竜ヶ崎第一高等学校　白幡探究Ⅰ数学領域

「山頂から見た三角形の相似比を用いた山の高さの測定法」

「Assay of the height of the mountain using the similar ratio of triangle which we looked at from top of the mountain」

茨城県立竜ヶ崎第一高等学校
1年　B組　　癸班

原本　Original

〈キーワード〉

山の頂上…top of the mountain

縄の長さ…length of rope

相似…similarity

現代語訳　Modern translation

山があって、その山の高さを知りたい。山の上と平地の斜面の距離は２５０間（これは町見術でわかった）次に２間半分降りて、竿をさして山の上と同じ高さにすると竿の高さ１間半あった。

左の図より△ADEと△ACBは相似なので、辺AEと辺BAの比が１：１００で、辺DEを１００倍して高さ１５０間と分かる。算ほうについては、△ADEのDEに、相似比がAB÷EAで１００。よって１：１００なので１００を掛けてACの長さがわかる。

また、山の坂は曲がりがあり、竿をさしても、縄で調べても、歪みはあるから、山の頂点から円をえがくように場所を移動してたくさん調べるとなおよい。

係：米川・矢沼　YONEKAWA and YANUMA are in charge of this.

英語訳　English translations above-mentioned

There was a mountain. We want to know the mountain height. I knew that hillside of the mountain distance is 455 meters. So I went down 3.64 meters from the summit and stuck a rod. The rod length from there to the top was 2.7 meters.

From the left figure, because triangle ADE and triangle ACB are similarity, side AE and BA's ratio is 1：100. So side DE multiply by 100, I found the mountain height is 270 meters. Triangle's resemblance ratio is 1：100 because side AB divided by side EA equals 100, so we know length of AC because side DE multiply by 100.

More over there are same in mountain's slope so there are crookedness for research rod or rope. It is better to research with moving like making a circle from top of mountain.

係：米川・矢沼
YONEKAWA and YANUMA are in charge of this.

数学的内容　Mathematical contents

△ABCの∠C＝90°　…①　△EADの∠D＝90°　…②。①、②より∠ACB＝∠EDA…③

辺DEは辺CAに平行…④

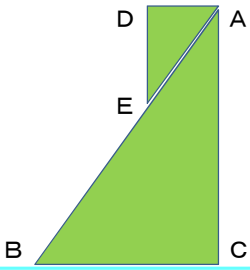
△ABCと△EADにおいて、④より錯角なので∠BAC＝∠AED…⑤

辺ACと辺BC、辺EDと辺ADはそれぞれ垂直に交わっているので、辺BC平行辺AD…⑥。⑥より錯角なので、∠ABC＝∠EAD…⑦

③、⑤、⑦より△ABC∽△EAD…⑧

辺AB＝２５０間、辺EA＝２間半（２．５間）より、相似比は１：１００。

辺ED＝１間半（１．５間）なので辺AC（山の高さ）は１５０間。



係：渡辺・渡辺
WATANABE and WATANABE are in charge of this.

英語訳　English translations above-mentioned

Triangle ABC's angle　C=90°　…①　Triangle EAD's angle D=90 …②

From ①,②, angle ACD=angle EDA…③

Side DE is a parallel line to side CA …④

Angle BAC and angle AED are alternate angles from ④.

So angle BAC=angle AED …⑤

Because, side AC and side BC, side ED and side AD are straight lines crossing at right angles, side BC and side AD are parallel lines…⑥

Because these angles are alternate angles, angle ABC =angle EAD…⑦

Triangle ABC and Triangle EAD are similarity from③,⑤,⑦

Side AB is 450 meters

Side EA is 4.5 meters. So triangle's resemblance ratio is 1：100,side ED is 2.7 meters.

Therefore mountain's height is 270 meters.

係：米川・矢沼
YONEKAWA and YANUMA are in charge of this.

まとめ・今後の課題・感想

まとめ

この和算曙では、山の傾斜に立てた竿の長さと山の頂上から竿までのロープの長さから、三角形の相似比を用いて山の高さを求めた。

今後の課題

各分担の仕事が早く終わってもほかの仕事を手伝うなど、班全員で協力しもっと手際よく活動できるように班長として正しい指示や行動をとれるようにしたいです。

感想

今回のプロジェクトは世界で誰もやっていなく、僕たちが初めてだということなので興味がありました。しかし実際にやってみるととても大変でした。それぞれ分担を分けていたけど難しいところはみんなで助けあって完成させました。

班長：山本

引用　quotation

見立算法規矩分等集

享保7年　著者　万尾　時春

Mitate Sanpou Kiku Buntousyu
A.D.1730　Author:MASHIO Tokiharu

Summary, The problem in future, Impression

Summary

In this wasansyo, I demanded the height of the mountain from the length of the pole which I put up on the slope of the mountain and the length of the ropes from the top of the mountain to a pole using triangular similarity ratio.

Impression

No one has done this project in the world. We did first, so I was interested.
But when we tried it actually, it was very hard. An allotment was separated,but I cooperate in a difficult problem each other by everyone and have completed it.

The problem in future

As a leader, I want to tell member to help others working if each one finish own working. And I think all of the member work more quickly in cooperation. I want to act to do it.

A group leader YAMAMOTO