Place Value

Place value is the value of each digit within a number. We can use the location of each digit within the number to understand how large or small a number is.

M	HTh	TTh	Th	H	T	O
		1	5	3	7	2
Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

Example

The number 15372 is equivalent to 1 ten thousand, 5 thousands, 3 hundreds, 7 tens and 2 ones.

We say this number as “fifteen thousand, three hundred and seventy-two”.

Rounding to the Nearest 10, 100 & 1000

Rounding to the nearest 10, 100 or 1000 allows us to **approximate the size of a number.**

Check the next digit to the **right**. If this digit is:
↑ 5 or more, round **up**.
↓ 4 or less, round **down**.

Example Round 1478 to the nearest 10, 100 and 1000

Nearest 10	Nearest 100	Nearest 1000
$147 \vdots 8$	$14 \vdots 78$	$1 \vdots 478$
10s digit	100s digit	1000s digit
1478 is between 1470 and 1480	1478 is between 1400 and 1500	1478 is between 1000 and 2000
Check the units digit (to the right). This digit is 8 so we round **up**.	Check the tens digit (to the right). This digit is 7 so we round **up**.	Check the hundreds digit (to the right). This digit is 4 so we round **down**.
$1478 = 1480$ (nearest 10)	$1478 = 1500$ (nearest 100)	$1478 = 1000$ (nearest 1000)

THIRD SPACE LEARNING

Rounding to Decimal Places

Rounding a decimal involves shortening it to a given number of decimal places. This is an **approximation** of the original number.

Check the next digit to the **right**. If this digit is:
↑ 5 or more, round **up**.
↓ 4 or less, round **down**.

Example Round 3.8742 to 1 and 2 decimal places.

1 decimal place	2 decimal places
$3.8 \vdots 742$	$3.87 \vdots 42$
Our answer will not include any digits after the first decimal place.	Our answer will not include any digits after the second decimal place.
1st decimal place	2nd decimal place
3.8742 is between 3.8 and 3.9	3.8742 is between 3.87 and 3.88
Check the hundredths digit (to the **right**). This digit is 7 so we round **up**.	Check the thousandths digit (to the **right**). This digit is 4 so we round **down**.
$3.8742 = 3.9 (1\text{dp})$	$3.8742 = 3.87 (2\text{dp})$

THIRD SPACE LEARNING

Rounding to Significant Figures

Rounding to significant figures is another way to approximate.
We start counting significant figures at the first non-zero digit.

Check the next digit to the **right**. If this digit is:
↑ 5 or more, round **up**.
↓ 4 or less, round **down**.

Example Round 4625 to 1 and 2 significant figures.

1 significant figure	2 significant figures
$4 \mid 625$	$46 \mid 25$
The values of these digits do not affect the answer.	The value of this digit does not affect the answer.
1st significant figure is 4000	2nd significant figure is 600
Check the **2nd** significant figure. This digit is 6 so we round **up**.	Check the **3rd** significant figure. This digit is 2 so we round **down**.
Our answer has **one** non-zero digit.	Our answer has **two** non-zero digits.
$4625 = 5000 (1\text{sf})$	$4625 = 4600 (2\text{sf})$

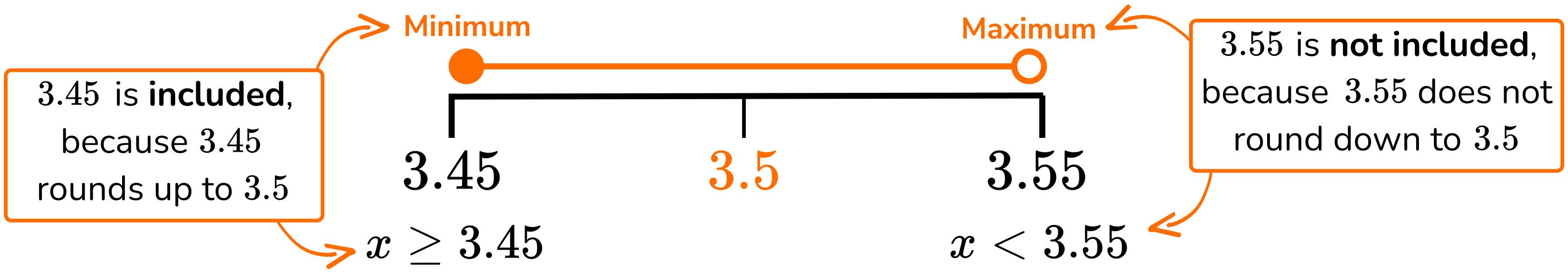
THIRD SPACE LEARNING

Error Intervals

Error intervals are the **limits of accuracy** when a number has been **rounded** or **truncated**. They are the **maximum** or **minimum** values that a number could have been before being approximated via rounding or truncation.

Example A length x is measured as 3.5cm correct to 1 decimal place.

The numbers between 3.45 and 3.55 all round to 3.5 (1dp).



We write the error interval as a double inequality: $3.45 \leq x < 3.55$

Upper and Lower Bounds

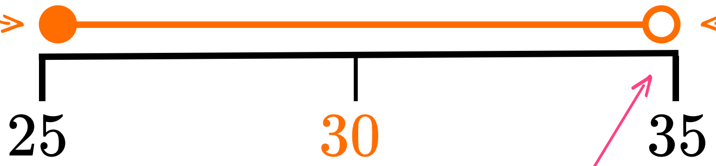
The **upper and lower bounds** of a rounded number are the biggest and smallest values that the number could have been before it was rounded.

Example A number is given as 30 correct to the nearest 10

The numbers between 25 and 35 round to 30 to the nearest 10.

25 is **included**, because 25 rounds up to 30

35 is **not included**, because 35 does not round down to 30



All of the decimal numbers up to 35 **are included** - so 34.5, 34.9, 34.999 would all round to 30

25 is the **lower bound**.

35 is the **upper bound**.

The error interval is $25 \leq x < 35$

Truncation

When we **truncate** a number, we **round down** to a given degree of accuracy.

The word "***truncate***" means "***shorten***".

Examples Truncate:

4.7392 to 2 decimal places

$$4.73 \vdots 92$$

This is the 2nd decimal place.

We **shorten** the number by **removing** all digits after the 2nd decimal place.

$4.7392 = 4.73$ (truncated to 2dp)

39.85 to 1 significant figure

$$3 \vdots 9.85$$

This is the 1st significant figure.

We **shorten** the number by **removing** all digits after the 1st significant figure.

Remember that the 3 means "3 tens" so we **must place a zero** in the ones column to maintain the correct place value.

$39.85 = 30$ (truncated to 1sf)

THIRD SPACE LEARNING

Estimation

When we **estimate**, we use **approximate values** in a calculation to find an **approximate** answer. A good rule of thumb is to round to 1 significant figure.

Example Estimate the answer to $\dfrac{57 \times 2.34}{0.45}$

Use short division:

$$5\,\overline{)\,1\,2\,0\,0}\quad = 0\,2\,4\,0$$

Round everything to 1 significant figure.

$$\frac{57 \times 2.34}{0.45} = \frac{60 \times 2}{0.5} = \frac{120}{0.5}\begin{matrix}\times 10\\ \times 10\end{matrix} = \frac{1200}{5} = 240$$

Round up $5\,|\,7 = 60$ (1sf)

Round down $2\,|\,.34 = 2$ (1sf)

Round up $0.4\,|\,5 = 0.5$ (1sf)

When dividing by a decimal, multiply by powers of 10 to make the divisor/ denominator an integer (whole number).

An alternative (quicker!) method is to recall that dividing by 0.5 is the same as multiplying by 2, so we can just calculate $120 \times 2 = 240$

THIRD SPACE LEARNING