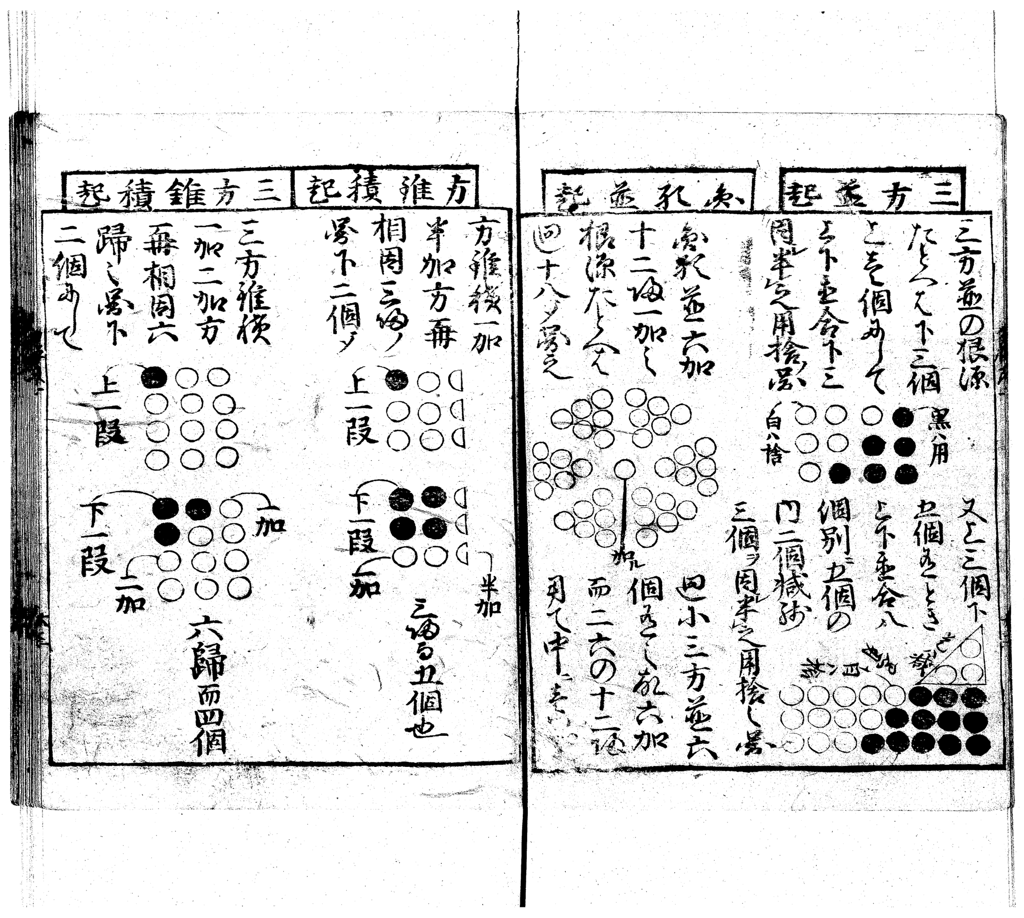
# 竜ヶ崎第一高等学校　白幡探究Ⅰ数学領域
# 玉の数を求める　Find The Number Of Balls
## 70th　1年B組　丙班

## 原本＊The　Original



KEY WORD

体積の公式
Formula of volume

等差数列
Arithmetical progression

## 現代語訳＊Modern translation

現代語訳

三方平の起こり
例えば下3個、上1個を合わせて3をかけて半分にした図。また、上3個、下5個を合わせて8個、別の5個の内2個減らして残りの3個をかけて半分にした図。
$(3+1)\times 3\times\frac{1}{2}=6$
円形並の起こり
周が18個になるように三方並が6個ある時、18個に6個加えて12個で割る。その後中に1個を加えて黒は37個になる。　　　　$18\times(18+6)\div 2+1=37$
方錐積の起こり
正四角錐の体積は横の行を1行加えて、縦の行を半行加えて求められる。
$(2.5\times 3\times 2)\div 3=5$
三方錐積の起こり
縦を1行と横を2行加えてできた長方形が2段ある。縦×横×高さをして6で割ると体積を求められる。
$(3\times 4\times 2)\div 6=4$

**係：坂本・川村**

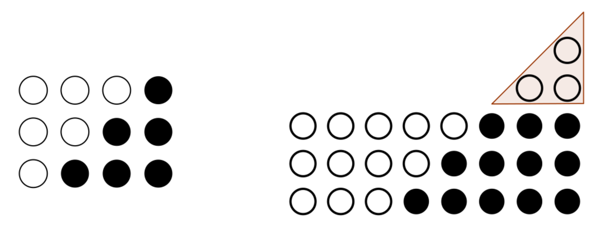
## 英語訳＊Modern translation

The origin of triangle which made from circles.
For example, there are three black circles in the third step, and there are also a circle in the first step.
Next,(third step + first step) × 3 ÷ 2.This calculation's diagram is first diagram.
White part is dumping part.
When there are also three black circles in third step, and there are five black circles in fifth step.
(third step + fifth step)= eight circles.
And decrease two white circles among other five circles on the right hand edge.
(other five circles on the right hand edge)－(white circles on this line)×(the other three circles)÷2
When as there are 18 circles in rim, there are 6 Sanhouheis.
18×(18＋6)÷12＝36＋(The circle which is on the center)
Therefore, we can find the number of the circles. We can find the volume of quadrangular to calculate.
(25×3×2÷3＝5)
The rectangle　which is made from (one vertical line＋two width line)
And same rectangle is overlapping with the rectangle.
(vertical)×(width)×(height)÷6　therefore, we　can find the　all number of balls which　make cuboid.

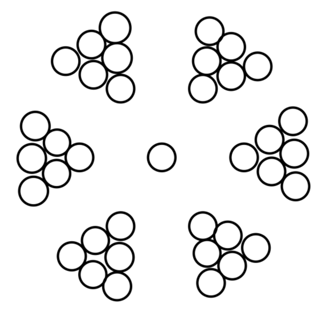
**A person in charge;　Saito Sakamoto**

## 数学的内容＊The mathematical contents

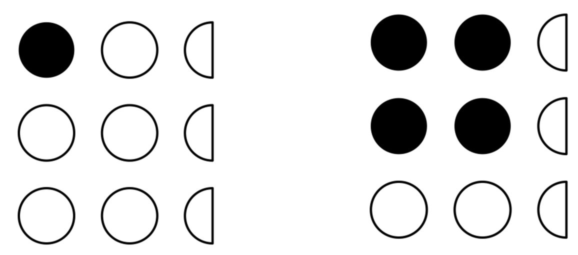
**三方並の起こり**
本文の3段のときの個数　$1+2+3=(3+1)\times 3\times\frac{1}{2}=4\times 3\times\frac{1}{2}=6$ **(個)**
上の式からn段のときの個数は　$1+2+3+4+\cdots+n=\frac{1}{2}n(n+1)$



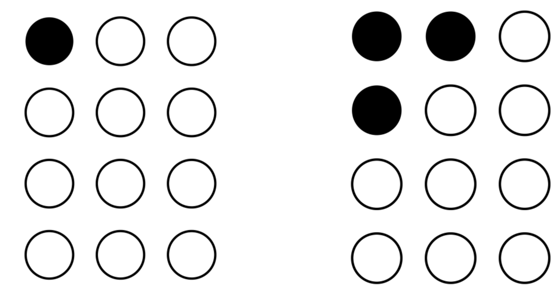
**円形並の起こり**
3段の三方並が6個並んだときの個数　$1+2+3+\cdots+n=\frac{1}{2}n(n+1)$
$\frac{1}{2}n(n+1)\times 6+1=\frac{n(6n+6)}{2}+1=\frac{6n(6n+6)}{12}+1$　6nは廻りの数になるので、
本文中の円形並の個数は　$\frac{18(18+6)}{12}+1=37$ **(個)**



**方錐積**
本文の2段のときの個数　$(2+1)\left(2+\frac{1}{2}\right)\times 2\div 3=3\times\frac{5}{2}\times 2\div 3$
$=5$ **(個)**
3段のときの個数　$(3+1)\left(3+\frac{1}{2}\right)\times 3\div 3=4\times\frac{7}{2}\times 3\div 3$
$=14$ （個）
4段のときの個数　$(4+1)\left(4+\frac{1}{2}\right)\times 4\div 3=5\times\frac{9}{2}\times 4\div 3$
**$=30$ （個）**
n段のときの個数
$(n+1)\left(n+\frac{1}{2}\right)\times n\div 3=\frac{1}{3}n(n+1)\left(n+\frac{1}{2}\right)$　と推測できる。



**三方錐**
本文の2段のときの個数　$(2+2)(2+1)\times 2\div 6=4\times 3\times 2\times\frac{1}{6}$
$=4$ （個）
3段のときの個数　$(3+2)(3+1)\times 3\div 6=5\times 4\times 3\times\frac{1}{6}$
$=10$ （個）
4段のときの個数　$(4+2)(4+1)\times 4\div 6=6\times 5\times 4\times\frac{1}{6}$
$=20$ （個）
n段のときの個数
$(n+2)(n+1)\times n\div 6=\frac{1}{6}n(n+1)(n+2)$　と推測できる。



**係：小久保、川村**

## 英語訳＊The mathematical contents

**・The origin of triangular which made from circle.**
$1+2+3=(3+1)\times 3\times\frac{1}{2}=4\times 3\times\frac{1}{2}=6$ (pieces)
$1+2+3+4+\cdots+n=(n+1)\times n\times\frac{1}{2}$
$1+2+3+4+\cdots+n=\frac{1}{2}n(n+1)$
Work out the sum of the natural number from one to n by this formula.

**・The origin of form circle**
$1+2+3+\cdots+n=\frac{1}{2}n(n+1)$

$\frac{1}{2}n(n+1)\times 6+1=\frac{n(6n+6)}{2}+1=\frac{6n(6n+6)}{12}+1$
6n=the number of a circle is eighteen pieces. $\frac{18(18+6)}{12}+1=37$ (pieces)

**・Volume of quadrangular pyramid.**
Pieces of the next to the under stair an occasion in this sentence.
$(2+1)\left(2+\frac{1}{2}\right)\times 2\div 3=3\times\frac{5}{2}\times 2\div=5$ (pieces)
The third to the under stair an occasion.
$(3+1)\left(3+\frac{1}{2}\right)\times 3=4\times\frac{7}{2}\times 3=42$ (pieces)　$42\div 3=14$
The fourth to the under stair an occasion.
$(4+1)\left(4+\frac{1}{2}\right)\times 4\div 3=5\times\frac{9}{2}\times 4\times\frac{1}{3}=30$ (pieces)n an occasion.
$(n+1)\left(n+\frac{1}{2}\right)\times n\div 3=\frac{1}{3}n(n+1)\left(n+\frac{1}{2}\right)$
We can presume from this an expression.
(A proof is omit.)

**・Triangular pyramid**
Pieces of the next to the under stair an occasion in this sentence.
$(2+2)(2+1)\times 2\div 6=4\times 3\times 2\times\frac{1}{6}=10$ (pieces)
The third to the under stair an occasion.
$(3+2)(3+1)\times 3\div 6=5\times 4\times 3\times\frac{1}{6}=10$ (pieces)
The fourth to the under stair an occasion.
$(4+2)(4+1)\times 4\div 6=6\times 5\times 4\times\frac{1}{6}=20$ (pieces)n an occasion.
$(n+2)(n+1)\times n\div 6=\frac{1}{6}n(n+1)(n+2)$
We can presume from this an expression　(A proof is omit.)

**A　person in charge;　Saito　Sakamoto**

## まとめ・今後の課題・感想*Summary・Future task・Impression

### まとめ
この問題は現代日本の高校二年生で習う「等差数列」というものを使っている。
江戸時代の数学と聞き侮っていたが、理解するのにとても苦しんだ。
先人たちのすごさを身に染みて実感した。

### 今後の課題
コンピューター操作になかなか慣れることができず手間取ってしまったこと。

### 感想
高校二年生で習う等差数列を活用した問題だったので、理解するのに苦労したがいい予習になったと思う。また、古典の時間に読んでいる古文とは内容が全く違くそれだけ難しかったが、苦労して読むのも、楽しかった。SSHの学校などでしか経験することのできない貴重な体験だった。

**班長：加藤**

### Summary
When we solve this problem , we use arithmetic ,which is taught to Japanese students who is a second-year senior high school students.
I made light of this problem because I had heard that this problem is made in Edo period . But we had difficulty to understand this problem.
We understood ancestor`s awesomeness too.

### Future　tasks
We had difficulty using computer, so we spent many times.

### Impression
When we solve this problem , we use arithmetic ,which is taught to Japanese students who is a second-year senior high school students, so we had difficulty.
But, this experience became good preparation.
And, this ancient is different from the ancients which is read by us in the Japanese classics.
So,we had had difficult . But we enjoy reading this ancient.

Group Leader;Kato


引用
算法勿憚改
*Sanpoufutsudankai*
延宝元年　　*A.D.1673*
著者：村瀬　義益
*Author：MURASE　Yosimasu*