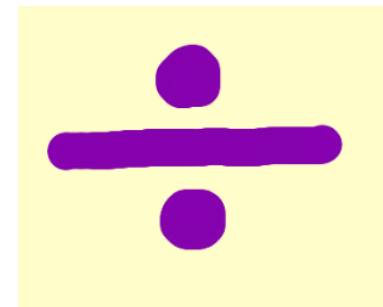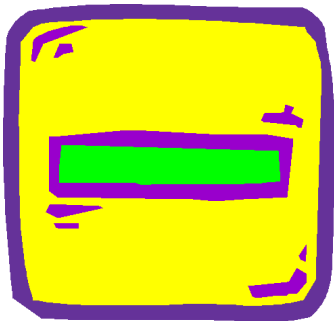# Canon Popham CE Primary Academy

WHOLE SCHOOL PROGRESSION IN CALCULATION STRATEGIES IN MATHEMATICS

GUIDANCE FOR PARENTS & FAMILIES

The Maths Curriculum

Aims of the National Curriculum

- The national curriculum for mathematics is to ensure that all children:

- become **fluent** in the fundamentals of including through varied and frequent mathematics, practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.

- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language

- can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

- Most importantly they MUST master all of these!

Year 5

Number and place value
- Reading, writing, ordering and comparing numbers to at least 1,000,000
- Counting forwards and backwards with positive and <u>negative</u> numbers
- <u>Rounding</u> any number up to one million to the nearest 10, 100, 1000, 10,000, 100,000

Calculating
- Adding and subtracting with numbers up to four digits using <u>column addition and subtraction</u>
- Identifying <u>factors and multiples</u> of different numbers
- Identifying <u>prime numbers</u>
- Multiplying four-digit numbers with two-digit numbers using <u>long multiplication</u>
- Dividing four-digit numbers by one-digit numbers using <u>short division</u>
- Multiplying whole numbers and decimals by 10, 100 and 1000
- Recognising and using <u>square numbers</u> and <u>cube numbers</u>
- Solving problems involving <u>all four operations</u>

Multiples, factors and prime numbers

The **MULTIPLES** of a number are what you get when you multiply that number by an integer. To put it more simple, multiples are just a number's times table.
So the multiples of 8 are 8, 16, 24, 32 etc.
The **FACTORS** of a number are all the numbers that divide into it.
So the factors of 8 are 1, 2, 4, 8.

A prime number is a whole number greater than 1 whose only **factors** are 1 and itself. A factor is a whole numbers that can be divided evenly into another number. The first few prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23 and 29.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Square and cube numbers

Square numbers

A square number is a number multiplied by itself. This can also be called 'a number squared'. The symbol for squared is ^{2}.

$2^2 = 2 \times 2 = 4$

$3^2 = 3 \times 3 = 9$

$4^2 = 4 \times 4 = 16$

$5^2 = 5 \times 5 = 25$

The square numbers up to 100 are: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100

Cube numbers

A cube number is a number multiplied by itself 3 times. This can also be called 'a number cubed'.The symbol for cubed is ^{3}.

$2^3 = 2 \times 2 \times 2 = 8$

$3^3 = 3 \times 3 \times 3 = 27$

$4^3 = 4 \times 4 \times 4 = 64$

$5^3 = 5 \times 5 \times 5 = 125$

The cube numbers up to 100 are: 1, 8, 27, 64

Year 6

Number and place value
•Reading, writing, ordering and comparing numbers to 10,000,000
•Calculating intervals across zero
Calculating
•Multiplying four-digit numbers by two-digit numbers using long multiplication
•Dividing four-digit numbers by two-digit numbers using long division
•Identifying <u>common factors, common multiples</u> and <u>prime numbers</u>
•Solving <u>multi-step problems</u> involving all four operations

Year 5

Fractions, decimals and percentages

•Comparing and ordering fractions whose <u>denominators</u> are all <u>multiples</u> of the same number

•Converting from <u>mixed numbers</u> to <u>improper fractions</u>

•Adding and subtracting fractions whose denominators are multiples of the same number

•Multiplying proper fractions and mixed numbers by whole numbers

•<u>Rounding decimals</u> with two places to the nearest whole number and to one decimal place

•Comparing numbers with up to three decimal places

•Begining to understand <u>percentages</u>

•Knowing percentage and decimal equivalents of 1/2, 1/4, 1/5, 2/5 and 4/5

Vinculum

numerator

denominator

$$\frac{3}{5}$$

Fractions

Proper Fractions:	The numerator is less than the denominator
	Examples: $\frac{1}{3}$, $\frac{3}{4}$, $\frac{2}{7}$

Improper Fractions:	The numerator is greater than (or equal to) the denominator
	Examples: $\frac{4}{3}$, $\frac{11}{4}$, $\frac{7}{7}$

Mixed Fractions:	A whole number and proper fraction together
	Examples: $1\frac{1}{3}$, $2\frac{1}{4}$, $16\frac{2}{5}$

Converting Improper Fractions to Mixed Fractions

To convert an improper fraction to a mixed fraction, follow these steps:

- Divide the numerator by the denominator.
- Write down the whole number answer
- Then write down any remainder above the denominator.

Example: Convert *11*/4 to a mixed fraction.

Divide:

11 ÷ 4 = 2 with a remainder of 3

Write down the 2 and then write down the remainder (3) above the denominator (4).

Answer:

2 *3/4*

https://www.mathsisfun.com/fractions_addition.html

Year 6

Fractions, decimals and percentages

- [Simplifying fractions](#)
- Comparing and ordering fractions
- Adding and subtracting fractions with different denominators
- Multiplying pairs of proper fractions, giving the answer in its simplest form
- Dividing proper fractions by whole numbers
- Multiplying and dividing numbers by 10, 100 and 1000
- Multiplying one-digit numbers with up to two decimal places by whole numbers
- Using written division methods in cases where the answer has up to two decimal places

Ratio and proportion

- Finding [percentages](#) of amounts
- Solving problems involving shapes and scale factors

Year 5

Measuring

• Converting between units of measurement

• Working out the perimeter and area of shapes (including irregular shapes)

• Solving problems involving money and measures

• Solving problems involving converting between units of time

Geometry

• Drawing and measuring angles

• Finding angles around a point, on a straight line and within a right angle

Statistics

• Solving comparison, sum and difference problems using information presented in a line graph

• Completing and interpreting information in tables, including timetables

Angles

Acute Angle
Less than 90°
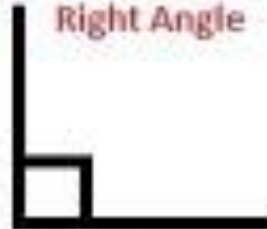
Right Angle
Exactly 90°

Obtuse Angle
Greather than 90° but less than 180°

Straight Angle
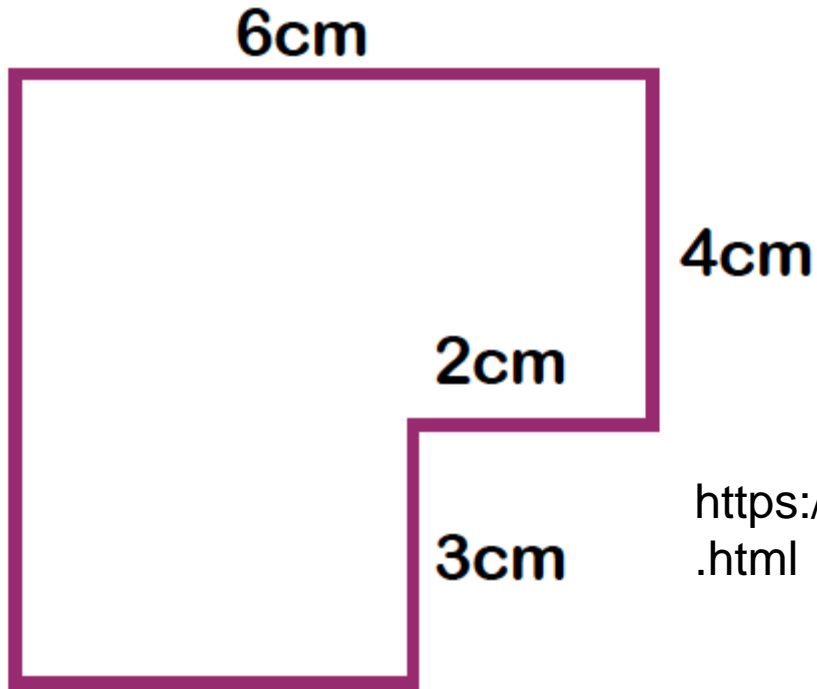Exactly 180°

Reflex Angle
Greater than 180°

Full Rotation
Exactly 360°

6cm

4cm

2cm

3cm
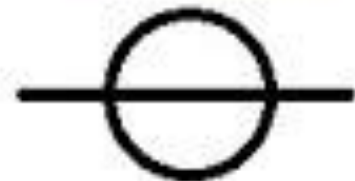
The perimeter is the distance around the edge of a 2D shape. At primary school, teachers will sometimes talk about an ant walking around the edge of a shape to make this concept clear to the children.

Year 6

Algebra
- Using simple formulae
- Generating and describing [linear number sequences](linear-number-sequences)
- Express missing number problems algebraically
- Find pairs of numbers that satisfy an equation with two unknowns

Measurement
- Converting between units of measurement, using decimal notation up to three decimal places
- Working out the perimeter and area of shapes (including parallelograms and triangles)
- Working out the volume of cubes and cuboids

Geometry
- Drawing a 2D shape using given dimensions and angles
- Finding unknown angles in any triangle, quadrilateral and regular polygon
- Illustrating and naming [parts of circles](parts-of-circles), including radius, diameter and circumference
- Recognising angles where they meet at a point, are on a straight line or are vertically opposite
- Plotting coordinates on all four quadrants
- Drawing and [translating simple shapes](translating-simple-shapes) on the coordinate plane and reflecting them in the axes

What do your children need to know?

- They MUST know their times tables and not always in order.

- They also need to know number bonds.

- Place value knowledge is important especially when it comes to working on decimals.

- Therefore, children need to know the value or worth of a number.

Million	Hundred thousand	Ten thousand						$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
M	HTH	TTH	TH	H	T	U	●	10ths	100ths	1000ths

Use the place value grid to help you solve the problems.

They need these vital skills in order to then be able to use written methods.
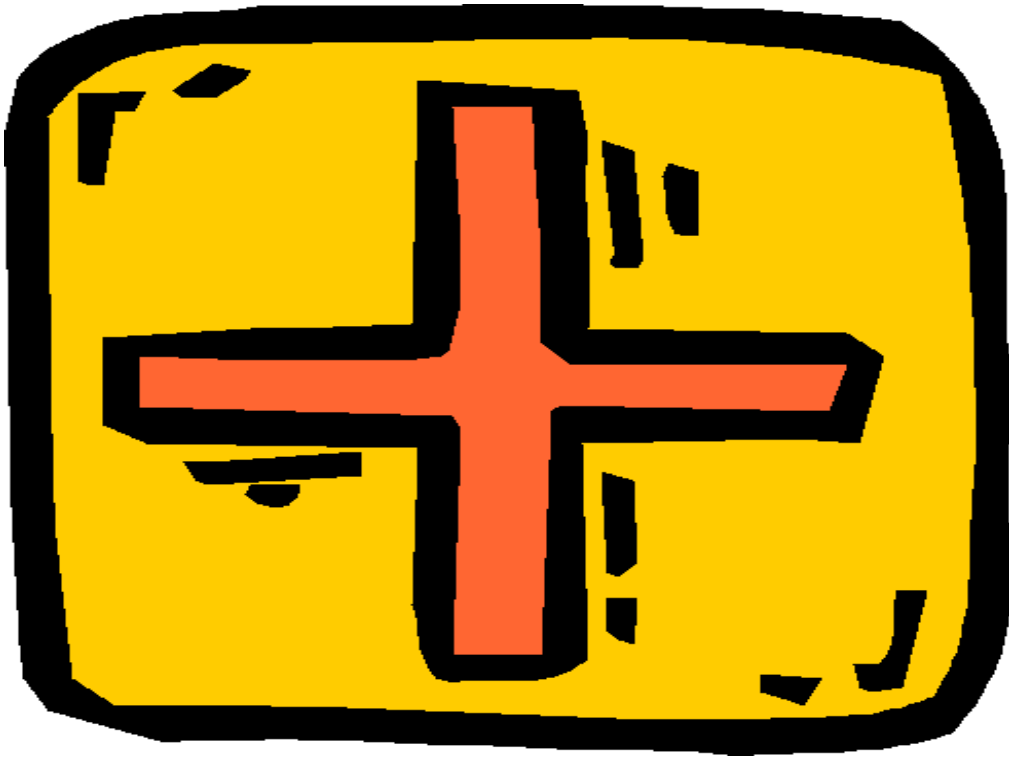
Formal Calculations

Note:

We teach the children to ask themselves 4 questions – in steps - about the calculations they are doing:-

1. Is it a calculation you can do in your head (mentally)? If yes, then do it mentally. If not, then …
2. Is it a calculation you can do with jottings? If yes, then do it using jottings. If no, then …
3. Is it calculation where you need a more formal written method? If yes, then choose the appropriate method.

ADDITION

Year 5

Addition

Add whole numbers >4 digits, including using **formal written methods** (**columnar addition**). Decimals up to 2dp (e.g. 72.5 + 45.7)	Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy. Solve addition multi-step problems in contexts, deciding which operations and methods to use and why.	**Solve problems involving number up to 3dp.** **Solve problems involving converting between units of time.** [*Measurement*] **Use all four operations to solve problems involving measure [e.g. length, mass, volume, money] using decimal notation including scaling. [*Measurement*]**		**Compact** vertical $\begin{array}{r} 23.70 \\ +\ \underline{48.56} \\ \underline{72.26} \\ 1\ 1 \end{array}$	*Pupils practise adding decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1.*

Year 6

Addition

Solve multi-step problems in contexts, deciding which operations/methods to use and why. Decimals up to 3dp (Context: Measures)	Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.	Use knowledge of the order of operations to carry out calculations involving subtraction.	**Solve problems which require answers to be rounded to specified degrees of accuracy.** [*Fractions*] **Solve problems involving the calculation and conversion of units of measure, using decimal notation to 3dp where appropriate. [*Measurement*]**	**Compact** vertical $\begin{array}{r} 3.243 \\ +\ \underline{18.070} \\ \\ \underline{21.313} \\ 1\quad 1 \end{array}$

Stage 6:

Compact column method

789 + 642 becomes

```
      7   8   9
  +   6   4   2
  ─────────────
      1   4   3   1
  ─────────────
          1   1
```

Answer: 1431

SUBTRACTION

Stage 6:

Compact method

874 – 523 becomes

```
    8  7  4
 −  5  2  3
 ─────────
    3  5  1
 ─────────
```

Answer: 351

932 – 457 becomes

```
    8   ¹2  ¹
    9̷   3̷   2
 −  4   5   7
 ─────────────
    4   7   5
```

Answer: 475

Year 5

Subtraction

Subtract whole numbers >4 digits, including using **formal** methods (**columnar subtraction**). Decimals up to 2dp (eg 72.5 - 45.7)	Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy. Solve multi-step problems in contexts, deciding which operations/methods to use and why.	**Solve problems involving number up to 3dp. [*Fractions*]** **Solve problems involving converting betw. units of time. [*Measurement*]** **Solve problems involving measure [eg length, mass, volume, money] using decimal notation including scaling. [*Measurement*]**		**Decomposition** $72.5 - 45.7 = 26.8$ $\begin{array}{r} {}^{6}7\,{}^{11}2.\,{}^{1}5 \\ -\ \ 4\ \ 5.\ 7 \\ \hline 2\ \ 6.\ 8 \end{array}$	*Pupils practise subtracting decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1.*

Year 6

Subtraction

| Solve multi-step problems in contexts, deciding which operations/methods to use and why. Decimals up to 3dp (Context: Measures) | Use knowledge of the order of operations to carry out calculations involving subtraction.

Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy. | **Solve problems which require answers to be rounded to specified degrees of accuracy. [*Fractions*]**

Solve problems involving the calculation and conversion of units of measure, using decimal notation to 3dp where appropriate. [*Measurement*] | • There was 2.5 litres in the jug. Stuart drank 385 ml. How much was left?
• 18.07 km - 3.243 km
• Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why. |

MULTIPLICATION

Multiplication

| Use a **formal** written method (including long x for TU nos)

TU x TU
HTU x U /
HTU x TU
ThHTU x U

Convert between units of measure (eg km/m; m/cm; cm/mm; kg/g; litre and ml) | 2741 x 6 = 16446 (estimate 3000 x 6 = 18000

2 7 4 1
× 6
1 6 4 4 6
4 2 | 24 x 16 = 384 (estimate 25 x 15 = 375)

2
2 4
× 1 6
2 4 0
1 4 4
3 8 4 | 124 x 26 = 3224 [see Y6]

1 2
1 2 4
× 2 6
2 4 8 0
7 4 4
3 2 2 4
1 1 | *Pupils connect multiplication by a fraction to using fractions as operators (fractions of), and to division. This relates to scaling by simple fractions, including those > 1. Find fractions of numbers and quantities, writing remainders as a fraction.* |

Multiplication

Multi-digit numbers (up to 4 digits) x TU whole number using the **formal** method of **long multiplication**.
 	
Multiply one-digit numbers with up to two decimal places by whole numbers
	256 x 18 = 4608 (estimate 250 x 20 = 5000)
	
	256
	× 18
	─────
	2560
	2048
	4608
	1
		124 x 26 = 3224
		
		   1 2
		  1 2 4
		× 2 6
		─────────
		  7 4 4
		2 4 8 0
		─────────
		3 2 2 4
		  1 1
		
		[NB See Y5 method]
			4.7 x 8 = 37.6 (estimate 5 x 8 = 40)
			
			4.7
			X 8
			────
			37.7
			5
			
			[Or 47 x 8, then divide the solution by 10.]
				*Use a variety of images to support understanding of x with fractions. Use understanding of relationship between unit fractions and ÷ to work backwards by x a quantity that represents a unit fraction to find the whole quantity (e.g. if ¼ of a length is 36cm, whole length 36 × 4 = 144cm).
				x numbers with up to 2dp by U/TU whole numbers (starting with simplest cases e.g. 0.4 × 2 = 0.8, and in practical contexts).*

Stage 6:

Short multiplication

24×6 becomes

```
      2  4
  ×      6
  ─────────
  1   4  4
      2
```

Answer: 144

342×7 becomes

```
      3  4  2
  ×         7
  ───────────
  2   3  9  4
      2  1
```

Answer: 2394

2741×6 becomes

```
      2  7  4  1
  ×            6
  ──────────────
  1   6  4  4  6
      4  2
```

Answer: 16 446

Stage 6:

Long multiplication

$$124 \times 26 \text{ becomes}$$

```
        1   2
    1   2   4
×       2   6
─────────────
    7   4   4
2   4   8   0
─────────────
3   2   2   4
─────────────
  1   1
```

Answer: 3224

DIVISION

Division

| Use the **formal** written method of **short division** (interpret remainders appropriately for the context). **HTU ÷ U** **ThHTU ÷ U**

 Convert between units of measure (eg km/m; m/cm; cm/mm; kg/g; litre and ml) | 432 ÷ 5 = 86 r2 (estimate: 400 ÷ 5 = 80)

 $\begin{array}{r} 8\ \ 6\ \ r\,2 \\ \hline 5\ \big|\ 4\ \ 3\ \ ^3 2 \end{array}$ | 8520 ÷ 6 = 1420

 $6\ \overline{\big)\ 8\,^2 5\,^1 2\,0}$ → 1420 | *Pupils connect x by a fraction to using fractions as operators (fractions of), and to ÷. This relates to scaling by simple fractions, incl. those > 1. Find fractions of numbers and quantities, writing remainders as a fraction.* |

Division

Divide numbers (up to 4 digits) by TU whole number using the **formal** method of **short/long division** (interpret as appropriate for the context). Use written division methods in cases where the answer has up to 2dp. *[Divide numbers up to 2dp by U/TU whole numbers.]*	$43.4 \div 7 = 6.2$ (estimate $42 \div 7 = 6$) $6 \quad \times 7 = 42$ $0.2 \times 7 = 1.4$	$43.68 \div 7 = 6.24$ (estimate: $42 \div 7 = 6$) [Or compute $4368 \div 7$, then divide the solution by 100.] $$\begin{array}{r} 6.24 \\ \hline 7\,\overline{)43.^16^28} \end{array}$$	$496 \div 11$ (estimate $500 \div 10 = 50$) $$\begin{array}{r} 4\quad5\ \ r\,1 \\ \hline 11\,\overline{)4\ \ 9^5\ 6} \end{array}$$ Answer: $45\frac{1}{11}$

Stage 6
Short Division

$98 \div 7$ becomes

$$
\begin{array}{c}
\ \ \ 1 \ \ 4 \\
\ \ \ \ \ \ \ \ \ ^{2} \\
7\, |\, 9 \ \ 8
\end{array}
$$

Answer: 14

$432 \div 5$ becomes

$$
\begin{array}{c}
\ \ \ 8 \ \ 6 \ \ \text{r}\,2 \\
\ \ \ \ \ \ \ ^{3} \\
5\, |\, 4 \ \ 3 \ \ 2
\end{array}
$$

Answer: 86 remainder 2

$496 \div 11$ becomes

$$
\begin{array}{c}
\ \ \ 4 \ \ 5 \ \ \text{r}\,1 \\
\ \ \ \ \ \ \ ^{5} \\
1\ \ 1\, |\, 4 \ \ 9 \ \ 6
\end{array}
$$

Answer: $45\frac{1}{11}$

Long Division

Dangerous Monkeys Swipe Bananas!

Complete the following calculation:

2544 ÷ 12

Go onto the next slide to see the division process for this calculation.

$$
\begin{array}{r}
2\;1\;2 \\
12\,\overline{)2\;5\;4\;4} \\
-\;2\;4 \\
\overline{1} \\
-\;1\;2 \\
\overline{2} \\
2\;4
\end{array}
$$

Let's start by dividing into the first and largest number.

Complete the following calculation:

7397 ÷ 13

Go onto the next slide to see the division process for this calculation.

$$
\begin{array}{r}
\ \ 5\ \ 6\ \ 9 \\
13\,\overline{\smash{\big)}\,7\ \ 3\ \ 9\ \ 7} \\
-\ 6\ \ 5 \\
\hline
8 \\
-\ 7\ \ 8 \\
\hline
1\ \ 1 \\
1\ \ 1\ \ 7
\end{array}
$$

Let's start by dividing the largest number.