Adding by partitioning

The partitioning of numbers is revisited each year in primary school adding more of the base 10 **parts** (such as hundreds, thousands, ten thousands etc.) each time, moving from 2 digit numbers up to 9 digit numbers by the end of primary school.

For example:

$$7,296 = 7,000 + 200 + 90 + 6$$

$$26,324 = 20,000 + 6,000 + 300 + 20 + 4$$

Up to now partitioning has been used to help solve calculations mentally. The next stage is to use partitioning to help us move towards the column method of addition used by most adults, although don't expect the method you are familiar with to appear just yet!

Let's start with a calculation using smaller numbers while we learn the method.

$$76 + 47 =$$

To solve the calculation mentally first partition the numbers into:

$$70 + 6 \quad \text{and} \quad 40 + 7$$

Then gather the tens together and the ones together.

$$70 + 6 \qquad 40 + 7$$

$$70 + 40 = 110 \quad 6 + 7 = 13$$

Finally add these answers together.

$$110 + 13 = 123$$

Vocabulary
Partitioning
The splitting up of a number into its base 10 parts
321 = 3 hundreds + 2 tens + 1 one **321 = 300 + 20 + 1**

The children use the written method above and perform the parts of the calculation mentally. Once they are confident with this they are then shown how to set it out in a more formal way using columns:

We have the beginnings of a column method!

$$
\begin{array}{r}
70 + 6 \\
+\ 40 + 7 \\
\hline
110 + 13 = 123
\end{array}
\qquad
\begin{array}{l}
\text{estimate} \\
80 + 50 = 130
\end{array}
$$

Again you can see we have estimated by rounding the tens and adding them. If our final answer is close to this answer it is likely to be correct.

A good grasp of partitioning numbers gained from practising adding numbers mentally is invaluable. So, if you've already been practising this with your child you will have helped enormously.

This method of laying out the numbers in the calculation shows clearly the value of the digits in each of the numbers.

Here's an example of a calculation solved by partitioning using three digit numbers.

What is the sum of 176 and 142?

$$
\begin{array}{cccccccc}
 & 100 & + & 70 & + & 6 & & \text{estimate} \\
+ & 100 & + & 40 & + & 2 & & 180 + 140 = 320 \\
\hline
 & 200 & + & 110 & + & 8 & = & 318 \\
\hline
\end{array}
$$

You may notice that the answers to these calculations have been estimated by rounding to the nearest 10. Your child will practise rounding in other maths lessons and will hopefully be using this skill to make sure the answers are 'about right'. If the estimate is very different from the calculated answer it is a warning to go back and check the working out, because something may have gone wrong. In both of the above calculations our estimates were close to our answers so all appears well!

Rounding

Now is a good time to look at rounding numbers in more detail. We round numbers to help us quickly arrive at an approximate figure when calculating mentally and an exact answer isn't necessary. We might use it to work out roughly what a shopping list costs to know if we have enough money in our purse, or to calculate the area of our lawn to see how much grass seed we need to buy. Crucially, estimating mentally first allows us to know if our written calculations seem about right. This is such a useful skill that the sooner a child can master it the better.

When rounding a number, we first need to decide how close to the original number it needs to be.

If, for example, we have the number **234,564** and round it to the nearest 10 this will give us **234,560** but it will still leave this number tricky to work with.

So we need to consider if this degree of accuracy is really necessary.

If it isn't we could consider rounding to the nearest 100 to get **234,600**, which is slightly easier to work with, or to the nearest 1,000 (**235,000**), 10,000 (**230,000**), or even 100,000 (**200,000**).

Rounding to the nearest 100,000 makes the number much easier to work with.

There is a system that helps us to round numbers that always works no matter how large the number.

Let's look at an example:

Round the number 2,346 to the nearest 10.

Firstly, identify the degree of accuracy needed, in this case to the nearest 10. Then, put an arrow above the digit in the number that corresponds to the degree of accuracy needed. Some children find it useful to write the column **place value headings** above the number, at least to begin with.

Vocabulary

Place value headings
The letters representing the value of the column the digit is in.

Th	H	T	O
2	3	4	6

So we need to put an arrow above the tens (T).

↓

Th H T O
2   3   4   6

Next, underline the digit to the right - in this case it is the ones column.

↓

Th H T O
2   3   4   <u>6</u>

The rule now is: If the underlined digit is 5 or higher you round the digit with the arrow on it up by 1, if it is 4 or lower you round down (so the digit with the arrow above it stays the same). A good way for children to remember whether the digit rounds up or down is to associate it with doing a '**high five**' as 5 and higher round up.

Our digit is a 6 so we round the number up and it becomes:

Th H T O
2   3   5   0

You will notice that the digits to the right of the arrowed column are now zero.

Let's work through the same process but rounding the number to the nearest 100 this time.

Put an arrow over the column being rounded to.

$$\downarrow$$

Th H T O
2 3 4 6

Underline the next digit to the right.

$$\downarrow$$

Th H T O
2 3 <u>4</u> 6

The digit 4 tells us to round down so the digit in the hundreds column stays the same and the following digits are made zero.
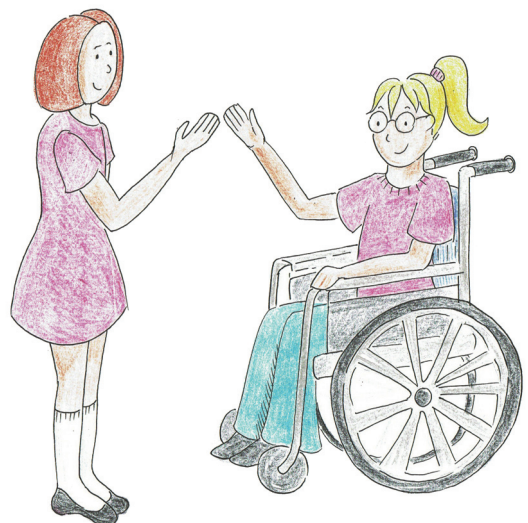
Th H T O
2 3 0 0

Vocabulary

Rounding
Changing a number to the nearest multiple of 10, 100, 1,000, 10,000 etc. to help make the number easier to work with when an exact answer isn't needed.

5 and higher rounds up
4 and lower rounds down

Remember this is the **'high five'** rule.

Activities to help at home

1   Practise rounding a number to the nearest 10.

Start with a two digit number then move onto three or four digits.

For example:

Round 56 to the nearest 10. Round 245 to the nearest 10 etc.

2   Practise rounding other numbers to the nearest 100 or 1,000.

3   Practise estimating addition calculations by rounding to the nearest 10.

For example: *Estimate 52 and 49 =*   (= 50 + 50 = 100)

Estimate 123 + 68 =   (=120 + 70 = 190)

4   Find times at home when you can use numbers in their real context to round or estimate totals.

For example:

What is the population of the UK to the nearest 100,000?

Approximately how many grams of ingredients will there be in this receipe?

5   Worded problems often cause problems for children because they don't remember all the vocabulary that tells them to add. Make sure when you give them problems to solve you use a range of different vocabulary:

*What is 3 **and** 7?*

***Add** 8 and 6.*

*What is 5 **more than** 12?*

*What is 24 **plus** 37?*

***Increase** 76 by 29.*

*What is the **sum of** 129 and 48?*

*Find the **total of** 69, 32 and 14.*

*What are 1,294 and 742 **altogether**?*