Long Division

Single unit division
To teach long division, we will build from a very simple problem to a more complex one. We begin by dividing the following:

```
   1            1            1            1            1
9)1234       9)1234       9)1234       9)1234       9)1234
               9            9            9            9
                            3            3           33
```

9 divides   we multiply   Subract   check by   Bring down
into 12 by 1   1 times 9   9 from 12   adding 3 to 9   the next number (3)
                                              getting 12   in the dividend

Now we repeat the process with the 33 being used instead of the 12.

```
  13           13           13           13           13
9)1234       9)1234       9)1234       9)1234       9)1234
   9            9            9            9            9
  33           33           33           33           33
               27           27           27           27
                             6            6           64
```

9 divides   we multiply   Subract   check by   Bring down
into 33 by 3   3 times 9   27 from 33   adding 6 to 27   the next number (4)
                                              getting 33   in the dividend

Now we repeat the process with the 64 being used instead of the 33

```
  137          137          137          137          137
9)1234       9)1234       9)1234       9)1234       9)1234
   9            9            9            9            9
  33           33           33           33           33
  27           27           27           27           27
  64           64           64           64           64
               63           63           63           63
                             1            1            1
```

9 divides   we multiply   Subract   check by   Simce there are no
into 64by 7   7 times 9   63 from 64   adding 1 to 63   more numbers the
                                              getting 64   1 is considered the
                                                                 remainder

After your child can do this problem quickly with lots of practice, have him/her do all the work in his/her head so that it looks like this:

```
   137 R1
9)1234
```

Two digit division
We are now going to divide 93 into the same number:

$$
\begin{array}{llll}
\underline{\quad 1\ } & \underline{\quad 1\ } & \underline{\quad 1\ } & \underline{\quad 1\ } \\
93)1234 & 93)1234 & 93)1234 & 93)1234 \\
& 93 & \underline{93} & \underline{93} \\
& & 30 & 304
\end{array}
$$

9 divides into 12,1	Multiply 93 by 1	subtract 93 from 123 and Check results	bring down the 4

We just look at the leading digit of the divisor to get the trial divisor of 1.

$$
\begin{array}{llll}
\underline{\quad 13\ } & \underline{\quad 13\ } & \underline{\quad 13\ } & \underline{\quad 13\ }\text{R 29} \\
93)1234 & 93)1234 & 93)1234 & 93)1234 \\
\underline{\ 93} & \underline{\ 93} & \underline{93} & \underline{\ 93} \\
304 & 304 & 304 & 304 \\
& \underline{273} & \underline{273} & \underline{273} \\
& & 29 & 29
\end{array}
$$

9 divides into 30 of the 304, for 3	Multiply 93 by 3	subtract 273 from 304 and check results	Remainder is 29

You will notice that we only use the leading digit of the divisor to find a trial quotient. We will use 1 or 2 digits of the dividend, This mental arithmetic saves us a lot of wasted writing.

Three digit divisor
In doing our mental arithmetic, we note when we multiply two digits we get one or two for an answer:

$$
\begin{array}{ll}
2 & 9 \\
\underline{x3} & \underline{x7} \\
6 & 63
\end{array}
$$

Thus when we are using a trial divisor we may use the first or first two digits of the dividend to get a trial quotient. When we test this trial quotient, we multiply by the first two digits of divisor because the carry might cause the number to be bigger than anticipated. This allows us to do mental arithmetic

$$937)\ \overline{4407648}$$ in your head 44/9 =4   4x93=372 which is <440

```
      4                    4                      4                        4
937)4407648        937)440768          937)440768            937)440768
                      3748                  3748                    3748
                                            659                    6596
                   multiply          subtract and check      bring down the 6
                                        659 < 937
```

in your head   65/9 =7   7x93=651 which is < 659

```
       47                              470_                470_                  4704
937)4407648    937>37      937)4407648    937)4407648      937)4407648
   3748        thus 0         3748           3748              3748
   6596        is trial       6596           6596              6596
   6559        quotient       6559           6559              6559
     37                        374           3748              3748
                                                                3748

               bring down 4      937>374
                                 bring down 8
```

With these instructions, you can now divide by five or more digits