

TAKE IT TO THE MAT

A NEWSLETTER ADDRESSING THE FINER POINTS OF MATHEMATICS INSTRUCTION



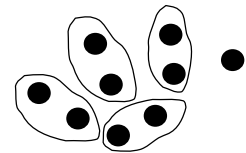
Southern Nevada Regional Professional Development Program
January 2005 — Elementary School Edition

www.rpd.net

A question has been put forth to the editorial staff of *Take It to the MAT* about handling remainders in division. Specifically, how do remainders relate to the decimal portion of a quotient when the dividend is not evenly divisible by the divisor? We'll tackle that question in this issue.

Let's start with a fairly simple example: $9 \div 2$. Before we do the computation, we need to think about what it means. How do we interpret that expression? Many would say, "Find out how many times 2 goes into 9." That is very common to hear, but we're not doing *guzinta* math in this newsletter. (*Guzinta* math is what kids frequently do when dividing—"2 guzinta 9 four times, "3 guzinta 7 two times," etc.)

We're going to focus on the word *groups*. Division is asking the question, "How many *groups* of the divisor are there in the dividend?" Our specific question is, "How many *groups* of two are there in nine objects?" As we can see by the diagram at right, there are four *groups* (of two) with one object left over.



The answer to the exercise $9 \div 2$ can be written in several different ways. The first is with the quotient of four and the remainder of one: $9 \div 2 = 4R1$. There are four groups of two objects with one object left over.

$$\begin{array}{r} 4R1 \\ 2 \overline{)9} \\ \underline{8} \\ 1 \end{array}$$

Now we want to know what to do with that remainder. It's not a whole group, but could be considered part of a group, that is, a *fraction* of a group. We have one object left over, and a group is two objects, so that's one-half of a group. Thus, $9 \div 2 = 4\frac{1}{2}$.

$$\begin{array}{r} 4\frac{1}{2} \\ 2 \overline{)9} \\ \underline{8} \\ 1 \end{array}$$

Finally, we could write the quotient with a *decimal fraction* rather than a *common fraction* as in the previous paragraph. One-half is equivalent to the fraction five-tenths, $\frac{1}{2} = \frac{5}{10}$, which is written as a decimal as 0.5. The remainder is 0.5 groups (of two).

$$\begin{array}{r} 4.5 \\ 2 \overline{)9.0} \\ \underline{8} \\ 10 \\ \underline{10} \\ 0 \end{array}$$

Therefore, $9 \div 2 = 4.5$.

There is an inclination for students to simply take the remainder and write it as a decimal, as shown in the figure. This is an incorrect procedure. (Sometimes it works when the divisor is a power of ten, but not always, and it's not worth taking the time to teach some shortcut for those rare occasions.) What we would be essentially saying is that there are four and one-tenth *groups*. The whole number portion, four, is correct. But there is not one-tenth of a *group* left over—there is one-half of a *group*.

$$\begin{array}{r} 4.1 \\ 2 \overline{)9} \\ \underline{8} \\ 1 \end{array}$$

Incorrect Procedure!

There are several reasons why kids make the mistake of simply writing any remainder as a decimal. Usually, they are taking their correct understanding that the decimal portion in the quotient relates to the remainder, but are incorrectly writing its value.