

**2nd Senior**  
**Special Subject: Maths**  
**III Term**

**Archimedes Volume Puzzle**

Like many people, Archimedes apparently did his best thinking while sitting in a nice tub of warm water. Because, as the story goes, this is the point at which Archimedes got into the bath. Actually, let me rewind for a second. Before he



ever got into that fateful tub, Archimedes realised what he needed to do to resolve the king's dilemma: He knew that the density (which is a measure of how much something weighs per unit volume) of pure gold is different than the density of gold mixed with some other metal. So Archimedes knew that if he could somehow find the density of the crown, he could compare it to the known density of pure gold to check to see if the king had been bamboozled.

Now, to calculate density you need to know both the mass of something and its volume. Archimedes knew the mass of the crown (it was the same as the mass of the pure gold the king started with). So in order to calculate the crown's density, he only needed to find its volume. But while it's easy to find the volume of a cube or a sphere or even a spheroid, it's really hard to find the volume of something bizarrely shaped like a crown. He could melt it down into a cube, but that would kind of defeat the king's goal of having a crown made.

So, Archimedes was stuck. And then he stepped into that fateful bathtub. When he did, he noticed that the water in the tub rose. As he sat down further in the water, it rose even more. Archimedes realised that if he dunked the crown in the tub, the water level would also rise ... and it would rise precisely in proportion to the volume of the crown (since that's the amount of water being displaced). If he carefully calibrated his tub of water, he could figure out the additional volume corresponding to each millimetre rise in water level. And thus, he could dunk the crown to find its volume, use this number to calculate its density, and solve the king's problem.

Upon realising what he had discovered, Archimedes leapt from the tub, forgot to grab a robe, and exuberantly ran down the street yelling “Eureka!” telling the world what he had figured out. According to the story, Archimedes confirmed the king’s suspicion and found that the density of the crown was different than the density of pure gold. I’m not sure what ended up happening to the goldsmith, although I’m betting it wasn’t good.

But while his fate might not have been so great, the fate of our quest to calculate the volume of a pumpkin—or any other oddly-sharpen object—is looking pretty peachy. Because we now know that no matter how oddly shaped our objects are, we can always measure their volumes. All we have to do is dunk them in a carefully calibrated bathtub, and the answers to our questions will be right there for us to see.

ANSWER THE FOLLOWING QUESTIONS:

**1. How Did Archimedes Solve His Puzzle?**

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**2. If he could somehow find the density of the crown, he could compare it to the known density of pure gold...**

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**3. How do you calculate the Volume of a Pumpkin?**

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**4. What did Archimedes yell when he made his discovery?**

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