Transcript: Can you Solve the riddle and escape Hades?

Maybe the fates got clumsy. Maybe Poseidon had one of his angry days. However it happened, the underworld is overcrowded, and Zeus has ordered Hades to let some spirits out. Hades arranges all the souls of the dead in a line before Cerberus. When one of his three heads bites down on the soul in front of it, they'll get returned to the land of the living. Anyone to the left must get out of line and stay in Hades forever. And everyone else shuffles forward, at which point Cerberus will feed again. Each of the dog's heads has an equal chance of being the one to bite each time, and no two ever bite simultaneously.

00:51
Unfortunately, Hades' minions forgot to tell you what was happening, and by the time you show up there are only 99 souls left in line. Hades looks furious and drawing attention to yourself won't end well. But suddenly, time freezes, and Hermes steps out of the shadows. He tells you he can instantly put you into the line, and no one will realize what happened. But he'll only grant his grace to someone clever enough to take full advantage of it. Choose the best place in line and he'll give you the spot. Choose wrong, and he'll leave you to rot.

01:27
Which spot should you pick?

01:29
Pause the video to figure it out yourself.

01:31
Answer in 3

01:32
Answer in 2

01:35
Answer in 1

01:37
It's possible to calculate the exact probability of going free in all 100 spots. But there's a much simpler path to the solution that requires surprisingly little calculation.

01:49
Imagine being anywhere in line. Way up at the front, one of the three heads will pick someone at random, and you'll move forward 1, 2, or 3 spaces. Since each is equally

likely, your chance of survival from wherever you started is the average of the chances from each of the three spaces in front of you.

02:10
And this is where you can find a huge shortcut. Averages must be on or between the extremes of what you're averaging— they can never be higher than the highest value or lower than the lowest. So whatever your chances of survival are where you start, one of the three places in front of you is at least as good, and probably better.

02:35
This observation is incredibly powerful. It means that wherever you are in line, it'd be wise to trade your place for one of the three spots in front of you. Let's ignore which for now and think of them as a trio— this trio's maximum value is better than this trio's, and so on. Keep going and you'll reach the front... These three spots must contain the extreme values— the best and worst probabilities— for the entire line. In other words, they're all we need to consider.

03:09
Place 1 is bad. Head one would save you, and the other two doom you forever. That's just a 1 in 3 chance to escape.

03:17
Place 2 is better: head two is great, head 3 is bad, and head 1 is ok in that it gives you another chance.

03:26
But place 3 is best, because head 3 saves you while heads 1 and 2 both give you extra chances.

03:35
If you did want to consider the exact probabilities, the odds of surviving in place 3 are 16 out of 27, or close to 60%. The spots later in line tend to be very close to having a 50% chance of survival. Why 50%? Because every time Cerberus sends one soul up to be reborn, he leaves 0, 1, or 2 souls in the underworld. That averages out to one person staying for each one who gets freed.

04:07
But you can beat those odds handily with what you now know. Hermes has places to be, and so do you. He rewards your insight by sneaking you into the third spot. And from there it'll be just a short wait to learn your ultimate fate.