Let's consider the universal gravitational law a little bit more.

Let's consider two objects in space.

Let's say this is the sun, and we have the earth here or the earth and the moon.

And of course, they're orbiting each other.

So we can pick a coordinate system that goes radially.

And so we're going to have an r hat direction here, and we're going to call this the r hat direction between objects 1 and 2.

What forces are acting on this little moon here?

Well, it's the gravitational force going inward.

It's force of 1, 2, F1 2, on object 2, due to the interaction between bodies 1 and 2.

For that, we can write down the universal gravitational law, F1 2 equals minus G, the gravitational constant, m1, m2 of r1 2 squared.

That one is the distance between the two objects times r1 2 hat.

And the minus goes, actually, with the unit vector here, because the force goes in the opposite direction from our r hat.

Let's now consider here is the earth again.

And we're going to move the moon or a little moon rock right to the surface of the earth.

And we want to now calculate and consider what kind of force this act on this moon rock, and what is the gravitational acceleration that this moon rock on the surface of the earth is experiencing?

So we have the earth.

Earth has one earth radius, and it has an earth mass.

And our moon rock has the mass m.

And we know, from this exercise here already, that, of course, this gravitational force is acting on our moon rock as well.

That hasn't changed.

What we are now considering in addition is that this moon rock is also experiencing a gravitational acceleration due to this force, and that goes inward as well.

So it is experiencing an mg.

And we know that that is the same as the magnitude of this force here.

So we can equate that with G, and then we have the earth mass and the mass of the moon rock times the distance squared, so an earth radius squared.

And from that, we already see that a, we can cancel out the small m, so the moon rock, and we get to g here.

So we can calculate the gravitational acceleration, which is capital G earth mass over earth radius squared.

So if we have this kind of information, we can determine the gravitational acceleration.

And of course, it will change, depending on which object we are considering.

It would be different if we plug in the solar mass and the solar radius or the moon mass and the moon radius, if we consider an astronaut standing here on the moon's surface.

Now let's put some numbers into this equation.

So we have g is capital G. That's the gravitational constant.

We have 6.67, 10 to 11, and then we have Newton and 1 over kilogram squared and mass squared times the earth mass, 5.97 10 to 24 kilograms.

And then we have to divide this over through the earth radius, 6.37 10 to the 6.

And we have to square that, and we have to square the meters.

If we calculate this, we get to 9.81 meter per second squared.

And surely you have seen this number before.

This number can either be calculated, if you know capital G, the gravitational constant, or you can determine that gravitational acceleration through an experiment.

And together with the earth mass and the earth radius, you can actually calculate the gravitational constant there.