

- A couple of mice.
A swarm of bees.
A herd of cattle.
A flock of birds.
A drove of horses.
17. Write the plurals of—
lady. day. tooth. negro.
tidy boy. eye. potato.
body. valley. foot. motto.
baby. money. calf. cargo.
povy. donkey. goose. tomato.
18. Write an inquiry about—
A carpet. The train. A knife. The time.
19. Write a statement, an inquiry, and a command.
20. Write a sentence containing ten words, and requiring four capitals.

—St. Louis Jour. of Ed.

A LESSON IN ARITHMETIC.

BY BELL S. THOMPSON,

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The lesson was given to a class of thirty children, between the ages of 10 and 12 years; the time occupied 25 minutes.

Point of the Lesson.—To lead the children to discover what is meant by multiplying one fraction by another, and to teach them the process.

Apparatus Used.—Each child was provided with four pieces of paper, each piece about six inches long and four inches wide.

Method.—The teacher wrote $\frac{1}{4}$ on the board, and told the children to find that fraction of one of the papers. After this had been done by all, a child when called upon said, "I divided my paper into four equal parts and took one of them; I have one-fourth."

The teacher then said, "I want you to find $\frac{1}{3}$ of that fourth; how will you do it?" A child said, "Divide the fourth into three equal parts and take one of them." All the class did so.

What part of the one-fourth have you found? "One-third of one-fourth." All hold up the answer.

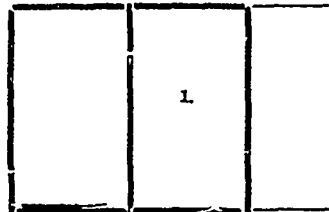
Examine this, and compare it with what is left of the first paper you divided. How many such parts as you have now (holding up $\frac{1}{12}$ of $\frac{1}{4}$) would it take to make the whole paper? "Twelve."

Then this must be what part of the whole paper? "One-twelfth?"

Then $\frac{1}{3}$ of $\frac{1}{4}$ is what part of the whole? "One-twelfth."

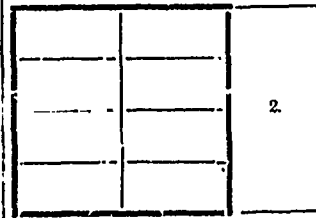
Teacher wrote on the board, $\frac{1}{3}$ of $\frac{1}{4} = \frac{1}{12}$.

The teacher then drew on the board a line 20 or 30 inches long, and had it divided into fifths. She then wrote the expression $\frac{2}{3}$ of $\frac{1}{5}$, and asked who could find it. From several volunteers one was selected, who promptly divided the fifth into three equal parts and indicated two of them. The class then discovered that it was $\frac{2}{15}$ of the whole line, because in each of the five parts there were three such small parts. $\frac{2}{3}$ of $\frac{1}{5} = \frac{2}{15}$ was then written on the board under the first discovery; $\frac{2}{3}$ of $\frac{2}{5} = \frac{4}{15}$ was easily discovered from the same line. An oblong drawn upon the board was divided into thirds, and two of them marked off thus (see No. 1):



Volunteers were called for from the class to divide the two-thirds into fourths. They were all ready, and one proceeded to the board and did it (see No. 2).

Another being called upon to mark off $\frac{1}{4}$ distinctly from the rest,

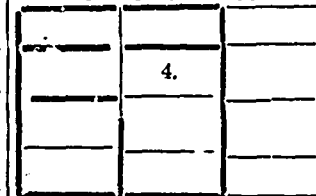


or $\frac{1}{6}$ " $\frac{1}{3}$ of $\frac{2}{3} = \frac{2}{9}$, or $\frac{1}{3}$ was then written on the board with the other expressions.

The children then folded the paper, and found that $\frac{1}{2}$ of $\frac{2}{3} = \frac{1}{3}$; $\frac{2}{3}$ of $\frac{1}{3} = \frac{2}{9}$ or $\frac{2}{9}$.

The teacher now went back to the first discovery, $\frac{1}{3}$ of $\frac{1}{4} = \frac{1}{12}$, and led the class by comparison to see and to say that to find $\frac{1}{3}$ of $\frac{1}{4}$, the whole unit is divided into three times four equal parts and one part taken. She then wrote,—

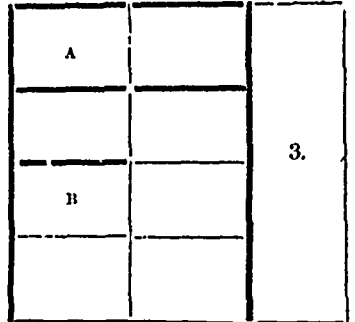
$$\frac{1}{3} \text{ of } \frac{1}{4} = \frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$$



did it (see No. 3, A). Another did it (see No. 3, B).

The teacher then carried the light lines across the exclusion third so as to exclude the whole oblong in the division (see No. 4), and asked what part of the whole oblong is $\frac{1}{3}$ of $\frac{2}{3}$ of it? The whole class answered, " $\frac{2}{9}$ "

or $\frac{1}{6}$ " $\frac{1}{3}$ of $\frac{2}{3} = \frac{2}{9}$, or $\frac{1}{3}$ was then written on the board with the other expressions.



Examining the second result (the real thing, not the figures), they saw and said, "the unit has been divided into 3 times 5 parts, and 2 times 1 part taken"; and as children dictated, the teacher wrote, $\frac{2}{3}$ of $\frac{1}{5} = \frac{2}{15} \times \frac{2}{3} = \frac{4}{15}$.

The other results were then examined, and the teacher wrote the process from dictation as before.

When $\frac{1}{3}$ of $\frac{2}{3} = \frac{2}{9}$ or $\frac{1}{3}$ was reached, the teacher called attention of the class to the fact that $\frac{2}{9}$ had been reduced to its lowest terms, and that this could be done before multiplying, thus saving time and labor when the numbers were larger; then the operation stood thus: $\frac{1}{3}$ of $\frac{2}{3} = \frac{2}{3} \times \frac{1}{3}$ (cancelling 2 in the numerator and 2 from the 4 in the denominator) $= \frac{1}{3}$.

After all the expressions whose results were known had been thus treated, the teacher wrote the following, whose answer was unknown: $\frac{2}{3}$ of $\frac{2}{3} = ?$ The children, reasoning from analogy, said, "To find $\frac{2}{3}$ of $\frac{2}{3}$, we must divide the whole unit into four times five parts, and take 3 times 3 of them, which will give $\frac{9}{20}$." They wrote the solution as before. They then verified the result with their papers.

They were now ready to solve any similar problems and to do it understandingly, cancelling or reducing to lowest terms whenever possible.

The teacher then proceeded to tell the class that such expressions as $\frac{2}{3} \times \frac{2}{3}$ mean $\frac{2}{3}$ of $\frac{2}{3}$, which the class interpreted to mean, "Take $\frac{2}{3}$ of a thing, divide it into 3 equal parts and take 2 of them. Of course they saw that they would have twelfths, and 6 of them, or $\frac{1}{2}$, and gave the solution thus:

$$\frac{2}{3} \times \frac{2}{3} = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$$

This lesson will be followed by practice in solving such problems by dividing real things into parts, and also by drill exercises, to make the class quick and accurate in the process of cancellation.—

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FRIDAY AFTERNOON.

BY GEORGE C. MASTIN, COUNTY SUPERINTENDENT OF CARROLL COUNTY, ILLINOIS.

In answer to a letter of inquiry asking for suggestions relative to