Problem solving and mathematics are unequivocally intertwined. One of the first puzzles that sparked my interest in the world of STEM was one that is quite familiar to a lot of us. One simple question that goes as follows. Can paper be folded more than 7 times? On the surface this seems like a relatively simple and easily solved dilemma but, when you start to research this veiled mathematical problem, it is clear that there is a lot of scientific meat to get our teeth stuck into.

The 7 times folded paper dilemma is a prime (excuse the pun) example of how mathematics lies in the very fabric of our existence. Whether it be in the equations of a rocket scientist or the humble limits or paper folding categorised by exponential growth.

After 7 folds, a 0.1mm thick piece of paper will be 12.8mm thick. This is derived from the geometric equation:
$T(7)=0.1\times2^{7}=12.8$

Is this really the limit to folding? If we can fold paper or any material more then it would be very useful for various things such as folding solar panels or rovers, so what variables really matter in this case?

The length, the thickness and the type of fold. We would need a long, thin sheet with folds in one direction as this reduces the thickness of the paper. If we want to find the maximum folds, we need to know what we can control, the length. As the length halves in size every fold, the length should be very large. Brittany Gallivan, the world record holder, had derived a formula L = pi×t(2^n+4) and used this to find the length needed to fold 12 times, which is 1200m.
This is unsurprising considering the exponential relationship between the number of folds and thickness. This meant that following the early formula, $T(12)=0.1\times2^{12}=409.6$mm

Incredibly, the exponential growth means that folding the paper only 42 times would be so thick it could reach the moon! From folding satellites to designing heart stents, paper folding has so many uses that transform everyday life.

In conclusion, it is clear that the idea that paper can't be folded more than 7 times is not an absolute truth but rather a misunderstanding of how fast exponential growth really is. When each fold doubles the thickness of the paper, it reveals a geometric sequence. Gallivan's work shows that with the right combination of variables the predetermined limit can be surpassed. But it also shows why it becomes impossible so quickly; the exponential growth is more than any material can withstand. The humble sheet of paper now represents a surprisingly beautiful side of mathematics of which could not have been discovered without a curious mind.