

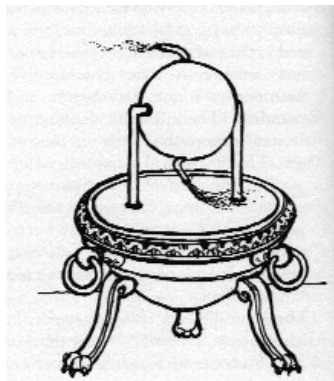
# Mathematician of the week

Heron (or Hero) of Alexandria  
Born about 62 AD



From Heron's writings it is reasonable to deduce that he taught at the Museum in Alexandria. His works look like lecture notes from courses he must have given there on mathematics, physics, pneumatics, and mechanics. He has written at least 13 works on mathematics, mechanics and physics. His most famous work today in math is Proposition 1.8 of his *Metrica*, which is known as the Heron Formula.

He also invented the first steam turbine, called the aeolipile.



At that time it was used as a toy for "magic" in temples. He used his steam engine in temples to create "miracles". Temple door would automatically open and doves rose and descended.

A hollow ball was supported on two brackets on the lid of a basin of boiling water. One bracket was hollow and conducted steam. The steam escaped from two bent pipes on the top, therefore creating a force that made it spin around. The movement of the ball was used to make puppets dance. Although it was very simple, Hero's aeolipile illustrated the scientific principle for Sir Isaac Newton's third law of motion which states that for every action there is

an equal and opposite reaction. Hero's steam engine helped a great deal with the development of the jet engine.

His most famous mathematical formula included finding the area of a triangle and the square roots of numbers.

His formula for finding the area of a triangle is  $A = \sqrt{s(s-a)(s-b)(s-c)}$  where  $s$  is the semi-perimeter  $s = \frac{a+b+c}{2}$  and  $a$ ,  $b$  and  $c$  are the sides of the triangle.

Use Heron's formula to find the area of a triangle with sides 5, 12 and 13.

Here are some of type of problems Heron's famous for.

1. Finding the square root of a number.
  - First choose an approximation.
  - Next find the average of the approximation and the number divided by the approximation.

E.g.: Find the square root of 8  
First approximation is 3 since  $3^2 = 9$ .  
Second approximation =  $\frac{1}{2}\left(3 + \frac{8}{3}\right) = 2.83$

Find the square roots using this method of 37, 14 and 27

2. Paul is having a Birthday party with 6 of his friends. His mother has baked him a square chocolate cake 7 inches long each side and 2 inches high. Paul wants everyone at the party to receive the same amount of icing.  
How can you cut the cake into 7 equal parts? Draw a diagram.
3. Mack takes his Labrador with him to work at the garage. He hooks Ace's collar to a 60 m chain mounted on the corner of the garage which is a 40 m by 80 m rectangular building. Ace enjoys sniffing around all day.  
What area does Ace, the Labrador, have to sniff around in? Draw a diagram.

### Answers to Heron's problems

- $\sqrt{37}$  first approximation 6, second approximation 6.08  
 $\sqrt{14}$  first approximation 4, second approximation 3.75  
 $\sqrt{27}$  first approximation 5, second approximation 5.20
- The perimeter of the cake is 28 inches. Therefore divided the perimeter into  $7 \times 4$ .
- Ace can roam for  $\frac{3}{4}$  of a circle of radius 60m and  $\frac{1}{4}$  of the circle radius 20m.  
Therefore Ace can sniff around in 8792 square metres of yard.