



Learning Objective

To use spatial visualisation and logical reasoning to solve problems

Materials

Square grid paper, blocks or squares in five different colours

Focus

These activities explore possible arrangements of shapes or combinations of coloured squares on a grid in order to determine how a particular outcome can be formed. Spatial as well as logical thinking and organisation are involved as students investigate all likely arrangements to ensure the final forms match the given criteria.

Possible difficulties

- Not rotating or flipping shapes to eliminate duplicates or to 'grow' a shape
- Inability to visualise the pattern needed to grow a shape
- Not considering both rows and columns

Extension

- Investigate growing other shapes using different numbers of squares or shapes.
- Extend the grid to 6-by-6 and use six different colours.
- Explore other shapes that can be made using four of Shape 1.
- Investigate making these shapes using Shape 3.

Teacher Notes for Activity 4



Learning Objective

To use strategic thinking to solve problems

Materials

12 counters (1 one colour, 11 another colour)

Focus

This activity introduces a more complex problem in which the most difficult step is to try and find a way of understanding the question and what it is asking. Using materials to explore the problem is one way this can be done. Another is to use a diagram to assist in 'thinking backwards' by trying and adjusting possible answers until a solution that matches all of the conditions is found.

Possible difficulties

- Using only the seven cars that Gina passed to determine her starting position
- Using only the three cars that passed Gina to determine her starting position
- Thinking only of the three cars between Jordan's starting position and first place
- Thinking that Jordan needs to pass 10 cars, when being in tenth position means he has to pass nine cars to win

Extension

- Students write their own car race problems based on these questions.
- Use a different context rather than racing cars for the stories.



Learning Objective

To read, interpret and analyse information

Materials

Some students may need counters or number expanders.

Focus

These activities explore relationships among numbers and then use this analysis to find a number that matches specific criteria. This process encourages students to disregard numbers that are not possible rather than simply looking for the ones that are likely to work. When placing the numbers in the problem situations, students need to read the stories carefully in order to work out what number goes where.

Possible difficulties

- Selecting a number that matches only the first criterion
- Not matching the number against all criteria
- Not considering terms such as 'twice' and 'half'

Extension

- Students think of a number and make up criteria to match it, then give it to other students to solve.
- Students can be encouraged to come up with mathematical criteria of their own rather than using just the same criteria listed.



Learning Objective

To analyse and use information word problems

Materials

Place value chart, calculator

Focus

These activities explore word problems that require addition, subtraction or multiplication. Students need to determine what the problem is asking and, in many cases, carry out more than one step in order to find the solution. Analysis of the problems reveals that unlike items may need to be added, which is more complex than just adding two or more like items together, while other problems contain additional information that is not needed.

If necessary, materials can be used to assist with the calculation, since these problems are about reading for information and determining what the problem is asking rather than just computation or basic facts.

Possible difficulties

- Inability to identify the need to add, subtract or multiply
- Confusion over the need to carry out more than one step or type of calculation to arrive at a solution
- Using all the numbers listed in the problem rather than just the numbers needed

Extension

- Students could write their own problems and give them to other students to solve.

Teacher Notes for Activity 11



Learning Objective

To use strategic thinking to solve problems

Materials

0–99 number board

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

Focus

This activity explores students' understanding of the number system and their ability to solve questions about numbers. Students need to coordinate the reading and writing of numerals with the symbols involved in writing the numbers 0–99.

Possible difficulties

- Unable to keep track of the number of times they determine a digit or word
- Confusion between saying and writing the digits
- Confusion with 11 and 22 and only seeing the digits '1' and '2' once when they actually occur in both the ones and tens places

Extension

- Make a table for the students to display their results and present a description of the problems and their solutions to another class or group.



Learning Objective

To develop spatial visualisation in order to solve problems and build a means of organising information in more complex problems

Materials

Tangram puzzles made from the template on page 55

Focus

These activities explore the use of tangrams to make shapes as well as the arrangement of shapes. Spatial and logical thinking as well as organisation are involved, as students investigate manipulating the pieces to make the various shapes. Being able to visualise in this way will assist students in solving many other problems in number, measurement, and chance and data, as well other spatial problems.

Point out to students that the shapes on the worksheets are not to scale with the tangram pieces.

Possible difficulties

- Not readily rotating and/or flipping pieces to complete the shapes

Extension

- How many small triangles are needed to make the square as well as medium and large triangles?
- What about the other shape (a parallelogram)?



Learning Objective

To identify, and use number understanding

Materials

Blocks, calculator

Focus

These activities explore the properties of magic squares and other shapes. Students must analyse the problems and locate the information necessary to find each magic number. With each square, once the magic number is known, it is then possible to proceed with finding the missing numbers.

Counters, blocks or a calculator can be used by students to assist them, as the focus is the concept of magic squares and magic numbers rather than addition, subtraction or basic facts.

Possible difficulty

- Considering only rows or columns rather than rows, columns and diagonals

Extension

- Discuss all possibilities the students discover for the magic shapes – are they really different from one another?
- Investigate other magic squares and magic numbers.

Teacher Notes for Activity 18



Learning Objective

To solve problems involving money and make decisions based on particular criteria

Materials

Some students may need counters, play money or a calculator.

Focus

This activity explores the students' abilities to read for information, obtain information from another source (the tuckshop menu) and use it to find solutions. The problems are about using money, making decisions based on money and comparing amounts of money, rather than adding or subtracting. Solutions can be obtained by using materials and comparing amounts. Counters, blocks, play money or a calculator may be used if needed.

Possible difficulties

- Unfamiliarity with the '\$' symbol
- Not taking into account that they may need two or more of the same item
- Believing that the exact amount of \$6 or \$10 has to be spent as opposed to not spending all of the amount

Extension

- Record and discuss the different choices students make to spend their \$10.
- In pairs, students write their own questions based on the tuckshop menu and give them to other pairs to solve.



Learning Objective

To use spatial visualisation and logical reasoning to solve problems

Materials

Coloured pencils (red, green, blue and yellow), grid paper

Focus

These activities explore possible arrangements or combinations of objects in order to determine all possibilities in a situation. Spatial as well as logical thinking and organisation are involved as students investigate all likely arrangements and make sure that they do not repeat combinations. Acquiring the skill of systematic thinking needed to solve these problems will also solve many other problems, not merely those that involve similar arrangements.

Possible difficulties

- Not recognising that a design has been used more than once
- Using all of the windows, whether they were needed or not

Extension

- Discuss the methods that can be used to systematically find all of the possible designs.
- Use grid paper to investigate the possibilities of having five panes of glass with five different colours.



Learning Objective

To analyse and determine information in written problems

Materials

Place value chart, calculator

Focus

These activities explore problems that require addition, subtraction and multiplication. Students must determine what the problem is asking and, in many cases, carry out more than one type of calculation to find solutions. Analysis of the problems reveals that some contain additional information that is not needed.

Materials can be used to assist with the calculation if necessary, as the focus of the problems is about reading for information and determining what the question is asking rather than computation or basic facts.

Possible difficulties

- Inability to identify the need to add, subtract or multiply
- Confusion over whether to carry out more than one step to arrive at a solution
- Using all the numbers listed in the problem rather than just the numbers needed

Extension

- Explore the possibilities as to whether the dry season would be before or after the summer.
- Discuss how problems can have more than one answer depending on different interpretations.
- Students could write their own problems and give them to other students to solve.

Teacher Notes for Activity 25



Learning Objective

To solve problems involving distance and map reading

Materials

Calculator, if needed

Focus

This activity explores finding and interpreting information from a map. Analysis of the map shows the distances between various animals' trees. Students are required to interpret this information and use it to find solutions. Some destinations are not direct and most have more than one possible route.

Possible difficulties

- Inability to read the map and to use the information to find solutions
- Not knowing what to do when there is no direct route
- Confusion with the distance terms; e.g. furthest, closest

Extension

- Students can use the map and write questions for other students to solve.



Learning Objective

To use spatial visualisation, logical reasoning and measurement to solve problems

Materials

Calculator, digital clock

Focus

These activities explore different ways of visualising a problem and the various possibilities that may provide a solution. Logical reasoning, as well as an understanding of measurement (metres and centimetres) and digital time (using both 12-hour and 24-hour), is needed. With each problem, diagrams can be used to organise, sort and explore the data.

Possible difficulties

- Unable to convert centimetres to metres and centimetres
- Confusion about moving along a side more than once
- Not calculating the sides whose length is not given
- Not understanding 24-hour time

Extension

- Students could write their own problems involving distance around a shape (perimeter), numbers on a balance, or time, and give them to other students to solve.
- Investigate further facts about the calendar – Why is the tenth month named October? Which two consecutive months have the same number of days, and why? Is 1 July the halfway point of a calendar year?



Learning Objective

To organise data and make predictions

Materials

Counters or a calculator, if needed

Focus

These activities explore different ways data can be analysed and recorded. In each situation, diagrams, tables and lists can be used to organise and sort the data in order to make predictions for further analysis and exploration. Visualisation and logical reasoning are involved in these investigations.

Possible difficulties

- Not using a table or list to manage the data
- Not seeing that, for example, a ham and cheese sandwich is the same as a cheese and ham sandwich
- Confusion working out how far was really travelled when moving both forward and backwards
- Not considering that more than 10 boxes were used

Extension

- Make a table showing the combinations of one filling, two fillings, three fillings, and so on.
- Make a table showing how far was travelled each day/hour.
- Draw and label a diagram to show the combinations of how many oranges, and so forth.



Learning Objective

To use spatial visualisation and logical reasoning to solve problems

Materials

Toothpicks; cubes, such as wooden or multilink cubes or Unifix™, in two different colours; isometric grid paper

Focus

These activities explore possible arrangements of two-dimensional and three-dimensional shapes to determine how particular outcomes are formed. Spatial as well as logical thinking and organisation are involved as students investigate all likely arrangements to ensure the final shapes match the given criteria or visualise a given shape in terms of its component parts.

Possible difficulties

- Focusing only on building exact replicas of the triangle or square and using more toothpicks than needed
- Unable to visualise the three-dimensional cubes in their representations on the two-dimensional page
- Considering only those cubes that can be readily seen

Extension

- Have students make other shapes using five cubes, and have other students follow them.
- Make stacks of cubes for other students to replicate. The number of cubes used should be specified.
- Have students use isometric paper to draw the shapes they make, and have other students follow them.

Teacher Notes for Activity 35



Learning Objective

To use strategic thinking to solve problems

Materials

Counters

Focus

This activity explores problems in which it seems there could be several answers but analysis of the connections among the data reveals there is a unique solution. A process of 'try and adjust' could be used; however, logical reasoning of the possibilities and then using a table, diagram or materials to organise them will be more productive. This will lead to the development of ways of thinking that can be generalised to other complex problems.

Possible difficulties

- Not using a table or diagram to manage the data
- Not considering that exactly 25 tables are needed in the first question or that \$95 is needed in the second question

Extension

- Discuss the various methods used by students to solve the problems. Include the ones discussed above.
- Construct other problems using the same form of complex reasoning for students to solve.