Thornleigh Salesian College
KS223 Curriculum Continuity and Progression

SMART STEPS – KS2 Scheme of Learning

MATHS UNIT

Title / Subject	Mathematics	**Length**	4 Sessions ▪ 1 x compulsory session taught in Year 6 ▪ 2 x optional sessions taught in Year 6 ▪ 1 x session reserved for Induction Day at Thornleigh
Year	6	**Term**	Summer

Unit context and overview	Unit to cover 5 topics which are taught in the first half term of year 7. Topic include negative numbers, factors and multiples, sequences and patterns, dealing with money and fractions and decimals

Compulsory session to be taught in Year 6 class

Objective: To test and understand probability.

Outcome: To plan and carry out a statistical trial; to analyse results and draw conclusions; and to draw simple tree diagrams to represent possible solutions to probability problems.

SMART Quality (s) in focus:
Teamwork and resilience

Session Plan

Read p78-82 of The Curious Incident of the Dog in the Night-Time by Mark Haddon (copies included) - this will describe the problem. (Don not show the children this until afterwards). The same problem is used in the film '21' starring Kevin Spacey. He presents it in a lecture theatre scene early on in the film.

Present the problem to the children and ask for their initial thoughts. What would they do? Why? Would we be more likely to win if we stick or change? Why? Identify children who are beginning to use the language of probability and praise/consolidate.

Ask the children how we could test our theories and lead them to decide that they could use 3 opaque cups as the doors and a counter/cube as the car. The trial will require two opposing contests: one who always sticks and one who always changes. Complete a set number of trials (perhaps 10) for each contestant and record each person's success rate. Who won most often?

The trial stage is best completed in groups of 3. After completing it will be beneficial to combine all the groups' results to create a class data-set. Why are the combined results more valid?

Hopefully the class results will prove that the 'changers' won most often. Why was this? Luck?
Use the tree-diagram from page 81 of the book to prove to the children the probability is 2/3 for the 'changers' and 1/3 for the 'stickers'.

Suggested follow-up activity:

Coin-tossing – can the children invent a trial for a coin toss? For instance, how likely are you to throw exactly 3 heads in a series of 5 tosses? Let the children have fun with coins, keeping a tally for how many times they throw 3 heads in 5 tosses. Will the probability change if the 3 heads all have to fall consecutively within the 5 tosses?

Children are to draw a tree diagram to show all permutations of the 5 coin tosses.

Success Criteria – How will you know if a student is making progress and is *ready for the next step*?

- Can the children plan and carry out a fair statistical trial?
- Can the children analyses statistical results and show an understanding of sample size and its impact on validity?
- Can the children draw a tree-diagram to illustrate all permutations of a statistical trial?

Differentiation –
How could you make each step more accessible?

Consider using mixed-ability groups of 3 for the trial stage. Alternatively, a group of LA pupils could complete the trial with support. Targeted questioning during the analysis and discussion stage will allow for support and challenge. Clear modelling of a 'tree-diagram' will help with the final stage, or a pre-prepared scaffold, which the missing information can be added to may allow for easier access.

How to ensure the session is challenging for all?

More able children could be asked to design their own trail independently and could be asked to prepare a diagram which shows all the possible permutations without any previous teacher modelling.

Key questions that you might ask students during the lesson:

How can we test whether your opinion is correct?
Can you prove that your opinion is correct?
How could we make the results of the statistical analysis more valid?

Method of assessment:
Observations of the children's trials.
Children's written explanations of their findings.

How to make this task shorter?

Complete the trial stage as a whole class.
Direct the children as to how to complete their follow-up activity involving a coin toss.

Optional session to be taught in Year 6 class

Objective: To be able to add, subtract, multiply and divide negative numbers

Outcome: Calculate with negative numbers and create their own questions that give them the highest values possible

SMART Quality (s) in focus:
Self-belief and awareness of others

Session Plan
Plan for Step 1: Practice calculating with negative numbers. Questions to attempt on this as a practice from previous knowledge.

Plan for Step 2: Build an army of questions by cutting out all of the numbers/symbols and arranging them so that they end up with the best answers possible (ten questions created). They then compare these in order with other students like top trumps, and the winner for each question gets a point. After all ten answers have been compared, the winner is the pupil with the highest score.

Plan for Step 3: Pupils to improve their army after a couple of games to try and win more games. Pupils to play against teachers army and compare armies. Suggest improvements to the teachers/other students armies

Success Criteria – How will you know if a student is making progress and is *ready for the next step*?
SC for Step 1: Calculate adding, subtracting, multiplying and dividing negative numbers

SC for Step 2: Create their own army and all calculations are correct

SC for Step 3: Compete against teacher army and know how to improve their army.

Differentiation – How to ensure the session is challenging for all.
How could you make each step more accessible?
Step 1: Only use multiply and divide questions which eradicate the misconceptions of double negatives etc…

Step 2: Have an army already built so that the pupil can concentrate on working out the answers rather than the strategy of organising the values to make the best soldiers

Step 3: Access to a number line so that pupils can use it to calculate answers

How could you make each step more challenging?
Step 1: Suggest ways to improve their army and compete with others to be able to beat everyone

Step 2: Compete against the teachers best army, can they get a 10-0 win? Is it possible?

Step 3: Include decimals/fractions and powers

Key questions that you might ask students during the lesson:

What happens when you multiply/divide 2 negative?
What happens when you add/subtract 2 negatives?
How can you ensure that you will always get a positive answer for your soldiers?

Method of assessment

Have pupils correctly answered their questions correctly? Are the soldiers accurate?

How to make this task shorter?

Have the numbers and symbols printed out ready so students do not need to cut them out.
Create a set of different Army's to allocate to students so that they can get straight onto playing the games rather than arranging themselves.

Optional session to be taught in Year 6 class

Objective: To be able to collect and display data in a variety of forms using suitable data collection and data representation methods. To be able to draw a conclusion from the data based on what they wanted to find.

Outcome: Pupils will be able to demonstrate that they understand the data cycle by carrying out a survey of their peers about 'How they feel about joining Thornleigh'. They will be expected to carry out the survey, record the data accurately and then represent the data in the form of charts and graphs. They will then be expected to come up with a conclusion based on their results.

SMART Quality (s) in focus:
Self-belief – to have the confidence to speak to other members of their class and to be able to answer questions asked by others
Teamwork – the data will be collected in class so pupils will need to work together to ensure they all get the data they need
Awareness of others – The questions they will be asking will be geared towards how students feel about starting at Thornleigh. They will have to be aware of how other pupils feel in the class about this time in their life

Session Plan
Plan for Step 1:
Pupils to come up with their question that they will ask their peers about 'starting at Thornleigh'. Examples of good and bad questionnaire questions will be shown to pupils for discussion so that pupils can confidently create a good question with which to collect data.

Plan for Step 2:
Pupils then need to collect the data using their questionnaire and create a suitable data collection table. Examples of good and bad data collection tables will be shown so that pupils are made aware of what makes a good data collection table. Give pupils time to get round to every member of the class. Pupils could be given a class list of names so that they can 'monitor the population' as they ask their questions

Plan for Step 3:
Pupils will then be required to present their findings in the form of charts and graphs. An introduction to discrete and continuous data will be needed here so that pupils know how to set out their graphs (discrete data has gaps between the bars, continuous has no gaps) as well as looking at examples of good and bad representations of data.

Success Criteria – How will you know if a student is making progress and is *ready for the next step*?
SC for Step 1:
Can create a questionnaire where all of the questions are relevant/accurate/not misleading. To ensure that there are no overlapping boxes on response boxes, the question has a time frame if needed and all options of answers are covered.

SC for Step 2: Can draw an accurate bar chart/line graph to represent their data, taking care to label axes and ensure gaps (or no gaps) between the bars.

SC for Step 3: Can represent the data with a more complex chart, such as a pie chart. Again ensuring accuracy of labelling and presentation.

Differentiation – How to ensure the session is challenging for all.
How could you make each step more accessible?
Step 1: A question is created for pupils so that they can concentrate solely of collecting and recording the data.

Step 2: Data collection table already created so that they just concentrate on thinking of a question and then asking their peers.

Step 3: Axes already drawn so that they can easily convert their data into a graph.

How could you make each step more challenging?
Step 1: Create a question for a questionnaire that is not accurate. Why is it not accurate?

Step 2: Is there only one way to collect the data for your question? Can you show another data collection table that could be used? What makes a good data collection table?

Step 3: Can pupils create any other charts and graphs? Give pupils some data from 'another source' and get them to create pie charts, cumulative frequency graphs etc…

Method of assessment: Students to present findings to each other as a class, this will allow students to show what they have found and share good ideas with others. Write a conclusion on what they have found based on the results.

How can we make the task shorter? Create some data that has already been 'collected' and students can analyse this. Have some ready created axes for students to draw bar charts with, as drawing axes takes students the most time and effort. Have some pre-created charts and graphs, i.e. pie chart/bar chart for students to analyse.

Optional session to be taught in Year 6 class

Objective: To be able to identify factors, squares and primes of numbers using multilink cubes to create different rectangles.

Outcome: Pupils can list factors of numbers up to 20 and can identify the square and prime numbers. Pupils can identify the highest common factor of two numbers up to 20.

SMART Quality (s) in focus: Teamwork, resilience

Session Plan

Plan for Step 1: Create rectnagles from multilink cubes – start off with 6 as an example. Show that the only rectangles that can be made from 6 cubes are 6x1 and 3x2. 1,2,3 and 6 are thr factors of 6. Pupils to work in pairs and fill in the table in their booklets for the numbers 1 – 20.

Plan for Step 2: Discuss that some rectangles only have two factors (use 7 as an example) and pupils to identify all of these. These are the prime numbers (2,3,5,7,11,13,17,19) and encourage pupils to do the same with square numbers (1,4,9,16).

Plan for Step 3: Pupils to begin to identify the HCF of two numbers (use 12 and 8 as an example) compare lists of factors and circle the largest

Success Criteria – How will you know if a student is making progress and is *ready for the next step*?

SC for Step 1: Identify all of the factors of numbers up to 20

SC for Step 2: Identify the prime and square numbers up to 20

SC for Step 3: Calculate the Highest Common Factor of 2 numbers up to 20

Differentiation – How to ensure the session is challenging for all.

How could you make each step more accessible?

Step 1: Could have the rectangles drawn out for pupils to just count the squares for factors.

Step 2: Use of a timestable grid to help with the factors if struggling to create rectangles (especially with cubes over 12)

Step 3: Diagrams of multilink cubes drawn already to illustrate the square numbers.

How could you make each step more challenging?

Step 1: Find factors of numbers larger than 20 and without using multilink to make rectangles.

Step 2: Identify prime and sqaure numbers over 20 by considering factors and division. Possible link onto cube numbers by making cubes from multilink (1,8,27)

Step 3: Calculate the HCF of numbers larger than 20 and calculate HCF of 3 or more numbers.

Key questions that you might ask students during the lesson:

What is the difference between a factor and a multiple?
What is the definition of a prime number?
What is a square number?
What is the difference between a square and rectangle?
How can you tell if a number is prime or not quickly?
How many different factors does a square number have compared to a non-square number?

Method of assessment:

Steps of questions to work through in booklet.
Step 1: Complete the factors table
Step 2: Identify all of the prime and square numbers (write them as a list)
Step 3: Finding the HCF example question using what they have learnt
Step 4(ext): Find th HCF of three or more numbers

Could students do any independent study to stretch and challenge themselves?

Sieve of Eratosthenes to identify primes up to 100 and extend learning on multiples.

How can you make this task shorter?

Have pictures ready of the different combinations of rectangles that can be made for each total. i.e. 20, have pictures of a 1x20, 2x10 and 4x5 rectangle so they can count. This means the students are spending time making rectangles themselves.

Session reserved for Induction Day at Thornleigh

Objective: To be able to identify a pattern and be able to describe how the pattern grows (in words and by using numbers)

Outcome: Pupils can identify the rule for a pattern, describe it and can create their own pattern that grows in a similar way.

SMART Quality (s) in focus:
Resilience, teamwork and motivation

Session Plan
Plan for Step 1: A pattern to be placed on the screen and pupils encouraged to describe how they see the pattern growing. Can they come up with two ways of describing it? In words and by using values as well? Class discussion to ensue with pupils sharing ideas of how it grows (there may be different ways students see it growing)

Plan for Step 2: Pupils to attempt questions based on this pattern such as 'What will the next term look like?' or 'How many squares will there be in pattern 6?'

Plan for Step 3: Pupils to design there own pattern and explain how it grows in words and in numbers if possible. Then pupils to swap patterns over and test each other on describing the pattern.

Success Criteria – How will you know if a student is making progress and is *ready for the next step*?
SC for Step 1: Pupils can spot the pattern and describe it by being able to draw the next term

SC for Step 2: Pupils can calculate the value of terms further down the sequence, for instance how many squares in term 8 and can demonstrate this rule mathematically

SC for Step 3: Pupils can create their own pattern of shapes and be able to describe the rule, and can describe the pattern of other pupils in the class.

Differentiation – How to ensure the session is challenging for all.
How could you make each step more accessible?
Step 1: Write the number of squares on the diagram for them so that they can see the numbers increasing if they cannot describe how the shapes are growing

Step 2: Scaffold the next term in the sequence so that the pupil can see how it should look but have to draw it themselves

Step 3: Have extended versions of the pattern so they can count the number of squares in pattern 10 rather than having to calculate it

How could you make each step more challenging?
Step 1: Pupils have to draw a pattern themselves based on a description only

Step 2: Pupils to calculate the rules algebraically using n^{th} term

Step 3: Pupils can identify if a term would appear in a pattern or not and can prove it algebraically, for instance 'The rule for this pattern is 3n+2, will there be a term in this pattern that could have 91 squares?' so pupils will have to solve 3n-2=91

Key questions that you might ask students during the lesson:
How do you see the pattern growing?
Will this work for all terms in this pattern?
Can you think of a rule for this pattern?

How can you make this task shorter? Have the patterns printed out ready for students to describe, rather than students drawing them all out. The accompanying PowerPoint features a range of different patterns.