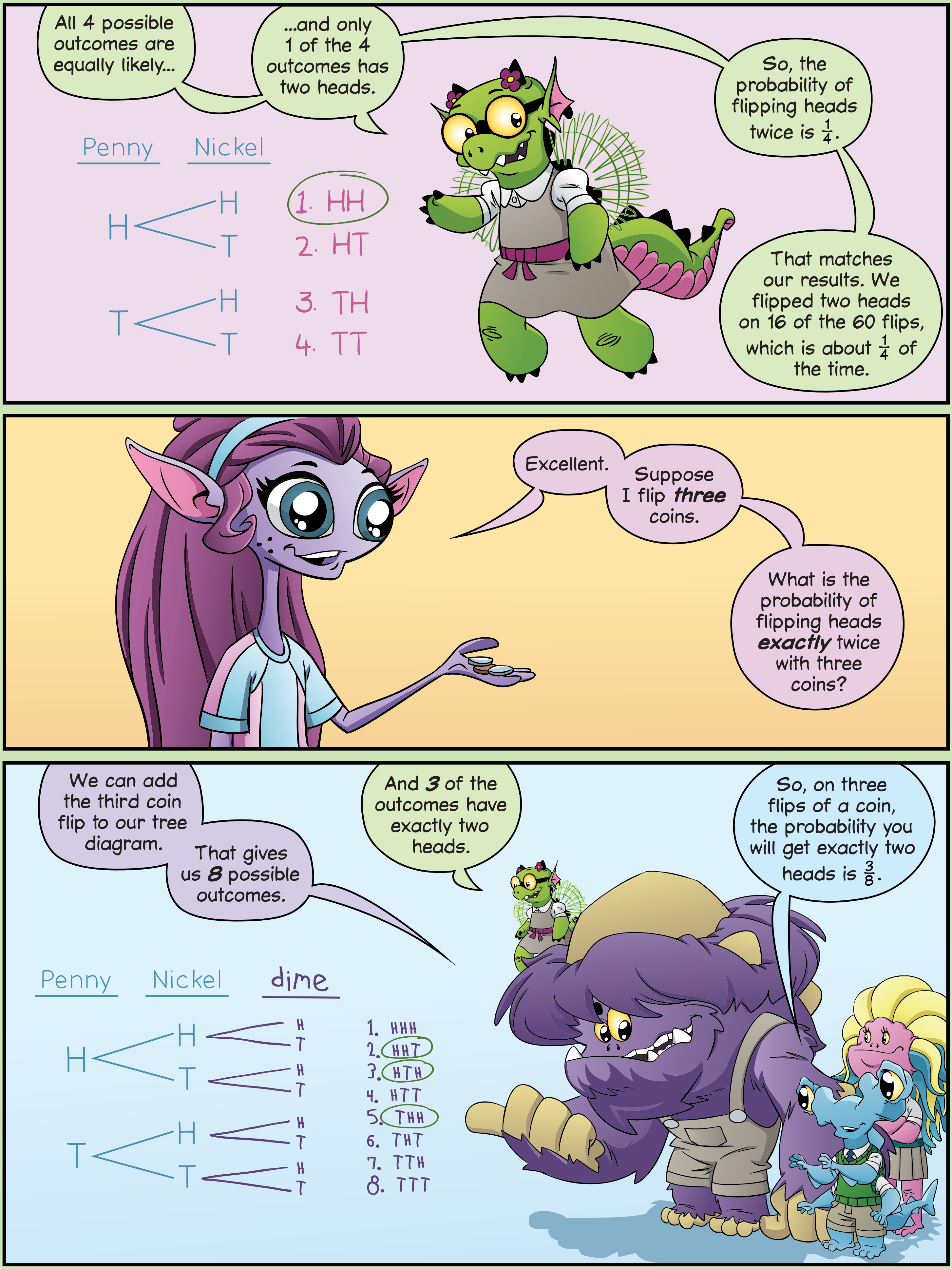


What is the probability of flipping heads on a coin flip?



Since 1 of the 2 possible outcomes of flipping a coin is heads, the probability of a flipped coin landing heads is $\frac{1}{2}$.
That just means that if you flip a coin a bunch of times and tally the results...
...it will land heads about half the time.
Good.
Things get a little trickier when we flip two coins.
Heads
Tails
MONSTEROPOLY
If I flip *both* of these coins, what is the probability that both will land heads?
We need to count all of the possible outcomes.
You can flip two heads...
...or two tails...
...or one of each.
Are all three outcomes equally likely?
Try flipping both of these coins 60 times and record how many times you flip two heads, two tails, and one of each.
Try it.


Here are our results.
Two Heads
Two Tails
One Each
We flipped two heads 16 times...
...two tails 13 times...
...and one of each ***31 times!***
Weird. Why did "one each" come up so often?
I know! There are two ways to flip one heads and one tails!
We can flip heads on the penny and tails on the nickel...
...or heads on the nickel and tails on the penny.
Winnie's right. We can make a tree diagram to show all of the possible outcomes.
The penny can land heads or tails...
...and the nickel can land heads or tails.
That makes ***four*** possibilities: heads-heads, heads-tails, tails-heads, and tails-tails.
Penny
Nickel
H
T
H
T
H
T
1. HH
2. HT
3. TH
4. TT


All 4 possible outcomes are equally likely...
...and only 1 of the 4 outcomes has two heads.
Penny
Nickel
H
H
T
T
H
T
1. HH
2. HT
3. TH
4. TT
So, the probability of flipping heads twice is $\frac{1}{4}$.
That matches our results. We flipped two heads on 16 of the 60 flips, which is about $\frac{1}{4}$ of the time.
Excellent.
Suppose I flip ***three*** coins.
What is the probability of flipping heads ***exactly*** twice with three coins?
We can add the third coin flip to our tree diagram.
That gives us ***8*** possible outcomes.
And ***3*** of the outcomes have exactly two heads.
Penny
Nickel
dime
1. HHH
2. HHT
3. HTH
4. HTT
5. THH
6. THT
7. TTH
8. TTT
So, on three flips of a coin, the probability you will get exactly two heads is $\frac{3}{8}$.


Awesome job!
Let's switch from coins to dice.
Have any of you played Monsteropoly?
Penny
Nickel
dime
MONSTEROPOLY
MONSTEROPOLY


I always get sent to jail in that game. *Directly* to jail.
How do you get out of jail?
You have to roll doubles with a pair of dice.
What's the probability of rolling doubles?
GO DIRECTLY TO JAIL
PASS GO, DO NOT COLLECT $200


We need to know how many different rolls are possible.
A coin only has 2 sides, but a die has 6!
We can make another tree diagram to show every possible roll.
What is the probability of rolling two of the same number with a pair of dice?