# HERON

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Heron, not named after the bird, lived around 2000 years ago in Alexandria. Not a great deal is known about this Greek mathematician and engineer, but we must talk about him as his inventions and discoveries were quite brilliant. Heron was startlingly good at geometry, optics, pneumatics and mechanics, and he put these abilities to good use by inventing hundreds of toys and machines.

The long list of his creations includes the first flamethrower, the first air gun and the first jet engine. This makes him sound rather violent, though this is not the case. Heron also invented the water fountain, the organ and, most bizarrely, a device for automatically opening the temple doors, just like at Tesco.

‘Lovely’, I hear you say, ‘but what about the maths?’ Well firstly Heron described how to use trigonometry to dig a tunnel through a mountain by excavating both sides simultaneously. Most famously, this method was applied when digging the Channel Tunnel. But he didn’t stop at geometry and trigonometry. An even more useful discovery was his method for finding square roots (see below). It is so simple, and so accurate, that some computers and calculators use Heron’s square root method to this day.

Interestingly, Heron actually used this method to help him calculate areas of triangles. Most people know the rule ‘half base times height’, and higher level students also use ‘half *ab*sin*C*’. But Heron derived a completely different rule using only the three sides, and neither the height nor any angles.

If you know the lengths of the three sides, say *a*, *b*, *c*, then the semiperimeter is (*a* + *b* + *c*) ÷ 2. Let’s call this *s*. Heron’s formula for the area is then

√(*s*(*s* – *a*)(*s* – *b*)(*s* – *c*))

Most maths teachers have never even seen this one! Of course, almost any shape can be split into triangles, so it is very useful for finding the areas of large plots of land, especially those with irregular shapes.

**Heron’s Square Root Method**

Call the starting number *N*.

1. Approximate the square root of *N* – use the nearest perfect square to help. Call it *r*. This is the first approximation.

2. Find the mean of *r* and *N* / *r*. This is the second approximation.

3. Repeat the above step until you have the accuracy you need. Five steps is accurate to 17 decimal places!