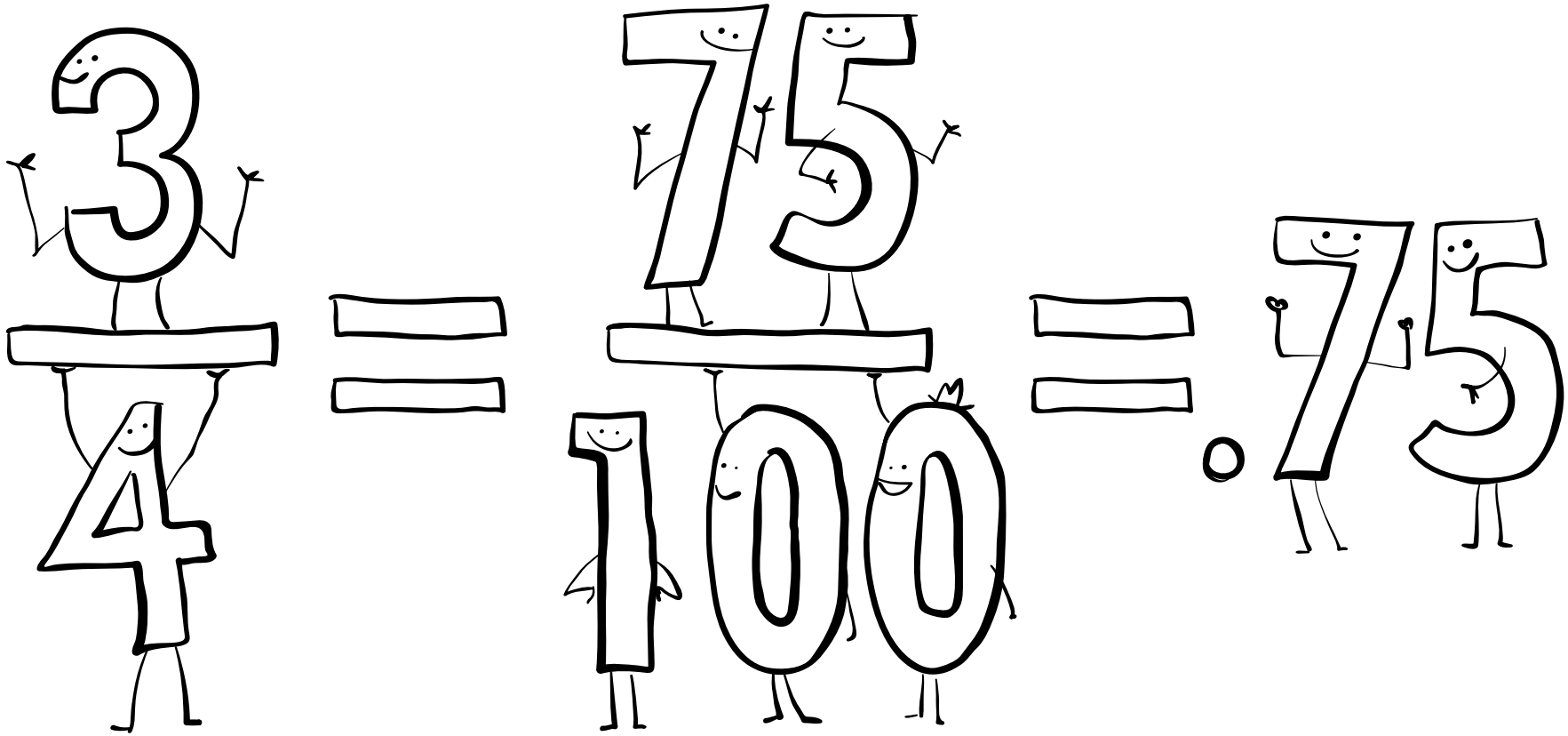

DECIMALS

The thirteenth scene in a series of articles
on elementary mathematics.

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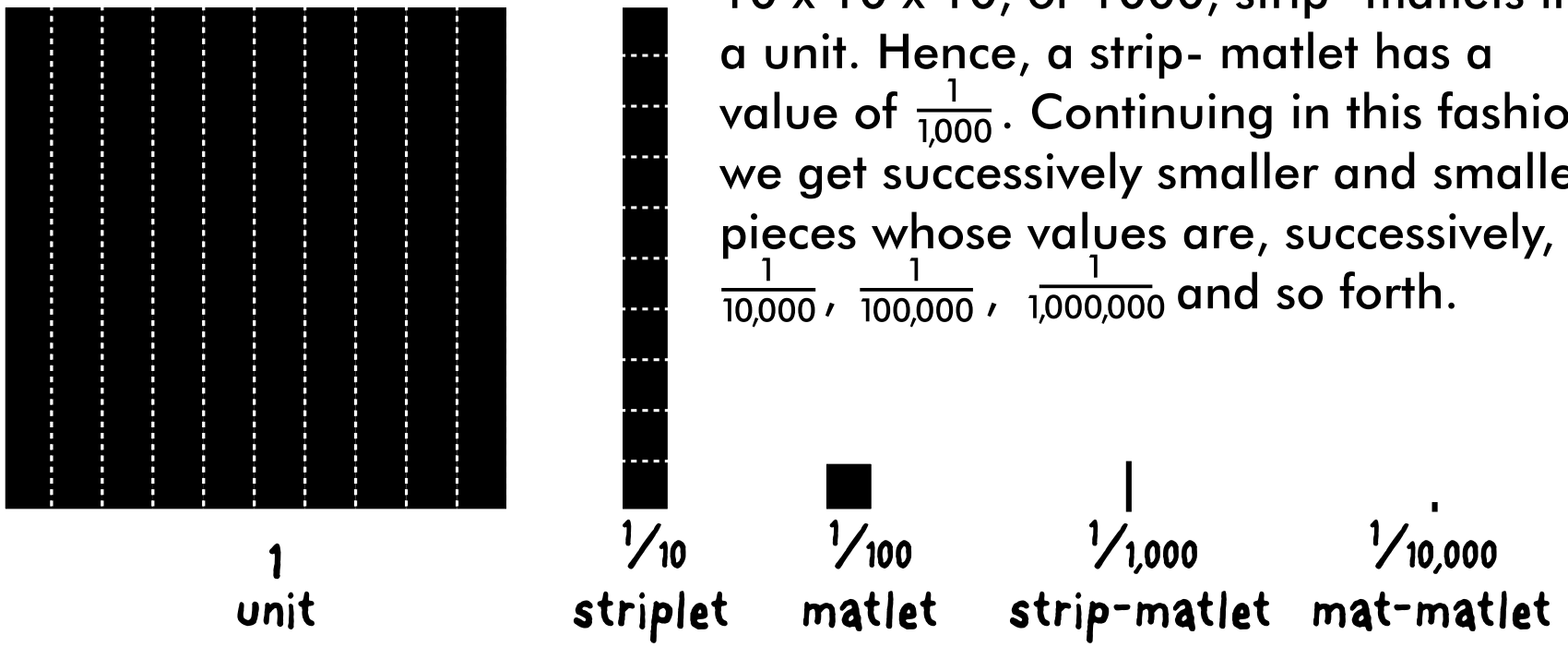
designed and illustrated by Tyson Smith

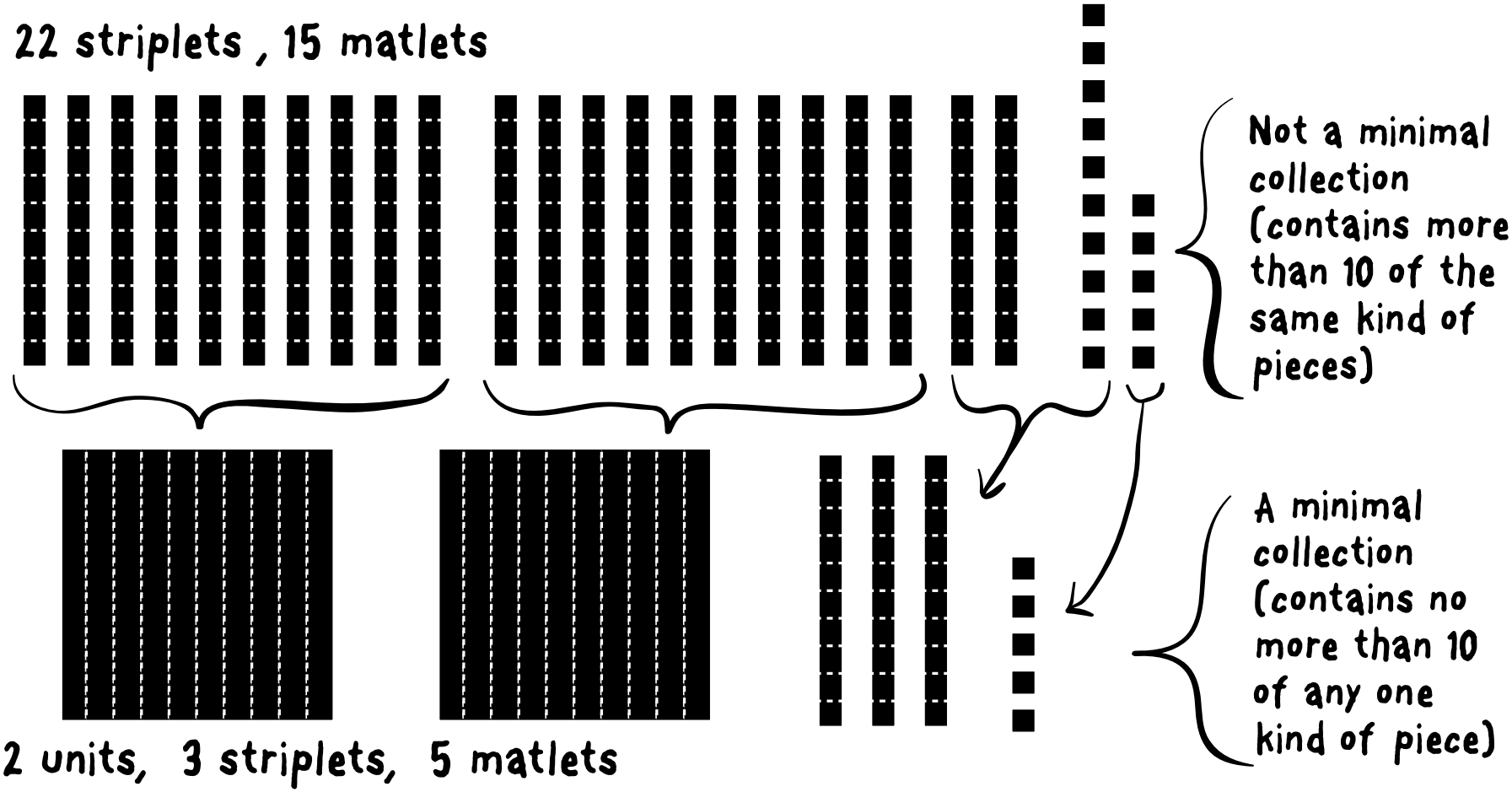
In Scene 1, we introduced the decimal system, a method of naming the counting numbers that depends on groupings of ten This system can be extended to get decimal names for fractions.

We begin by taking a unit tile, which represents 1, and dividing it into 10 equal strips each of which we call a ***striplet***. Since a striplet is the result of dividing 1 into 10 equal parts, the value of a striplet is $\frac{1}{10}$. We now divide a striplet into 10 equal squares, each of which we call a ***matlet***. Since there are 10 matlets in a striplet and 10 striplets in a unit there are 10 x 10, or 100, matlets in a unit. Hence, a matlet has a value of $\frac{1}{100}$. Next we divide a matlet into 10 equal strips, each of which we call a ***strip-matlet***. There are 10 x 10 x 10, or 1000, strip- matlets in a unit. Hence, a strip- matlet has a value of $\frac{1}{1{,}000}$. Continuing in this fashion, we get successively smaller and smaller pieces whose values are, successively, $\frac{1}{10{,}000}$, $\frac{1}{100{,}000}$, $\frac{1}{1{,}000{,}000}$ and so forth.

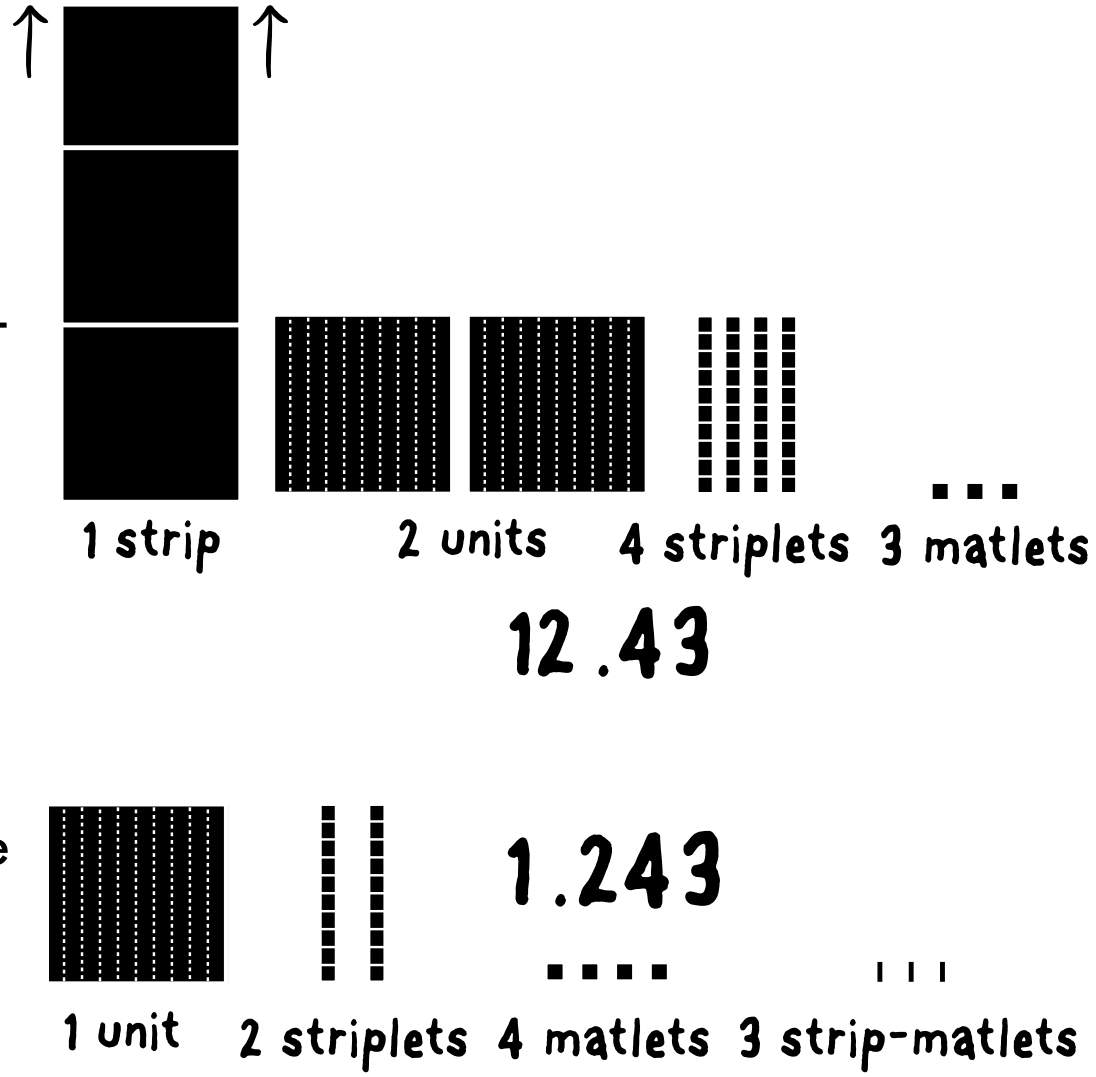


Any 10 pieces of the same type have the same value as 1 piece of the next larger type. Thus 10 strip-matlets have the same value as 1 matlet, 10 matlets have the same value as 1 striplet, 10 striplets have the same value as 1 unit, 10 units have the same value as 1 strip, 10 strips have the same value as 1 mat, and so forth. Because of this, any collection of pieces can be converted to a so-called ***Minimal*** collection—a collection which contains less than 10 of any particular type of piece.

For example, a collection of 22 striplets and 15 matlets has the same value as a minimal collection of 2 units, 3 striplets and 5 matlets:



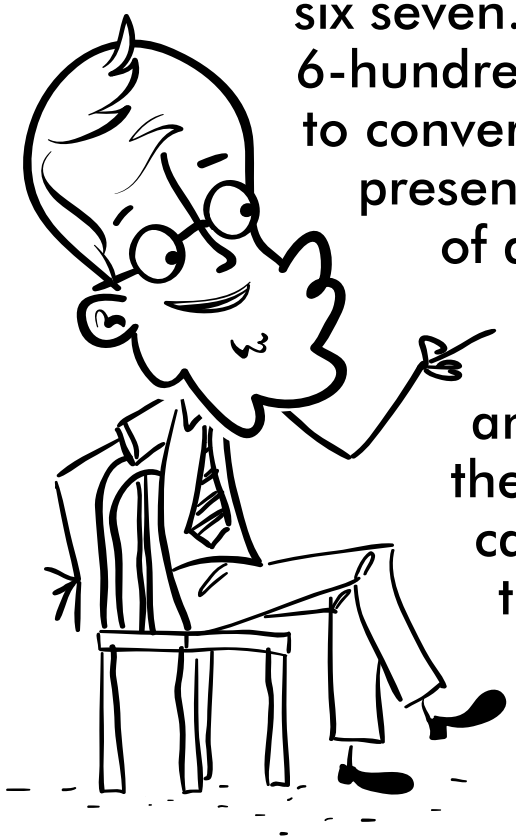
The first step in recording the value of a minimal collection is listing in order the number of pieces of each type from largest to smallest. For example, for a collection consisting of 1 strips, 2units, 4 striplets and 3 matlets we write 1243. Then, to distinguish this from a collection, say, of 1 units, 2 striplets, 4 matlets and 3 strip-matlets, we place a period between the number of units and the number of striplets. Thus, the value of the former collection is recorded as 12.43 while that of the latter collection as 1.243.



The period placed between the number of units and the number of striplets is called a ***decimal point***. Recording the value of a collection may require one or more zeros to the right of the decimal point. E. g., the value of a collection consisting of 3 strip-matlets is recorded .003 since it contains no striplets or matlets.

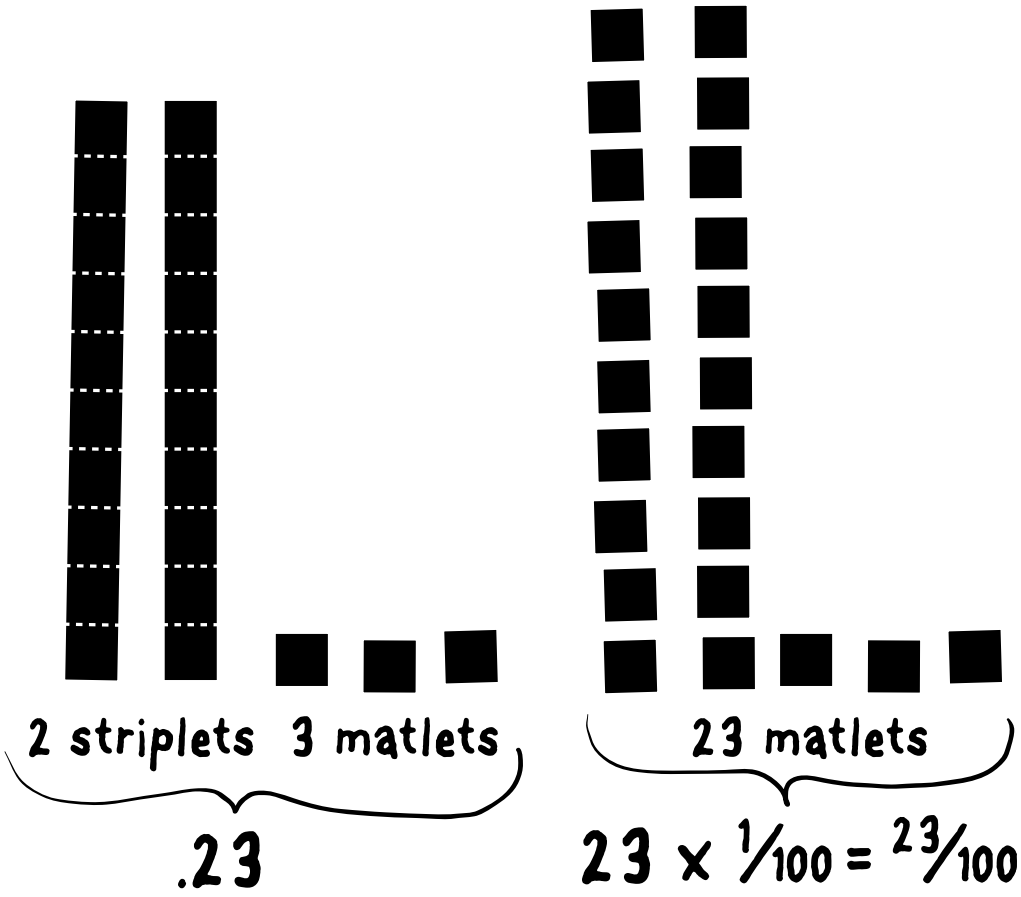
FYI. Some texts avoid starting a numeral with a decimal point so that, for example, the value of a collection of 6 striplets is recorded as 0.6 rather than .6. In British publications, the decimal point may be raised: 3•45. The use of a decimal point is not universal; in some non-English speaking countries, a decimal comma is used, for example, 3.45 is written 3,45.

There are a number of ways in which a decimal like .467 can be read. One way, which is easy to say and easy to understand, is "point four six seven." Another, not very common way, is "four-tenths, 6-hundreths, and 7 thousandths." The most common way is to convert all pieces in a collection into the smallest piece present and report the number of these: .467 is the value of a collection containing 4 striplets, 6 matlets and 7 strip-matlets which can be converted into 467 strip-matlets (each matlet contains 10 strip-matlets and each striplet contains 100 strip-matlets). Since the value of each strip-matlet is a thousandth, .467 can be read "four-hundred-and-sixty-seven thousandths." Similarly .68 can be read "68 hundreths" and .2346 can be read "two-thousand-three-hundred-and-forty-six-ten-thousandths."



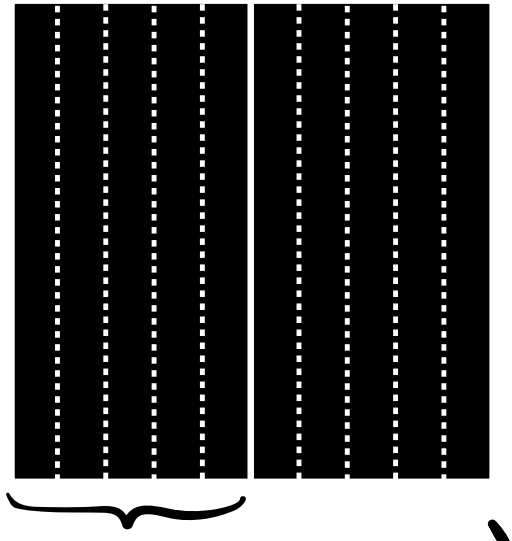
Every decimal can be written as a fraction. Take, for example, .23. It is represented by a collection of 2 striplets and 3 matlets. Since each striplet contains 10 matlets, this collection is equivalent to a collection of 23 matlets each of which has value $\frac{1}{100}$. Thus the entire collection has value $23 \times \frac{1}{100}$, or $\frac{23}{100}$.

Thus, $.23 = \frac{23}{100}$

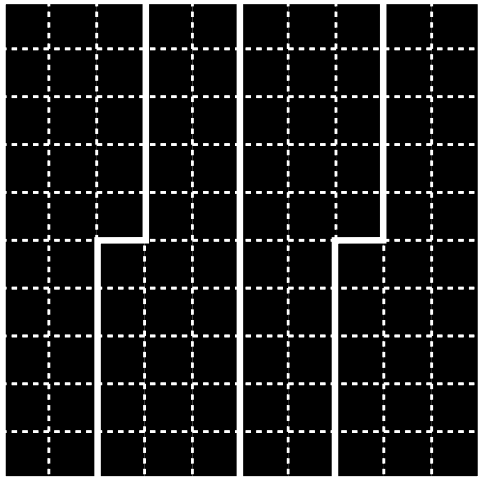


Similarly, a collection for .176 can be converted into 176 strip matlets each of which has value $\frac{1}{1{,}000}$. Hence, $.176 = \frac{176}{1{,}000}$.

Conversely, a fractions whose denominator is a factor of a power of 10 can readily be written as a decimal. For example, $\frac{1}{2} = \frac{5}{10} = 5 \times \frac{1}{10}$. Hence, $\frac{1}{2}$ is represented by 5 striplets. Thus, $\frac{1}{2} = .5$



$1/2$ = 5 striplets = .5



$1/4$ $1/4$ $1/4$ $1/4$

$3/4$ = 7 striplets, 5 matlets = .75

Also, for example, $\frac{3}{4} = \frac{75}{100} = 75 \times \frac{1}{100}$ and hence $\frac{3}{4}$ is represented by 75 matlets, 70 of which can be exchanged for 7 striplets, so $\frac{3}{4}$ is represented by a collection of 7 striplets and 5 matlets. Thus $\frac{3}{4} = .75$.

In a later scene, we shall see how any fraction can be written as a decimal.

END of SCENE 13:
DECIMALS

For comments and questions
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