Long Multiplication

Before looking at long multiplication we will remind you of how to do some basic multiply with a single digit (number) being the multiplier.

```
      2 6
X  ₁  2
   5 2
```

Steps
1. Say "2 x 6 = 12"
2. 2 goes in the units column under the line and the 1 goes in the tens column above.
3. Say "2 x 2 = 4"
4. Add the 4 (tens) and 1 (carried) ten together and put answer in tens column under the line.

1.
```
      4   3
X         2
   1  2   6
```

2.
```
      2   2   4
X         ₁   3
      6   7   2
```

3.
```
      1   2   5
X     ₁  ₂    4
      5   0   0
```

4.
```
      1   2   4   5
X     ₁  ₂  ₃   6
      7   4   7   0
```

We can also use this technique for multiplying decimals by a single digit
Calculations should be set up as follows:

1.
```
      1  .  3
X            2
      2  .  6
```

2.
```
      2  .  4
X   ₁        3
      7  .  2
```

When multiplying we start from the right, the tenths column, and work to left.

3.
```
      1   2  .  5
X   ₁  ₂        4
      5   0  .  0
```

4.
```
      1   2   4  .  5
X   ₁  ₂  ₃      6
      7   4   7  .  0
```

We use the multiplication algorithm as previously taught for multiplication of whole numbers

Long multiply is an extension of basic multiple we add rows for each additional digit.

Steps

```
      2   6
X    1₁   2
      5   2
+   2₁6   0
    3  1  2
```

1. Start with first number on right and say "2 x 6 is 12"
2. 2 goes in the units column under the line and the 1 goes in the tens column carried over above.
3. Say "two twos are four"
4. Add the four (tens) and 1 (carried) ten together and put answer in tens column under the line.
5. Start new row with 0 and then multiply by the 1, the next digit.
6. Say "1 x 6 =6" answer goes under the 5.
7. Say "1 x 2 = 2" answer goes next to the 6.
8. Then add the two rows together. So 12 x 26 = 312.

1.

```
           4   3                      2   2   4
X          3   2              X          4₁   3
           8   6                      6₁  7   2
+    1   2₁  9   0            +    8₁  9₁  6   0
     1   3   7   6                9   6   3   2
```

When multiplier has more digits we add extra rows and 0's.
Below are examples of 3 and 4 digits.

3.

```
          1    2    5                       1    2    4    5
X        3₁  2₂    4             X        1₁  1₂   2₃   6
          5    0    0                       7    4    7    0
     2    5    0    0                  2    4    9    0    0
+  3₁  7₁    5    0    0           1    2    4    5    0    0
   4    0    5    0    0        +  1   2₁  4₂  5₁   0    0    0
                                  1    4    0    1    8    7    0
```

In some cases there is an alternative to long multiplication for which learners need to be confident with there multiplication tables to be able to use.

The first example above 32 x 43 can be carried out as a two step calculation as 32 appears on the 4 and 8 times table. Therefore a two step calculation can be done by changing 32 to 4 x 8

1.
```
        4  3    Two step         4  3              3  4  4
   X    3  2    alternative   X ₂  8          X          4
   ───────      change 32     ───────         ──────────
        8  6    to 8 x 4      3  4  4          1  3  7  6
+  1  2₁ 9  0
   ───────────
   1  3  7  6
```

2.
```
        2  4  6    Two step        2  4  6          2  2  1  4
   ×       8  1    alternative  X ₄ 5  9       X ₁  1  3  9
   ─────────────   change 81    ──────────     ────────────
        2  4  6    to 9 x 9     2  2  1  4      1  9  9  2  6
+  1  9  6₁ 8  0
   ──────────────
   1  9  9  2  6
```

Long multiplication is also a technique that we use for multiplying a decimal by a decimal. This is the same technique as with whole numbers to start with as we initially ignore the point until the final answer.   Then to place the point in the final answer we count the total number of digits before the point.

1.
```
      2  .  3
   X  3 .₁  4
   ──────────
         9  2
+     6  9  0
   ──────────
      7. 8  2
```
2.3 has 1 digit before the point, the 3.
3.4 has 1 digit before the point, the 4.
Therefore total number of digits is 2, so in the answer we count two digits from the right and place the point.

2.
```
         1  2  .  6
   X        4 .₁  2
   ────────────────
            2  5  2
+     5  0  4  0
   ────────────────
      5  2. 9  2
```

3.
```
   3  .  2  6
X     2 .₁  2
──────────────
      6  5  2
+  6₁ 5  2  0
──────────────
   7. 1  7  2
```
Remember that the smaller numbers are your carry overs. 2 x 6 is 12, so put down 2 carry 1.

4.
```
        4  .  2  1  2
   X          3  .  3
   ──────────────────
         1  2  6  3  6
+  1  2  6  3  6  0
   ──────────────────
   1  3. 8  9  9  6
```

Here are some activities to try

1. Play simple mental quiz games with your child. Take turns of asking each other simple multiplication questions to practice simple multiplication table facts.   E.g. 2 x 8, 9 x 3, 12 x 6,

2. Then start introducing larger numbers and multiply them by 10, 100 and 1000.

3. Then introduce larger numbers but multiply them on paper with single, then double and triple digit numbers.

   It is important that the working is written down. This booklet will help with the method used at school. If you are still concerned ask the teacher and they will explain the methods being used.

4. Play 'BINGO' but instead of just calling the numbers, call them in the form of a mental adding or subtracting sum.

5. Some stores sell colouring books where all the red section are in the 2 times tables, blue is the 3 times tables etc…

6. Ask your child to work out the cost of more than one of a given item at a shop.   E.g. 3 packets of crisps, 4 cans of juice

7. Play with dice and multiply the numbers together. This can be extended to playing with two dice each and multiplying their totals together.

Web Resources
http://math.about.com/cs/multiplication/a/multws.htm
http://www.mathsisfun.com/timestable.html
http://www.wikihow.com/Do-Long-Multiplication
Visual Podcast
http://www.youtube.com/watch?v=t_bnlB2KRL4
http://www.youtube.com/watch?v=3zdt1Y1lpJc&feature=related
http://www.youtube.com/watch?v=m5z6pOsxF_8&feature=related