

PAPER BY PROF. MILLER TO TEACHERS

Mathematics in Secondary Schools—How They Are Presented.

The following is a paper read by Prof. J. A. Miller, principal of the Albuquerque high school before the Territorial Educational association, in session at Santa Fe:

"Mathematics in the Secondary Schools, What, How Much, How Presented."

In the subject assigned me I have in effect been requested to propose a course of study in high school mathematics and recommend the method or methods to be followed in its presentation.

It is not necessary to defend the right of mathematics to a place in the high school course of study. Even before Xenocrates called it the handmaid of philosophy...

So strong is the tendency to make broad the field of electives and so numerous are the subjects which now clamor for recognition, that the microscope of practicality is kept in constant use.

The task now presenting itself is that of determining what branches of mathematics will best serve the desired ends, best meet the test of activities, and best fit the purpose of the task.

The division of this great subject into three parts supposed to correspond to the three divisions of school, the grades, the high school and college or university, differing in content, methods and aims...

Consequently what follows is based on the assumption that we are dealing with students who have entered the high school as most of us do enter, having had a complete course in practical arithmetic.

The first three named, elementary algebra, plane and solid geometry, are required as prerequisites to almost all courses; the last two, plane trigonometry and advanced algebra, are required in certain scientific and technical courses.

The "How Much" of each has not so arbitrarily established as the subject itself. The customary requirement for algebra is that subject be covered through

quadratics. This is a requirement so general that it permits not a little private interpretation, not only on the part of one preparing a course of study but on the part of the teacher as well.

Let us then formulate our course more specifically. First by prescribing more or less definitely what is to be taught in high school algebra, and, second, by pointing out topics frequently included in text books but which would better be excluded from the required course in algebra.

Definitions. The four fundamental operations for rational expressions.

Factoring, including the determining of the H. C. F. & L. C. M. by factoring.

Fractions, including complex. Equations of the first degree, both numerical and literal, containing one or more unknown quantities.

Evolution, including the use of the binomial theorem.

Evolution, including square and cube root.

Radicals, including fractional and negative.

Quadratic equations, including simultaneous quadratics.

Problems involving such equations. Second, what exclude:

Complicated factoring, such as H. C. F. by the long division process.

Complicated fractions.

Proof of the binomial theorem.

Simultaneous equations involving more than three unknown quantities.

Roots other than square and cube and roots readily extracted through these.

To complete the course as thus outlined will require a year and a half of forty-four weeks.

Time is almost sure to result in desultory work and a consequent lack of thoroughness. No one teaches algebra as an end in itself but rather as a means by which desirable ends are made possible.

But passing this we turn to the subject which at this point very appropriately presents itself, plane geometry. I am one of the many who yet believe that this is the proper

time for its introduction to the course. It should not precede algebra, but it should be introduced simultaneously with algebra, but should follow. I am well aware that in some sections such a statement would stir up lively opposition.

As to just what the course in either plane or solid geometry shall be there is given but little room for individual opinion. It is here as in Caesar, Cicero and Virgil not so much a question of what as how.

The usual theorems and problems of good text books are recognized as the standard of requirement; neither can the teacher vary the order of presentation from that of his text without serious inconvenience.

The question has been raised whether or not local problems and theory of loci should be included in the high school course. While these subjects do not lend themselves to practical application in the sciences and mechanics, they are of value to other more general ones.

I do not see how they can be omitted from the course without seriously handicapping the student in his understanding of many important principles.

It is well to keep before the mind the fact that the knowledge acquired from a course in geometry is of but secondary value to the great majority of those who pursue it.

With it the additional fact that this subject presents the first and usually the only course in close and logical reasoning with which any considerable number of them will ever become acquainted.

The student, who from precept, from example, by imitation and by practice has acquired the habit of seeking a reason for things, who has developed the ability to reason out sound and logical deduction for himself, has gained more than knowledge; he has gained power.

A teacher of geometry should then have for guiding principles those laid down by Pascal, "To leave no obscure term undefined; to assume nothing not perfectly evident; to prove everything at all doubtful by reference to admitted principles."

The third division of my subject, "how presented," has already been somewhat anticipated. I consider it neither advisable nor profitable to dwell long on this topic.

Not because method is an unimportant thing to consider but because its importance is so great and of such bearing that any consideration of it in this manner can scarcely be expected to bear fruit.

The good teacher or mathematician will not use my method, your method, or that of any one else exclusively. As occasion demands he will make use of the good features of any or all. But whatever the method the aim should always be the same, that of developing in the pupil the ability to think

independently. It seems trite to say that the mind acquires knowledge only by its own activity, that the task of the student is not to learn proofs but to prove, not to memorize processes in algebra but to learn principles, make them his by assimilation and use them in logical reasoning.

Then by way of recapitulation. Assuming a previous knowledge of practical arithmetic, we would require a year and a half in algebra, followed by a year in plane geometry and a half year in solid. If conditions permit add a half year of plane trigonometry and an additional half year of more advanced algebra as electives in the senior year.

OKLAHOMA OFFICIALS CAN'T GET ALONG

The Governor and the Attorney General are at Odds—Executive Committee Branch of Official Etiquette.

Guthrie, Okla., Dec. 27.—Attorney General Charles J. West has not yet received official notice of the passage of any of the bills during the preholiday session of the legislature, although the request that this be done was made by him to the administration. The branch is continuing to widen between the attorney general and the administration, and is now nearing the impassable stage.

It is now understood that W. C. Hughes of Oklahoma City, a member of the constitutional convention and a close friend of Gov. Haskell, will have an attorneyship created for himself soon along the same line as that of Edward O. Cassidy of Shawnee, attorney for the School Land Leasing board.

Hughes will be attorney to the State Corporation commission. These attorneyships, although they were originally intended to be under the direction of the attorney general's office will be separate and distinct because of Haskell's falling out with Judge West.

That the Billings prohibition enforcement is too drastic and should not become the law in its present form was the declaration of Dr. A. S. Riddle of Chickasha, one of the representatives from Grady county.

"I am against the bill," he said. "As passed by the senate it will never become the law. When the house gets through amending it it will be scarcely recognizable. Dr. Riddle also expressed himself as against the enforcement commission created by the bill and the search of the state without warrants.

The state departments of labor and charities and corrections and labor organizations of the state are fighting a clause in one of the juvenile court bills introduced in the legislature, which provides a military school for training juvenile offenders, and they are favoring instead the clause in another bill providing for an industrial school training. The district manager of the Order of Railway Telegraphers and other high officials of the telegraphers' and railway employees unions are here lobbying for the passage of the eight-hour day bill. They are demanding, however, an amendment to the pending bill, claiming it has the same loopholes as the Texas law along the same line.

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PSYCHOLOGISTS, WHO MAKE A BUSINESS OF SORTING OUT IDEAS, SAY INTO THE WORLD THEY ARE BORN, SAY THAT AFTER YOU PASS THE AGE OF ABOUT TWENTY, YOUR IDEA-BEARING DAYS ARE ETERNALLY OVER. IF YOU ARE STILL ON THE TENDER SIDE OF THIS AGE--AND ARE WISE--YOU MAY WISH TO READ THIS STATEMENT AGAIN.

NOW THE ALBUQUERQUE CITIZEN CARRIES IDEAS IN STOCK, WHERE THEY CAN BE BOUGHT BY ANY PARENTS WHO ARE INTERESTED IN THE BUILDING AND TRADE GETTING. THESE IDEAS WILL BE SOLD, LEASED OR RENTED TO THE PUBLIC, FOR CASH OR ON THE INSTALLMENT PLAN.

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A NUMBER OF ALBUQUERQUE BUSINESS MEN HAVE ALREADY MADE SUCH ARRANGEMENTS, AND ARE DOING IT EVERY DAY. ONE WISE MERCHANT, WHO ATTEMPTS TO DRAW A LINE DIVIDING THE PATRONAGE HE RECEIVES FROM ADVERTISING, FROM THAT COMING THROUGH OTHER CHANNELS, INFORMED US ONLY YESTERDAY THAT HIS ADVERTISING IN THE ALBUQUERQUE CITIZEN DURING THE TWO MONTHS IT HAS RUN, HAS NETTED HIM SUFFICIENT TO PAY FOR THE ADVERTISING FOR SIX MONTHS. ANY ADVERTISER THAT WANTS TO SELL IN DIRECT, IMMEDIATE RETURN, IS A GOOD INVESTMENT, BECAUSE YOU GET YOUR MONEY BACK, AND THE EXTENDED PUBLICITY TO BOOT. BUT WHEN RESULTS ARE SUCH AS THIS MAN EXPERIENCED YOU ARE GETTING LITTLE LESS THAN A GOLD MINE.

THE FIRST MAN IN THE ADVERTISING FIELD REAPS THE FINEST OF THE WHEAT, THE LATE-COMERS GLEAN THE STRAW. DUKE, THE TOBACCO KING, IN CONVERSATION WITH THE WRITER ONCE SAID: "I BEGAN LIFE ON A STONE PATCH, WITH A WIFE, A BLIND MULE AND TEN DOLLARS. I AM NOW WORTH THIRTY TWO MILLION DOLLARS. BUT I HAVE SPENT FORTY MILLION IN ADVERTISING." PROBABLY NO MAN IN ALBUQUERQUE HAS HAD A MORE MODEST BEGINNING THAN MR. DUKE, AND THERE IS NO REASON WHY ANY MAN WITH EQUAL BUSINESS ABILITY, AND POSSESSED OF THE SAME BUSINESS FORESIGHT, SHOULD NOT SUCCEED AS WELL. IF THERE IS STATE IT TO YOURSELF, AND BE CONVINCED, IT IS AN OLD SAW, BUT A KEEN CUTTER, THAT SAYS: "IT PAYS TO ADVERTISE."

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