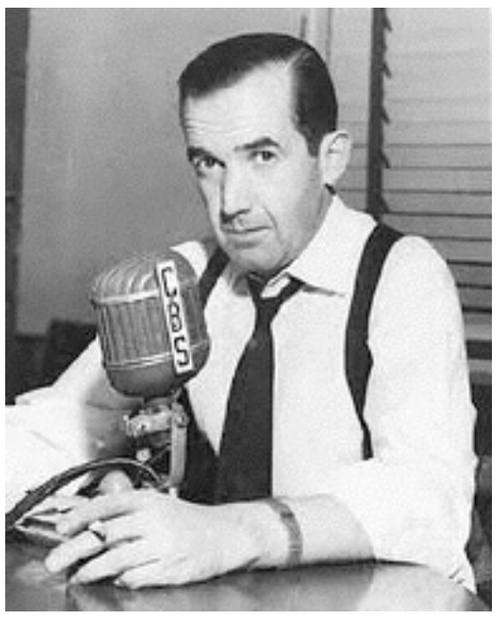
What is calculus really doing?

We took to the historical streets to find out...

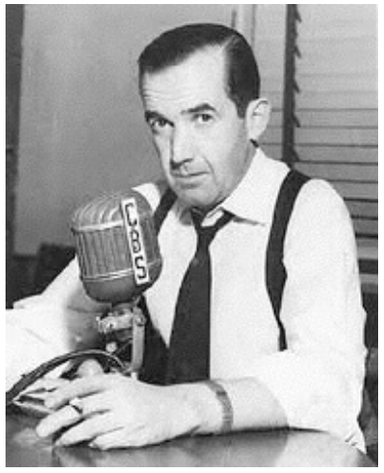


We asked a few movers and shakers in the calculus world to explain to us just what exactly they're doing when they find a so-called *instantaneous rate of change*.

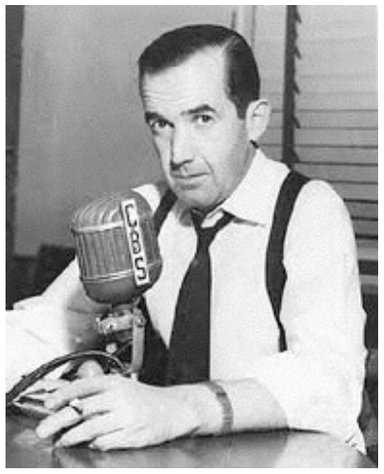
We spoke with both of the individuals credited with the invention of calculus:

Isaac Newton, 1643-1727
Lucasian Professor of Mathematics
Cambridge University

Gottfried Leibniz, 1646-1716
Privy Counsellor of Justice
House of Brunswick



So, Mr. Newton, how do you find instantaneous speed?



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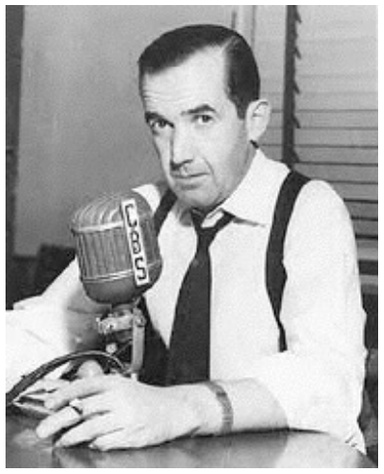
What you do is you find the ratio (distance)/(time) for a very small interval.



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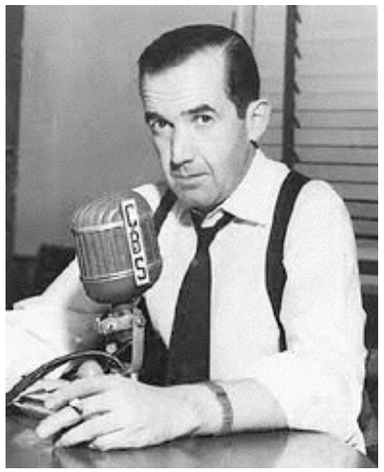
Then, you let the interval shrink and shrink, till it disappears.

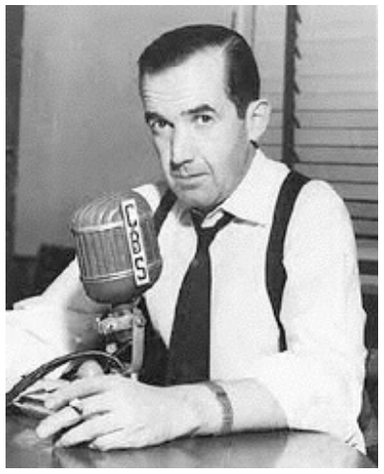


So, Mr. Newton, how do you find instantaneous speed?

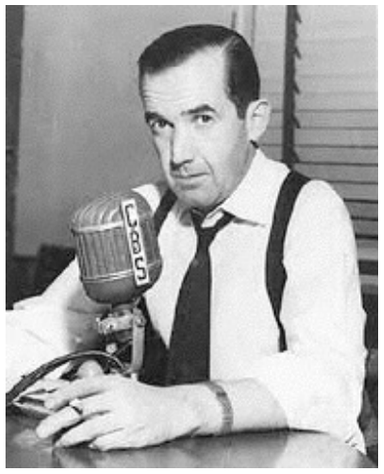
What you do is you find the ratio (distance)/(time) for a very small interval.

Then, you let the interval shrink and shrink, till it disappears.

At the moment that the interval disappears, you look and see what the ratio is. That's the speed.

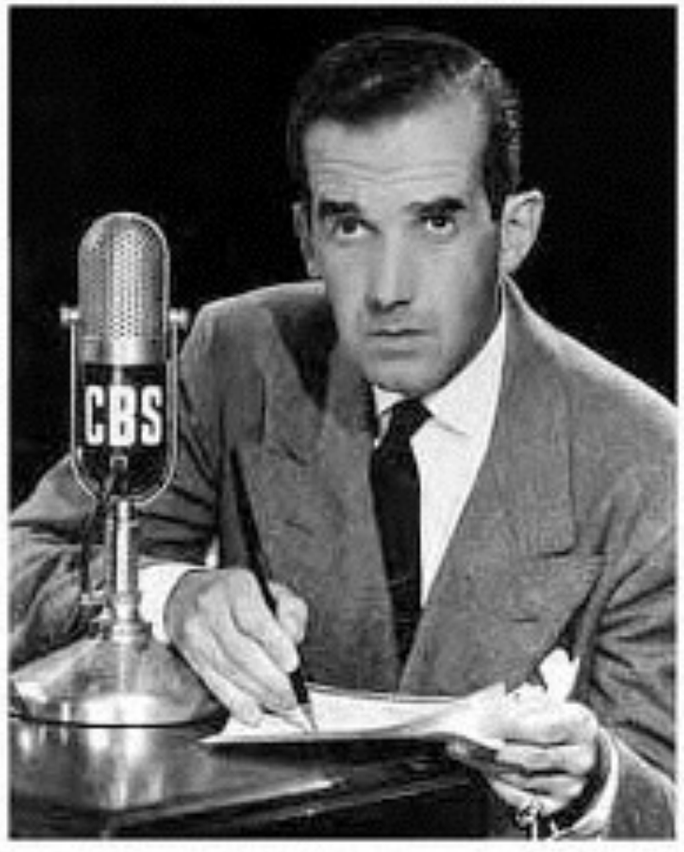


Right while it’s disappearing?



Right while it’s disappearing?

Yup!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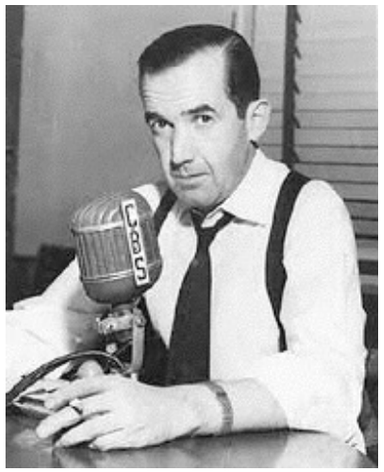
I’m having a bit of trouble observing the ratio in the moment of its disappearance.

Perhaps Mr. Leibniz will be able to shed some light for us...



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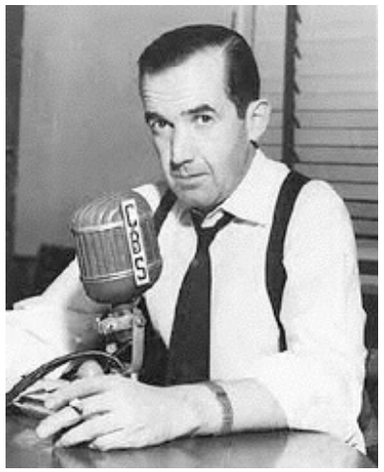

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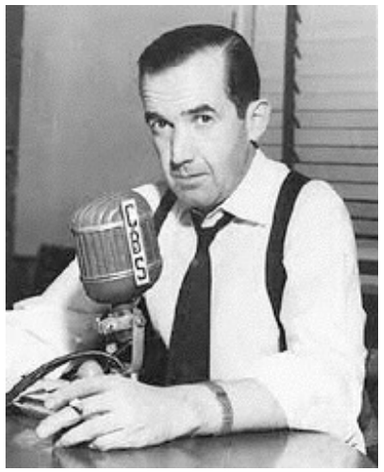
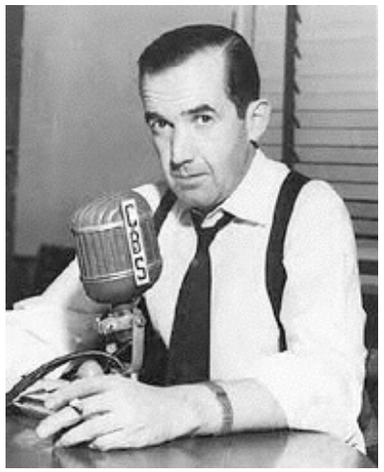


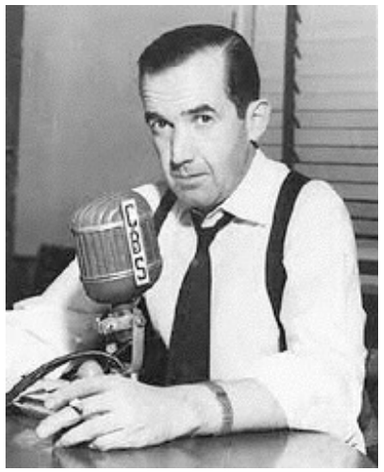
So, Mr. Leibniz, how do *you* find instantaneous speed?

Well, first you observe the distance the object travels during an infinitely small amount of time.

Then you just divide: distance / time. That's the speed!

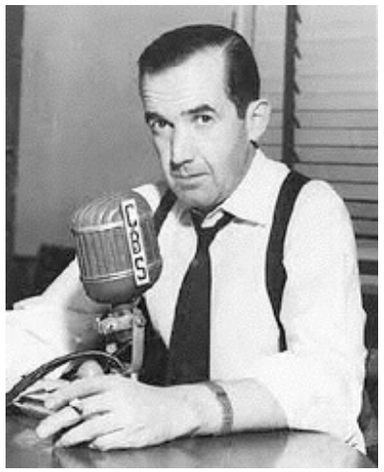


What's it mean, "infinitely small amount of time?" Like, a millisecond?

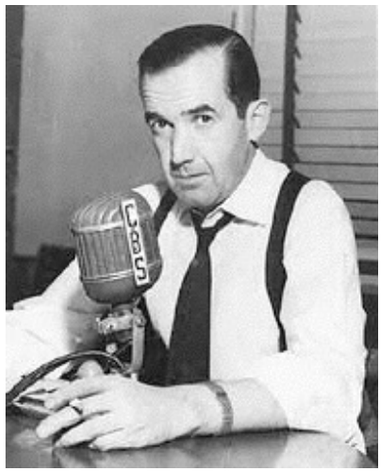


What's it mean, "infinitely small amount of time?" Like, a millisecond?

No, no, way smaller than that.

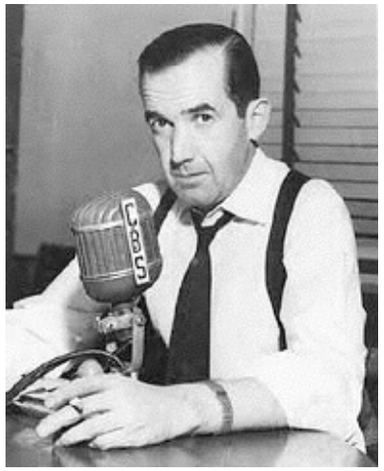


A nanosecond?

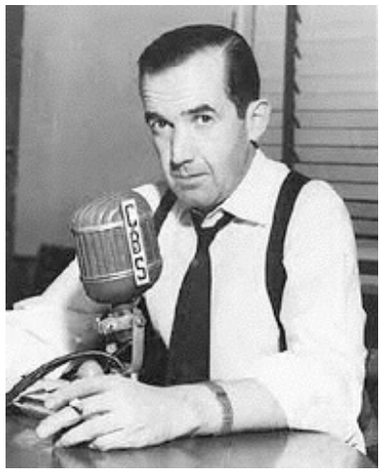


A nanosecond?

No, not at all. You're missing the point. *Smaller than any finite amount of time.*

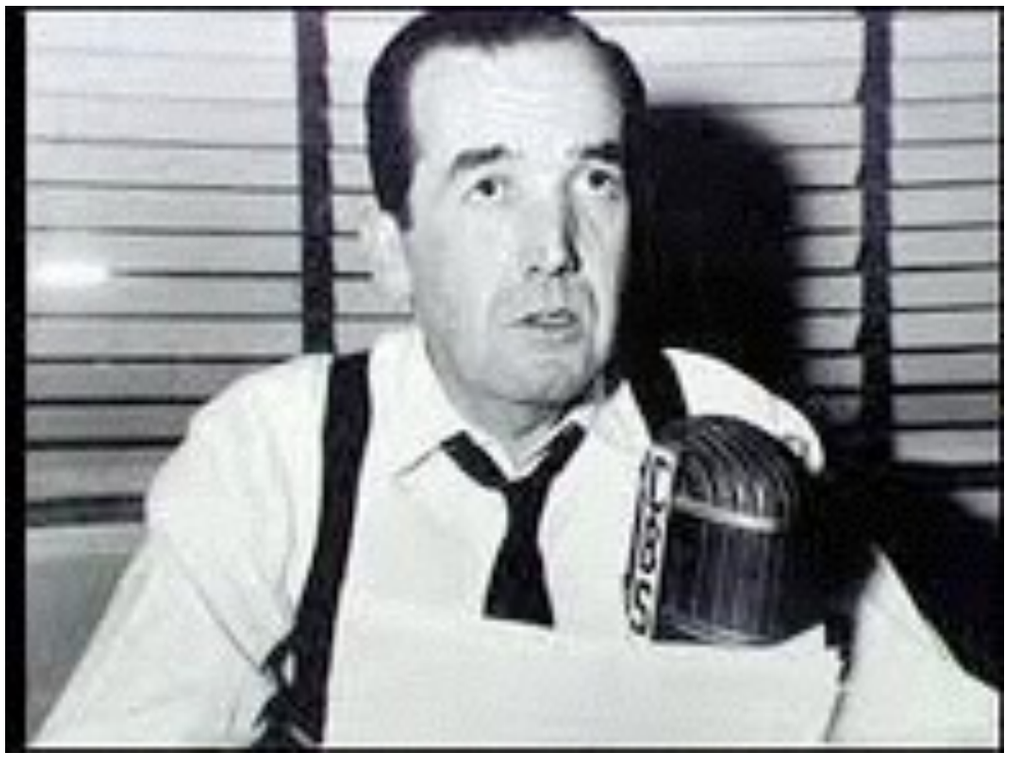


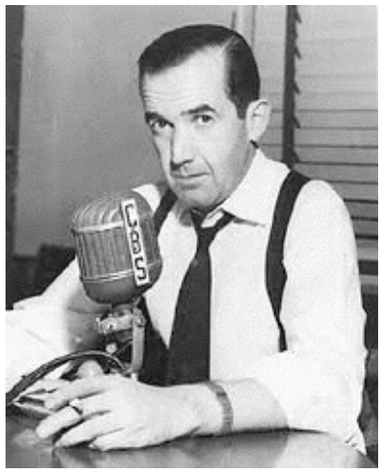
So, no time at all?



So, no time at all?

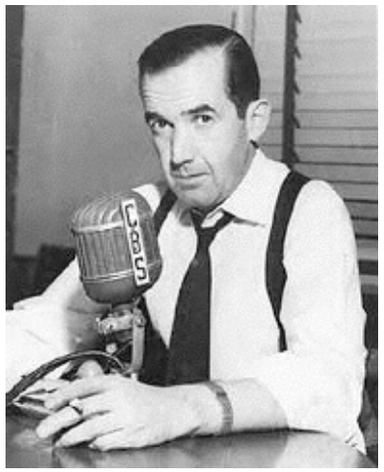
No. Bigger than that.





We've opened up the telephone lines.

Our first caller is an 18th century theologian and philosopher.



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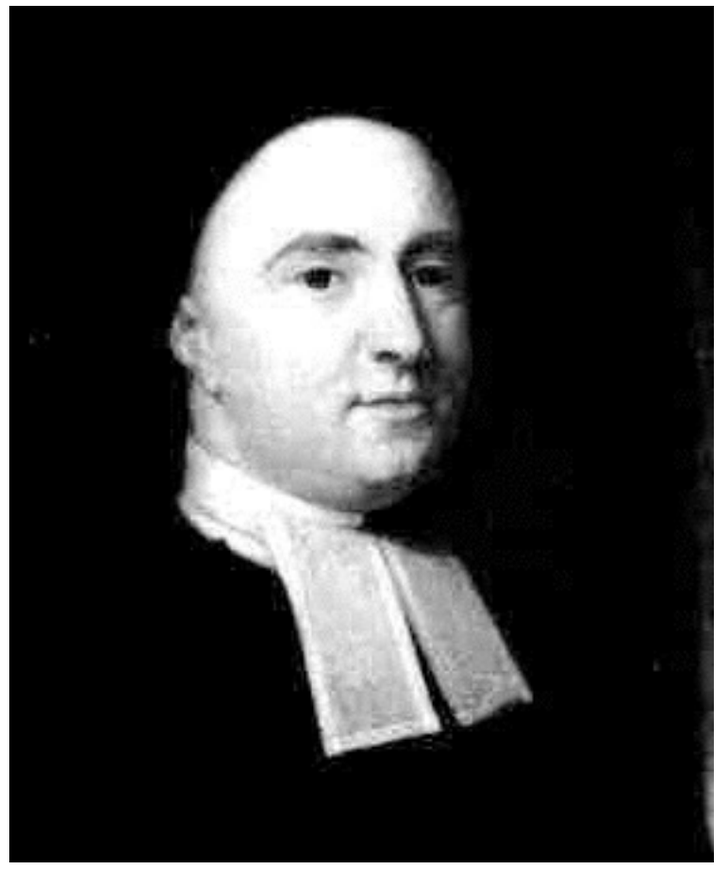
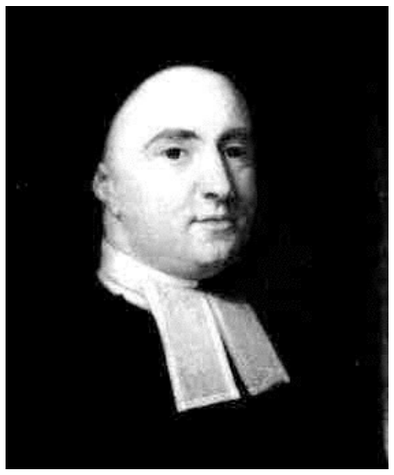
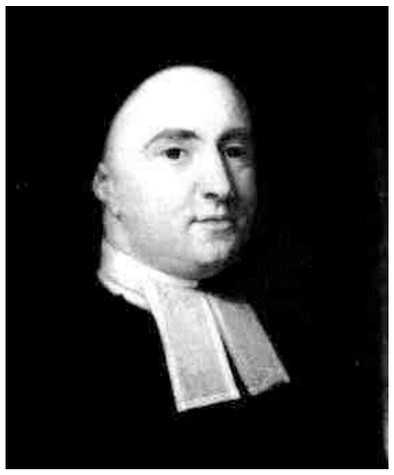
George Berkeley
1685-1753
Bishop of Cloyne





Both of those infidels are full of it!



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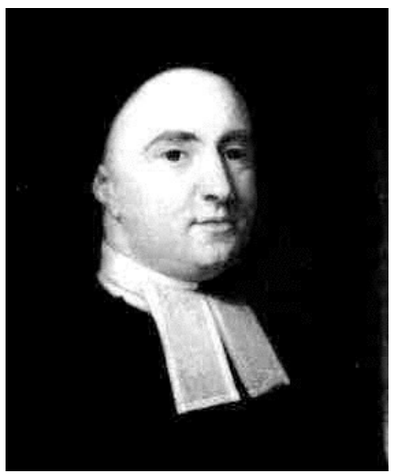

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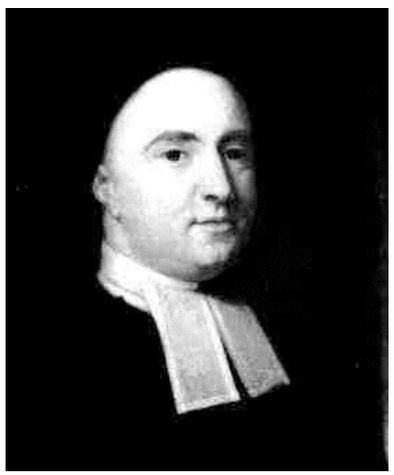

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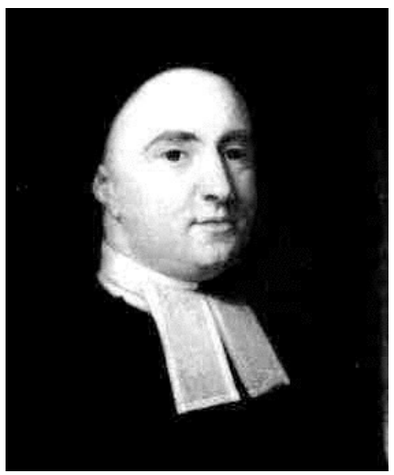

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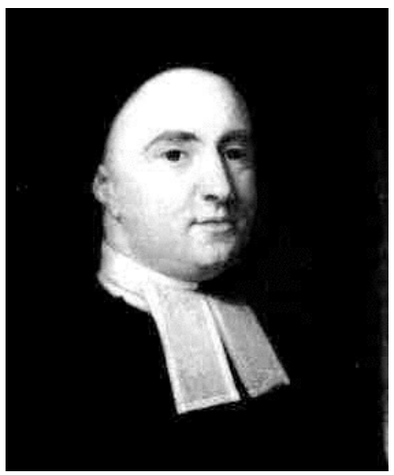

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Hey! I am very devout!

Me too!