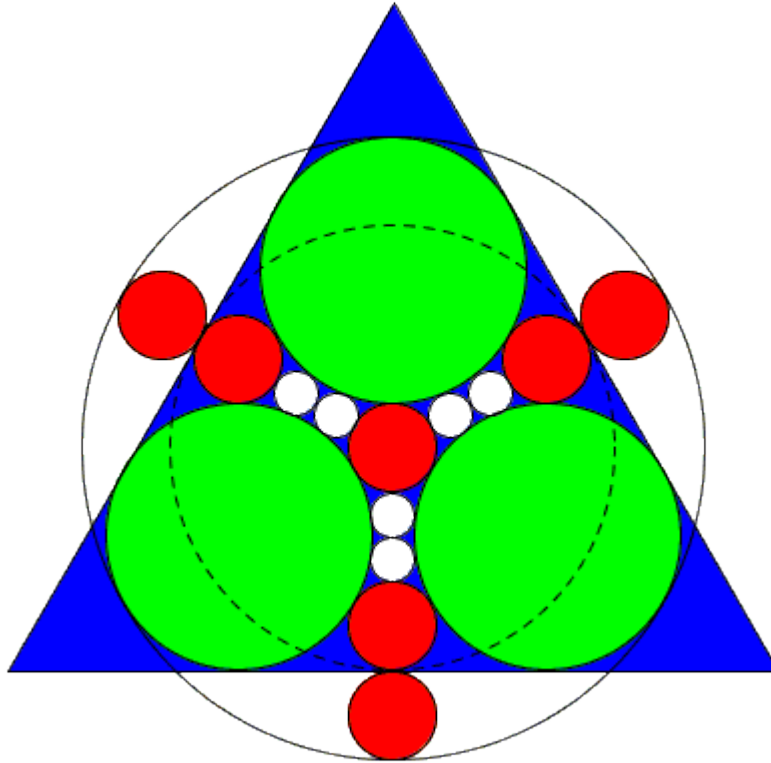


## A Sangaku by a Teen

It is said that during the Edo period hanging sangaku in temples and shrines was so popular that even women and children partook of the activity. While I am sceptical that sangaku was so popular as to involve a significant slice of the population, some sangaku have indeed been created by children. Here's one example.



In a blue equilateral triangle, three green circles of radius  $a$ , seven red circles of radius  $b$ , and six white circles of radius  $c$  touch each other as shown. If  $R$  is the radius of the outer circle, and  $r$  is the radius of the dashed circle, find  $c$  in terms of  $r$ .

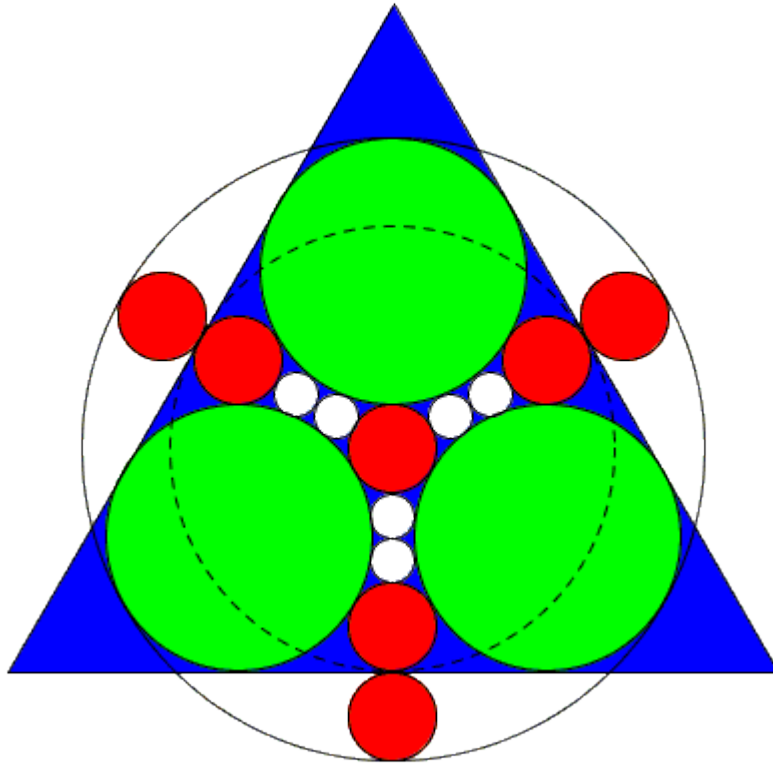
This sangaku has been hung by Tanabe Shigetoshi, aged fifteen, in the year 1865 at the Meiseirinji temple in Ogaki City, Gifu prefecture.

The sangaku has a very simple\* solution, although it was anything but simple to come up with such a configuration.

<http://www.cut-the-knot.org/pythagoras/TeenSangaku.shtml>

\* Well *I* don't think it's that simple!!

## Solution



By direct inspection

$$\begin{aligned}r &= 3b + 4c, \\R &= 5b + 4c, \\R &= b + 2a, \\a + b &= 2b + 4c. \quad *\end{aligned}$$

Solving these simultaneously we see that  $b = 2c$ ,  $a = 6c$ ,  $r = 10c$  and  $R = 14c$

\* This is the one that I don't get!! Help welcome!!!!

Later: got there in the end:  $a+b$  is the distance from the centre of a green circle to the centre of the middle red circle, and it is one side of an equilateral triangle,  $b+2c+2c+b$  being one of the other sides....