

MATH TEAM

Coins and Dice

Alright, little monsters...
...climb aboard.

We're off to the math relays.



Do you think we have a chance of winning?

Some probabilities are almost impossible to compute.

But others aren't so tough.

For example, what is the probability that a tossed coin will land on heads?



It's a lot more likely to land on my head than on Lizzie's.

But, I guess it depends on where you aim it.

That is *not* what she means.

Most coins have a heads side, with the head of a famous monster...

...and a tails side, with the tail of the famous monster.

Landing heads means landing with the heads side face-up.



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



Try it.

Here are our results.

<u>Two Heads</u>	<u>Two Tails</u>	<u>One Each</u>

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.

	<u>Penny</u>	<u>Nickel</u>	
	H	/ H \ T	1. HH 2. HT
	T	/ H \ T	3. TH 4. TT

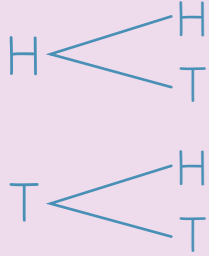
All 4 possible outcomes are equally likely...

...and only 1 of the 4 outcomes has two heads.

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.

Penny Nickel



1. HH
2. HT
3. TH
4. TT



Excellent.

Suppose I flip **three** coins.

What is the probability of flipping heads **exactly** twice with three coins?

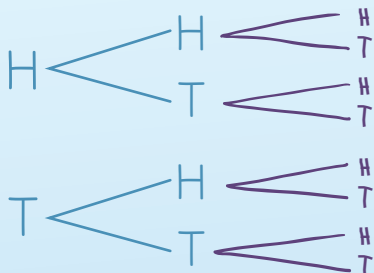
We can add the third coin flip to our tree diagram.

That gives us **8** possible outcomes.

And **3** of the outcomes have exactly two heads.

So, on three flips of a coin, the probability you will get exactly two heads is $\frac{3}{8}$.

Penny Nickel dime



1. HHH
2. HHT
3. HTH
4. HTT
5. THH
6. THT
7. TTH
8. TTT

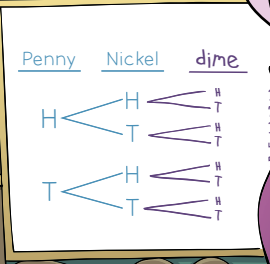




Awesome job!

Let's switch from coins to dice.

Have any of you played Monsteropoly?

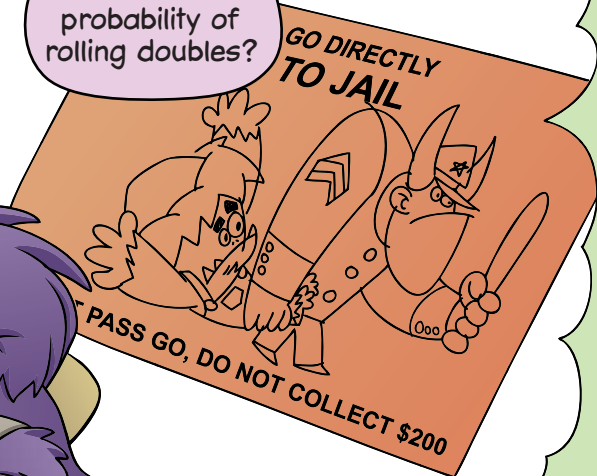


I always get sent to jail in that game. Directly to jail.

How do you get out of jail?

You have to roll doubles with a pair of dice.

What's the probability of rolling doubles?



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?