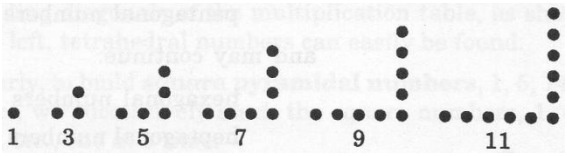
Baccalauréat, toutes séries Session de juin 2014

Épreuve de section européenne

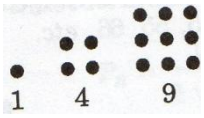
Figurate numbers

Gnomons are the geometrical representations of odd numbers as dots on equally long legs of a right angle. The name refers to the angle's likeness to the Babylonian sundial, the gnomon.



By adding gnomons, the Pythagoreans built square numbers from which they deduced many interesting connections between those numbers.

Indeed, square numbers 1, 4, 9, *etc.*, are figurate in this way:



A square thus formed demonstrates the relationships:

$$1 + 3 = 2^2$$
$$1 + 3 + 5 = 3^2$$
$$1 + 3 + 5 + 7 = 4^2$$
...

From *Mathematics From the Birth of Numbers*, by J. Gullberg

Questions

1. What was a gnomon for the Babylonians?
2. Draw the square number 16. Explain how it can be built using gnomons.
3. Use question 2 to explain the third relationship given at the end of the text.
4. Which general formula do you obtain about the sum of the odd numbers from 1 to $2n-1$ if you continue the relationships given at the end of the text?