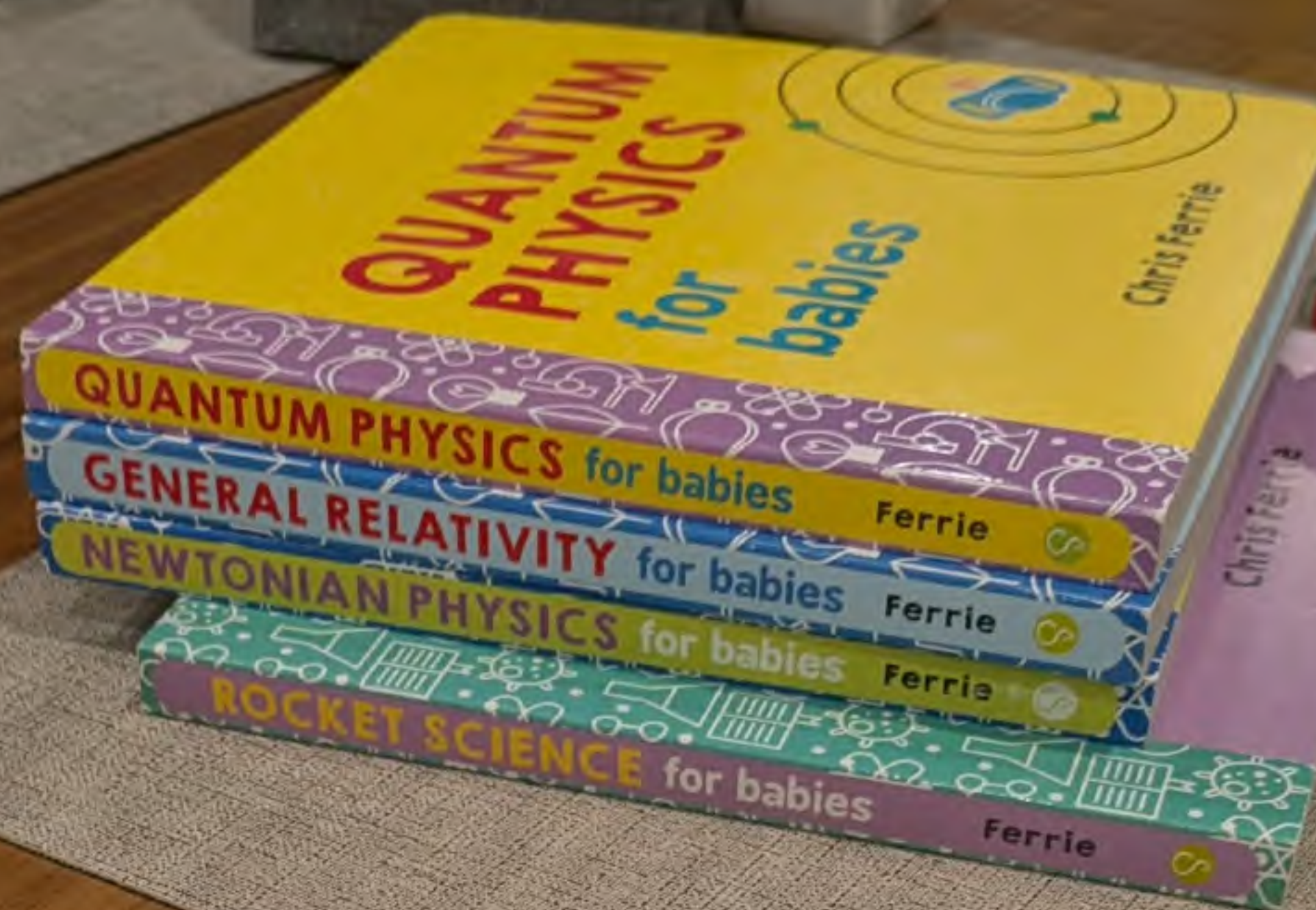




This is a ball.



This is its shadow.



The surface area of the ball is...



exactly four times the area of its shadow.
Let's prove it!



Wrap paper around the ball.



=



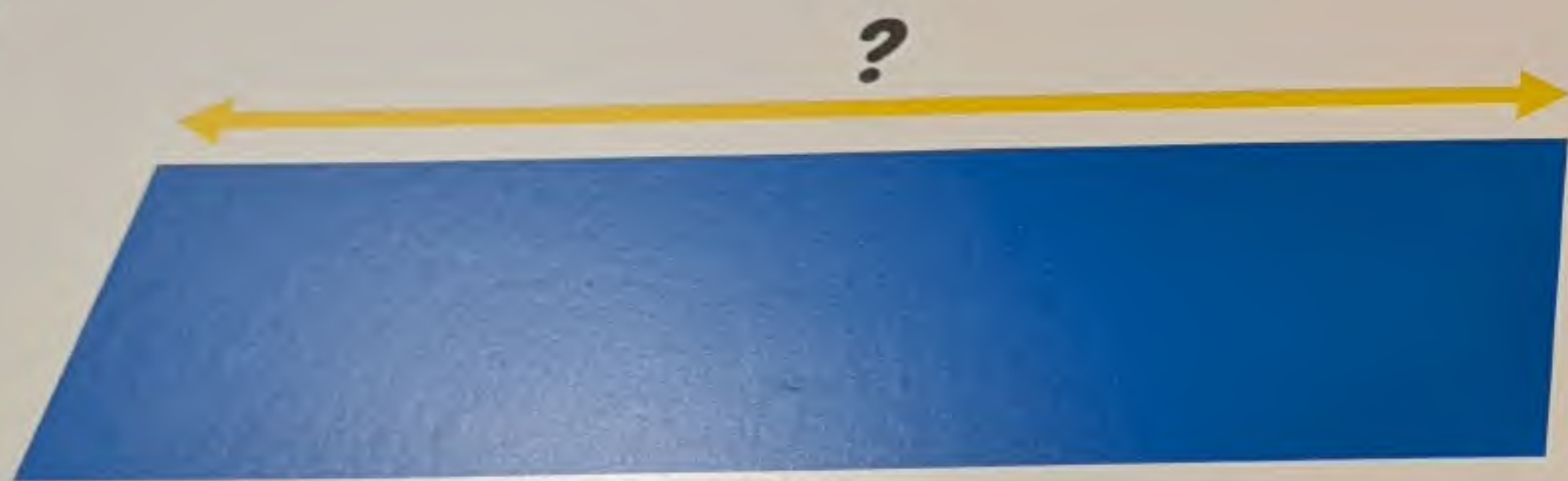
The paper and the ball
have the same surface area.



How tall is the paper?



It's the same as the diameter of the ball.



How wide is the paper?



It's the same as the
circumference of the ball.



What is the area of the shadow?

...

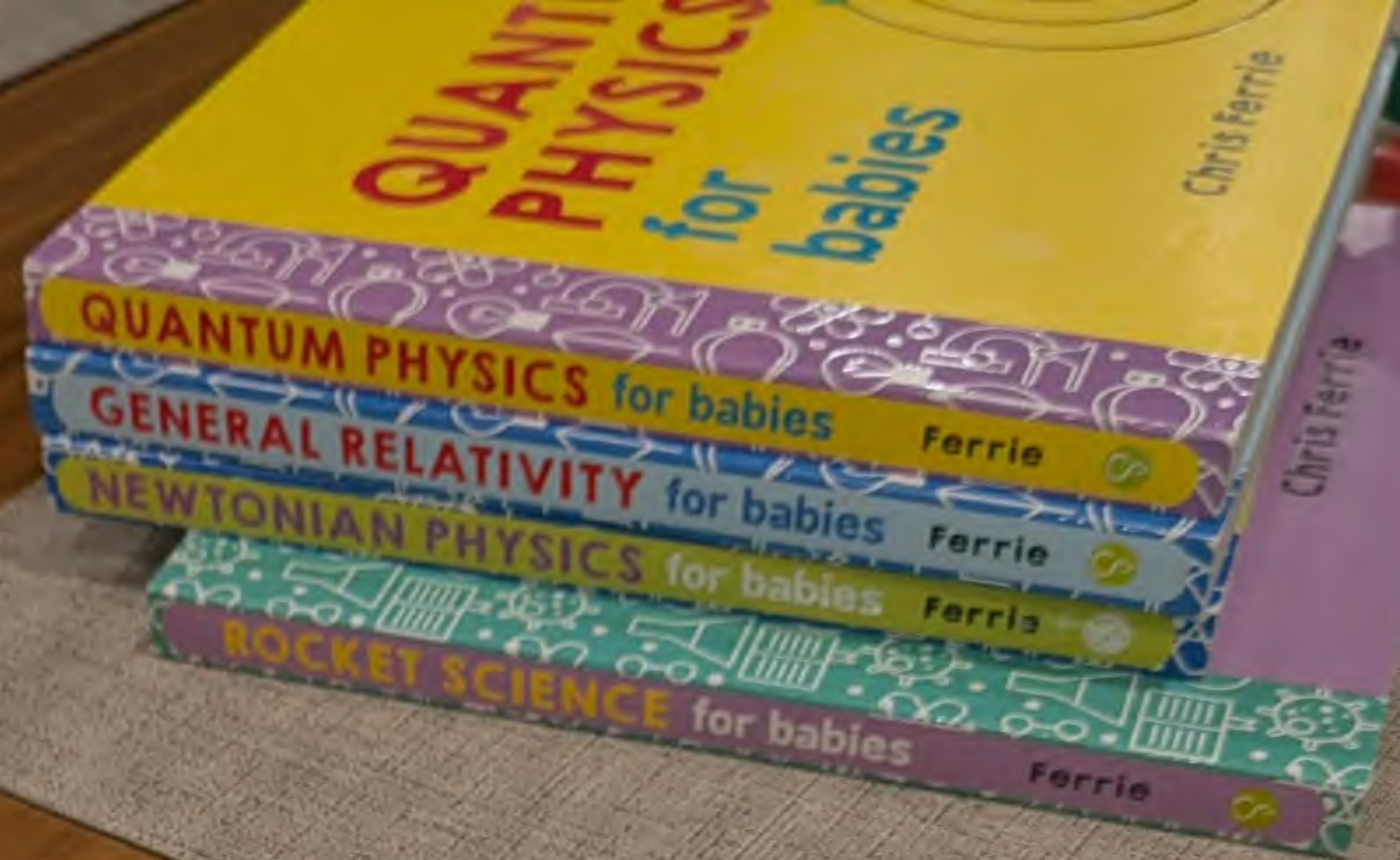
For that, we need calculus!



Cut the circle into pie slices



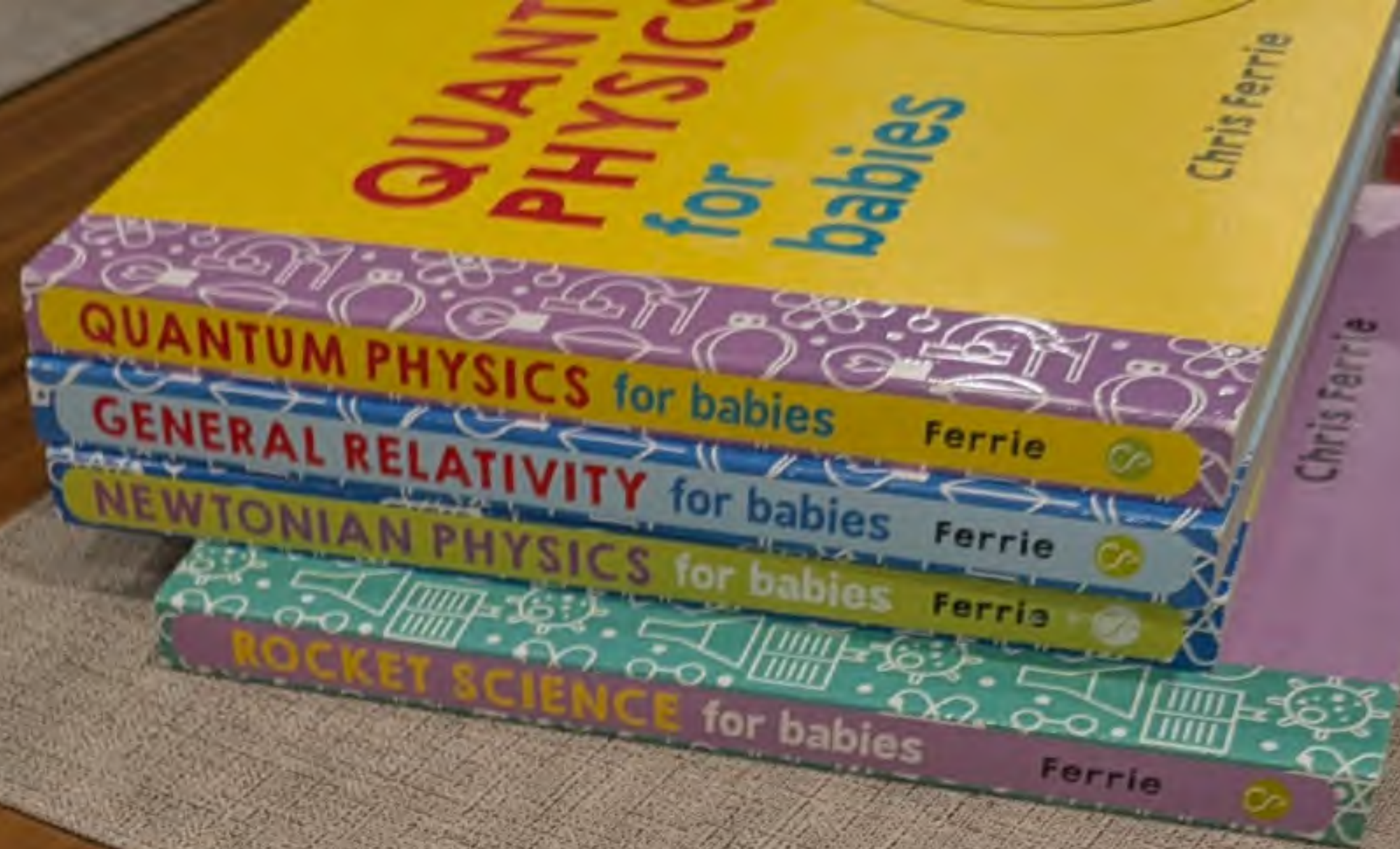
and stack them like this.



Now cut the circle into more pie slices...



and more...



And more...



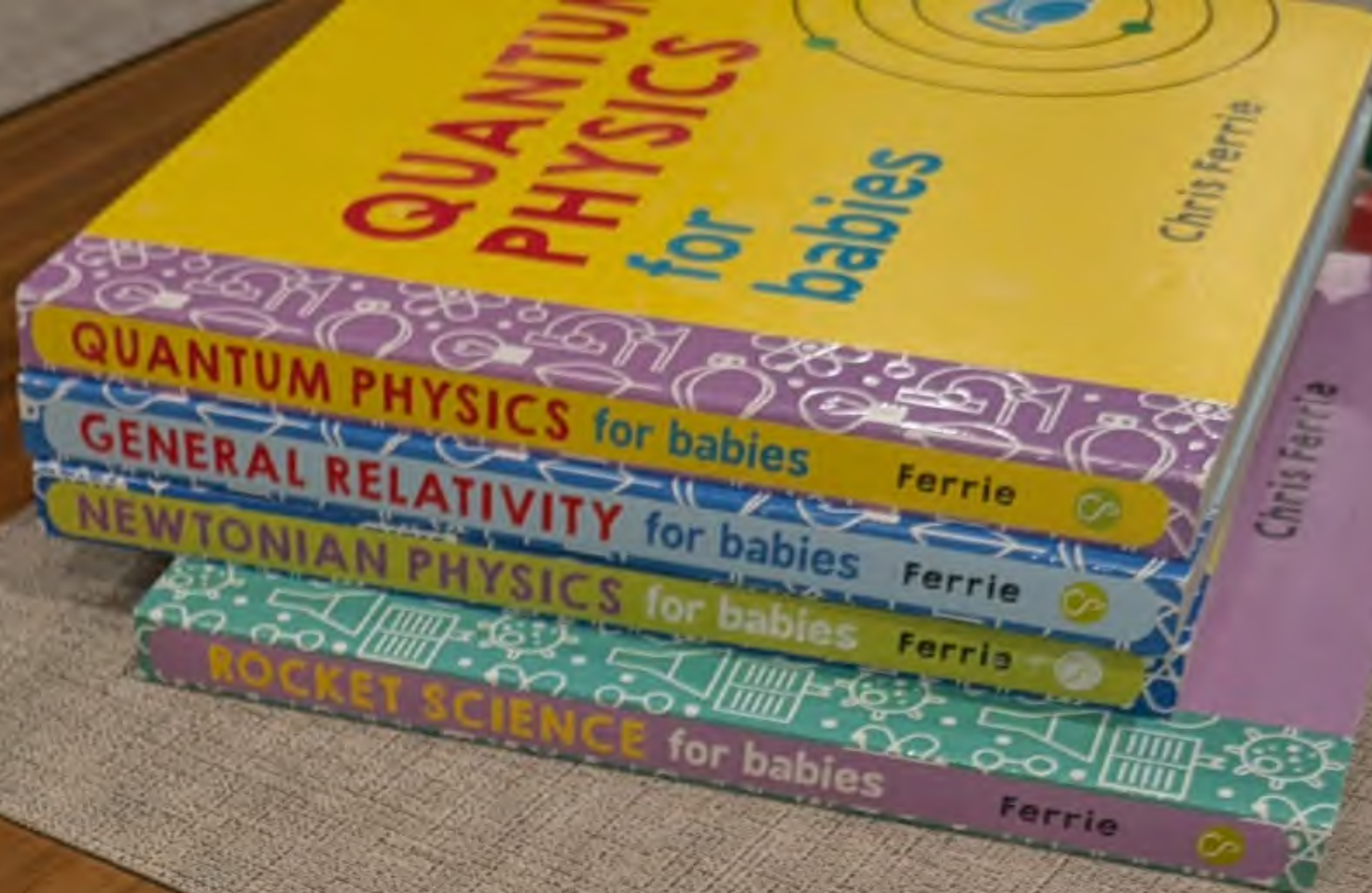
Smaller and smaller slices look closer and closer to a rectangle.

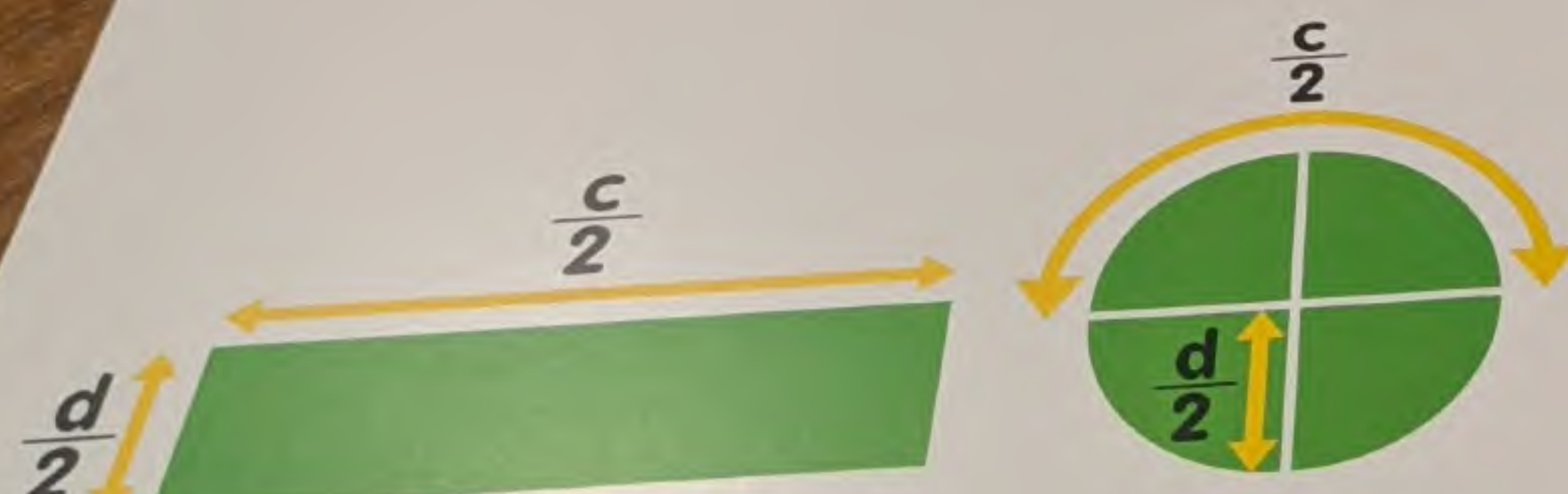


Imagine an infinite number of slices!

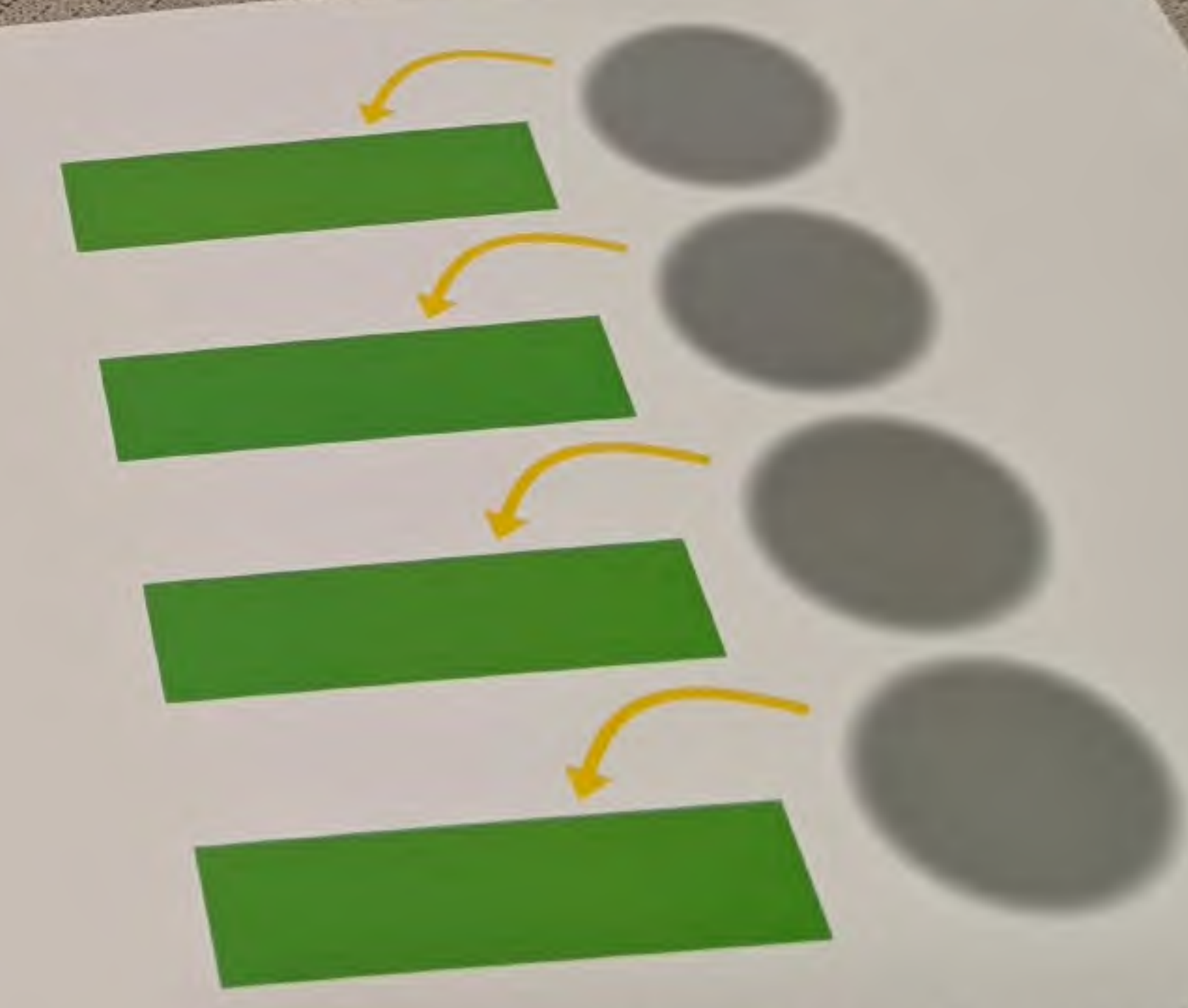


And you have a perfect rectangle.

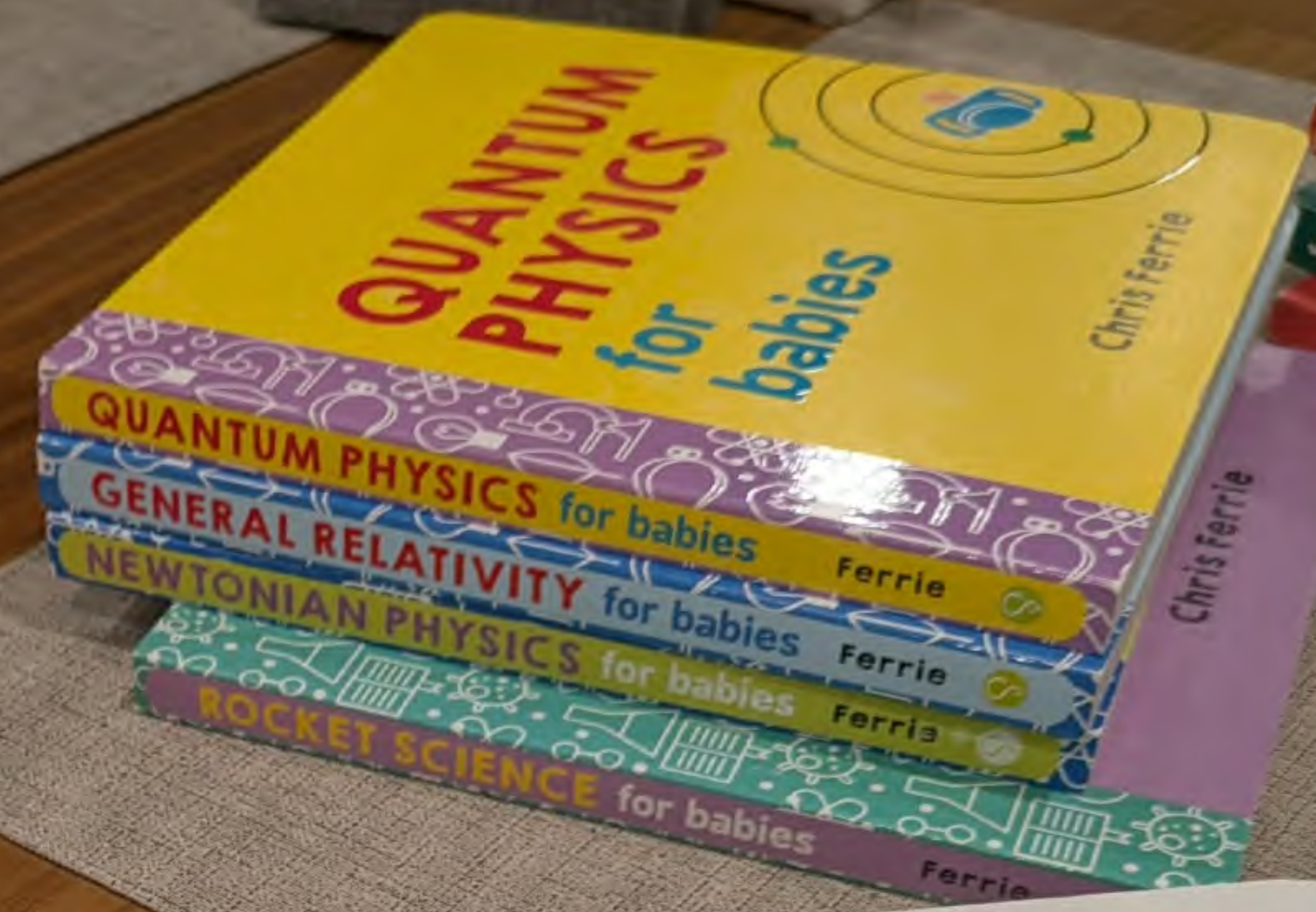


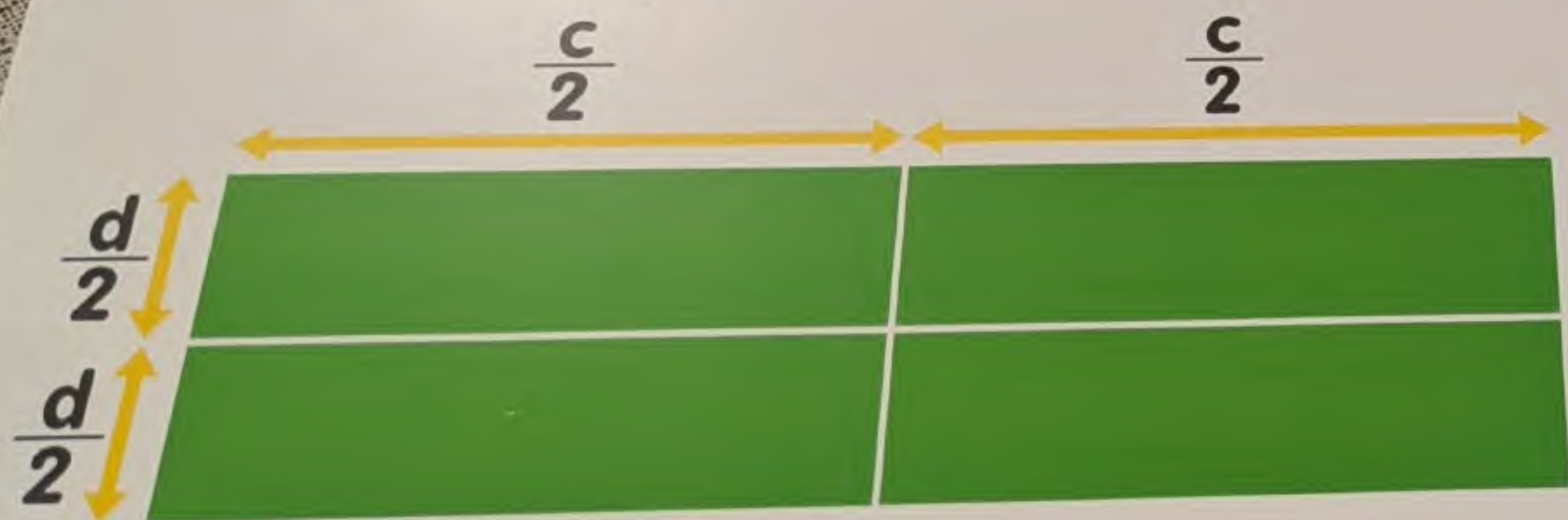
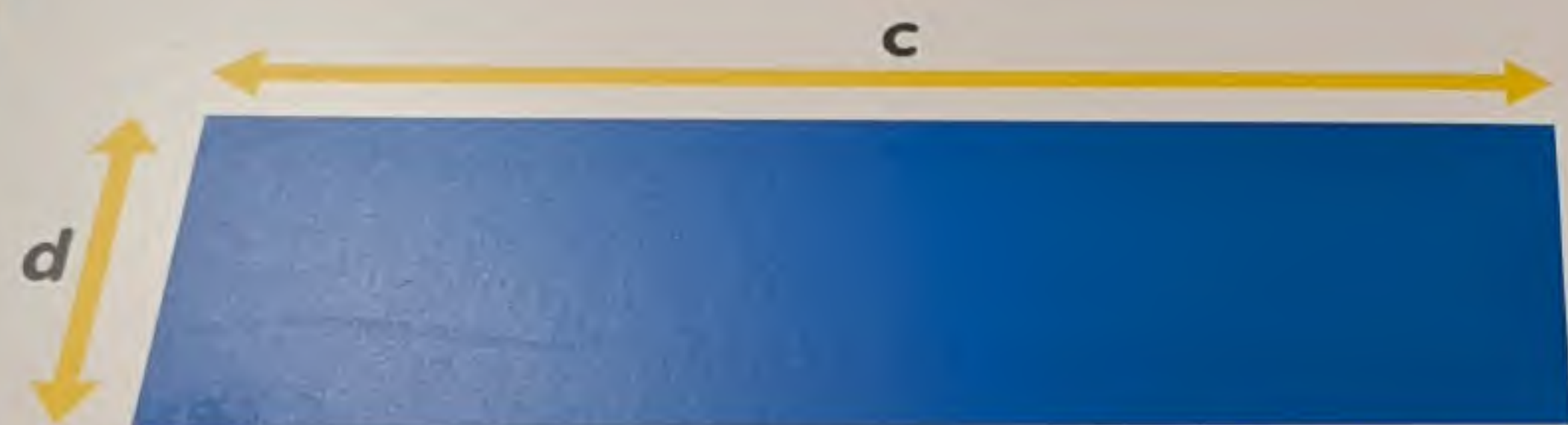


The rectangle is half the height and half the circumference of the circle.



Do the same thing for four shadows.





All four shadow rectangles together are the same area as the ball's surface!

**Now you
know
CALCULUS!**