SCHOOL SCIENCE AND MATHEMATICS

VOL. XVII, No. 6 JUNE, 1917 WHOLE No. 143

A MATHEMATICAL VICTORY.

A Play in Two Acts.

Written under the auspices of the Mathematics Club of the Los Angeles State Normal School of California, those contributing especially being:

PHILIPPI H. HARDING, JEANNETTE BOWER,
MILDRED TRAVIS, KATHERINE HEGEMAN,
STELLA CHAMBERLEN.

ACT I.

Scene I.

EGYPT—Court of Sesostris.

Characters: *Sesostris; Vellah*, the King's spokesman; *Mendez*, overseer; *Geometry*, a priestly man; *slaves, priest.*

Vellah. Mendez, step forth. The great, all-powerful, and wise Sesostris, our master, commands you to measure out by how much the land has become smaller. The ever-shifting Nile snake has eaten from the lands of his people. It is his most sacred and far-seeing Justice which decrees that the tax should be lessened for each person, according to the amount of his original quadrangle that has been devoured by the floods. Go, ye, therefore, and see that thy slaves do the work as commanded. (*Overseer bows himself out.*)

(*Sesostris issues orders to spokesman who then commands slaves, during the following monologue.*)

Geometry. Aye, and it is only because of my instructions that that common Mendez can make the measurements as commanded. It is we of the sacred priesthood only who know all things. Much of my knowledge I do not give; it would not be understood.

(*A slave speaks to Vellah, who bows before Sesostris.*)

Vellah. Oh, great master of our land, the high priest, Ramosestris, of the temple of the most wise and learned god, Theuth,

to whom the Ibis is ever sacred, asks an audience with thee on matters of high import.

Sesostris. Let him approach.

(*Priests enter.*)

Ramosestris. Oh exalted and just ruler, we bring thee greetings from Theuth, the most wise god, inventor of many arts. We bring thee tidings which are of deep importance, and we would, therefore, beg that thy slaves be dismissed.

(*Slaves go out, leaving priests, Geometry, Vellah, and Sesostris.*)

Ramosestris. (*Unfolding papyrus scroll.*) One of our brothers has discovered, in an ancient and unknown cavity of the sacred altar, a scroll, written by a great scholar, Ahmes, containing deep learning. Our brother, Geometry, is very wise and can measure thy lands—

Geometry. (*Interrupting.*) Aye, and I can make a right angle by the stretching of ropes. See! (*Illustrated by three players with rope.*) And I can find the area of any piece of ground. (*Illustrated by an isosceles triang'e formed by players, number of persons on base times number of persons on one side equals the area.*) No one can do more.

Ramosestris. Yea, but in this "Directions for Obtaining the Knowledge of all Dark Things," one may read the instructions for performing all such marvelous computations; and, besides, there is a table giving the values of fractions; and in this great work, an *unknown* number can actually be found if you know what the sum of it and one of its parts is. Aye, 'tis a great work which we have discovered, and will mean much power for us. And you, Geometry, this means that it is time you worked out something *new;* your offering to knowledge is ancient.

Geometry. (*He has been growing less proud during this revelation, and now throws himself on his knees before Sesostris.*) Oh, great master, I do now realize how little I know. But I vow, by the sacred name of our great god, Theuth, that I will make new knowledge. New truths will I bring to light, and then, then will no one dare to scorn me.

ACT 1.

Scene 2.

Greek School.

Characters: *Thales, Plato, Socrates, Euclid, and other scholars, Geometry, Algebra, Messenger.*

Thales. (*He is looking out over the sea from under his hand*). Methinks my eyes perceive a noble galleon approaching from

out the mist of distance. Look thou, also, Socrates. Is it not the "Thalanus"?

Socrates. Though it is vague in outline, it must be thy vessel, O master.

Plato. The ship-benches are all full. When does the "Pharaoh" leave?

Thales. Tonight at sundown, does it not, Euclid?

Euclid. So it stands in our tables. But how soon will the "Thalanus" glide to shore?

Thales. We must know immediately. Get thou the instruments, Socrates. I have taught thee, before, how to get the distance of a ship from the land by means of similar triangles. Go, then, Plato and Socrates, and measure thy distances, and show how much ye profit by my teachings.

(*Socrates and Plato go out.*)

(*Enter a Messenger from the Temple.*)

Messenger. Hark ye, O great scholars. I bring ye a message from the priests of the temple. (*Reads from scroll.*) "It is willed by the powerful god Apollo that we double the size of his cubic altar before the sun sets tonight. We are overshadowed by the cloud of his displeasure, and if we fail to accomplish the task as commanded, this horrible plague which is upon us will be doubled in fury—a red fire of vengeance to wreak the will of the heavens. Lend thy wisdom, then, O learned masters. The curse of the gods rests upon us."

Thales. Tell thy lords the priests that all the wisdom of the greatest scholars shall be put to the task of lifting this curse. (*Messenger goes out.*)

Euclid. I will go to measure the altar. (*Exit.*)

(*Enter Socrates and Plato.*)

Thales. We have a message from the temple. (*He hands it to them.*) Euclid has gone to measure the altar.

(*All stand in suspense.*)

(*Euclid returns.*)

Euclid. The altar is a cube, two cubits on a side.

Thales. I think our problem is simple. We shall only have to double the side. Let us make a miniature model.

(*They use small cubes in their model.*)

Euclid. Let us say each cube is two cubits on a side. (*He makes a cube four cubits on a side.*)

Thales. This cannot be right, for this cube is four times the size of the altar.

(*Enter Geometry.*)

Euclid. Welcome, Geometry. Have you heard of the will of Apollo?

Geometry. The anxious voices of the people have carried it to me, and I come to solve your problem.

Thales. Your presence is most welcome, Geometry, for we, alone, are helpless. Here are the models.

Geometry. This problem is simple. (*He places two cubes together.*)

Socrates. But that is not a cube.

(*They all manipulate the cubes to no avail.*)

(*Enter Algebra.*)

Thales. Welcome, Algebra. Can you solve the problem required by Apollo?

Algebra. I cannot. (*She explains as follows.*) The volume of the new altar must be twice the original volume of Apollo's altar. This is what?

Euclid. Since the volume is now eight cubic units, the new volume must be sixteen cubic units.

Algebra. Since sixteen cubic units must be the volume of the new altar, one of its sides would have to be the cube root of 16, which is $2\sqrt[3]{2}$. As you well know, we have no way of finding such a number.

Messenger. (*Enters hastily.*) The sun doth shield his rays. The priests send for the solution of the problem.

The Scholars. (*Looking helplessly at Algebra.*) We are unable.

All. (*Rushing out.*) The plague! The plague!

(*Algebra flees in one direction; Geometry and the others in the opposite direction.*)

ACT 2.

Scene 1.

German Class.

(This scene was copied from Young's *Mathematics in Prussia.*)

Characters: Teacher, and pupils.

$$\frac{x}{2}-\frac{x}{3}+\frac{x}{4}-\frac{x}{6}+\frac{x}{8}+\frac{x}{12}=11.$$

(*All write problem from book, one reading aloud as he writes and adding: "We seek first the common denominator."*)

Teacher. How do we do that? By a rule?

John. No, by inspection.

Teacher. Right. What is the common denominator?

John. 24.

Teacher. Right. What do we do next, Heinrich?

Heinrich. We multiply both members by 24.

Teacher. What is the result, Wilhelm?

Wilhelm. (*Reading as all write.*) $12x - 8x + 6x - 4x + 3x + 2x = 264.$

Teacher. What do we do next, Karl?

Karl. We unite the terms in the left member.

Teacher. Give the result, Fritz.

Fritz. (*All write as Fritz reads and writes.*) $11x = 264$.

Teacher. What do we do next, Peter?

Peter. We divide both sides by 11.

Teacher. What is the result?

Peter. (*Reads and all write.*) $x = 24$.

Teacher. We will now work another equation.

(*Original from this point on.*)

(*One of the pupils raises his hand.*)

Teacher. Karl.

Karl. We could make equations from what we learned about triangles the other day. I made one about the sum of the angles of a triangle. Couldn't we work it now?

Teacher. We do not work geometry in an algebra class. That is for the hour on Thursday and Friday only.

(*The class proceeds to work the problem dictated.*)

ACT 2.

Scene 2.

OFFICE OF PROFESSOR MYERS IN THE UNIVERSITY OF CHICAGO.

Characters: *Prof. Myers, Mr. Breslich, Geometry, Algebra, and a class of boys and girls.*

(*Enter Breslich and Myers.*)

Myers. It is a privilege to attend such a meeting. What do you think of the proposed change, Breslich?

Breslich. I think as all intelligent persons must. The adoption of this brings us nearer the Utopia of Education when each student will have an opportunity to study what he desires in our courses in the University. Time will change anything, Prof. Myers.

Myers. Yes, change anything. Isn't it amazing to think over the struggles and the obstinacy occasioned by the application of psychological principles to pedagogy. Yes, remarkable! Think of the new subjects introduced, the new methods employed and the general onward progress even against the most vigorous opposition. I have been dreaming of another great change which I am hoping may be introduced into our department of mathematics. It would mean much to our young people. (*He looks at Breslich questioningly.*)

Breslich. You know, I, for one, may be counted upon to further any plans for advancement. How may I be of assistance?

Myers. Here is our University High School; we have both

algebra and geometry; but it is my impression that each of these branches of the great science of mathematics carries on its work as though ignorant of the presence of the other. If these two could be brought together, they would aid each other immeasurably! (*He gets up and paces excitedly.*) Can't you see what the union of these two subjects would mean to education?

Breslich. (*Nodding.*) Yes, it is an admirable idea. I assure you that I shall thoughtfully consider your suggestion. Good-day.

Myers. (*Musing, not seeming to know that Breslich has left. After a slight pause, there is a knock at the door.*) Come in. Ah, it is you, Geometry.

Geometry. Yes. I have come to ask your opinion of my worth. My uselessness presses upon me. Humanity has a need which I have been unable to supply.

Myers. I have been planning something for you, Geometry. I know that your heart is in your work, so I am going to confide in you. The plan is this: I am confident that the results of your efforts would be more satisfactory if you should join forces with another of our workers, who has practically the same interests as yourself—

Geometry. (*Interrupting.*) I am afraid not. I am quite sure that I could not be a congenial coworker with anyone—that is, except—

Myers. (*Prompting.*) —except?

Geometry. It is a long story, but quickly told. It was on the sands of Greece long ages ago, that we—I and the other—then but infant sciences, played on the sands; the wise men and scholars of the country looked on, some scorned, some encouraged us. But those were happy days when we were together; what we did was childish, but done with joy and hope in the work. Our aim was to lead men to a true knowledge of science. This companionship was ruthlessly ended, and we were separated by the witless interference of man, doomed never to meet again through the long ages which have passed. I have striven to do my work well; my companion likewise, I am sure. But we cannot do, for these generations, what we could do if we were working together. It grieves me to displease you, but it would be impossible for me to work in harmony with any but my true companion.

Myers. And by what name was your companion known?

Geometry. Algebra.

Myers. (*Starting.*) Is it possible—

(*He turns and presses a bell. He tells the stenographer who enters to summon some one.*)

(*He seats himself, and a short, strained silence ensues.*)

(*Then comes a knock at the door. Algebra enters.*)

Algebra. You sent for me?

Myers. Though you have been working in the same school for so many years, I feel sure you have not as yet realized the existence of one, who, though working near you, has never here crossed your path. As I am confident you would make inseparable and invaluable coworkers in your science, I am taking this opportunity to reunite you.

Algebra. (*Interrupting.*) But—

Myers. One moment, please. (*He walks over to Geometry, who, lost in thought, has not observed what has just passed. Myers lays his hand on his shoulder.*) Behold your future comrade: the long-lost companion of your youth.

(*Algebra and Geometry start on recognition, and Geometry reverently kisses the hand of Algebra.*)

Myers. My dream will be realized! Algebra and Geometry, brother and sister sciences, united at last, and my ideal of correlation reached!

(*Breslich enters, excitedly.*)

Breslich. I felt that your thoughts must be taking shape. Ah, it has come. Algebra and Geometry united! What a future I see for them!

Myers. Yes, yes. The help they will give each other is immeasurable! Their friendship and natural need for each other will draw the learners closer in their work. Another change, another step in advance. It has been realized here, and soon will have entered into the educational systems of all countries.

Breslich. Ah, I am even now planning a text for the guidance of students. Let me talk of it with you. (*They stand as though discussing this, and a modern lesson in first year correlated mathematics is revealed to the side, as though an embodiment of their thoughts.*)

MODEL LESSON.

Teacher. What were we studying yesterday, Mary?

Mary. Triangles.

Teacher. What do we know about triangles?

Jane. A triangle is a figure having three sides and three angles.

Teacher. Into what two classes may the angles of any triangle be divided, William?

William. Into interior and exterior angles. The interior

angles are those inside the triangle, and the exterior angles are those formed by extending the sides of the triangle.

Teacher. Very good. What did we learn about one of the classes of angles yesterday?

Henry. We discovered that the sum of the interior angles of any triangle equals a straight angle, or 180°.

William. Well, will the sum of the exterior angles of a triangle equal 180°?

Teacher. Good question. We'll find out. We shall need a figure for that. John, will you please draw a figure and name the parts?

Teacher. What are some of the things that we know which may help us out, Louise?

Louise. We know yesterday's problem.

Teacher. Write it on the board in terms of the angles.

(*Louise steps to board, and writes:* $x+y+z=180°$).

Teacher. What else do we know?

(*Silence for a moment, and then one raises her hand.*)

Mary. We know that $x + w = 180°$ because they form a straight angle.

John. Well, then $z + t = 180°$ and $s + y = 180°$ for the same reason.

Teacher. Write it on the board. (*John writes these facts upon the board.*)

John. We can make another equation by adding our letters and degrees.

Teacher. Do it. (*John goes to board and writes* $x + y + z + w + t + s = 540°$.) Now, what shall we do? Is it of any use to have two equations instead of one?

Jane. We can add the two equations.

Pupils. (*Chorus of "No."*)

John. We should subtract, because then we will have just the exterior angles left, and that is what we are working for.

Teacher. Do you all agree?

Pupils. Yes.

Teacher. Do this step for us, Jane.

(*Jane goes to board and does subtraction.*)

Jane. Then that leaves $w + s + t$, the sum of the exterior angles.

Teacher. What does the sum of these exteriora ngles prove to be?

Pupils. 360°.

Mary. Geometry is just like algebra, isn't it?

John. I can do it another way. (*By paper folding he puts the angles together and makes a circle.*) The sum of the exterior angles of a triangle is equal to 360°.