Mathematics progression skills with reasoning – Power Maths

Year 5

Number: Number and Place Value with Reasoning

COUNTING
Year 5
interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero Autumn: Unit: 2
count forwards or backwards in steps of powers of 10 for any given number up to 1000 000 Autumn: Unit: 1
Spot the mistake: 177000,187000,197000,217000 What is wrong with this sequence of numbers? **True or False?** When I count in 10's I will say the number 10100? **What comes next?** 646000-10000= 636000 636000 –10000 = 626000 626000- 10000 = 616000 …….

COMPARING NUMBERS

read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
(appears also in Reading and Writing Numbers)

Autumn: Units 1, and 2

Do, then explain
747014 774014 747017
774077 744444
If you wrote these numbers in order starting with the smallest, which number would be third?
Explain how you ordered the numbers.

IDENTIFYING, REPRESENTING AND ESTIMATING NUMBERS

Children should be secure in these. Continue to consolidate.

READING AND WRITING NUMBERS (including Roman Numerals

read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
(appears also in Comparing Numbers)

Autumn: Units 1, and 2

read Roman numerals to 1000 (M) and recognise years written in Roman numerals.

Autumn: Unit 1

UNDERSTANDING PLACE VALUE

read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
(appears also in Reading and Writing Numbers)

Autumn: Units 1, and 2

recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
(copied from Fractions)

Spring: Unit 11

Do, then explain
Show the value of the digit 5 in these numbers?
350114 567432 985376
Explain how you know.

Make up an example Give further examples
Create six digit numbers where the digit sum is five and the thousands digit is two.
Eg 3002000 2102000
What is the largest/smallest number?
Do, then explain
Show the

ROUNDING

round any number up to 1 000 000 to the nearest 10, 100, 1 000, 10 000 and 100 000

round decimals with two decimal places to the nearest whole number and to one decimal place
(copied from Fractions)

Spring: Unit 11

Possible answers
A number rounded to the nearest thousand is 76000 What is the largest possible number it could be?

What do you notice?
Round 343997 to the nearest 1000. Round it to the nearest 10000. What do you notice? Can you suggest other numbers like this?

PROBLEM SOLVING

solve number problems and practical problems that involve all of the above

Autumn: Unit 2

Number: Addition and Subtraction with Reasoning

NUMBER BONDS

Year 5

KIRFs, Fluent in 5, Manipulating the additive relationship and securing mental calculation.
(NCETM materials)

MENTAL CALCULATION

add and subtract numbers mentally with increasingly large numbers

Autumn: Unit 3

True or false?

Are these number sentences true or false?6.17 + 0.4 = 6.57

8.12 – 0.9 = 8.3

Give your reasons.

Hard and easy questions

Which questions are easy / hard?

213323 - 70 =

512893 + 300 =

819354 - 500 =

319954 + 100 =

Explain why you think the hard questions are hard?

WRITTEN METHODS

add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)

Autumn: Unit 3

Convince me

□ + 1475 = 6□24

What numbers go in the boxes?

What different answers are there?

Convince me

INVERSE OPERATIONS, ESTIMATING AND CHECKING ANSWERS

use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy

Autumn: Unit 3

Making an estimate

Which of these number sentences have the answer that is between 0.5 and 0.6

11.74 - 11.18

33.3 – 32.71

Always, sometimes, never

Is it always, sometimes or never true that the sum of four even numbers is divisible by 4.

PROBLEM SOLVING

solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Autumn: Unit 3

Number: Multiplication and Division with Reasoning

MULTIPLICATION & DIVISION FACTS

Year 5

count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
(copied from Number and Place Value)

Autumn: Units 1 and 2

Missing numbers
6 x 0.9 = ☐ x 0.03

6 x 0.04 = 0.008 x ☐
Which numbers could be written in the boxes?

Making links Apples weigh about 170 g each. How many apples would you expect to get in a 2 kg bag?

MENTAL CALCULATION

multiply and divide numbers mentally drawing upon known facts

Spring: Unit 7

Use a fact:

3 x 75 = 225

Use this fact to work out
450 ÷ 6 =
225 ÷ 0.6 =

To multiply by 25 you multiply by 100 and then divide by 4. Use this strategy to solve
48 x 25 78 x 25
4.6 x 25

multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Autumn: Unit 5

Summer: Unit 12

Making links

7 x 8 = 56
How can you use this fact to solve these calculations?
0.7 x 0.8 =
5.6 ÷ 8 =

WRITTEN CALCULATION

multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers

Spring: Units 7

divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context

Spring: Units 7

Prove It
What goes in the missing box?

12 ☐3 ÷ 6 = 212

12 ☐3 ÷ 7 = 212

22 ☐3 ÷ 7 = 321 r 6

323 x ☐1 = 13243

Prove it.

PROPERTIES OF NUMBERS: MULTIPLES, FACTORS, PRIMES, SQUARE AND CUBE NUMBERS

identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers. Autumn: Unit 5	know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers Autumn: Unit 5	establish whether a number up to 100 is prime and recall prime numbers up to 19 Autumn: Unit 5
recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}) Autumn: Unit 5		

Always, sometimes, never?

Is it always, sometimes or never true that multiplying a number always makes it bigger

Is it always, sometimes or never true that prime numbers are odd.

Is it always, sometimes or never true that when you multiply a whole number by 9, the sum of its digits is also a multiple of 9

Is it always, sometimes or never true that a square number has an even number of factors.

ORDER OF OPERATIONS

This objective is 'met' in year 6. Children need to be secure in additive and multiplicative relationships as well as the 'why' and 'how' of each operation.

INVERSE OPERATIONS, ESTIMATING AND CHECKING ANSWERS

Use the inverse

Use the inverse to check if the following calculations are correct:

4321 x 12 = 51852

507 ÷ 9 = 4563

Size of an answer

The product of a two digit and three digit number is approximately 6500. What could the numbers be?

PROBLEM SOLVING		
solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes Autumn: Unit 5	solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign Spring: Unit 14	solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates Spring: Unit 12

Number: Fractions (including Decimals and Percentages) Reasoning

Year 5

COUNTING IN FRACTIONAL STEPS

Spot the mistake

0.088, 0.089, 1.0

What comes next?

1.173, 1.183, 1.193

RECOGNISING FRACTIONS

recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
(appears also in Equivalence)

Summer: Unit 12

What do you notice?
One tenth of £41
One hundredth of £41
One thousandth of £41

Continue the pattern
What do you notice?

0.085 + 0.015 = 0.1
0.075 + 0.025 = 0.1
0.065 + 0.035 = 0.1
Continue the pattern for the next five number sentences.

True or false?
0.1 of a kilometre is 1m.
0.2 of 2 kilometres is 2m.
0.3 of 3 Kilometres is 3m
0.25 of 3m is 500cm.

2/5 of £2 is 20p

COMPARING FRACTIONS

compare and order fractions whose denominators are all multiples of the same number

Spring: Unit 8

Give an example of a fraction that is more than three quarters.
Now another example that no one else will think of.
Explain how you know the fraction is more than three quarters.

Imran put these fractions in order starting with the smallest. Are they in the correct order?
Two fifths, three tenths, four twentieths
How do you know?

COMPARING DECIMALS

read, write, order and compare numbers with up to three decimal places

Spring: Unit 11

Missing symbol

Put the correct symbol < or > in each box

4.627 ☐ 4.06

12.317 ☐ 12.31

What needs to be added to 3.63 to give 3.13?

What needs to be added to 4.652 to give 4.1?

ROUNDING INCLUDING DECIMALS

round decimals with two decimal places to the nearest whole number and to one decimal place

Spring: Unit 11

Do, then explain

Circle each decimal which when rounded to one decimal place is 6.2.

6.32 6.23 6.27 6.17

Explain your reasoning

Top tips

Explain how to round decimal numbers to one decimal place?

Also see rounding in place value

EQUIVALENCE (INCLUDING FRACTIONS, DECIMALS AND PERCENTAGES)

identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths

Spring: Unit 8

Odd one out.

Which is the odd one out in each of these collections of 4 fractions

6/10 3/5 18/20 9/15

30/100 3/10 6/20 3/9

Why?

What do you notice?

Find 30/100 of 200

Find 3/10 of 200

What do you notice?

Can you write any other similar statements?

read and write decimal numbers as fractions (e.g. 0.71 = $^{71}/_{100}$) Spring: Unit 11	recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents Summer: Unit 12

Complete the pattern

71/100	??/100	??/100	??/100
0.71	0.81	???	???

Complete the table.

Another and another Write a fraction with a denominator of one hundred which has a value of more than 0.75?
… and another, … and another, …

recognise the per cent symbol (%) and understand that per cent relates to "number of parts per hundred", and write percentages as a fraction with denominator 100 as a decimal fraction

Spring: Unit 11

Ordering

Put these numbers in the correct order, starting with the largest.
7/10, 0.73, 7/100, 0.073 71%
Explain your thinking

Which is more:
20% of 200 or 25% of 180?
Explain your reasoning.

ADDITION AND SUBTRACTION OF FRACTIONS

add and subtract fractions with the same denominator and multiples of the same number Spring: Unit 9	recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number (e.g. $^{2}/_{5} + ^{4}/_{5} = ^{6}/_{5} = 1^{1}/_{5}$) Spring: Unit 9

What do you notice?

¾ and ¼ = 4/4 = 1
4/4 and ¼ = 5/4 = 1 ¼
5/4 and ¼ = 6/4 = 1 ½
Continue the pattern up to the total of 2.

Can you make up a similar pattern for subtraction?

The answer is 1 2/5 , what is the question

MULTIPLICATION AND DIVISION OF FRACTIONS

multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams

Spring: Unit 10

Continue the pattern

¼ x 3 =
¼ x 4 =
¼ x 5 =
Continue the pattern for five more number sentences. How many steps will it take to get to 3?

5/3 of 24 = 40
Write a similar sentence where the answer is 56.

The answer is 2 ¼, what is the question

Give your top tips for multiplying fractions.

MULTIPLICATION AND DIVISION OF DECIMALS

Undoing

I divide a number by 100 and the answer is 0.33 What number did I start with?

Another and another Write down a number with two decimal places which when multiplied by 100 gives an answer between 33 and 38.
... and another, … and another, …

PROBLEM SOLVING

solve problems involving numbers up to three decimal places

Summer: Unit 12

solve problems which require knowing percentage and decimal equivalents of $^{1}/_{2}$, $^{1}/_{4}$, $^{1}/_{5}$, $^{2}/_{5}$, $^{4}/_{5}$ and those with a denominator of a multiple of 10 or 25.

Spring: Unit 11

Number: Ratio and Proportion with Reasoning

Statements only appear in Year 6 but should be connected to previous learning, particularly fractions and multiplication and division.

Number: Algebra with Reasoning

Year 5

EQUATIONS

use the properties of rectangles to deduce related facts and find ***missing lengths and angles***
(copied from Geometry: Properties of Shapes)

Summer: Units 13 and 14

Connected Calculations

The number sentence below represents the angles in degrees of an isosceles triangle.
A + B + C = 180 degrees
A and B are equal and are multiples of 5.
Give an example of what the 3 angles could be.
Write down 3 more examples .

FORMULAE

Undoing

The perimeter of a rectangular garden is between 40 and 50 metres.
What could the dimensions of the garden be?

SEQUENCES

NRICH Sticky triangles

Measurement with Reasoning

Year 5

COMPARING AND ESTIMATING

calculate and compare the area of squares and rectangles including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes (also included in measuring)

Autumn: Unit 6

estimate volume (e.g. using 1 cm^3 blocks to build cubes and cuboids) and capacity (e.g. using water)

Summer: Unit 16

Top Tips
Put these amounts in order starting with the largest.
130000cm^2
1.2 m^2
13 m^2
Explain your thinking

Undoing
A school play ends at 6.45pm. The play lasted 2 hours and 35 minutes. What time did it start?

Other possibilities
(links with geometry, shape and space)
A cuboid is made up of 36 smaller cubes. 

If the cuboid has the length of two of its sides the same what could the dimensions be?
Convince me

MEASURING and CALCULATING

use all four operations to solve problems involving measure (e.g. **length, mass, volume, money**) using decimal notation including scaling.

Summer: Unit 16

Write more statements
Mr Smith needs to fill buckets of water. A large bucket holds 6 litres and a small bucket holds 4 litres.
If a jug holds 250 ml and a bottle holds 500 ml suggest some ways of using the jug and bottle to fill the buckets.

measure and calculate the **perimeter** of composite rectilinear shapes in centimetres and metres

Autumn: Unit 6

Testing conditions
Shape A is a rectangle that is 4m long and 3m wide.
Shape B is a square with sides 3m.
The rectangles and squares are put together side by side to make a path which has perimeter between 20 and 30 m.
For example

Can you draw some other arrangements where the perimeter is between 20 and 30 metres?

calculate and compare the area of squares and rectangles including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes

Autumn: Unit 6

recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})
(copied from Multiplication and Division)

Autumn: Unit 5

Always, sometimes, never
When you cut off a piece of a shape you reduce its area and perimeter.

See also Geometry Properties of Shape

TELLING THE TIME

solve problems involving converting between units of time

Summer: Unit 16

Working backwards
Put these lengths of time in order starting with the longest time.

105 minutes
1 hour 51 minutes
6360 seconds

CONVERTING

convert between different units of metric measure (e.g. kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)

Summer: Unit 16

solve problems involving converting between units of time

Summer: Unit 16

understand and use equivalences between metric units and common imperial units such as inches, pounds and pints

Summer: Unit 16

The answer is ….

0.3km

What is the question?

What do you notice? What do you notice?
1 minute = 60 seconds
60 minutes = ☐ seconds

Fill in the missing number of seconds
down some more time facts like this.

Geometry: Properties of Shapes with Reasoning

Year 5

IDENTIFYING SHAPES AND THIER PROPERTIES

identify 3-D shapes, including cubes and other cuboids, from 2-D representations

Summer: Unit 14

What's the same, what's different? What is the same and what is different about the net of a cube and the net of a cuboid?

Visualising
I look at a large cube which is made up of smaller cubes. 

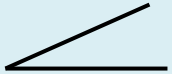
If the larger cube is made up of between 50 and 200 smaller cubes what might it look like?

DRAWING AND CONSTRUCTING

draw given angles, and measure them in degrees (°)

Summer: Units 13 and 14

Other possibilities
Here is one angle of an isosceles triangle. You will need to measure the angle accurately.
What could the other angles of the triangle be?
Are there any other possibilities?



COMPARING AND CLASSIFYING

use the properties of rectangles to deduce related facts and find missing lengths and angles Summer: Units 13 and 14	distinguish between regular and irregular polygons based on reasoning about equal sides and angles Summer: Unit 14

Always, sometimes, never
Is it always, sometimes or never true that the number of lines of reflective symmetry in a regular polygon is equal to the number of its sides n.

Other possibilities
A rectangular field has a perimeter between 14 and 20 meters.
What could its dimensions be?

ANGLES

know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
Summer: Unit 13

identify:

* angles at a point and one whole turn (total 360°)
* angles at a point on a straight line and ½ a turn (total 180°)
* other multiples of 90°

Summer: Units 13 and 14

Convince me

What is the angle between the hands of a clock at four o clock?

At what other times is the angle between the hands the same?
Convince me

Geometry: Position and Direction with Reasoning

Year 5

POSITION, DIRECTION AND MOVEMENT

identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed

Summer: Unit 15

Working backwards

A square is translated 3 squares down and one square to the right.
Three of the coordinates of the translated square are:
(3, 6) (8, 11) (8, 6)
What are the co-ordinates of the original square?

PATTERN

Continue to give children the opportunity to order and arrange combinations of mathematical objects in patterns and sequences.

Statistics with Reasoning

Year 5

INTERPRETING, CONSTRUCTING AND PRESENTING DATA

complete, read and interpret information in tables, including timetables

Autumn: Unit 4

Summer: Unit 16

True or false? (Looking at a train time table) "If I want to get to Exeter by 4 o'clock this afternoon, I will need to get to Taunton station before midday".

Is this true or false?
Convince me.
Make up your own 'true/false' statement about a journey using the timetable.

What's the same, what's different?
Pupils identify similarities and differences between different representations and explain them to each other

SOLVING PROBLEMS

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

Autumn: Unit 4

Create a questions Pupils ask (and answer) questions about different statistical representations using key vocabulary relevant to the objectives.
(see above)