竜ヶ崎第一高等学校　白幡探究Ⅰ数学領域

71st　1年　G組　7班

8元連立1次方程式を用いて求める鶴1羽の値段

Value of crane to find using
Simultaneous linear equation in eight unknowns

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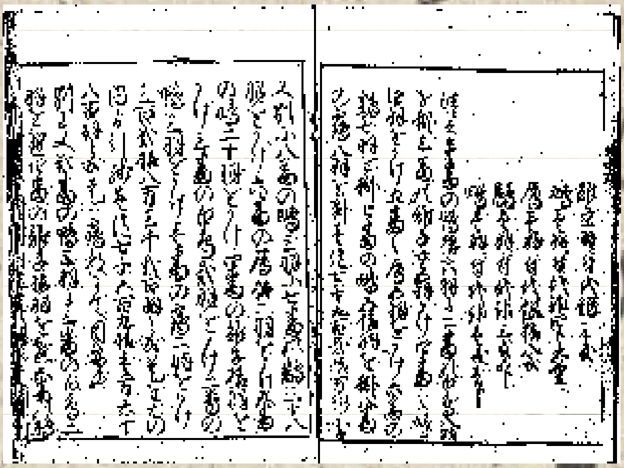
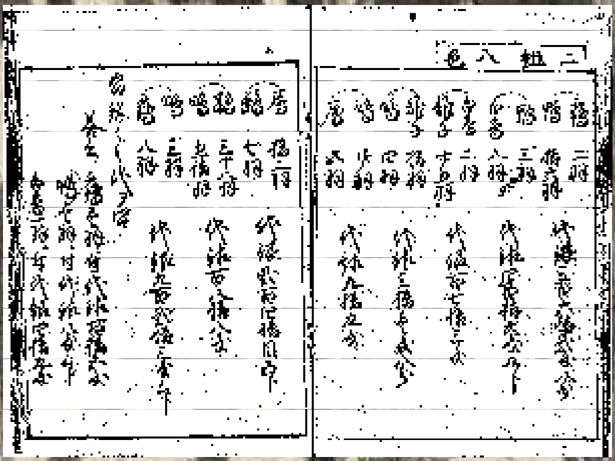
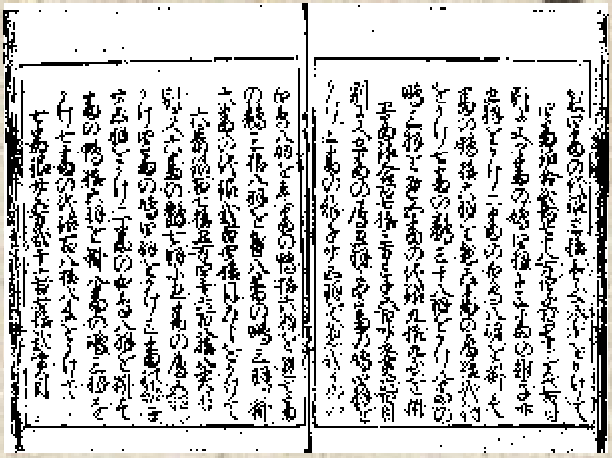
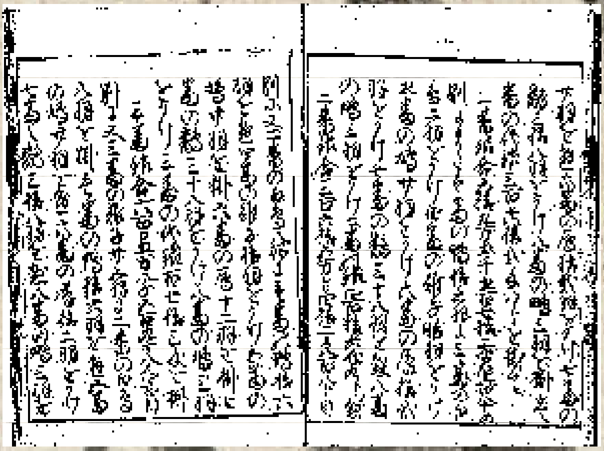
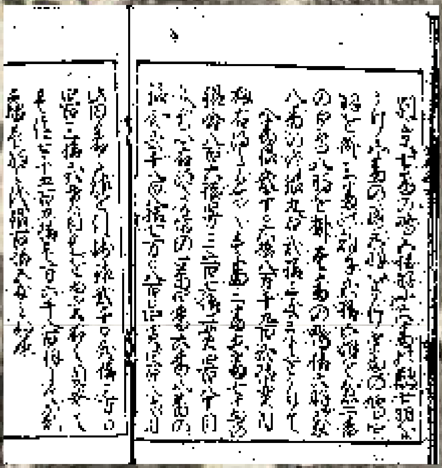
原文
【The text】











〈キーワード〉

8元連立1次方程式：
simultaneous linear equation
in eight unknowns

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数学的内容
【Modern translation of Japanese】

靏=a 鴨=b 白鳥=c 雉子=d 鳩=e 雁=f 鷭=g 鴫=h　とする
これより以下の式において八元連立一次方程式となる

2a+16b=362.8 …①
3b+8c=416.9 …②
2c+25d=173 …③
10d+4e=31.8 …④
20e+5f=99 …⑤
12f+7g=240.5 …⑥
38g+50h=188 …⑦
3h+8a=923.3 …⑧

aの1次方程式をつくって靏一羽の値段を求める。

3⊖−16⊜　2×3a−8×16c=362.8×3−416.2+16 …⑨
10⊛−25④　2×10c−4×25e＝173×10−31.8×25 …⑩
12⑤−5⑥　20×12e−7×5g＝99×12−240.5×5 …⑪
3⑦−50⑧　38×3g−8×50a＝188×3−923.3×50 …⑫

2×10⑨+8×16⑩
2 × 3 × 2 × 10a − 4 × 25 × 8 × 16e ＝ {362.8 × 3 − 416.9 × 16} × 2 ×10+{173×10−31×25}×8×16…⑬
38×3⑪+7×5⑫
20×12×38×3e−8×50×7×5a={99×12−240.5×5}×38×3+{188×3−923.3×50}×7×5…⑭

20×12×38×3⑬+4×25×8×16⑭
{3283200 − 179200000}a=595572480+6058598400+1733529600+252672000 − 3650042880 − 2784153600 − 1754688000 − 20681920000
175916800a=28870804480−8640372480
175916800a=2023043200
a=115

よってa=靏より
靏一羽の値段は115目

現代語訳
【Mathematical contents of Japanese】

解法は、1番のカモ16羽に、2番の白鳥8羽と3番のキジ25羽と4番のハト4羽と5番のカリ5羽と6番のバン7羽と8番のツル8羽をそれぞれかけると1億7920万羽となる。（これを㋐とする。）また8番のシギ3羽に、7番のバン38羽と6番のカリ12羽と5番のハト20羽と4番のキジ10羽と3番の白鳥2羽と2番のカモ3羽と1番のツル2羽をかけると328万3200羽となる。（これを㋑とする。）㋐から㋑を引くと、1億7591万6800羽となる。これはツル数において目安となる。また2番のカモ3羽に、3番の白鳥2羽と4番のキジ10羽と5番のハト2羽と6番のカリ12羽と7番のバン38羽と8番のシギ3羽をかけると1番の代銀362め8ぶをかけて1番銀を合わせると5955万72かん480めになる。また1番のカモ16羽に3番の白鳥2羽と4番のキジ10羽と5番のハト2羽と6番のカリ12羽と7番のバン38羽と8番のシギ3羽をかけてさらに2番の銀416め9ぶをかけると2番銀合わせて3654万2かん880めとなるまた2番の白鳥8羽に1番のカモ16羽と4番のキジ10羽と5番のハト2羽と6番のカリ12羽と7番のバン38羽と8番のシギ3羽をかけてさらに、3番の代銀173めをかけると3番銀を合わせて6055万8598かん400めとなる。また3番のキジ25羽に2番の白鳥8羽と1番のカモ16羽と5番のハト2羽と6番のカリ12羽と7番のバン38羽と8番のシギ3羽をかけてさらに4番の代銀31め8ぶをかけると4番銀合わせて2778万4153貫600めとなる。また4番のハト4羽に3番のシギ25羽と2番の白鳥8羽と1番のカモ16羽と6番のカリ12羽と7番のバン38羽と8番のシギ3羽をかけて5番の代金99めをかけると5番銀合わせて1733万5329貫6000めとなる。また5番のカリ5羽に4番のハト4羽と3番のキジ25羽と2番の白鳥8羽と1番のカモ16羽と7番のバン38羽と8番のシギ3羽をかけて6番の代銀240め5ぶをかけると6番銀は1752万4688貫めとなる。6番のバン7羽に5番のカリ5羽と4番のハト4羽と3番のキジ25羽と2番の白鳥8羽と1番のカモ16羽と8番のシギ3羽をかけて、7番の代金188めをかけると7番銀2526万72貫めとなる。また7番のシギ50羽に6番のバン7羽と5番のカリ5羽と4番のハト4羽と3番のキジ25羽と2番の白鳥8羽と1番のカモ16羽をかけて8番の代金923め3ぶをかけると8番銀2068万1920貫めとなる。これより1番、3番、5番、7番銀合わせると8644万3722貫480めとなる。また2番、4番、6番、8番の銀合わせて2887万804貫480めとなる。これより右の銀を引くと残銀は、2023万432貫めとなる。これを分子として、右の目安の1億7590万6800羽にて割ると、つる1羽の代金を115と知る事ができる。

英語訳
【Modern translation of English 】

Let “a” “b” “c” “d” “e” “f” “g” “h” be “crane” “duck” “swan” “pheasant” “pigeon” “wild goose”　“water hen” “snipe”.
It becomes a simultaneous linear equation in eight unknowns in the following expressions than this.

2a+16b=362.8 …①
3b+8c=416.9 …②
2c+25d=173 …③
10d+4e=31.8 …④
20e+5f=99 …⑤
12f+7g=240.5 …⑥
38g+50h=188 …⑦
3h+8a=923.3 …⑧

I make a linear equation of “a” and find a price of a crane.

3①−16②　2×3a−8×16c=362.8×3−416.2+16 …⑨
10③−25④　2×10c−4×25e＝173×10−31.8×25 …⑩
12⑤−5⑥　20×12e−7×5g＝99×12−240.5×5 …⑪
3⑦−50⑧　38×3g−8×50a＝188×3−923.3×50 …⑫

2×10⑨+8×16⑩　2×3×2×10a−4×25×8×16e＝{362.8×3−416.9×16}×2×10+{173×10−31×25}×8×16…⑬
38×3⑪+7×5⑫20×12×38×3e−8×50×7×5a={99×12−240.5×5}×38×3+{188×3−923.3×50}×7×5…⑭

20×12×38×3⑬+4×25×8×16⑭
{3283200−179200000}a=595572480+6058598400+1733529600+252672000−3650042880−2784153600−1754688000−20681920000
175916800a=28870804480−8640372480
175916800a=2023043200
a=115

So “a” is crane. The price of a crane is 115.

英語訳
【Mathematical　contents of English】

The method of solution is multiply 16 ducks called No.1 by 8 swans called No.2 by 25 pheasants called No3.by 4 pigeons called No.4 by 5 wild geese called No.5 by 7 moorhens called No.6 by 8 cranes called No.8 is 179200000.　It is called ㋐.

For another thing,　multiply 3 snipes called No.8 by 38　moorhens called No.7 by 12 wild geese called No.6 by 20 pigeons called No.5 by 10 pheasants called No.4 by 2 swans called No.3 by 3 ducks called No.2　by 2 cranes called No.1 is 3283200. It is called ㋑.　And　subtract ㋐　from ㋑ is 175916800.The number to be cranes.
For another thing, multiply 3ducks called No.2 by 2 swans called No.3 by 10 pheasants called No.4 by 2 pigeons called No.5 by 12 wild geese called No.6 by 38 moorhens called No.7 by 3 snipes called No.8　by price called NO.1 plus silver called No.1 is 5955572.
For another thing multiply 16 ducks called No.1 by 2 swans called No.2 by 10 pheasants called No.4 by 2 pigeons called No.5 by 12 wild geese called No6 by 38 moorhens called No7 by three snips called No8 by silver called NO.2 plus silver called No.2 is 36542880.
For another thing 8 swans called No.2 by 16 ducks called No.1 by 10 pheasant called No.4 by 2 pheasant called No.5 by 12 wild gooses called No.6 by 38 moorhens called No.7 by 3 snips called No.8 by silver called No.3 plus silver No.3 is60585980400.
For another thing 25 pheasants called No.3 by 8 swans called No.2 by 16 ducks called No.1 by 2 pigeons called No.5 by 12 wild gooses called No.6 by 38 moorhens called No.7 by 3 snips called No.8 by silver called No.4 plus silver called No.4 is 27841530600.
For another thing 4 pigeons called No.4 by 25 snips called No.3 by 8 swans called No.2 by 16 ducks called No.1 by 12 wild gooses called No.6 by 38 moorhens by 3 snips by silver called No.5 plus silver called No.5 is 17335290600.
For another thing 5 wild gooses called No.5 by 4 pigeons called No.4 by 25 pheasant called No.3 by 8 swans called No.2 by 16 ducks called No.1 by 38 moorhens called No.7 by 3 snips called No.3 by silver called No.6 is 17546880000. 7moorhens called No.6 by 5 wild gooses called No.5 by 4 pigeons called No.4 by　25 pheasants called No.3 by 8 swans called No.2 by 16 ducks called No.1 by 3 snips called No.8 by silver called No.7 is 2526720000.
For another thing 50 snips called No.7 by 7 moorhens by 5 wild gooses called No.5 by 4 pigeons called No.4 by 25 pheasants called No.3 by 8 swans called No.2 by 16 ducks called No.1 by silver called No.8 is 206819200000.

For another thing silver called No.1 plus No.3 plus No.5 is 86403720480. There is A.

For another thing silver called No.2 plus No.4 plus No.6 plus No.8 is 202300000432. There is B.

A-B is 202300000432.There is moorhens dividing from 175906800 is crane one bird of price is 115.

江戸文化
【Culture of Edoperiod】

問題文から、鶴など鳥を売り買いしている様子が見られる。
江戸時代には鳥の用途も限られていると思われることも含めて、売買されている鳥は食用としても使われていたのではないかと考えられる。

江戸時代の鳥料理
江戸時代はまだ鶏を食用とすることは一般的とは言えませんでした。江戸の料理書などでも野鳥が主となっています。

.食用の鳥の格付け第1位は鶴（姿も美しく縁起のよい鳥とされたこともあり、将軍や大名に珍重され朝廷にも献上された。）

・鶴は秋から冬の食材で、それ以外の季節には塩漬けにされたそうで、汁物や煮物などに調理されました。
・ほか江戸時代ではポピュラーだったのが白鳥。
串焼きなどにしたそうだ。

・『合類日用料理抄』(1689)には「焼鳥」の調理方法が描かれている。

↓

「鳥肉を串に刺して、かるく塩を振ってよく焼いた後、醤油＆酒のタレにつけて乾かないうちに食べてもらいましょう。キジなんかの場合は初めからタレにつけて焼きましょう」
江戸時代の初期には焼鳥の料理法はほぼ完成していたようである。

http://edo-g3.com/blog/2016/02/nikushoku.html

_http://yakitori-party.com/chishiki/

英語訳
【culture of Edoperiod of English】

From the examination sentence, we can see that birds such as cranes are bought and sold.
Besides, I think application of birds in Edo period was limited.
Based on these factors, these birds were considered to be for food.

FOEL-DISHES OF EDO PERIOD.
In the Edo period, it was not popular to eat chickens.

Cranes were the top of Edible birds (These were presented to lord because of good figure and good fortune.)
There were cooked such as salted, soup, and boiled dishes.
The others, swans were popular. There were roasted on a skewer.
Japanese cook book says that how to make "YAKITORI"

⇓

To skewer a meet, sprinkle salt on that, and roast.
After that, marinated in *Soy sauce& Sake for cooking.*
How to make YAKITORI seems to had been finished in early Edo period.

まとめ・今後の課題・感想
【Summary・Future issues・His thoughts of Japanese】

まとめ
【Summary]】

この和算は要するに、８元連立１次方程式で鳥１羽の値段を求める事の証明である。

今後の課題【Future issues】

古文を現代語訳にしたり、英訳にするのに多くの時間を費やしてしまったので、今回の和算を通して改めて、自分たちの力不足を実感しました。なので、今後は古文や英語の力をつけていきたい。

感想【His thoughts】

今回の活動はとても難しかった。なぜなら８元１次方程式を使ったからだ。
しかし私たちは和算にふれることのできたよい経験になった。

英語訳
【Modern translation of English 】

まとめ
【Summary]】

I mean this Wasan is the proof of finding a price of bird by simultaneous linear equation in eight unknowns.

今後の課題【Future issues】

The works that modern translation of ancient tongues and translation into English took a hell of a time.
There, we again felt our locking ability through this ability.
For the reason, we want to build up more that strength.

感想【His thoughts】

This activity was very difficult because we used the troublesome an equation in eight unknowns degree.
But we could have a good experience that to contact with Japanese mathematics of japan.

引用
【References】

算法勿憚改
延宝元年 A.D. 1673
著者 村瀬 義益（Murase Gieki）