竜ヶ崎第一高等学校 白幡探究 I 数学領域 ○吉田千尋 山口菜々子 森いずみ

木の種類ごとの使い道 ~ The way of using each kind of trees ~

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Original

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⑥柊木 ③ 栗 木 ② 桧 木 ④松木 栗匁木 銀を足す

英語訳 English version

Question **Xunit...Monme**

The first Four of fir trees

> Change silvers...42monme One of Japanese cypress

The second Five of Japanese cypresses

Change silvers...94monme

Six of chestnut trees

The third Ten of chestnut trees Change silvers...80^{me} 6^{bu} **Two of pine trees**

The fourth Nine of pine trees

Twenty of Japanese cedars Change silvers...89monme 2bu

The fifth Fifty of Japanese cedars

Eight of hiiragis Change silvers...60^{me}

The sixth Seven of hiiragis

Change silvers...31^{monme} 3^{bu} One of zelkova tree

The seventh Three of zelkova trees

Twelve of fir trees Change silvers...160^{me} 8^{bu}

In the equation, multiplying one of the first Japanese cypresses to six of the second chestnuts to two of the third pine trees to twenty of the fourth Japanese cedars to eight of the fifth hiiragis to one of the sixth zelkova trees to twelve of the seventh fir trees, number of fir trees are twenty three thousand and forty.

And multiplying three of the seventh zelkova trees to seven of the sixth hiiragis to fifteen of the fifth Japanese cedars to nine of the fourth pine trees to ten of the third chestnut trees to five of the second Japanese cypresses to four of the fir trees, number of fir trees are five hundred sixty seven thousand.

The above, number of fir trees are five hundred ninety thousand forty. This is datum line.

And multiplying five of the second Japanese cypresses to ten of the third chestnut trees to nine of the fourth pine trees to fifteen of the fifth Japanese cedars to seven of the sixth hiiragis to three of the seventh zelkova trees to 42^{monme} 6^{bu} of the first silvers are 6038^{kan} 550^{me}.

In particular besides multiply first of a white cedar by third of two chestnuts multiply it by fourth of nine pine trees, multiply it by fifth of five hollies multiply, multiply it by sixth of seven hollies, multiply it by seventh of three Japanese zelkovas, multiply it by second of price, 92 momme.

Second of silver 2664kan900momme

In particular besides multiply second of six castaneas by first of a white cedar, multiply it by fourth of nine pine tree, multiply it by fifth of five Japanese cedars, multiply it by sixth of seven holly trees, multiply it by seventh of three Japanese zelkovas, multiply it by third of price, 80.6momme. Third of silver, 1371kan6momme.

In particular besides multiply third of two pine trees by second of six castanea crenatas, multiply it by first of a white cedar, multiply it by fifth of five hollies, multiply it sixth of seven hollies, multiply it by seventh of three hollies, multiply it by fourth of price, 80.2momme.

Fourth of silvers 333kan1706momme.

In particular besides fourth of twenty Japanese cedars by third of two pine trees, multiply it by second of six Japanese chestnuts, multiply it by first of a white cedar, multiply it by sixth of seven holly trees, multiply it by seventh of three Japanese zelkovas, multiply it by fifth of price, 60momme

Fifth of price 302kan400momme

In particular besides, multiply fifth of eight hollies by fourth of twenty pine trees, multiply it by third of two chestnuts, multiply it by second of six Japanese castaneas, multiply it by first of a white cedar, multiply it by seventh of three Japanese zeloyas, multiply it by sixth of price, 31.3momme Sixth of silver, 180kan288momme

In particular besides multiply sixth of a Japanese zelkov, by fifth of eight hollies, multiply it fourth of twenty Japanese cedars, multiply it by third of two pine trees, second of six castanea cenatas, multiply it by first of a white cedar multiply it by seventh of price, 160.8momme

Seventh of silver 308kan 736momme

Now, first silver plus third silver plus fifth plus seventh silver are 8020kan692momme besides in particular

Second silver plus fourth silver plus sixth silver are 3182kan364momme 3182lan364momme minus 8020kan692momme is 4838kan328momme 4832kan692momme cut 590040 is, a white cedar silver, 8.2momme In this way, we can know each price.

担当:森、山根

数学的内容 Mathematical

contents 樅木をα 桧木をℓ 栗木c 松木d 杉木をe 柊木をf 槻木をgとする。

4a + 6 = 42.6 (1)

 $5 \ell + 6c = 9 4$ 2

 $1 \ 0 \ c + 2d = 8 \ 0 \ . \ 6 \ 3$

9d + 20e = 89.24

1 5e+8l=60 5

 $7 \ell + g = 3 1. 3 6$

3g+12a=160.8 7

解説

③と4 5と6 を連立させる。 ⑦はそのままとする。

①と②の場合

 $4 \times 5a + 5 \times b = 42.6 \times 5$ $6c+5\ell = 94$ $4 \times 5a - 6c = 42.6 \times 5 - 94$...(8)

③と4の場合

 $10 \times 9c + 2 \times 9d = 80.6 \times 9$

 $20 \times 2e + 9 \times 2d = 89.2 \times 2$

 $10 \times 9c - 20 \times 2e = 80.6 \times 9 - 89.2 \times 2...9$

5と6の場合

 $15e \times 7 + 8f \times 7 = 60 \times 7$

 $7f \times 8 + 8g = 31.3 \times 8$ $15e \times 7 - 8g = 60 \times 7 - 31.3 \times 8...$

⑦の式を⑪とする

⑧と⑨の式を連立させる

 $(4 \times 5a - 6c) \times 10 \times 9 = (42.6 \times 5 - 94) \times 10 \times 9$

 $(10 \times 9c - 20 \times 2e) \times 6 = (80.6 \times 9 - 89.2 \times 2) \times 6$

 $4 \times 5a \times 10 \times 9 - 20 \times 2e \times 6$

 $= (42.6 \times 5 - 94) \times 10 \times 9 + (80.6 \times 9 - 89.2 \times 2) \times 6...12$

⑪と⑪の式を連立させる

 $(15e \times 7 - 8g) \times 3 = (60 \times 7 - 31.3 \times 8) \times 3$

 $(3g + 12a) \times 8 = 160.8 \times 8$

 $15e \times 7 \times 3 + 12a \times 8 = (60 \times 7 - 31.3 \times 8) \times 3 + 160.8 \times 8...$

12と13の式を連立させる

 $(4 \times 5a \times 10 \times 9 - 20 \times 2e \times 6) \times 15 \times 7 \times 3$

 $= \{(42.6 \times 5 - 94) \times 10 \times 9 + (80.6 \times 9 - 89.2) \times 6\} \times 15 \times 7 \times 3$

+) $(15e \times 7 \times 3 + 12a \times 8) \times 20 \times 2 \times 6$

 $= \{(60 \times 7 - 31.3 \times 8) \times 3 + 160.8 \times 8\} \times 20 \times 2 \times 6$

 $4\times5a\times10\times9\times15\times7\times3+12a\times8\times20\times2\times6$

 $= \{(42.6 \times 5 - 94) \times 10 \times 9 + (80.6 \times 9 - 89,2 \times 2) \times 6\} \times 15 \times 7 \times 3$

 $+\{(60 \times 7 - 31.3 \times 8) \times 3 + 160.8 \times 8\} \times 20 \times 2 \times 6...$

個の式からaの値を求める

a=8.2 よって樅木の一本あたりの銀は八匁二分ということがわかる。

担当:吉田、山口

英語訳 English version

Fir tree is a, Japanese cypress is b, chestnut tree is c,pine tree is Make the simultaneous equations by 8 and 9. d, Japanese cedar is e, hiiragi is f, and zelkove tree is g.

 $4 \mathbf{a} + \mathbf{b} = 4 2 . 6 1$

 $5 \, \mathbf{b+6c} = 9 \, 4 \, (2)$

1 0 c+2d = 8 0. 6 3

9d+20e=89.24

1.5 e + 8f = 6.0 (5)

7 f + g = 3 1. 3 6

3g+12a=160.8

Explanation

Make the simultaneous equations by 1 and 2,3 and 4,5 and 6.

Case 1 and 2.

 $4 \times 5a + 5 \times b = 42.6 \times 5$

6c + 5b = 94

 $4 \times 5a-6c=42.6 \times 5-94 \dots 8$

Case 3 and 4.

 $10 \times 9c + 2 \times 9d = 80.6 \times 9$

 $20 \times 2e + 9 \times 2d = 89.2 \times 2$

 $10 \times 9c - 20 \times 2e = 80.6 \times 9 - 89.2 \times 2...9$

Case 5 and 6.

 $15e \times 7 + 8f \times 7 = 60 \times 7$

 $7f \times 8 + 8g = 31.3 \times 8$

15e \times 7-8g = 60 \times 7-31.3 \times 8...(10)

7 is 11.

 $(4 \times 5a-6c) \times 10 \times 9 = (42.6 \times 5-94) \times 10 \times 9$

 $(10 \times 9c - 20 \times 2e) \times 6 = (80.6 \times 9 - 89.2 \times 2) \times 6$

 $4 \times 5a \times 10 \times 9 - 20 \times 2e \times 6$

 $=(42.6 \times 5-94) \times 10 \times 9+(80.6 \times 9-89.2 \times 2) \times 6...12$

Make the simultaneous equations by 10 and 11.

 $(15e \times 7-8g) \times 3 = (60 \times 7-31.3 \times 8) \times 3$

 $(3g+12a) \times 8=160.8 \times 8$

 $15e \times 7 \times 3 + 12a \times 8 = (60 \times 7 - 31.3 \times 8) \times 3 + 160.8 \times 8...$

Make the simultaneous equations by 12 and 13.

 $(4 \times 5a \times 10 \times 9-20 \times 2e \times 6) \times 15 \times 7 \times 3$

 $= \{(42.6 \times 5-94) \times 10 \times 9 + (80.6 \times 9-89.2) \times 6\} \times 15 \times 7 \times 3$

+) $(15e \times 7 \times 3 + 12a \times 8) \times 20 \times 2 \times 6$

 $=\{(60 \times 7-31.3 \times 8) \times 3+160.8 \times 8\} \times 20 \times 2 \times 6$

 $4 \times 5a \times 10 \times 9 \times 15 \times 7 \times 3 + 12a \times 8 \times 20 \times 2 \times 6$

 $= \{(42.6 \times 5-94) \times 10 \times 9 + (80.6 \times 9-89, 2 \times 2) \times 6\} \times 15 \times 7 \times 3$

 $+\{(60 \times 7-31.3 \times 8) \times 3+160.8 \times 8\} \times 20 \times 2 \times 6...[4]$

14 the expression for a

a=8.2 Silver per one fir tree is 8^{monme} 2^{bu}.

担当:吉田、山口

英語訳 English

version The way of using trees of Edo era

- 1 Mass consumption of building engineering works material
- For example The Edo Castle, houses of each daimyo, Buke, the town-house and so on.
- The construction fad lasted for tens of year in Japan.
- →At that time, planting Japanese cedar trees on the mountain was started because mass felling made the mountain bare.
- →Four hundreds of Japanese cedar trees was sold at neighboring area in 1781.

(From "History of Wood - Akikawa Cooperative Society of Wood")

- 2 The way of using each trees
- **◎Fir tree-Momi-**

Heartwoods and sapwoods of them were used to make daily necessities. And they used to make tableware because they don't have odor.

OJapanese cypress-Hinoki-

They were used to make paper balloons. And they were used in "The raising paper balloons of Kamihinokinai".

©Chestnut tree-Kuri-

They were used foundation of the house, tie of the railroad, bathroom board, flap of the ship and so on because they are materials of superior durability.

OPine tree -Matsu-

It was used for wood, and fuel in dry-distilled wood turpentine which is gotten from root.

When famine happened, its leaves and bak were used for food.

OJapanese cedar-Sugi-

It was used for building material, furniture, cask, tub, clog, unsplit chopsticks, wood used for civil engineering, and deck. Besides its leaves and branch were used for joss stick and so on. Its resin were used for medicine, and essential oil which was included in heart wood was added in rice wine.

©Holly-Hiiragi-

It is used in day before the beginning of spring. Its small branch was lited with head of funky pilchard.

It was believed it will rount out devils.

©Zelkova-Keyaki-

It is high conservative the best wood which can abide moisture, and used for architect, ship, machine, musical, carvings, and so on.

★the way to use "fair tree", "white cendar", "pine tree", "Japanese cedar", "holly", and "zelkova".

→from "wood100.net/"

★the way to use of "castanea crenata"

→from "Wikipedia"

担当:森、山根

まとめ・今後の課題・感想 Summary, Future tasks, Impression

まとめ

昔の人々も現代と同じように数学を 日常生活に取り入れていた。

今後の課題

英訳が不自然になってしまったので、まとまりのある正確な英文を書くこと。

感想

触れたことのない和算を解読することで、江戸時代の文化を深く知ることができました。また、これまでとは違った視点から数学を学ぶことができました。この経験を今後数学を学ぶときに生かしていきたいと思います。

英語訳 English

version

Summary

The ancient people adopted mathematics for everyday life in the same way as modern people, too.

Future tasks

To write correct and coherence English because English translation sentences for this time were unnatural.

Impression

We could know the culture of Edo era because we deciphered Japanese old math which we hadn't touched on. And we could learn math from different perspective.

We will make use of this experience when we learn math from now on.

算法勿憚改

sanpouhutsutankai

延宝元年

A.D.1673

著者:村瀬義益

MuraseYoshimasu



担当:渡邉

担当:森