Table of Contents

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Introduction

First-year students can solve problems. Students will learn and understand basic computation and the need for it – if they are given interesting problems to solve. Students need a great deal of teacher direction when first learning to solve problems. However, after they have had some experience with a particular strategy, pairs or small groups of students can successfully solve the problem on their own.

It is important to allow students to verbalise how they solved the problem. Some students may give a detailed account of the problem-solving techniques used, while others may simply say, 'I drew a picture', or 'I tried different ways until it worked'. The sharing of problem-solving techniques among students provides important learning at all year levels. Whenever possible, ask students to write something about their problem-solving process. This may be a picture and a few words or a complete description of the methods used to solve a problem.

Students should be aware very early that there are activities and problems in mathematics that have more than a single correct answer. And they should understand that most problems can be solved in more than one way. Many problems in maths and in life have a single correct solution, but there may be as many ways to reach that solution as there are people attempting to solve the problem. This program includes problems and suggested techniques to demonstrate these concepts.

Throughout the program, students are asked to make predictions before finding an actual solution. This is an important aspect of problem solving. Students need to be encouraged to guess even if they have no idea of the answer. When they respond, react to all answers in a positive manner. This positive reinforcement should take place in the early years to encourage risk-taking and to eliminate students' fear of responding only when absolutely sure of a correct answer.

The Student Book

The problems presented in the student book are grouped into five different strategies to help you introduce and practise each strategy with students. Students should not be restricted to solving the problem with only that particular strategy. At all times, it is important to allow the students the freedom to use their own creativity and inventiveness.

The last section of the booklet contains **Reviews** for each of the five strategies. The booklet ends with a **Final Review** of problems that can be solved using the strategies presented in the lessons.

Using the Student Book

Students should write or draw their answers in the spaces provided. Encourage students to write in any blank spaces in their booklets so they can keep their computation and other work close to the problems they are solving.

Guiding students through all the problems in the strategy lessons is recommended. Once students have learned a strategy, you may want to put more capable students in pairs or small groups to solve some problems on their own. Provide any necessary assistance and manipulatives. Remember the importance of having students verbalise what they have done to solve the problems.

The Teacher Guide

The teacher guide consists of procedures for teaching the strategy lessons and guidance for presenting the **Review** pages. The teacher guide also contains six blackline masters to be duplicated and distributed to students for solving particular problems.

Using the Teacher Guide

It is suggested that you lead students through the strategy lessons provided in the teacher guide. As a teacher, only you will be able to decide what and how much your students can do on their own.

Each lesson includes an **Introduction** with suggestions for presenting the concept in the problem, often relating it to a real-life situation. The **Teaching Procedure** uses situations, manipulatives and questions that lead to an understanding of an appropriate method for solving the problem. After the **Answer**, most lessons include one or more related **Extension** problems to provide additional practice or challenge with the concept.

Throughout the lessons, you will find suggestions for using manipulatives – objects that appeal to many senses and can be handled – which help students understand both the meaning of mathematical ideas and the application of these ideas to real-life situations. Although specific objects are suggested, you may wish to substitute items found in your classroom. Also, you may find it helpful to put students in groups of two to four to work cooperatively on problems for which they can use manipulatives.

Answer: 2 six-cube buildings, 3 four-cube buildings, 4 three-cube buildings, 6 two-cube buildings, 12 one-cube buildings. Accept solutions in which the cubes are placed either horizontally or vertically.

Extension:

- Try this problem with other numbers of cubes, including odd numbers such as 5 or 7. Help students to realise that these buildings can include only 1 block each.
- If possible, build the buildings or record the answers for various even numbers of cubes. Lead students to conclude that for even numbers, you can always build 2 buildings with the same number of cubes or a number of buildings with 2 cubes.

Draw a Picture

Providing a picture of objects, events, or relationships in a problem often helps students clarify what must be done to solve the problem. From the picture, students can discover relationships between parts of problems and gain understanding of spatial relationships. This strategy is very useful for primary and beginning problem solvers and for students who learn best with visual aids.

Materials

- Student Book pages 4–6
- 10 five- and ten-cent and a few twenty-cent coins (real or play money) for each student or for every 2 students
- A floor number line (commercial or teacher-made), numbered 0–10 and large enough for students to walk on
- A paper square for each student or for every 2 students, large enough to be easily manipulated and cut in half
- Scissors
- Blackline Master 1, Teacher Guide page 24 (optional)

Introduce the Strategy: Explain that using a picture is often a good way to get a better understanding of a problem. Tell students that they will use pictures to solve all the problems in this lesson.

Problem 1
Introduction

Preview this problem by working with money. Using five- and ten-cent coins, review the values of the coins. Explain that we don't use one-cent coins, but one cent is still used as a unit in calculating prices. Ask students to count small groups of coins and state the total value. Include written symbols in this review (10¢, 15¢, etc.) by having volunteers write the values on the blackboard. You may also want to reinforce the names of the shapes at this time: circle, rectangle, triangle.

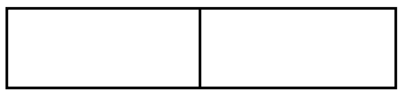
NOTE: When discussing the characteristics of a rectangle, students should learn that a rectangle has 4 sides, 4 square corners, and the opposite sides are equal. Do not include that a rectangle has 2 long sides and 2 short sides. This is incorrect information and will need to be unlearned when students get older. Primary students should learn that a square is part of the rectangle family, but all of its sides are the same length.

Teaching Procedure

On the blackboard, draw the 3 shapes from the student book labelled with appropriate values. Read aloud each question below. Have students use coins and/or draw a picture to find the answer.

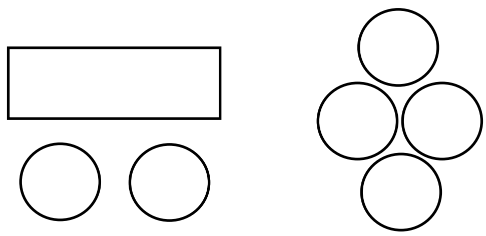
- How many five-cent coins do you need for 1 rectangle? (2) For 2 rectangles? (4) Using other coins, what is another way to show 20¢? (2 five-cent and 1 ten-cent coin)
- How many five-cent coins do you need for 1 triangle? (4) Using other coins, what is another way to show 20¢? (2 ten-cent coins)

Show these shapes on the blackboard, on chart paper or on an overhead projector:



Explain that these shapes are worth 20¢.

- Can you make another picture worth 20¢? Invite a volunteer to draw the picture. (2 possible drawings)



- Is 20¢ more or less than 10¢? (More)

If students need more direction before attempting the problem, demonstrate possible pictures for 25¢, 35¢ etc.

Read aloud the problem in the student book. Ask students if they can solve the problem using just rectangles and then to explain why or why not. Be sure that students understand that the problem asks them to use more than 1 shape.

Provide each student or student pair with a few five-, ten- and twenty-cent coins. Suggest that they use the coins to help solve the problem and/or check their solution. Tell students to draw their pictures in the book, and then ask them to explain what they have drawn.

- How many tails do you think you will see if you see 20 legs? (Answers may vary.) Record a variety of answers and ask students to explain why they guessed the number they did.

Read aloud the problem in the student book. Have students work individually or with a partner to solve the problem. Provide cotton buds or other manipulatives available for students to use.

Answer: 5 tails. Allow students to write the number 5 or draw 5 tails.

Extension: If I see 10 tails, how many cows' legs do I see? (40) If appropriate, explain how to use the fact that 10 is double 5 to determine the answer. You may wish to ask the same question using a smaller number.

You may want to create a table to show students the relationship between legs and tails.

Legs	Tails
4	1
8	2
12	3
16	4
20	5
24	6
28	7

Show that tails are consecutive numbers. Explain that to find legs, you can count by fours. If students have worked with calculators, you may wish to have them use the constant feature (+4) to work out the answers.

Problem 2

Introduction

Ask students if they have ever played a target game in which the object of the game is to throw something at a target containing numbers (beanbag toss, shuffleboard, darts). Remind them that the score is usually figured by finding the sum of the numbers that the beanbag (or other object) lands on.

Teaching Procedure

On the blackboard, on chart paper or on an overhead projector, reproduce the number square from the problem. Read aloud each question below, working through each question with students.

- If you toss just 1 beanbag onto the target, what are the different scores you can get? (1, 2, 3 or 4)
- What is the highest score you can get with 1 beanbag? (4) The lowest score? (1)
- If you toss 2 beanbags onto the target, what is the highest score you can get? (8) How can you make that score? (Both beanbags land on 4.)
- If you toss 2 beanbags, what is the lowest score you can get? (2) How can you make that score? (Both beanbags land on 1.)
- If you toss 2 beanbags, what other scores are possible? How are they made? Record the following information on the blackboard, on chart paper or on an overhead projector:

Score	How made
2	1 + 1
3	2 + 1
4	3 + 1 or 2 + 2
5	4 + 1 or 2 + 3
6	4 + 2 or 3 + 3
7	4 + 3
8	4 + 4

Ask students what they notice about the way you recorded the information. (Scores are in order, even though students probably did not give them to you that way.) Point out that all scores between 2 and 8 are possible. Explain the importance of organising data when solving problems.

Read aloud the problem in the student book. Tell students to record their answer. Encourage them to look for more than 1 way to score 8 points. Provide manipulatives for students who need them, and allow the use of calculators.

Answers: 1 + 3 + 4; 2 + 2 + 4; 2 + 3 + 3

Extension:

- If 1 beanbag missed the target, could you still get a score of 8? (Yes) How? (4 + 4)
- If all 3 beanbags hit the target, what other scores can you get? Which scores can be made in more than 1 way?

Score	How made
3	1 + 1 + 1
4	1 + 1 + 2
5	1 + 1 + 3 or 1 + 2 + 2
6	1 + 1 + 4 or 1 + 2 + 3
7	1 + 2 + 4 or 1 + 3 + 3 or 2 + 2 + 3
8*	1 + 3 + 4 or 2 + 2 + 4 or 2 + 3 + 3
9	2 + 3 + 4 or 1 + 4 + 4
10	2 + 4 + 4 or 3 + 3 + 4
11	3 + 4 + 4
12	4 + 4 + 4

* Although students have already figured the possible combinations for a score of 8, you may want to include 8 to display a complete chart.

Answer: 33 will be in Row A.
Ask students to share how they found the answer. Many of them will simply continue the chart until they reach 33 in Row A. Some students will note that all the numbers with a 3 in the ones place (3, 13, 23) are in Row A. Other students will note that all odd numbers are in Row A and that 33 is an odd number.

Extension:

- Choose additional numbers and ask students which row the number will be in. Ask students to name some 'big' numbers along with the rows in which row each number will appear.
- If there are 3 rows of numbers, can you find the answer in the same way? (No, there is no pattern of odds and evens, and no pattern in the ones digits.)
- As a challenge, make 5 rows of numbers and ask about the many patterns that exist.

Row A	1	6	11	16	21	26
Row B	2	7	12	17	22	27
Row C	3	8	13	18	23	28
Row D	4	9	14	19	24	29
Row E	5	10	15	20	25	30

Ask which row has the numbers that are used to count by fives. (Row E) Continue with questions similar to the following: Which row will have 33, 62, 75, and so on?

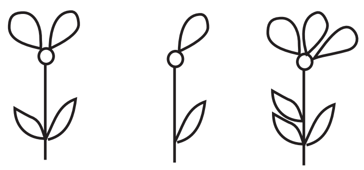
Problem 3

Introduction

Draw a picture of a birthday cake. Ask a volunteer to draw the candles that would be on the cake for a child who is a year old. Then have students draw a picture of what this child's birthday cake might look like on his or her next birthday. Talk about things that follow sequential patterns, like this example (year levels; 1, 2, 3; days of a month). You may want to mention the numbers at which these examples stop and start (28, 29, 30 or 31 days in a month, and so on).

Teaching Procedure

Draw the following pictures on the blackboard, on chart paper, or on an overhead projector.

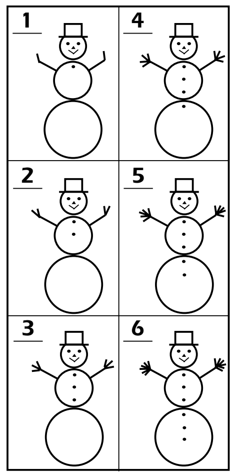


Ask students to look carefully at the pictures, pointing out that each picture is different. Read aloud each question below and have students use the drawings to find each answer.

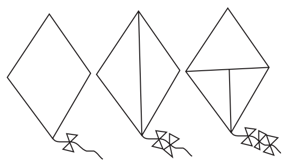
- How are the drawings different? (The number of leaves and petals differs in each.)
- If you had to put the drawings in order, which one would go first? (Answers may vary. Most students will put the drawing with 1 petal and 1 leaf first.)
- Why would you put that drawing first? (Answers will vary.) Allow students who chose a different first picture to explain their reasoning.
- What do you think the fourth picture would look like? (Answers will vary. Sample answer: a flower with 4 leaves and 4 petals.)

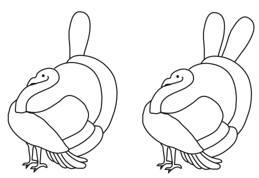
Read aloud the problem in the student book. You may wish to have students work in pairs to identify the pattern. Be sure students understand that three snowmen must be numbered and completed.

Answer:



Extension: Create another problem like this or suggest that students make up their own. It could be related to something seasonal or to a science or social studies topic. For example:





Problem 4

Introduction

Have students describe different types of displays found in supermarkets, department stores, and other retail outlets. Ask if anyone has seen displays where tins or boxes are piled on top of each other in rows. Encourage students to guess why the bottom rows have to be as large as or larger than the top rows.