Problem solving strategies

The importance of problem solving

Developing the problem solving performance of students is a major objective of the proficiency strand of the Australian Curriculum: Mathematics. The ability to solve problems involves the application of previously acquired mathematical skills and processes in new or unfamiliar contexts.

Problem solving requires analysis and synthesis – the ability to formulate an answer. Many students find problem solving difficult because they do not know how to tackle the question confronting them. Successful problem solvers use certain strategies and these strategies can be taught, encouraged and developed over time with practice.

Problem solving strategies

1. Guess and check
2. Make a table or chart
3. Draw a picture or diagram
4. Act out the problem
5. Find a pattern or use a rule
6. Check for relevant or irrelevant information
7. Find smaller parts of a large problem
8. Make an organised list
9. Solve a simpler problem
10. Work backwards

Problem solving strategies in iMaths

There is no correct or incorrect way to solve problems, but there are some commonly used strategies that students can access to help them. Throughout the iMaths Program (Foundation to Year 6), 10 of the most commonly used strategies are taught and practised. These are shown in the sticky note on the right.

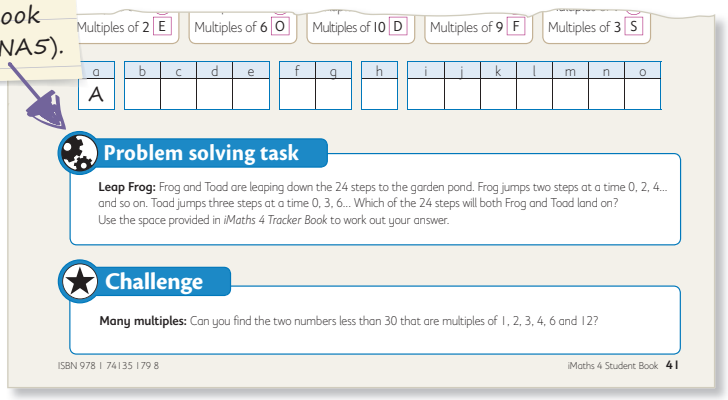
Problem solving strategies and tasks are found in the following sections of the Student Books:

1 **Strategies and practice** – the 10 strategies and practice problems are listed on pages 150–169 of the Student Book.

2 **Problem solving tasks** – problem solving tasks are found in the following Topics:

- **NA5** Multiples 3, 4, 5, 6, 7, 8, 9
- **NA6** Multiplication facts 2, 3, 5, 10
- **NA7** Multiplication facts 4, 6, 8, 9
- **NA11** Division problem solving
- **NA17** Multiplication 3-digit x 1-digit
- **NA23** Equivalent fractions
- **NA32** Purchases and giving change
- **NA33** Investigating patterns
- **NA35** Equivalent number sentences
- **MG1** Graduated scales
- **MG4** Perimeter
- **MG6** Litres and millilitres
- **MG7** Volume
- **MG9** Read and interpret timetables
- **SP2** Judgments

Problem solving task from Student Book page 41 (Topic NA5).

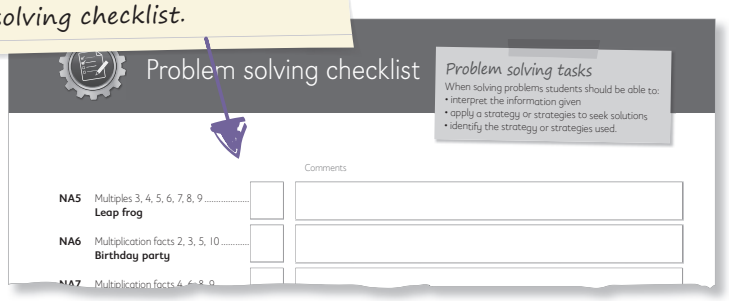


3 **Problem solving working space** – the Tracker Book contains space for students to record their working for each of the problem solving tasks. They then use the grid provided with each task to highlight the strategy or strategies used to solve the problem.

For each of the tasks, the answers on pages 178–181 of this book show an appropriate strategy or strategies that students might use to solve the problem. However, students should always be given the opportunity to justify their choice of strategy.

The problem solving checklist at the back of the Tracker Book is provided for keeping notes on how the student is progressing in their problem solving development.

Notes on a student's progress can be made in the Problem solving checklist.



4 **Problem solving in the Investigations** – all the Investigations in iMaths 4 have a problem solving component. For example, in **Investigation 8** Super sports stadium students are required to measure and calculate the space needed for spectators when designing their stadium to seat 2000 people. They use the strategies *act out the problem* and *find smaller parts of a large problem* to calculate the space occupied by a row of ten seats, and then extrapolate the data to find the dimensions for 2000 people.

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The 10 problem solving strategies

1 Guess and check
This strategy involves students starting with a reasonable guess, testing it to see if the answer is correct, and then repeating the process until the answer is correct. This is the simplest of all problem solving strategies, and one that some students rely on exclusively.

2 Make a table or chart
When students are confronted with a problem that contains a lot of information or data, the best way to see the information more clearly is to sort the information by drawing a table or chart.

3 Draw a picture or diagram
This strategy is used to turn an abstract concept into a visual representation the student can see. Look at the problem on the sticky note opposite. Using this strategy, draw four houses numbered 1, 2, 3, 4. As you re-read the problem slowly, write the name of each person below each house, then solve.

4 Act out the problem
This strategy is similar to the one above in that it is used when an abstract concept is solved by using people and objects, making the problem real or concrete.

5 Find a pattern or use a rule
This strategy is similar to applying the knowledge learned from Topics **NA33** and **NA34**. The use of this strategy shows a more sophisticated logical thought than using the *guess and check* or *draw a picture or diagram* strategies.

6 Check for relevant and irrelevant information
Many students try to use all the information that is given to them to solve a problem, rather than finding the information that is useful for them. This strategy is more powerful when used together with the *make a table or chart* strategy. The relevant information is extracted from the rest of the information and placed in a table.

7 Find smaller parts of a large problem
This strategy involves breaking a problem down into manageable parts, then working on the parts one at a time to eventually solve the whole problem.

8 Make an organised list
Sometimes a problem may have a random collection of information, that students require to solve the problem. By placing the information in an organised list, all possibilities can be listed and no information will be left out. For example, students are given six lunch items and asked to choose three. What combinations of three items could they choose? By placing each combination of items in an organised list, they can easily see the number of combinations.

9 Solve a simpler problem
Some problems involve operations with large and complex numbers. An easy way to solve these problems is to change the large numbers into smaller or simpler ones. For example, suppose you sold 66 bead necklaces at $5 each at your market stall on Saturday. How much did you make? To simplify the problem, 66 x $5 is the same as 33 x $10. 33 x $10 = $3300 from your stall.

10 Work backwards
This strategy involves using the data from the end of the information and systematically working back to solve the problem. Look at the problem on the sticky note to the right. To solve this problem you have to start with the number of biscuits Sienna received. Working backwards, double the number each person received. That is Sienna = 2, Harry = 4, Susy = 8, Justin = 16 and Hannah = 32.

Draw a picture or diagram

Four houses stand side-by-side in the same street.
Alf lives in the first house.
Dom lives in the fourth house.
Ben lives beside Alf.
Curly's house is between Ben and Dom's.
Who lives between Alf and Curly?

Work backwards

Hannah gave half of her biscuits to Justin who gave half his biscuits to Susy. Susy gave half her biscuits to Harry who gave half his biscuits to Sienna. Sienna received 2 biscuits. How many biscuits did Hannah start with?

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