*‘Perfect numbers, like perfect men, are very rare’* (Rene Descartes 1596 - 1650)

**Perfection**

A perfect number is equal to the sum of its factors, excluding itself.

6 is the first perfect number: 1 + 2 + 3 = 6

The second perfect number is 28.

* Show that 28 is a perfect number.
* Show that 36 is not a perfect number.

36 is an abundant number.

22 is a deficient number.

* Suggest a reason for these names.

**Perfect pictures**

This diagram shows why 6 is a perfect number.

|  |  |
| --- | --- |
| https://upload.wikimedia.org/wikipedia/commons/6/66/Perfect_number_Cuisenaire_rods_6.png | https://upload.wikimedia.org/wikipedia/commons/6/66/Perfect_number_Cuisenaire_rods_6.png |
| *Image: by Hyacinth - own work, CC BY-SA 4.0,* [*https://commons.wikimedia.org/w/index.php?curid=48357566*](https://commons.wikimedia.org/w/index.php?curid=48357566) |

Create a similar diagram to show why 28 is a perfect number.

**Perfect patterns**

The first five perfect numbers are:

6, 28, 496, 8128, 33,550,336

Each of these perfect numbers can be written in the form

2*p* – 1(2*p* – 1)

For example: if *p* = 2, then

22 – 1(22 – 1) = 21 × (4 – 1) = 2 × 3 = 6

* Find the value of *p* for each of the first five perfect numbers.
* What do you notice about the values of *p* that you have found?