# YEAR 10 – USING NUMBER...

# Non-calculator methods

## What do I need to be able to do?

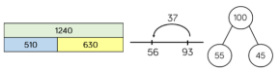
By the end of this unit you should be able to:

- Use mental/written methods for the four number operations
- Use four operations for fractions
- Write exact answers
- Round to decimal places and significant figures
- Estimate solutions
- Understand limits of accuracy
- Understand financial maths

## Keywords

**Truncate:** to shorten, to shorten a number (no rounding), to shorten a shape (remove a part of the shape)
**Round:** making a number simpler, but keeping its place value close the what it originally was
**Credit:** money that goes into a bank account
**Debit:** money that leaves a bank account
**Profit:** the amount of money after income - costs
**Tax:** money that the government collects based on income, sales and other activities
**Balance:** The amount of money in a bank account
**Overestimate:** Rounding up – gives a solution higher than the actual value
**Underestimate:** Rounding down – gives a solution lower than the actual value

## Addition/ Subtraction




Modelling methods for addition/ subtraction

- Bar models
- Number lines
- Part/ Whole diagrams

Addition is commutative

6 + 3 = 3 + 6

The order of addition does not change the result

Subtraction the order has to stay the same

360 – 147 = 360 – 100 – 40 – 7

- Number lines help for addition and subtraction
- Working in 10's first aids mental addition/ subtraction
- Show your relationships by writing fact families

Formal written methods

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| | H | T | O |
|---|---|---|---|
| | 1 | 8 | 7 |
| + | 5 | 4 | 2 |
| | | | |

| | H | T | O |
|---|---|---|---|
| | 4 | 2 | 7 |
| – | 2 | 4 | 9 |
| | | | |

Remember the place value of each column. You may need to move 10 ones to the ones column to be able to subtract

**Decimals have the same methods remember to align the place value**

## Division methods

3584 ÷ 7 = 512

Short division

$$7 \overline{)\,3\,{}^{3}5\;8\;{}^{1}4}\quad 5\;1\;2$$

Complex division

÷ 24 = ÷ 6 ÷ 4

Break up the divisor using factors

### Division with decimals

The placeholder in division methods is essential – the decimal lines up on the dividend and the quotient

24 ÷ 0.02 → 24 ÷ 0.2 → 240 ÷ 2

All give the same solution as represent the same proportion
Multiply the values in proportion until the divisor becomes an integer

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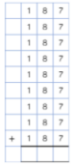
## Multiplication methods

| | H | T | O |
|---|---|---|---|
| | 1 | 8 | 7 |
| × | | | 9 |

Long multiplication (column)

| × | 100 | 80 | 7 |
|---|---|---|---|
| 9 | | | |

Grid method



Repeated addition

Less effective method especially for bigger multiplication

### Multiplication with decimals

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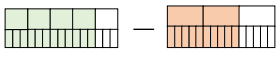
Perform multiplications as integers
e.g. 0.2 x 0.3 → 2 x 3

Make **adjustments** to your answer to match the question: 0.2 x 10 = 2
0.3 x 10 = 3
Therefore 6 ÷ 100 = 0.06

## Four operations with fractions

### Addition and Subtraction

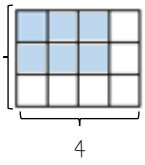
$$\frac{4}{5} - \frac{2}{3}$$



$$\frac{12}{15} - \frac{10}{15} = \frac{2}{15}$$

### Multiplication

$$\frac{3}{4} \times \frac{2}{3}$$




$$= \frac{6}{12} = \frac{1}{2}$$

### Division

$$\frac{2}{5} \div \frac{3}{4}$$

$$\frac{2}{5} \times \frac{4}{3}$$

Multiplying by a reciprocal gives the same outcome

$$= \frac{8}{15}$$

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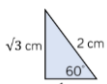
## Exact Values

Leave in terms of $\pi$


$$= \frac{120}{360} \times 36\pi$$

$$= \frac{1}{3} \times 36\pi = 12\pi$$

Leave as a surd




$$\text{Tan}30 = \frac{1}{\sqrt{3}}$$

## Rounding

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2.46192 (to 12dp) - Is this closer to 246 or 247

246 ← 247

2.46 | 192

This shows the number is closer to 246

### Significant Figures

370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00000037 to 1 significant figure is 0.0000004

SF: Round to the first nonzero number

## Estimation

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Round to 1 significant figure to estimate

21.4 x 3.1 ≈ 20 x 3 ≈ 60

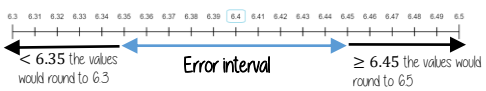
The equal sign changes to show it is an estimation

This is an **underestimate** because both values were rounded down

It is good to check all calculations with an estimate in all aspects of maths – it helps you identify calculation errors

## Limits of accuracy

A width $w$ has been rounded to 6.4cm correct to 1dp



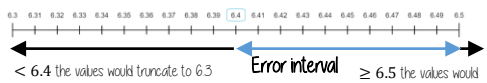

< 6.35 the values would round to 6.3 | Error interval | ≥ 6.45 the values would round to 6.5

The error interval

$6.35 \leq w < 6.45$

Any value within these limits would round to 6.4 to 1dp

A width $w$ has been truncated to 6.4cm correct to 1dp




< 6.4 the values would truncate to 6.3 | Error interval | ≥ 6.5 the values would truncate to 6.5

$6.4 \leq w < 6.5$

Any value within these limits would **truncate** to 6.4 to 1dp