Processes in Mathematics

Using Mathematics

Select, with help from the teacher, materials and equipment for a task, *eg "What containers should we use to fill the bottle?"; "What can we use to find out which parcel is heavier?"; "What could we use to make 6 in different ways?"*

Use, with teacher support, mathematical materials, *eg to make own repeating patterns using sets of shapes or beads; to sort a collection of buttons in different ways.*

Solve everyday problems in the classroom or in role play, *eg "Are there enough knives, forks and plates for four?"; "Can you fit the blocks into the box?"*

Solve problems based on stories, *eg "Which bowl belongs to Mummy Bear?"; "Which bed is bigger than Baby Bear's but smaller than Daddy Bear's?"*

Select with help from the teacher, materials and equipment to use in a task by understanding their special characteristics, *eg materials with 2 or 3 properties; Cuisenaire Rods.*

Choose and use appropriate number operations and mental strategies to solve problems in a wide variety of contexts, *eg adding 7+8 by doubling and adjusting; subtracting 16 from 20 by counting on; adding 4+7 by putting the larger number first.*

Talk about the information that needs to be gathered, *eg to plan food for a class party.*

Select, with help, appropriate forms of mathematical representation, *eg block graph; Carroll diagram; Venn diagram; picture; model.*

Select appropriate materials and equipment for a task through an understanding of their special characteristics, *eg choose a trundle wheel to measure the perimeter of the playground.*

Choose and use appropriate number operations and ways of calculating in a wide range of contexts, *eg calculate the sum of two 2-digit numbers mentally by partitioning.*

Suggest the information needed to carry out a task, how to obtain the information and ways to record it *eg, when carrying out a survey of vehicles passing the school.*

Begin to organise own work and work systematically, *eg when finding out who can jump furthest.*

Solve simple two-stage problems set in real life contexts, *eg "How many packets of sweets costing 24p can we buy for £2 and how much change would we have?"*

Begin to suggest how to present findings, *eg using a list; table; drawing; diagram; bar chart; pictogram.*

Select and use materials and equipment required for their work, *eg computer database or graphical package; scales; stopwatch.*

Identify and collect information required for a task, initially with teacher support.

Suggest ways a task might be approached, *eg by simplifying the task; looking for a pattern; making a list.*

Plan own work and work systematically.

Suggest how to present findings, *eg using a data collection sheet; sketches/diagrams/charts; organised lists; tables (including frequency tables); prose.*

Select and use effectively, materials and equipment required for their work, *eg squared paper; angle measurer; stopwatch.*

Decide what information is required for a task and how to obtain it.

Decide whether the information gathered is appropriate and sufficient for the task

Select and use appropriate methods and strategies, *eg breaking the task into small steps; working backwards; using trial and improvement methods.*

Plan and organise work in a systematic and efficient way.

Decide how to present findings, *eg using symbols (%, <, >); line graphs; pie charts; frequency tables (grouped data).*

Recognise and apply mathematics in contexts across the curriculum, *eg show science results using a line graph.*

Communicating Mathematically

Use informal language to respond to questions and to talk about their work, *eg "I put this shape there because it looks the same as the others but is bigger".*

Understand and use mathematical language, *eg bigger; altogether; more; forwards,* when talking about their work.

Explore, through discussion, simple open-ended questions, *eg: "How can we find out?"; "What should we do first?"; "What could we try next?"; "What materials could we use?"; "How could we sort these materials?"*

Talk about and/or record in own way, how a simple investigation was carried out, *eg finding different ways of making 6.*

Understand and use an increasing range of mathematical language and symbols.

Begin to respond to open-ended questions, *eg: "What information should we collect?"; "How should we organise it?"; "If the answer is 20, what might the question be?"; "How can we find out which jug holds most?"*

Discuss possible approaches to solving a problem.

Suggest ways of recording information.

Use personal methods to record findings/present information.

Use a variety of mathematical representations to present findings, *eg a given table; diagram; pictogram.*

Ask questions to clarify information.

Discuss and respond to open-ended questions, *eg "What materials would help us?"; "What information should we collect, and how?"; "How are we going to report our findings?"; "What activity would take about 15 minutes to complete?"*

Use a writing frame to plan what is needed to start solving the problem.

Present findings in an appropriate way, *eg using a writing frame; making a list; drawing a table, diagram or sketch; completing a bar chart.*

Talk about how they carried out a task, *eg "We used a trundle wheel to measure each side of the playground, counting the clicks and writing down each length. We added the lengths together to find the distance round the outside."*

Discuss and respond to open-ended questions, *eg: "What information do we need to carry out the task?"; "How can we obtain the information?"; "How can we record the information?"; "What shapes can you make using 2 identical triangles?"*

Discuss and compare ideas and methods with others.

Where appropriate, select or design a writing frame to plan work.

Choose a format to record work and give reasons for the choice.

Present findings using prose, numbers and symbols, to show how the problem was solved/investigation was carried out.

Use appropriate language to describe orally their work, *eg the mathematics used; the findings and how they are presented.*

Discuss and respond to open-ended questions, *eg: "What strategies could we use?"; "What is the most appropriate way of presenting our findings?"; "How could you make an estimate of this calculation?"; "How do you know if this shape tessellates?"*

Discuss the mathematical thinking and strategies of others.

Use mathematical language and symbols to record findings.

Refine ways of recording, *eg using computer software.*

Use the language of mathematics to express mathematical ideas precisely, *eg the approach to the task, the mathematics used, the findings and how they are presented.*

Mathematical Reasoning

Talk about how a task might be approached, *eg making scales balance; comparing 2 sets to find which is larger.*

Recognise simple patterns and say what comes next.

Make simple predictions, giving reasons for them, *eg predict which shapes will roll and which will slide; predict what will happen when 2 objects are put on the balance scales.*

Begin to explain their thinking, *eg:*

- *how a task was approached/a problem was solved;*
- *simple patterns or relationships;*
- *the reason(s) for making a simple prediction;*
- *personal calculation strategies (eg, to add 5 and 6, you add 5 and 5 and 1 to make 11);*
- *how an estimate of a simple calculation or measurement was made;*

Review own way of working with (teacher/peers), *eg the steps taken; any patterns found or predictions made; that information and/or findings are presented in an organised way.*

Consider alternative ways of working (with teacher/peers), *eg different ways to solve problems (eg adding 29 and 17 by rounding and adjusting; identifying a pattern); a more efficient way of working; ways to overcome difficulties.*

Check accuracy of own work (with teacher/peers), *eg that entries have not been entered twice; that all information has been recorded; using addition and subtraction as inverse operations; the reasonableness of their outcomes.*

Explain their thinking, *eg the reasons for choices made in selecting materials and mathematics to use; how a task was approached/a problem was solved; the reason(s) for making a simple prediction; personal calculation strategies (eg, to find 15-8 you take away 5 to leave 10 and then take away 3); how an estimate of a simple calculation or measurement was made; simple patterns and relationships.*

Compare own methods/findings/presentation with that of others.

Explore and use a range of problem solving strategies, persevering when difficulties are encountered, *eg finding patterns; making a list; drawing a picture/diagram; simplifying by using smaller numbers or working through identified steps;*

Review and explain own way of working, *eg the steps taken; any patterns found or predictions made; that information and/or findings are presented in an organised way.*

Check accuracy of own results and findings, *eg check half of 32 =16 by doubling 16; the reasonableness of their outcomes.*

Explain their thinking, *eg the method/approach used and give reasons for the choice; personal calculation strategies (eg 337-180 is the same as 337-200+20); mathematical relationships, (eg, the perimeter of a regular shape).*

Compare methods of presentation and discuss which shows the results most clearly.

Discuss a general statement with teacher/peers and check whether particular cases match it, *eg any even number can be written as the sum of two odd numbers.*

Discuss and share benchmarks for making estimates *eg, "My handspan is approximately 10 cm."*

Use a range of problem solving strategies, trying different strategies when difficulties are encountered, *eg using smaller numbers; using trial and improvement; breaking the task into small steps; working backwards.* Give reasons for the choice of strategy used.

Independently review own way of working, *eg the steps taken; that information/findings have been presented in an organised way; any patterns found or predictions made.*

Independently use a variety of ways of checking results of calculations, *eg using multiplication and division as inverse operations; using the range in which the answer should lie.*

Independently investigate a general statement, *eg, "All square numbers have an odd number of factors"; "Every even number from 6-100 can be made by adding together two prime numbers".*

Make general statements based on findings and check using new examples.

Recognise and use mathematical connections, *eg recognise that each angle in a regular hexagon is 120º because it is two corners of adjoining equilateral triangles.*

Make and justify estimations and approximations.