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Section 1 — Teaching Strategies for Problem Solving

Introduction to Teaching Strategies

Often the most difficult part of problem solving is simply in knowing where to start. The system presented here gives both student and teacher that starting place. The clearly defined four-step method is easily applied to both simple and complex problems and will allow students consistent practice in the thought processes needed to reach correct solutions. Students are provided with ten different strategies to choose from to use as tools in working through problems.

A 4-Step Method to Problem Solving

Step 1 – Discover what the problem is asking you to solve. To do this you must identify the important information and the information that does not help to solve the problem. You must also determine if any necessary information is missing and what you must do to get that information.

Step 2 – Choose a strategy that will help to solve the problem. There may be more than one strategy that you need to use. Find the strategy or strategies that will aid in finding the answer to the problem.

Step 3 – Solve the problem. Work the problem until you find the answer or answers using the strategy or strategies you chose.

Step 4 – Go back over the problem. Check the solution to see that it answers the question.

Problem Solving Strategies

Use Objects To Solve The Problem

You may find it helpful to use objects to try and solve a problem. This will allow students to develop visual images of both the information given in the problem and the solution process. You can use objects such as coloured counters, or scraps of paper. Objects do not need to be elaborate.

Make And Use a Drawing Or Model

It may be helpful to use a drawing or diagram when trying to solve a problem. This could help the student understand data that is in the problem.

Make A Table

Students may find that making a table helps them keep track of data, see that there is missing data and discover data that is asked for in the problem.

Make A Systematic List

Recording work in a systematic list makes it easier to review what has been done and to identify further steps that need to be completed.

Guess And Check

Guess and check is helpful when a problem presents large numbers or many pieces of data. When students use this strategy, they guess the answer and then test to see if it is correct; if the previous answer is incorrect, they guess again. They continue the process to come closer to the solution. This is a trial and error strategy.

Look For A Pattern

By identifying a pattern, students can predict what will come next. This is an important strategy and is used to solve many different kinds of problems.

Work Backwards

In order to solve certain problems, the student needs to make a series of computations starting with information presented at the end of a problem and ending with information presented at the beginning of the problem.

Use Logical Reasoning

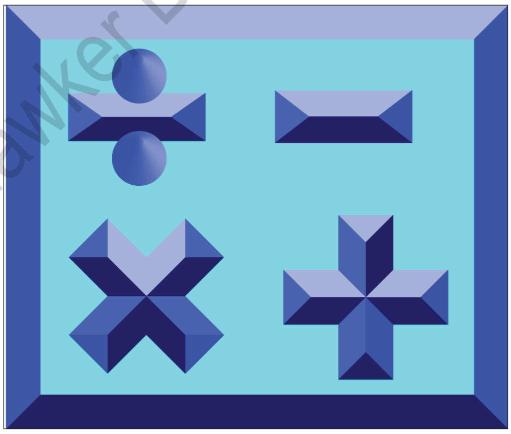
Some problems will include or imply various conditional statements such as: “if-then-else” or “if something is true, then....” or “if something is not true, then...” This kind of problem requires logical reasoning.

Make It Simpler

Making a problem simpler may mean reducing large numbers to smaller ones, or reducing the number of items given in a problem. This in turn may suggest what operation or process to use and could reveal a pattern to use.

Brainstorming

This strategy can be used when all else fails. This strategy means looking at a problem in new and inventive ways. This requires the student to be creative, flexible and to keep trying until the light goes on.



Problem-Solving Practice Exercises

Logical Reasoning

The after school team is playing softball on the playground. Sue, Colleen, Dave and Mike are playing together.

- Sue and Dave have gloves.
- Dave does not have a hat.
- Mike and Colleen have hats.
- Colleen has a bat.

What name belongs on each player?

What Do You Know

- What question do you have to answer?
- How many are playing softball?
- What are their names?
- What do you know about Sue?
- What do you know about Dave?
- What do you know about Mike?
- What do you know about Colleen

Find the Answer

- What does the first clue tell you?
- What does the second clue tell you?
- What does the third clue tell you?
- What does the fourth clue tell you?

How I Know I'm Right

- Look back to see if your answer fits with what the problem tells you and asks you to find. Read the problem again. Does your answer seem to fit?

Answers

Sue =  Dave =  Mike =  Colleen = 

Act Out Or Use Objects

Sandy has three 5¢ coins, three 10¢ coins and three 20¢ coins. She put them in 3 rows and 3 columns. When she finished, there was one 5¢ coin, one 10¢ coin and one 20¢ coin in each row and in each column. Where did Sandy put each of her coins?

What Do You Know?

- What question do you have to answer?
- How many 5¢, 10¢ and 20¢ coins are there?
- How many rows and columns are there?
- What was in each row and in each column?

Find The Answer

- Where is the 5¢ coin in each row?
- Where is the 10¢ coin in each row?
- Where is the 20¢ coin in each row?
- Look at the columns. Make sure there is on of each in the columns.

How I Know I'm Right

- Does your answer fit with what the problem asks you to find?
- Read over the problem again.
- Does your answer fit?

Answers

5¢ 10¢ 20¢

10¢ 20¢ 5¢

20¢ 5¢ 10¢

The Big Dig!

How much will it cost to excavate a basement that is 10 metres long, 8 metres wide and 2 metres deep, if the cost for excavation is $3.50 per cubic metre?

My Maths Work

My answer is ________________________________.

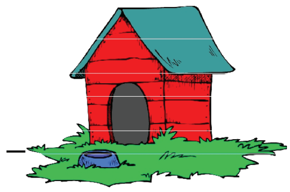
My Thinking

How I Know I'm Right

My Name ____________________________________

If you need more space, use the back of this paper.

Doghouses



Kurt has a Saint Bernard. Its body is 90 centimetres high, 60 centimetres wide and 120 centimetres long. The council requires Kurt to have a doghouse for his dog and it must have at least six times as many cubic metres of space as the dog. Design a doghouse for Kurt's dog that meets the law. Explain why you think your doghouse is a good choice.

My Maths Work

My answer is ______________________________.

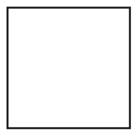
My Thinking

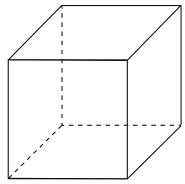
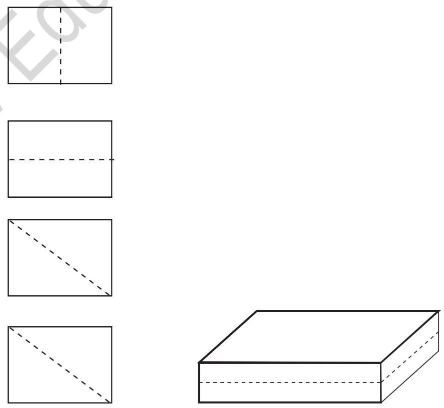
How I Know I'm Right

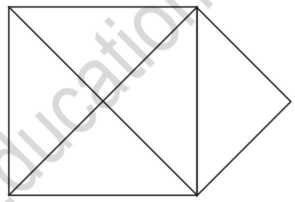
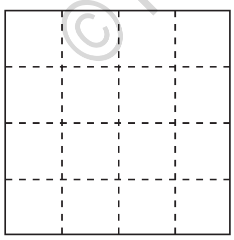
My Name ________________________________

If you need more space, use the back of this paper.

Geometry – Level 1

Andrea's Design – Andrea has drawn a design on a sheet of graph paper. The area of the design has been shaded in. Each square is equal to 1 square metre. What is the area of Andrea's design? (Design is on the worksheet.)	The area of Andrea's design is 62 square metres.
Area – The area of a particular shape was found to be 18 square centimetres. Draw the possible shapes and label their sides. Show as many as possible.	Each shape must have an area of 18 square centimetres. Possible answers include: Rectangle with dimensions of 1 centimetre by 18 centimetres. Rectangle with dimensions of 2 centimetres by 9 centimetres. Rectangle with dimensions of 3 centimetres by 6 centimetres.
Bedroom Wall – Wendy's bedroom wall has 4 equal sides and 4 equal corners. What is the shape of the wall? Draw a sketch of a wall.	The wall is a square. A sketch should show all four sides equal and the angles should be the same (right angles). 
Building a Box – How many shapes like A and how many shapes like B do you need to make a complete box? Show your thinking. *(Shape A is a square with all sides having a length of 2 centimetres and Shape B is a rectangle with a width of 2 centimetres and a length of 6 centimetres. See worksheet for graphic.)*	I will need two of Shape A and four of Shape B to build a box. The two A's will be the two ends. Two of the B's will be used for sides and the other two B's will become the top and bottom.
Changes in Area – Alex says that if you double the length and width of a rectangle, its area also doubles. Mindy disagrees. She says that if you double the length and width of a rectangle, its area becomes four times bigger. Who is right? How do you know?	Mindy is right. The area becomes four times bigger. To show this, students should draw a rectangle, label its sides and calculate its area. They should then draw another rectangle with sides that are twice as big as the first rectangle, labelling them with the size. Now calculate the area. It should be four times larger than the area of the first rectangle. An example: Rectangle 1 has sides of 2 centimetres and 4 centimetres. The area is 2 x 4 or 8 square centimetres. Rectangle 2 has sides of 4 centimetres and 8 centimetres. The area is 4 x 8 or 32 square centimetres. The area of Rectangle 2 is four times larger than that of Rectangle 1 (4 x 8=32).

Cubes – If you have a cube and want to write a number on each face, how many numbers must you use?	You must use 6 numbers as a cube has six faces. A top, bottom and four sides. 
Cutting a Square Cake – Dani has baked a square cake that has a perimeter of 32 centimetres. If she cuts the square cake in half, what will be the shape of the two halves and what will be the length of each side? Show another way to cut the square in half to get a different shape.	I can cut the cake into two rectangles, with sides of 4 centimetres by 8 centimetres. I could also cut the cake diagonally from one corner to its opposite corner, giving me two triangles of the same size. The two legs will be 8 centimetres long and the third side will be longer than 8 centimetres.
Cutting Five Cakes – Anna made five cakes in the shape of a rectangle. She wants to cut each cake in half. Show how she can cut the cakes so that each cake is cut in half differently.	Cakes can be cut in the following ways. The first four are top view. The last is side view. 
Doghouses – Kurt has a Saint Bernard. Its body is 90 centimetres high, 60 centimetres wide and 120 centimetres long. The council requires Kurt to have a doghouse for his dog and it must have at least six times as many cubic metres of space as the dog. Design a doghouse for Kurt's dog that meets the law. Explain why you think your doghouse is a good choice.	The dog takes up .648 cubic metres of space (0.9 x 0.6 x 1.2 = 0.648). The doghouse must provide at least 3.88 cubic metres of space, as the criteria specified six times as many cubic metres of space as the dog. The doghouse must also be tall enough for the dog. Its body is 90 centimetres high, so it probably should have a height of at least 120 centimetres. Any doghouse that meets these criteria is a good choice, but size should be reasonable.

Fencing a Garden – Bonnie wants to make a fenced garden. She has 36 metres of fence and wants the garden to be the biggest area possible. What length would she make each side of the garden?	Bonnie would make each side 9 metres long and the perimeter would be 36 metres. This gives an area of 81 square metres. Any other rectangular shape would have an area less than 81 square metres. An example would be if we had a rectangle with sides of 6 metres and 12 metres. The perimeter would still be 36 metres, but the area would only be 72 square metres.
Fractional Area – Draw a square and shade in 1/2 of its area. Show any other possible answers as well.	The square should be divided in some way to show half of it shaded in and the other half not shaded.
Goat Pens – Mr McGregor has 5 goats. Each goat needs a separate pen. He has 10 sections of fence and wants each goat pen to be of equal size. Show how you can make the 5 pens from the 10 sections of fence.	One possible solution – Five equilateral triangles. 
Length and Width – The perimeter of a certain rectangle is 90 centimetres. The length is four times the width. What are the dimensions of the rectangle?	The width is 9 centimetres and the length is 36 centimetres. This size would have a perimeter of 90 centimetres (9+9+36+36 = 90). It would have a length that is four times the width (36 is equal to 4 x 9).
One Quarter of the Whole – The figure below represents one quarter of the area of a whole shape. Create three different possible whole shapes. Justify how you know that each new shape is one whole. 	Any shape will work, as long as it has an area of 64 small squares. If each of the squares in the following shapes has an area of 16 square units, any one would correctly answer the problem statement. Of course, there are others as well.