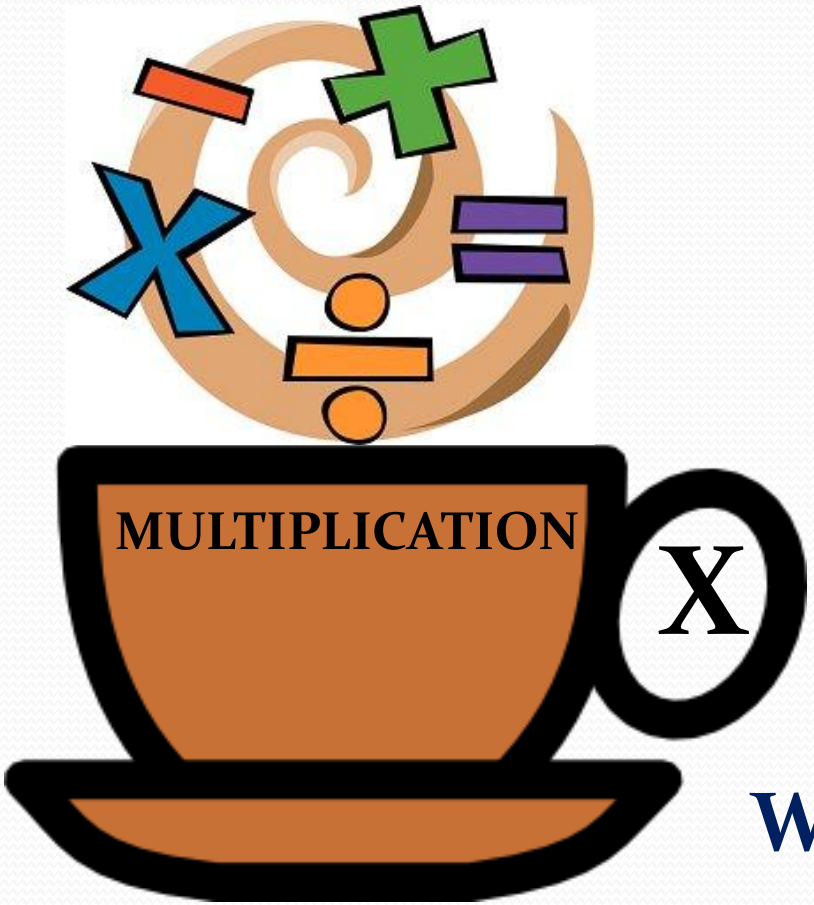
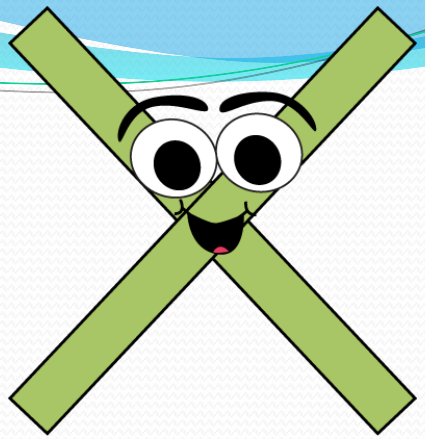
Coffee and Calculations



Workshop 3

Aims of session



To help you:

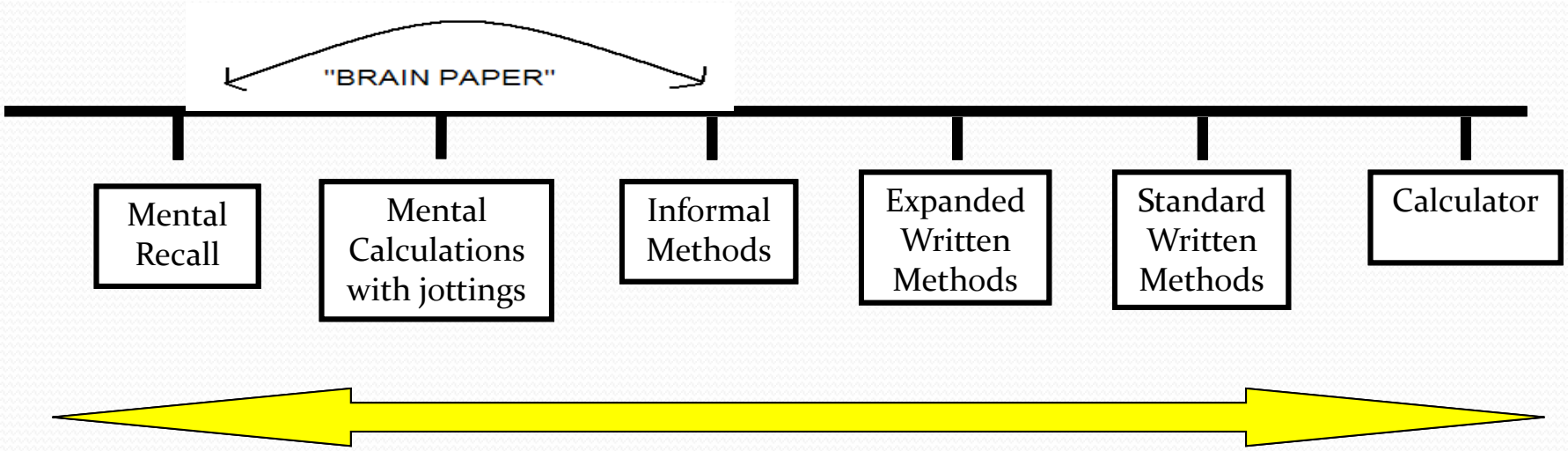
- **Develop your knowledge of the methods children are taught and use in school for multiplication**
- **Understand the progression in methods used as children move up through the school**
- **Support your child's learning at home**

At Gillespie

We want children to be able to do mathematics in their heads, and if the numbers are too large, to use pencil and paper.

Our aim is for children to learn quick and efficient mental and written methods.

The calculating continuum



The calculating repertoire

- Children constantly move up and down the continuum
- Learning a new method of calculating does not mean other ways are no longer relevant
- Children should always be looking for calculations they can do wholly or partly mentally

EXAMPLE:

25 x 8 or

$$\begin{array}{r} 25 \\ \times\ 8 \\ \hline \end{array}$$

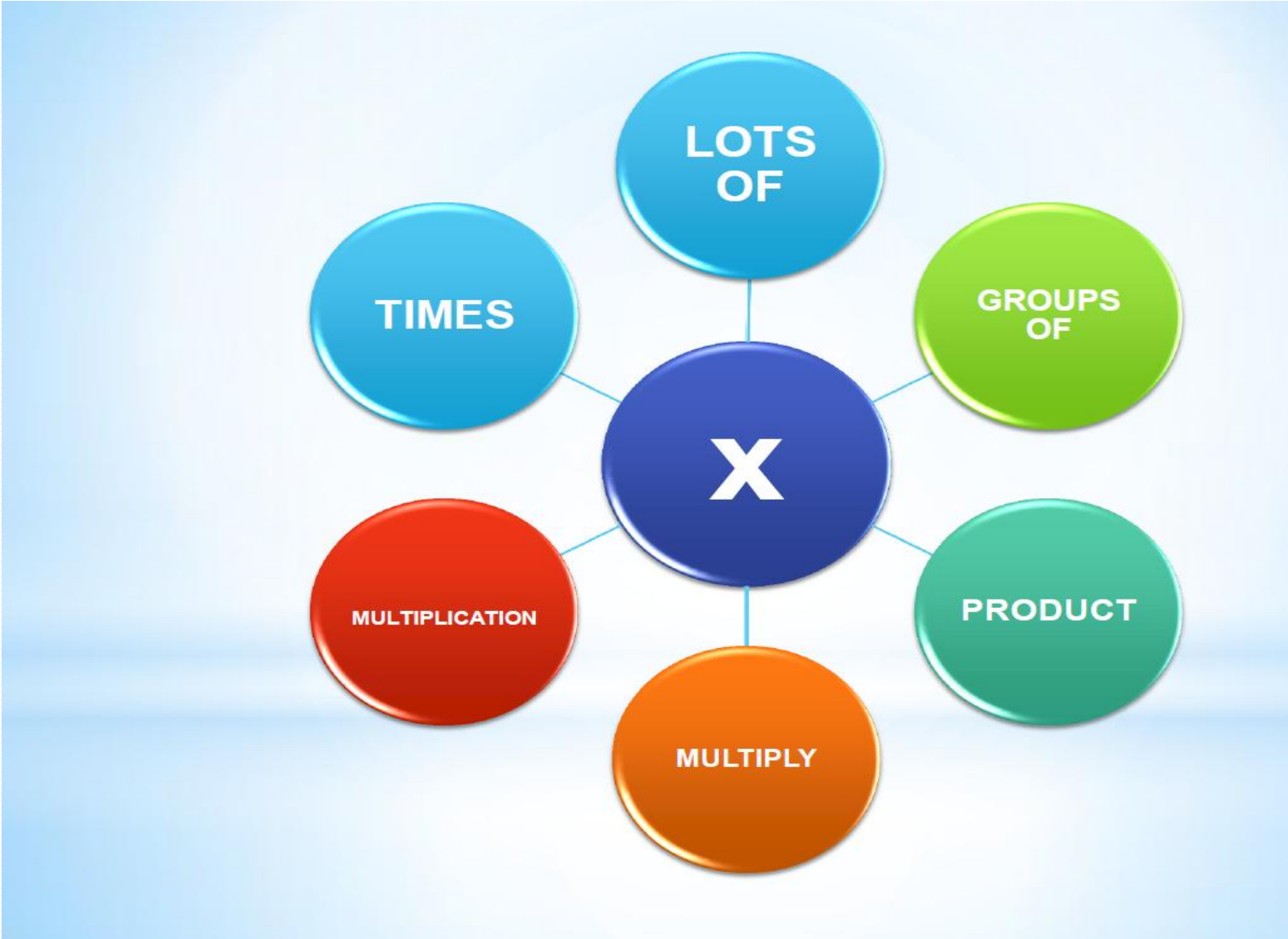
Can I do some of this in my head? What do I already know?

Children relying on written procedures forget how much they can do mentally.

25 x 8 is double 25 x 4

?

Vocabulary of multiplication



Developing successful written methods for multiplication & division relies on children;

- having a secure understanding of place value and partitioning

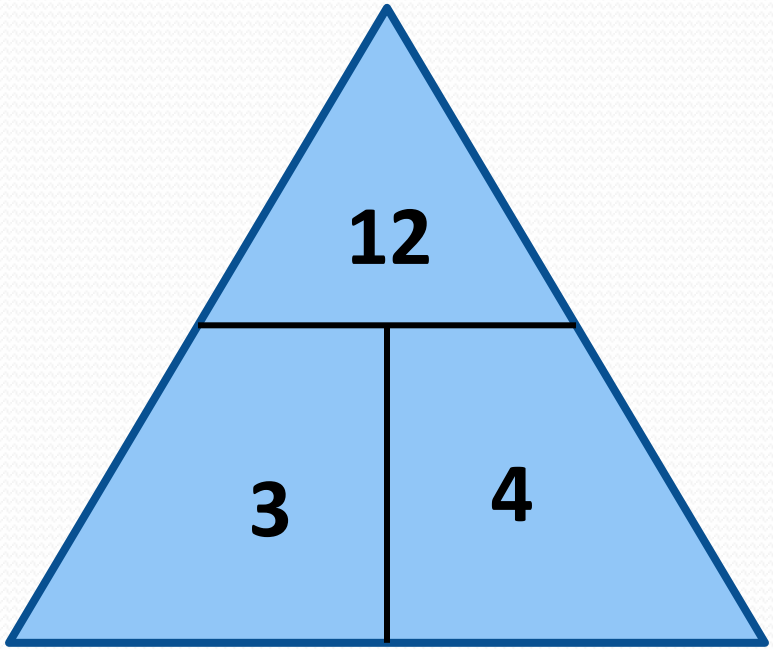
e.g. 37 = 30 + 7 246 = 200 + 40 + 6

- being able to double and halve numbers (x2 & ÷2)

15 + 15 = 30 (15 x 2) 30÷2 = 15

- Understanding how × and ÷ are related (inverse)

Having a thorough understanding of all of the times tables, including division facts.



3x4=12

4x3=12

12÷3=4

12÷4=3

Written methods require children to continuously recall known facts e.g. times tables. Those insecure with multiplication facts can struggle later on.

Multiplication Square

X	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	60	72	84	96	108	120	132	144

Multiplying numbers by 10

When a number is multiplied by 10, it moves one column to the left, e.g.

6 x 10 = 60

H	T	U
		6 (x 10)
	6	0

Multiplying numbers by 10

The same principle applies with bigger numbers

302 x 10 = 3020

Th	H	T	U	
	3	0	2	(x 10)
3	0	2	0	

Children can't rely on the rule that multiplying by 10 means 'add a zero'. They need to understand that the number is changing and getting ten times bigger.

Progression in multiplication

Children are taught multiplication; ✖

- as repeated addition
- represented as arrays
- on a number line (informal method)
- using the grid method
- using more formal written methods

Repeated addition

2 x 4 =

Each child has two eyes. How many eyes do four children have?

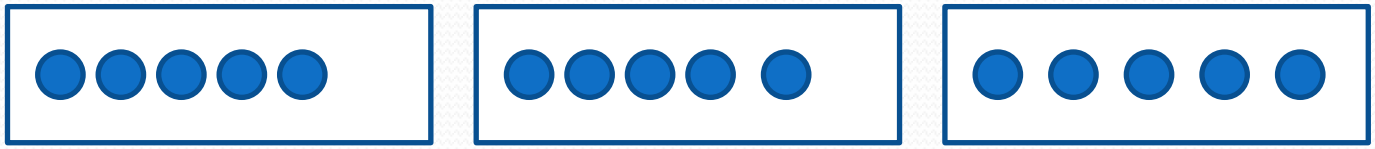
2 + 2 + 2 + 2

Using pictures can help children in the early stages.

5 x 3 =

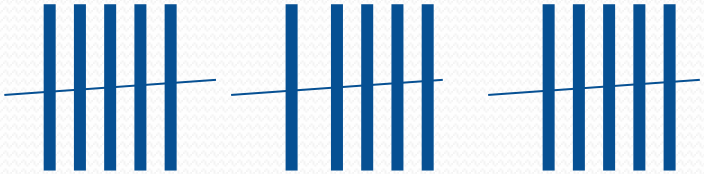
There are 5 cakes in a pack.

How many cakes in 3 packs?



5 + 5 + 5

or

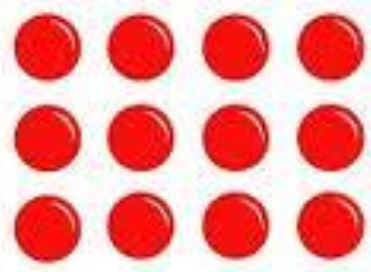


3 groups of 5 or 3 packs of 5 cakes

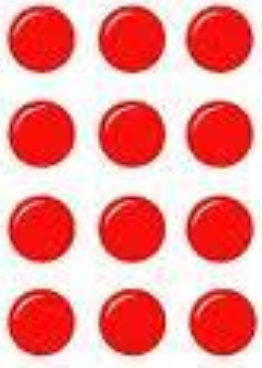
Dots or tally marks are drawn in groups to support repeated addition – quicker than drawing pictures

Arrays 4 x 3 =

A ball costs 4p. How much do 3 balls cost?



or



Drawing an array (3 rows of 4 or 3 columns of 4) gives children an image of the answer. It also helps develop the understanding that 4 x 3 is the same as 3 x 4.

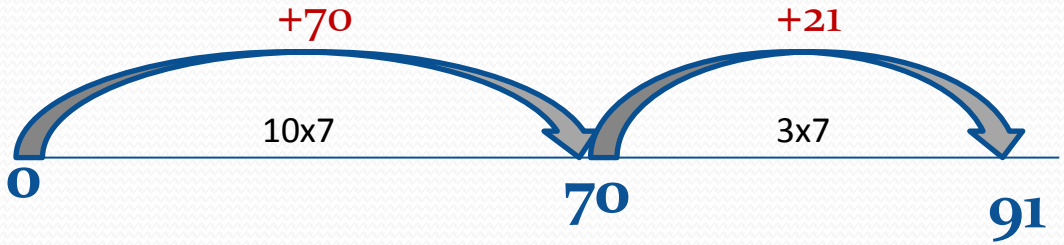
Number lines

6 x 4

There are 4 cats. Each cat has 6 kittens. How many kittens are there altogether?

Children could count on in equal steps, recording each jump on an empty number line. This shows 4 jumps of 6.

There are 13 pens in a box. How many pens in 7 boxes?



70 + 21 = 91 pens in 7 boxes

When numbers get bigger, it is inefficient to do lots of small jumps.

Partition (split) 13 into 10 & 3. This gives you two jumps (10x7 and 3x7).

Grid method for multiplication

47 x 8 =

x	40	7	
8	320	56	376

37 x 46 =

x	30	7	
40	1200	280	1480
6	180	42	222
			1702

Add these together

The grid method visually shows children, that <u>each part</u> of a number is being multiplied by another

Expanded column method

23 x 4 = 92

	T	U
	2	3
x		4
	1	2
	8	0
	9	2

A step before the standard method – the multiplication of units and then tens are recorded in full before adding.

1. Multiply the 'unit' digits together (3x4)
2. Multiply the 'tens' digit by the single 'unit' digit
3. Add the two totals together

Column multiplication- compact (standard) written method

```
  7 2
x   6
-------
 432
-------
  1
```

```
  7 2
x 3 4
-------
  288
 2160
-------
 2448
-------
  1
```

Remember to include the zero here

Misconceptions

3 x 0 = 3 Confusion between × and +

0 x 3 = 3

$$\begin{array}{r} 36 \\ \times\ 3 \\ \hline 39 \end{array}$$

Adding instead of multiplying

$$\begin{array}{r} 36 \\ \times\ 3 \\ \hline 918 \end{array}$$

Carrying digit inserted in the answer. (Place value difficulty)

```
  36
x  3
 98
 ---
  1
```

Forgetting to add the carrying digit

```
  36
x  3
 48
```

Addition of tens column including carrying digit (confusion with addition algorithm)

```
   7 2
x  3 6
  432
  216
  648
```

Incorrect positioning of the tens multiplication (place value error)

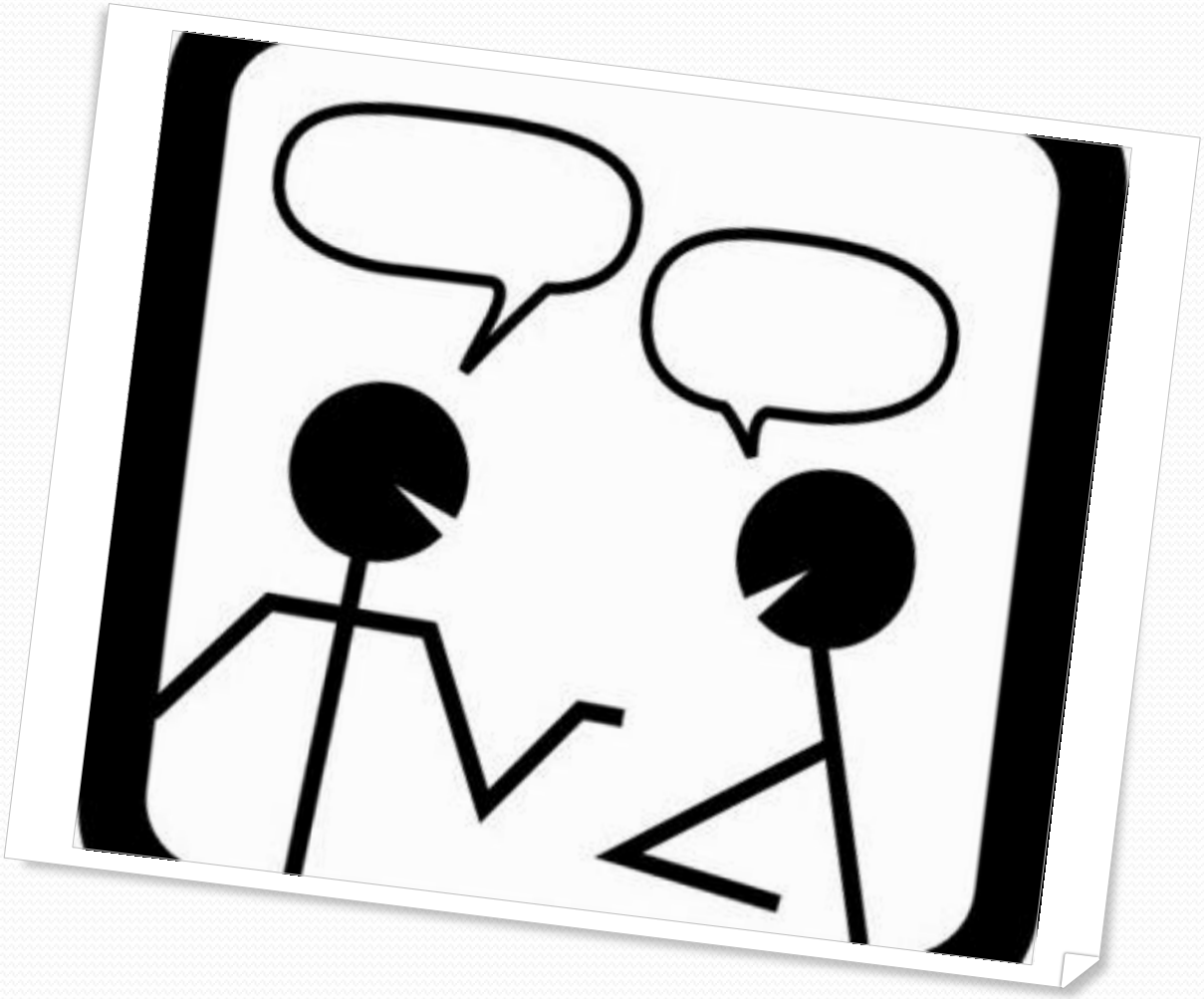
$32 \times 10 = 320$

$3.2 \times 10 = 3.20$

Not understanding that × 10 changes the number and it becomes 10 times bigger. Although answer is correct in the first calculation, problems occur when decimals involved. A rule has been learnt without real understanding.

Encourage the children to approximate first, e.g. 4.92 x 3.1 is approx 5x3, so answer should be approx 15.
Start with mental strategies first…25 x 0.4 is 10 times smaller than 25 x 4, i.e. 10 times smaller than 100, = 10.

Over to you!



Any Questions?