Mathematics

Activity Book 3

Math Problem-Solving

Teacher Edition

GRADES 6-7

NewPath Learning

Math Problem Solving Series

Book 3

Strategies and techniques covering all strands of the curriculum, with activities to reinforce each problem solving method.

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NewPath Learning Products are developed by teachers using research-based principles and are classroom tested. The company's product line consists of an array of proprietary curriculum review games, workbooks, posters and other print materials. All products are supplemented with web-based activities, assessments and content to provide an engaging means of educating students on key, curriculum-based topics correlated to applicable state and national educational standards.

Rationale

Mathematical problem solving is the ability to use a variety of mathematical thinking processes and skills to interpret familiar and unfamiliar situations.

Students completing mathematical problems will draw upon, and further consolidate a range of strategies, skills, known mathematical concepts and positive attitudes in order to solve the given problem.

Strategies students can use include:

- Guess and Check
- Use a Table
- Find a Pattern
- Logical Reasoning
- Create a Diagram
- Make a List
- Work Backwards
- Solve an Easier Version

Students indicate their understanding of the problem by choosing one or more of the above strategies and devising a plan. Appropriate skills and attitudes must be identified and used by the student to carry out the plan successfully. These skills and attitudes are important for students to develop, not only to solve the mathematical problem, but also to apply to other life situations. Appropriate skills and attitudes include:

- Making decisions
- Showing persistence
- Working collaboratively
- Being flexible
- Choosing technology (calculator, concrete materials)
- Working individually
- Showing initiative
- Developing clear written and verbal skills

Students of age 10 and 11 enjoy working with their peers. When working collaboratively, students will need to verbally communicate clearly to explain their ideas and solutions to their peers. They will also develop their skills to express and listen to different ideas and views. Students will also know that working independently will give them the chance to firmly grasp the features of the problem.

Importantly, through the process of solving mathematical problems, students will need to apply and further develop their understanding of a range of mathematical concepts. The activities in this book will address the following concepts:

- Number
- Space
- Measurement
- Chance and Data

The purpose of this book is to provide 10 to 11 year old students with a range of mathematical problems, together with solutions.

The Problems

Structure

The mathematical problems in this book are divided into sections according to the strategy that is required to be used to help solve the problem. At the beginning of each section there is an explanation and example of the strategy. Within each section there is at least one problem to solve from each of the above concepts

Concrete Materials

Students at 10 and 11 years of age should be encouraged to have access to, and use, concrete materials to aid their problem solving.

Solutions

Solutions are given for each problem. There may be other solutions that are correct.

Ideas with Activities

The activities in this book have been produced so that they can be used in a variety of ways. The problems are presented as worksheets, for class use, use as homework exercises or even as questions on tests. Alternatively, the activities can be copied onto cardstock and completed by individual students or by groups of students at convenient times. Problems can be tackled and discussed as a whole class, although students should be given opportunities to solve problems individually as well as part of a small group.

Suggestions

The following suggestions may assist with the teaching of problem solving skills:

1. Try completing each problem solving activity in this book yourself. You will get to know what is involved in a problem and how you may help students to find a solution.
2. Ensure opportunities for success. Success in problem solving will ensure increased student enthusiasm.
3. Give students adequate time to think about, and if necessary, discuss each problem.
4. Encourage students to clearly set out their working and clearly write and/or verbalize their conclusions.
5. The main emphasis shouldn't be placed on the final correct solution. Instead the student's efforts at working out the problem should be recognized and praised even if the final answer is incorrect.

Contents

Teachers' Notes

This book contains a collection of activities for students aged 11+ to enable them to develop their Mathematical problem solving skills. Strategies for solving problems are introduced individually and explained, so that these can be taught explicitly, practiced and then applied to problems which relate to the students' school or life experience.

The book is devised as a course in mathematical problem solving and should be **worked through sequentially**, rather than "dipped into". It is divided into seven sections, one for each of the problem solving strategies to be taught. There is no need for teachers or students to have prior familiarity with any of the strategies presented. At the beginning of each section there is an explanation of the strategy to assist teachers and students, and then students are guided through a 'scaffolding' approach to eventual independence. Although the tasks become progressively more complex in each section, all students should be able to manage the initial example and thus become familiar with the strategy. Subsequent problems could then provide extension and/or enrichment activities which are meaningful and interesting.

Examples are provided for each of the learning areas of Number, Space, Measurement, and Chance & Data. Students are encouraged to work mathematically through the problem solving approach used, where students need to choose and use operations, make decisions about their "plan of attack" and strategies to be employed.

The activities provided represent excellent opportunities for teachers to see how students apply operational skills learned in mathematics and they would be ideal to use as part of an assessment portfolio if required.

Teachers may even wish to use these activities in curriculum areas other than Mathematics, as many of the problems could easily fit into a Social Studies, Health or Technology & Enterprise program, for example.

Teachers' Notes: Guess and Check

This strategy is an excellent way to introduce students to a problem solving approach to mathematics. Many of them will find that they have employed this strategy informally without recognizing it as such, and therefore it will seem familiar and within their "comfort zone." Validating "Guess and Check" as a method will be a terrific confidence boost and should help students feel able to approach the other strategies with a positive attitude. At the same time, the students will learn and practice sensible guessing and understand the importance of accuracy in the "check" part of the strategy.

As its name suggests, the students first of all guess an answer to the problem and then use that answer to check whether all requirements of the problem have been met. If not, then the answer is adjusted and checked again.

Teachers should stress that it is extremely unlikely that their "guess" is going to be correct – that is not the point – and that the guess provides a starting point, which is the key to all problem solving.

Student Information Page

When approaching problem solving, the main problem can often be figuring out "where to start"!

Sometimes the easiest and most sensible way is to simply take a guess at what you think the answer might be and then check to see if that's possible. You've probably done something like that yourself. If someone told you that your school cafeteria sells twice as many hotdogs as hamburgers, and that altogether 87 hotdogs and hamburgers were sold in a week, could you tell them how many hotdogs and how many hamburgers were sold?

You could soon find out by the "Guess and Check" method. Your guess is probably going to be closer than you think, although it's not likely it will be spot on.

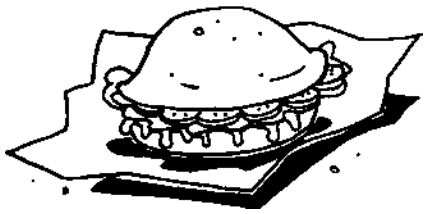
❑ Firstly, think about what you know:

You know one number has to be double the other and that they both have to add up to 87. Therefore, the easiest thing to do would be to start with a number for the hamburgers, double it for the hotdogs, and then see if they both add up to 87. So, you won't guess that there were 4 hamburgers sold, because then there must have been 8 hotdogs, and together that makes only 12. Likewise, you won't guess 50 for the hamburgers as that means 100 hotdogs, which is 150 altogether. Already you have an idea of a range inside which the answer may lie.

It can be useful to draw up a grid, based on what you know, and then use it to help you find the solution. As you get the answer for each of your guesses, decide whether your number of hamburgers needs to go up or down.

Here is an example of how this could have been done:

1st guess	2nd guess	3rd guess	4th guess	Answer
20	35	26	28	HAMBURGERS 29
40	70	52	56	HOTDOGS (double) 58
60	105	78	84	TOTAL **87**



Desired Outcomes:
Understands mathematic conjectures as more than simply a guess; makes straightforward tests of conjectures and discards those that fail the test.
Calculates with whole numbers, money and measures, drawing mostly on mental strategies to add and subtract two-digit numbers and for multiplications and divisions related to basic facts.

Class Action

❑ Use the "Guess and Check" procedure to find the solution to this problem:

Your new class has 30 students in total. There are 4 more boys than girls in the class. Use the "Guess and Check" method to find out how many boys and how many girls are in the class. Use the grid below to help you – remember, write in what you know first.

1st guess	2nd guess	3rd guess	4th guess	Answer
				Girls
				Boys (+4)
				Total

The solution is 13 girls and 17 boys.

How many guesses did you need? _____

Sports Storage Stumper

❑ Now have a try at solving the next problem by yourself. Draw up a grid below and write in what you know, before you have your first guess.

As part of your job as sports monitor, you need to conduct a weekly check of all the balls in the gym closet. When you checked, you could see that there were 3 more baseballs than tennis balls lined up on the shelf. When you counted the balls, you counted them together and only got a total number of 45 for the two kinds. Now the gym teacher is asking you how many tennis balls are in the closet. Can you find out, without going back and counting them?

Create a grid in the box below to help you solve the problem.

Desired Outcomes:

Understands mathematic conjectures as more than simply a guess, makes straightforward tests of conjectures and discards those that fail the test.

Calculates with whole numbers, money and measures, drawing mostly on mental strategies to add and subtract two-digit numbers and for multiplications and divisions related to basic facts.

Going Round in Circles

You can use the "Guess and Check" strategy to solve practical problems of measurement as well. The only difference is that you are working with length, mass, area or volume/ capacity instead of just with numbers.

❑ Try using the strategy to solve this:

At training sessions for the interschool sports, two members of your school's running team practice on a 500 meter circular running track. At the last session, the combined distance run by the two of them in 10 minutes is 5,020 meters, and one runner beat her friend by 40 meters.
Complete the grid to work out how many kilometers each person ran.

Show Time

❑ Now try this one:

Someone in your family has recorded two movies on a video tape, using up a total of 4 hours and 50 minutes playing time. You want to use the counter to find where the second movie starts, but you don't know how long each movie lasts. However, your sister tells you she thinks the second movie was about 20 minutes longer than the first one. What would you fast-forward (or rewind!) the counter to in order to find the beginning of the movie you want?

Desired Outcomes:
Understands mathematic conjectures as more than simply a guess, makes straightforward tests of conjectures and discards those that fail the test.
Takes purpose and practicality into account when selecting attributes, units and instruments for measuring things and uses the relationship between metric prefixes to move between units.

Mapping the School

To solve this next problem, you can incorporate the "Guess and Check" strategy into your problem solving, but you will also need to think about what has to be done first – your approach to the whole problem. This time, **you** have to find what it is you need to know. You will explain how you would go about finding the solution, right from the start. Your use of the "Guess and Check" strategy will form part of your explanation. It's easiest if you explain in a series of steps – you may not need all of the numbered steps in the format below. Just fill in what you need.

❑ You have been given a wall map of your school and asked to make a reduced-size copy onto a piece of 8.5 x 11 graph paper. Your new map needs to be at the largest possible scale which will fit onto your paper.

What scale will you use?

Steps:

1. _____

2. _____

3. _____

4. _____

5. _____

Guess and Check Grid:

Desired Outcomes:
Understands and uses scale factors and the effect of scaling linear dimensions on lengths, areas and volumes of figures and objects produced on grids or with cubes.
Visualizes and sketches the effect of straightforward translations, reflections, rotations and enlargements of figures and objects using suitable grids.
Understands mathematic conjectures as more than simply a guess, makes straightforward tests of conjectures and discards those that fail the test.

Red, White and Blue

The "Guess and Check" strategy can be used to help determine how likely something is to happen, or not happen, or whether one thing is more or less likely to occur than another.

❑ When you play 5-a-side basketball on a Friday afternoon, sometimes you get a red vest, sometimes a blue one, and just occasionally a white one. You prefer the red vests, but you know that there are 10 more blue vests than red ones. You don't like the white vests at all, but fortunately there are only 10 of those. The school has sufficient vests for a total of 10 teams.

Expressed as a percentage, what are your chances of receiving a red vest? Show your working in the box below.

Thirsty Pets

❑ Now try problem solving a graphing task which needs the "Guess and Check" strategy to get the data for your graph.

You need to use 8.5 x 11 1 cm graph paper at a scale of 1 cm: 1 liter to graph the weekly water consumption of three pets – a dog, a cat and a rabbit. The pets' bowls are emptied if necessary and then filled daily from a large water container which holds 40 liters. The pet owner refills the large container every week and notices that each week there are 2.5 liters still remaining in the container. She wants to find out how much water each pet uses each week, but she uses an unmarked jug to fill each animal's bowl. However, she tells you that she places one jug full in the cat's bowl, two in the rabbit's, and three in the dog's bowl.

❑ Use the space below to problem solve and then prepare the graph of the results on your graph paper.

Desired Outcomes:
Understands mathematic conjectures as more than simply a guess, makes straightforward tests of conjectures and discards those that fail the test.
Interprets and makes numerical statements of probability based on lists of equally likely outcomes and using fractions and percentages.

Teachers' Notes: Make a List

This strategy involves identifying all possibilities for a solution by listing them systematically. Sometimes this will need to be done just to find out how many different options are possible, and at other times the strategy is employed in order to have the information upon which to base a decision.

The making of systematic lists enables information to be checked to ensure that all possibilities are valid and that all permutations have been included. It also helps to develop the logical and ordered thinking necessary for effective problem solving.

Students should find that list-making will be incorporated with other strategies as they become more adept at problem solving.

Student Information Page

This strategy is easy to use and helps you to "think straight". Sometimes a problem does not involve any real calculating, but there is just too much information for you to handle in your head – so, you write it down.

By making a list, you can think about each part in turn without worrying that you will forget parts that came before.

If you were asked how many different lunch combinations of one entreé item and a piece of fruit you could make from your school cafeteria menu of meat and salad rolls, salad only rolls, hotdogs, hamburgers, pizza, apples, oranges, bananas and grapes, no doubt your head would spin if you tried to work it out mentally. However, you would have to agree that there are no difficult calculations involved – the difficulty lies only in making sure you "get them all".

❑ Here's how the "Make a List" strategy helps.

You need to find a system to write down all the possible combinations which fit the rules – in this case, you must have one entreé item and one piece of fruit.
Start by listing all the entreé and fruit items separately:

Entreé:	**Fruit:**
meat & salad rolls	apples
salad only rolls	oranges
hotdogs	bananas
hamburgers	grapes
pizza	

☆ Now take the first entreé item and match it to each piece of fruit in turn:

meat & salad roll with:
- apple
- orange
- banana
- grapes

TOTAL: 4 combinations

☆ Now do the same for the next entreé item:

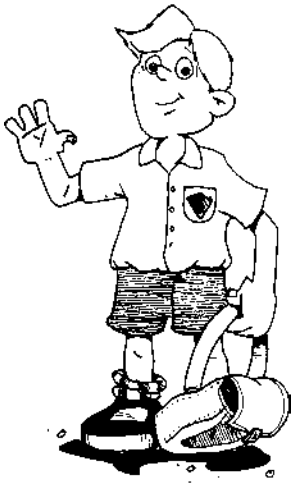
salad only roll with:
- apple
- orange
- banana
- grapes

TOTAL: 4 combinations

You should be able to see that for each of the entreé items, there will be **4 possible combinations**, and as there are 5 entreé items, the total number of combinations will be 5 lots of 4 = 20. In this case the list-making helped you to see the pattern which could be applied to find the solution.
Without writing anything down now, can you say how many combinations would be possible if tuna sandwiches were added to the menu, and then nectarines as well?

Looking Good at School

Try this one on your own now, but be careful because this time you need to use the information about possible combinations in order to make a decision – it's the decision, not the number of combinations, which is the solution.



❑ You seem to have grown out of all your school uniform items but your mom is not keen to buy you all the items of the new uniform as you will be finishing elementary school at the end of the year. You really don't want to have to wear exactly the same uniform combination every day. Your school uniform includes two different shirts, a sweater, a zippered jacket, track pants, shorts, a skirt and a dress. Girls may wear any of the items, but most boys choose not to wear the skirts or dresses!
Your mom has said that she will buy the **minimum** amount needed so that you have a different combination each school day.

☆ What do you ask mom for?

List 1	*List 2*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Combinations: (Start with the first item from List 1.)

_____

_____

_____

_____

_____

_____

☆ How many items must you have in order to wear a different combination each day of the week? _____

Desired Outcomes:
Recognizes, describes and uses patterns involving operation on whole numbers, and follows and describes rules for how terms in a sequence can be linked by multiplication or an addition or subtraction based strategy.

Still Looking Good

Remember the problem presented on Page13.

Later on, one of your classmates leaves the school and passes on their unwanted uniform to you. This means you now have one of each item in the uniform. How many days in a row could you now come to school in a different combination? Make a list in the box below.

(If you found the pattern, this will be easy to answer).

Eating Decisions

The strategy of making a list can also be useful for determining the number of possible ways items may be placed in order. For instance, if you had a serve of fries and a chocolate bar, no doubt you can see that there are two possible orders in which you can eat them – although only one sensible way, if you like your hot fries hot! However, if you had a muffin, an apple and some rice crackers to eat, would there then be three possibilities for the order in which you could eat them?

You can check by making a **systematic** list. Start by placing the first item first and follow with all possibilities, then try the second item first and follow with all possibilities, and so on:

Muffin, apple, rice crackers
Muffin, rice crackers, apple
Rice crackers, muffin, apple
Rice crackers, apple, muffin
Apple, muffin, rice crackers
Apple, rice crackers, muffin

There are now in fact six possibilities!

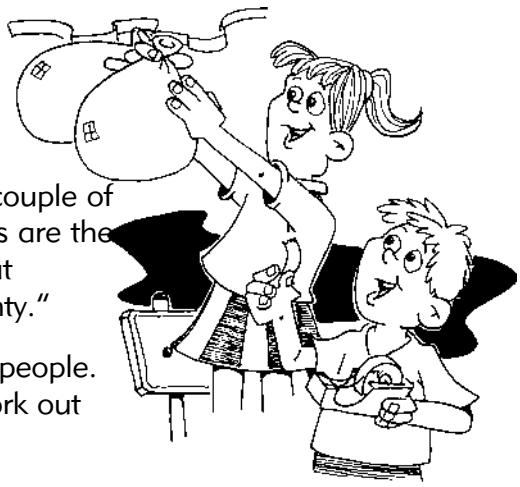
After you have solved the next problem, see if you can discover a **pattern** which applies to increasing the possibilities as more items are added.

What is the pattern? _____

Desired Outcomes:
Recognizes, describes and uses patterns involving operation on whole numbers, and follows and describes rules for how terms in a sequence can be linked by multiplication or an addition or subtraction based strategy.

Blow it Up!

❑ Your class has been asked to decorate the assembly area for a school dance and balloons are to be put up around the walls. To make it interesting, your teacher has asked each class member to put up 4 different colored balloons, in a different order to everyone else in the class. You have plenty of packets of balloons, but they only come in red, green, blue and yellow.
"That won't be enough colors!" someone says. "We have 26 people in this class!"
"Oh yes," replies your teacher. "But we need a couple of people to supervise and make sure no two orders are the same. So if two people could volunteer to do that rather than put up balloons, then we'll have plenty."



You are not so sure and neither are a few other people. Is your teacher right? Use the space below to work out your solution.

Desired Outcomes:
Recognizes, describes and uses patterns involving operation on whole numbers, and follows and describes rules for how terms in a sequence can be linked by multiplication or an addition or subtraction based strategy.

Taking a Chance

Just as you used the "Guess and Check" strategy to help you decide how likely something was to happen, you can use list-making to give you the information you need to determine risk or likelihood. Systematic lists will enable you to "work out" answers that will seem amazing to people trying to do it in their head.

In order to solve the next problem, you may find that it takes you a little longer to carefully think of all the possibilities, but if you list them all as you go, it will be easy to check back. Take your time and think of one thing at a time.

❑ One wet lunch break, you and a friend are playing a board game using one die. The bell is about to go, and there is time for one more turn each. The winner will be the person closest to the end when the bell goes, or the first one to get exactly to the end of the board. If you throw a higher number than needed, you count back onto the board.

You are 3 spaces from the end of the board, but your friend is only 2 spaces behind you. If he lands on you, you are out. It is your friend's turn next. How would you rate your chances of winning? (Hint: Start by thinking: What if he throws a 1? Think of all the possibilities. Then what if he throws a 2? And so on.)

Work out your solution below:

Desired Outcomes:
Places events in order from those least likely to those most likely to happen on the basis of numerical and other information about the events.

Vexatious Veggie Garden

❑ Your class has decided to set up a vegetable garden and you have researched the sizes needed for what you want to grow. You will need a total area of 18 m2. The school gardener has said you may have the space, but wants you to draw the proportions so that he can fit it neatly into one of the available spots in the school grounds.

You want to have a rectangular garden and now need to determine the lengths of the sides. If you keep to whole meters only for each side, what are the possibilities? Use the space below for your working.

❑ Unfortunately, none of those possible measurements will fit well into the positions the gardener has available. You have the idea that if you allowed two of the four sides of the rectangle to be measured into (whole) centimeters, that would create more possibilities.

Does it? _____ Try it below.

Your friend now says that all four sides of the rectangle could be measured in whole centimeters, not just whole meters, as that would then create even more possibilities and you would be sure to fit the garden in. You are horrified at that suggestion and say that it would take far too long to find all the possibilities. Instead, you suggest adding possibilities by trying shapes other than rectangles. Your friend thinks that would be more difficult.

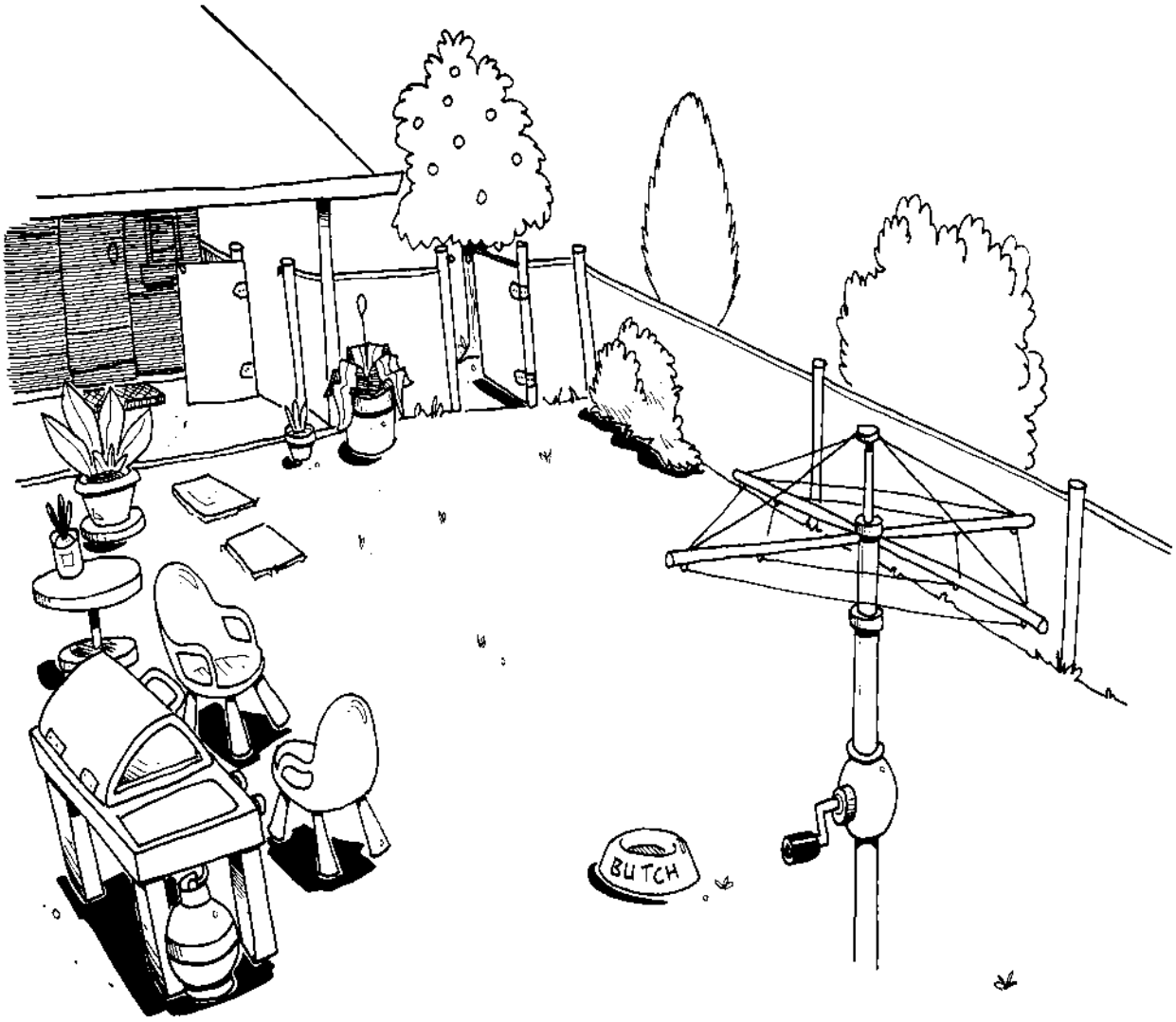
❑ Can you prove yourself right? Use the back of this sheet to make your list. (Note: You don't have to find all the possibilities; just demonstrate whose suggestion would be more workable.)

Desired Outcomes:
Understands and applies directly length, area and volume relationships for shapes based on rectangles and rectangular prisms.

Treasure Hunt

You are devising a treasure hunt for your brother's birthday party. You decide on six hiding places: the clothes line, the apricot tree, under the dog's bowl, in the biggest potted plant, under the back door mat and under the barbecue lid. You want the children to back track as they follow the clues, to keep them busy for longer. However, the apricot tree is through a gate which is difficult for little kids to come back through as it only swings one way and latches out of reach. They can get back into the house yard through another gate which swings the other way.

❑ Work out all the possible ways in which you could order the clues for the treasure hunt, and then decide which you will use and draw it on the picture below.



Desired Outcomes:
Identifies the essential features of a location or arrangement needed to serve a purpose and represents in networks and other diagrams.

Teachers' Notes: Find a Pattern

Much higher order mathematical thinking involves applying patterns which are understood and known to be true, and mathematicians are used to looking for and "seeing" patterns as part of their approach to their work. Thus, developing a facility for patterning is an important facet of developing numeracy.

Students will no doubt be familiar with exercises in which they have to identify, and then possibly continue, patterns in number or shape. However, in many of these exercises, merely finding the pattern is the point.

In this section, students practice finding patterns in order to solve a problem or reach a solution. It is the application of the pattern which is important.

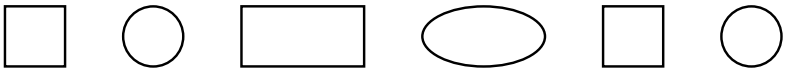
Student Information Page

No doubt you will have come across math questions which ask you to do things like:

Find the next number in this sequence: 2, 4, 6, 8 _____

or:

Draw the next three shapes in this pattern:



❑ People who enjoy math puzzles like to solve more complex sequences. Try these:

Can you find the next two numbers in this sequence?

1, 3, 7, 15, 31, 63 _____

Now try this one:

7, 13, 24, 45, 86, 167 _____

Although the second problem was more complex, the approach to solving it is the same. The question to begin with when trying to find a pattern is **"What has been done to the first one to get to the second?** And then from the second to the third, and so on.
You then need to think of the possibilities. As the two examples above are number patterns, the possibilities will be anything that can be done to numbers. Any combination of the four basic operations: addition, subtraction, multiplication and division could be used. In the first example, multiplication and addition are used, with the variables being the same in each step. The second example uses multiplication and subtraction, but one of the variables changes – however, there is a **pattern** in the way it changes.
If you didn't solve either of the two questions, have another go now. You may find that you will start to incorporate another strategy you've already learned, such as "Guess and Check" or "Make a List", to help you with these.

❑ Use the working space below:

_____

_____

_____

_____

_____

Desired Outcomes:
Recognizes, describes and uses patterns involving operation on whole numbers, and follows and describes rules for how terms in a sequence can be linked by multiplication or an addition or subtraction based strategy.

More Balloons

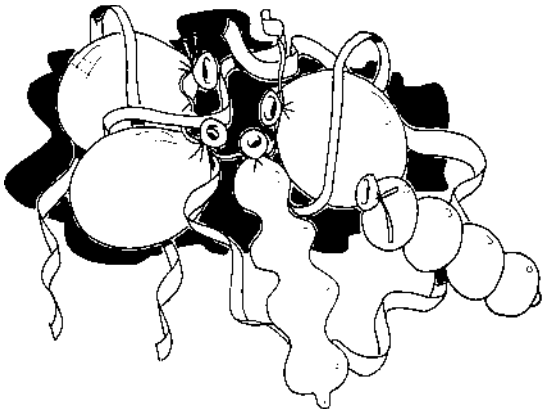
The key to solving number pattern problems or puzzles is **finding the relationship between the numbers.** Once this relationship has been identified, you can apply the pattern to perform calculations that would be extremely time consuming.

Remember the question about lunches on page 12? If you were now asked how many possible lunch combinations of a entreé item and a piece of fruit it was possible to make, if the menu included 12 entreé items and 7 different fruits, it would take a long time to work them all out by making a list.

However, if you remembered the pattern from your previous work on that strategy, you could say straight away that the answer is _____.

❑ Think back to the puzzle in which you decorated the assembly area with balloons for a school dance (page 15).

Using 3 different colors gave 6 possible orders, but 4 colors gave 24. Using 5 colors would give 120.
Without making a list, can you tell how many different orders you could make if you had 7 different colored balloons?



Answer: _____

Explain how you worked out the answer:

_____

_____

_____

_____

_____

_____

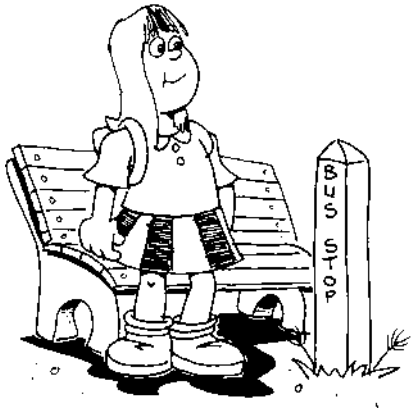
_____

Desired Outcomes:
Recognizes, describes and uses patterns involving operation on whole numbers, and follows and describes rules for how terms in a sequence can be linked by multiplication or an addition or subtraction based strategy.

Watching Your Watch

The bell for the start of school sounds when your watch shows a time of 8:48 a.m. and you think you're starting school two minutes early. But at the morning break, which begins at 10:20 a.m., your watch shows 10:17 a.m. Then at lunch break, officially at 12:05 p.m., your watch shows 12:01 p.m. You won't be able to adjust your watch until you get home and use the special tool. You need to catch a bus home at the correct time of 3:35 p.m., but you want to get a book from the library first.

❑ What time, according to your watch, will you have to be at the bus stop for your bus?



Patterns in the Water

You are growing bulbs in your classroom and recording the rate of growth and the amount of water needed. You have marked the side of the jar into 20 ml gradations, and each day you check the water and top the level up to 200 ml.

On the first day, you decide no water is needed as you can see the level has barely changed; however, by the next day it is down to 190 ml, so you top it up. You then have to wait until Monday to check your bulb, and on Monday morning, the plant needs 18.75 ml to bring it back to 200 ml.

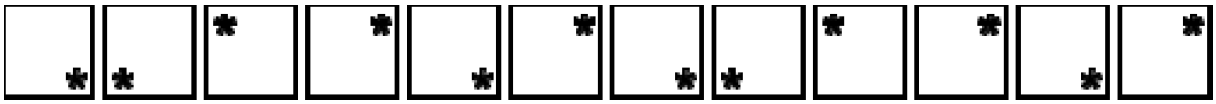
❑ Which day can you expect to find the jar completely dry?

Desired Outcomes:
Recognizes, describes and uses patterns involving operations on whole or fractional numbers and follows and describes rules for how successive terms in a sequence or paired quantities can be linked by a single operation.
Measures by counting uniform units including where part-units are required, and measures length, mass, capacity, time and angle, reading whole number scales.

Arranging Shapes

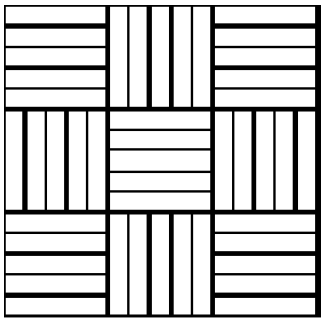
Patterns are often found in shapes or in the way shapes are arranged, and artists and designers experiment with such patterns to create interesting and attractive results.

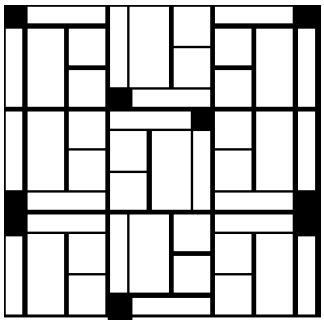
❑ Look at the following diagrams and note the position of the asterisk inside the square.



Can you detect a pattern in the way the square has been rotated? Remember to consider clockwise and counter-clockwise rotations. Use the space below to help work it out.

Floor tiles often use tessellations to create attractive designs. The tiles need to be laid in the correct pattern of rotation to achieve the desired result. Sometimes two differently shaped or sized tiles are used, which together form the pattern.





Desired Outcomes:
Recognizes rotations, reflections and translations in arrangements and patterns and translates, rotates and reflects figures and objects systematically to produce arrangements and patterns.

Terrific Tiles

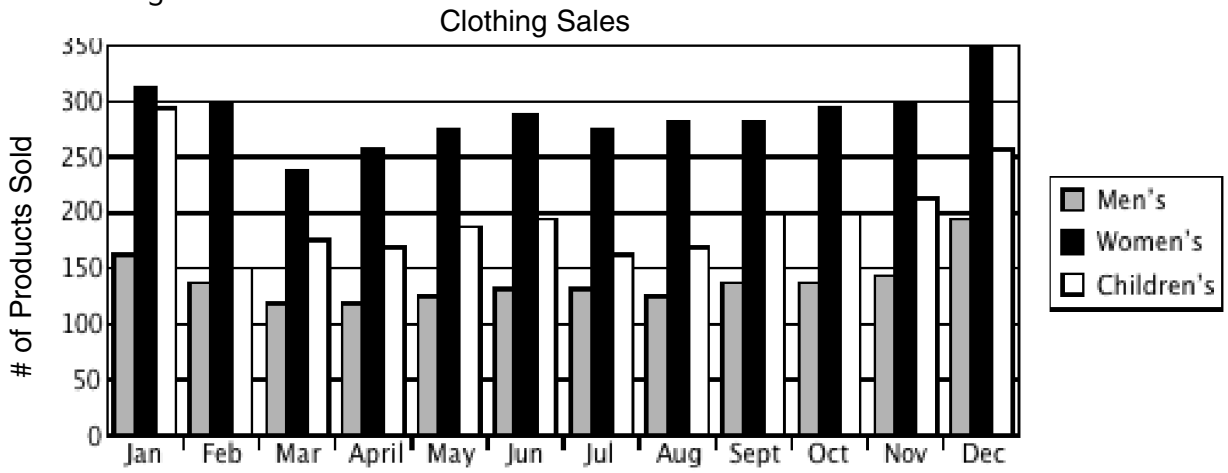
❑ Design a tile (or perhaps two which tessellate) and show how the rotation pattern forms a design. Use the space here to try out ideas and then transfer your final design and pattern onto art paper.

Desired Outcomes:
Recognizes rotations, reflections and translations in arrangements and patterns and translates, rotates and reflects figures and objects systematically to produce arrangements and patterns.

Clothing Patterns

Part of the value in preparing graphs is that they reveal patterns to the reader which are readily discerned. Statisticians, as well as accountants and retailers, are just as interested in these patterns as they are in the individual figures which form the graphs.

❑ Look at the graph below which shows sales figures for men's, women's and children's clothing.



There are several patterns which can be found in the graph which covers one year's sales. The most obvious is that the most sales are for women's clothing, followed by children's and then by men's.

❑ Now consider the time of year, as well as the sales for women, men and children. What patterns can you see?

_____

_____

_____

_____

_____

❑ The marketing manager wants to increase sales of men's winter clothing at a time when women's winter clothing sales are strong.
During which months should the store advertise men's winter clothing?

_____

_____

Desired Outcomes:
Reads and makes sensible statements about trends and patterns in the data in tables, diagrams, plots, graphs and summary statistics and comments on their data collection processes and their results.

Teachers' Notes: Solve an Easier Version

This strategy is similar to "Find a Pattern". The students find the solution to a complex problem by working out an easier version and then applying the same rules to the more difficult problem.

Example: There are 30 people at a meeting. Everyone shakes hands with each person once.
How many handshakes take place?

Students could first work out how many handshakes would occur with a group of five and then look for a pattern to apply to the more difficult problem.

The key lies in simplifying the variables – whether it be distances or size of spaces, numbers, or amounts of time, so that the student can be confident of the type of calculation which needs to be done. The variables should be simplified to the point where students will be sure their answer is correct, as this will then give them the confidence that their approach is appropriate.

Student Information Page

Sometimes problems look more difficult than they really are just because of the size of the numbers or measurements involved, and that can make them seem impossible to solve!

For instance:

During one season, 5000 trucks each brought 150 bales of hay to the store. The hay had to be loaded into holding sheds which each held 8 000 bales. How many sheds would havehay in them and how much room would be available in the partly filled shed? How many more truck loads could be stored?

Before you reach for your calculator and hope you're doing it right, what if we change the size of the numbers – **Solve an Easier Version** first, so that you will have a better idea of whether you are doing it right?

Try this:

50 trucks brought 5 bales each to the store. The sheds each held 100 bales. How many sheds would be full and how much room would be available in the partly filled shed? How many more truckloads could be stored?

Easy! 50 trucks x 5 bales each = 250 bales of hay altogether.

Each shed holds 100 bales. So 250 divided by 100 = 2.5. Therefore 2 sheds would be full and the third would have 50 bales in it, leaving room for another 50. Each truck brings 5 bales, so (50 divided by 5) there is room for another 10 truckloads.

- ❑ You should be able to see that your answer makes sense and is correct because of the simple numbers used. Now that you are sure of the calculations needed, try the original problem again.

Explain your work in the space below.

Desired Outcomes:
Calculates with whole numbers, money and measures (at least multipliers and divisors to 10) drawing mostly on mental strategies to add and subtract two digit numbers and for multiplications and divisions related to basic facts.

A Colorful Problem

❑ The art teacher mixes up powdered dye for art lessons twice each week. She uses a tablespoon of powder in 500 ml of water for each color and provides seven different colors each time she mixes up a batch. How much water and how much powder is needed in a year to provide the dye? (Assume 40 school weeks in a year.)

Hint: This time, do an easier version first by changing the amount of time.

❑ Write out your final calculation here – be careful about the number of weeks.

Flying High

Solve this next problem by finding a way to make an easier version, then calculate the answer to the original question. Show all your work, including notes for any information you needed to get in order to give an accurate answer.

❑ A plane flies out of the airport every 10 minutes. How many planes leave the airport in a year?

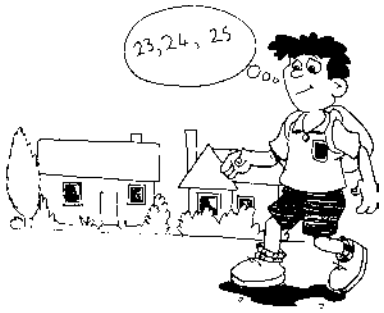
(Hint: Rather than calculating 52 weeks a year, base your answer on the fact that there are 365 days a year as this will be more accurate.)

Desired Outcomes:
Calculates with whole numbers, money and measures (at least multipliers and divisors to 10) drawing mostly on mental strategies to add and subtract two digit numbers and for multiplications and divisions related to basic facts.

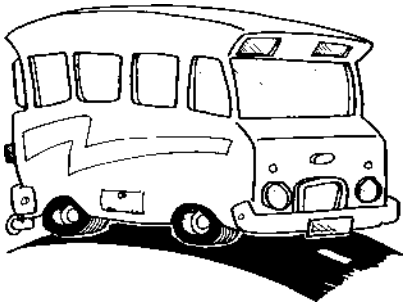
What Do You Do All Day?

For these problems assume there are 40 full weeks in a school year. Use the space to show your work.

1. Each school day you walk 350 meters from your home to the bus stop. How many meters do you walk in a year to get to and from the bus stop?

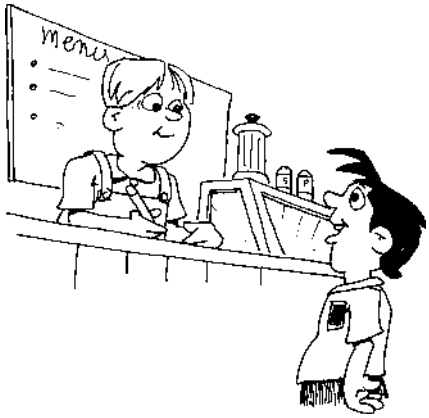


2. Your bus trip to and from school takes 20 minutes each way. How much time do you spend on the bus in one year?



3. How much time do you spend in a school term ordering your lunch?

Explain how you worked out your answer.



Desired Outcomes:
Calculates with whole numbers, money and measures (at least multipliers and divisors to 10) drawing mostly on mental strategies to add and subtract two digit numbers and for multiplications and divisions related to basic facts.
Understands the meaning, use and connections between the four operations on whole numbers, and uses this understanding to choose appropriate operations and construct and complete simple equivalent statements.

Face Painting

❑ How much paint will you need to paint all surfaces of this brick wall if it takes 10 ml to cover one long face and the short faces are half the size of the long face?

Explain your work:

A Comet for Life

A certain comet appears once every five years in the northern hemisphere and is visible to the naked eye in the night sky for 75% of the 20 days during October that it is over the United States. However, each year there is an average of 4 days that weather conditions prevent it from being visible. If you were born in March in a comet year and lived to be 82, how many opportunities would you expect to be able to view the comet? (Even if you couldn't remember it!). Show your work:

Desired Outcomes:
Visualizes and makes models of 3D shapes and arrangements and interprets and produces conventional mathematical drawings of them.
Calculates with whole numbers, decimals and fractions.

Teachers' Notes: Draw a Diagram or Table

Many people find that a visual representation helps to organize thoughts – you literally" can see what's happening". Tables help to organize information when the information needs to be recorded under more than one heading or a matrix is required. Diagrams are especially helpful when solving problems of measurement and space – and of course, graphs and pie charts are a form of organized diagram. Because of this, the problems included to teach this strategy have combined elements of measurement and space and so are presented as integrated tasks.

This strategy links in to other problem solving approaches. In solving some kinds of problems, the diagrams are in fact just "making a list" in graphic form. The students should be helped to understand this.

Student Information Page

You may have heard of or seen people drawing a picture to help explain something to someone. Often things then become clearer. Thus, the strategy of drawing organized diagrams can be helpful in problem solving. Once again, it is just another way of organizing your information and dealing with the problem "little-by-little".

In the first task, you will need to draw a diagram to help solve the problem. However, if you think back to the "Make a List" strategy, you should be able to see that all you are doing here is making a list in diagrammatical form – using "pictures" instead of numbers or words.

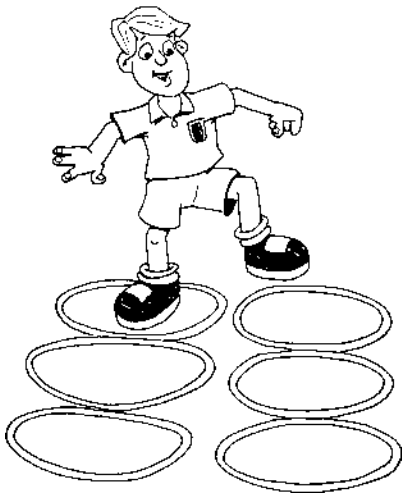
Triangle Puzzle

Make some puzzles for younger students in your school by cutting a piece of 8.5 x 11 cardstock into triangles. You need a total of seven triangles. One of the triangles must be half of the whole area of the paper. The children solve each puzzle by reassembling the triangles into the 8.5 x11 rectangle.

❑ How many different puzzles are you able to make? Use the space to draw your "list of diagrams".

Desired Outcomes:
Selects, describes and compares figures and objects on the basis of spatial features, using conventional geometric criteria.
Understands and applies directly length, area and volume relationships for shapes based on rectangles and rectangular prisms.

Hoop-lah



Your teacher asks you to set up an obstacle course on the playing field using various sized hoops from your equipment closet You must use all of the sizes available. The hoops need to be touching but not overlapping each other and must fit within a rectangle 20 m x 10 m defined by markers or domes. Design an arrangement which uses the maximum number of hoops, but the number of each sized hoops used should be as even as possible. For instance, it may not be possible to have 5 of each of three sizes
available, but 5 each of two of the sizes and 4 of the other size is much better than 12 small, 2 medium and 1 large.

Check your solution with someone else in your class who has solved this problem. See if your designs are the same and whether you both used the same number of hoops.

You can use the space here for your diagram or you may wish to use graph paper. Or use both!

Desired Outcomes:
Visualizes and makes models of 3D shapes and arrangements and interprets and produces conventional mathematical drawings of them.
Understands and applies directly length, area and volume relationships for polygons and circles, prisms and pyramids.

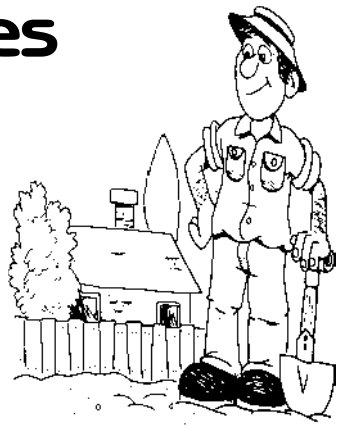
Roll Call

This week it is your job to run errands around the school. On Fridays, that means collecting the attendance rolls from all the classrooms and taking them to the office. Your teacher has a competition running, with a prize for the student who can work out the shortest route from your classroom door to the office door with all the rolls. You must collect each roll from each classroom – no combining!

❑ Draw a rough map of your school and use it to work out your entry.

Desired Outcomes:
Uses distance, direction and grids on maps and plans and in descriptions of locations and paths.

Rows of Veggies



Your dad is making a new vegetable garden and marks out a rectangular space 20 m x 5 m which he then divides into 4 equal squares. Then he decides to add another row underneath of squares the same size as the first row, but decides he will only have 3 squares in the second row. After he has finished, he realizes he needs to know how much area he has in his garden, and he asks you to get the calculator to help him work it out. You tell him you'll draw him a picture instead – it will be easier.

❑ Draw the garden in the space below, showing the total area and the area of each square.

Desired Outcomes:
Understands and applies directly length, area and volume relationships for shapes based on rectangles and rectangular prisms. Meets simple criteria relating to shape or structure when making or drawing things, making recognizable copies of arrangements of shapes.

Using Venn Diagrams 1

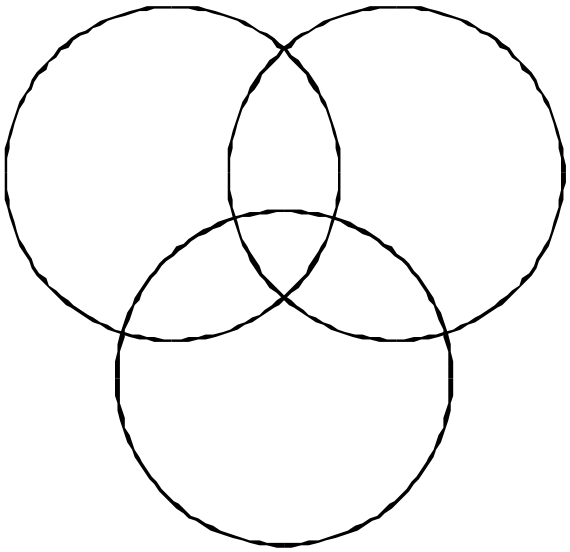
Venn diagrams are an ideal type of diagram to construct if you are attempting to sort data (information) in order to find items which suit certain criteria, or which have characteristics in common with other items, or if you want to find "the odd one out". You could discover what you needed to know through list-making, but organizing the data diagrammatically in these cases is much simpler and faster. It also makes it far easier for other people to read the information.

Puzzling Pencil Cases

Six people in your class have just a blue pencil case; four have just a red one. Five have a red and a blue; three have a red, a blue and a green pencil case. Two have a green and a red. Three more people have a green and a blue pencil case than have just a green case. There are 27 students in your class altogether: How many have a green and a blue, and how many have just a green?

If you label the three-way Venn diagram below with one color for each circle and then enter the information you have been given, you should be able to solve the problem easily and all information which may be needed is available "at a glance". It makes it easier to answer any more questions about the pencil cases, such as:

- ☆ Are there more people who have just a green pencil case than people who have one of each color?



Did you notice that you needed to use the "Guess and Check" strategy to help you find the answer? _____

Desired Outcomes:

Calculates with whole numbers, money and measures, drawing mostly on mental strategies to add and subtract two-digit numbers and for multiplications and divisions related to basic facts.
Organizes and interprets data in Venn diagrams.

Using Venn Diagrams 2

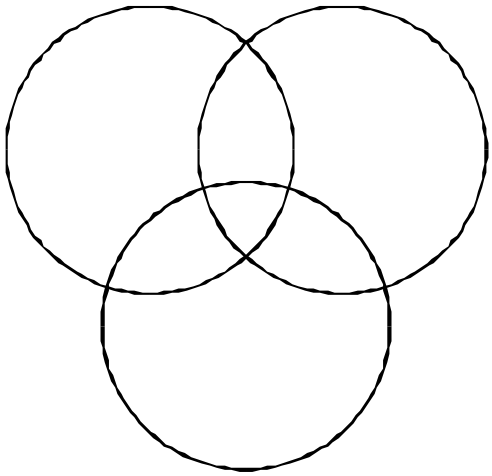
Like Peas in a Pod

Here is a more complicated version of the same type of problem on the last page.

Your class members have collected a selection of pieces from bushes and trees from their gardens and brought them to school for a science study project. Altogether, the selection includes pieces with leaves, seed pods and flowers.

Two more pieces have seed pods only than have flowers only. There are 37 pieces that do not have seed pods at all. Two more have both flowers and leaves but no seed pods than have seed pods only. A total of 60 have leaves, but only 9 of them have leaves only. 12 have flowers only. 1 more piece has seed pods only than seed pods and leaves only, and 3 more have flowers and seed pods but no leaves than have flowers and leaves but no seed pods.

❑ Use the three-way Venn diagram below and fill in the sections of the circles from the information given. You may need to read it several times! When you have entered all the data, check through all the clues again and make sure your entries "add up".



❑ Now it should be easy to answer the following questions:

1. How many pieces have leaves, flowers and seed pods? _____

2. How many have flowers and seed pods but no leaves? _____

3. How many have flowers and leaves but no seed pods? _____

4. How many do not have flowers? _____

5. How many only have seed pods? _____

6. How many pieces were brought in to the classroom? _____

Desired Outcomes:

Organizes and interprets data in Venn diagrams.

Calculates with whole numbers, money and measures, drawing mostly on mental strategies to add and subtract two-digit numbers and for multiplications and divisions related to basic facts.

Teachers' Notes: Work Backwards

This is a useful strategy to employ when an outcome is clear and known, but the range or sequence of events which produced the known result may be needed.

Thus, the type of problems which call for this strategy will typically involve calendars or other measures of time.

The resolving of these problems, much like the chance & data examples in the "Draw a Diagram" section, usually involves the plotting of information so that a number of questions concerning the events can then be answered.

Student Information Page

You can use this strategy when you know the end result of what has happened, and you want to find out about the course of events which led to that result. You may need to know the starting point, or want to be able to isolate any part of the process.

Swimming Laps

For instance, if a friend was increasing the number of laps he swims by 1 each day, and he tells you he swam 17 laps yesterday (a Tuesday), you could work out when he started and how many laps he swam last Thursday. You would count backwards from yesterday. As with all problem solving, think about how to organize your information. In this case, the information is in numbers and days. Draw up a grid to help you, with the days of the week across the top.

Picking Strawberries

❑ Use the same approach to find the answer to this number problem.

Your friend is paid to pick strawberries during spring break and tells you she earned $55 today. She has become more efficient at picking since she began working and each day she manages to earn $5 more than the day before. You think it sounds like good money and ask if she can get you work. She says she will try, but you should remember that it took her nine days to be able to earn $55 day. How much would you expect to earn on your first day, assuming you work at the same rate as she did?

Desired Outcomes:
Adds and subtracts whole numbers and amounts of money and multiplies and divides by one digit whole numbers, drawing mostly on mental strategies for additions and subtractions readily derived from basic facts.

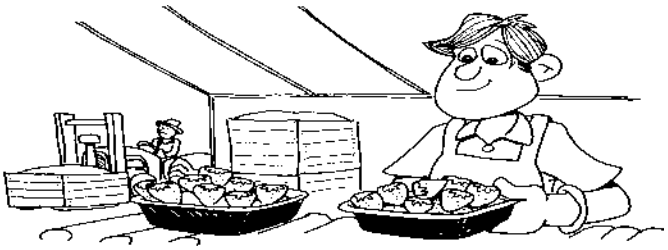
More Strawberries

❑ Check back to the 'Picking Strawberries' activity (page 39) for details on this problem.

After you have been working at the strawberry farm for a while, you cannot work any more efficiently and your maximum earnings are $65 day. After three days of earning the maximum daily amount, you decide you have had enough and you quit. Your last work day is a Thursday. You had last Sunday off and then found that on Monday you only earned the same as you had on the Saturday before your day off.

Draw a grid to help you answer the questions below. Plot the information that you already have onto the grid.

1. On what day of the week did you start working? _____
2. How much did you earn a week ago? _____
3. On your day off, you went shopping at the mall and spent $60 of your earnings. On which day was that a whole day's pay? _____
4. How many days did you work altogether? _____
5. Your dad says that if you'd stayed two more days, working at your maximum rate, you would have $700. Is he right?



Desired Outcomes:
Adds and subtracts whole numbers and amounts of money and multiplies and divides by one digit whole numbers, drawing mostly on mental strategies for additions and subtractions readily derived from basic facts.

Silkworm Sizes

Your group has been observing silkworms that have been hatched from eggs in your classroom. You are plotting their growth on a graph which you have divided into 5 millimeter gradations, with the lowest measurable value at 5 millimeters. You measure the caterpillars every Monday and notice that they double their size every week. Your measurement for today is 4 centimeters.

When did you make the first graph entry? _____

How long were the silkworms three weeks ago? _____

Amoeba Division

A single cell amoeba divides and forms two cells every 20 minutes. Each new cell continues to multiply at this rate.

The science lab has several jars containing amoeba cultures. One jar contains 256 cells and a second jar contains 2,048.

It is now 2:40 pm.

What time did the amoeba in the second jar first divide and grow? _____

How much longer have the amoeba in the second jar been growing than the culture in the first jar? _____

❑ The lab assistant shows you a jar which she says contains over half a million cells and asks you to guess when you think the culture was begun.

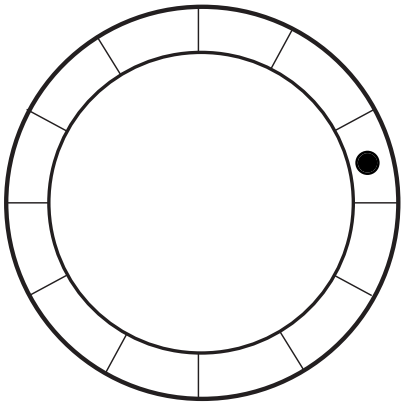
What would your guess be? _____

Desired Outcomes:
Displays and summarises data using frequencies, measurements and many-to-one correspondences between data and representation.
of a sensible size for the descriptions and comparisons to be made.
Recognizes, describes and uses patterns involving operations on whole and fractional numbers and follows and describes rules for how successive terms in a sequence or paired quantities can be linked by a single operation.

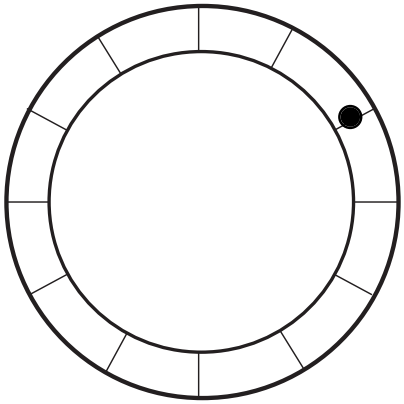
Set the Dial

The dial on the timer for the kiln in the art room has lost its markings, but you know that zero is at the top of the dial, although one full rotation of the dial is not equal to one hour. It is wound in a clockwise direction to set the timer. Your group needs to place your pots in the kiln for an hour and ten minutes, after another groups' same pots have finished. You need to work out where to set the dial.

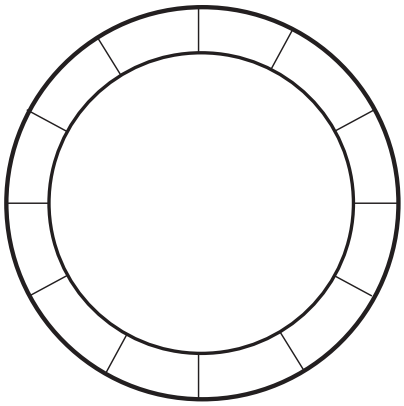
❑ When you look at the dial, you see that the marker is in the following position:

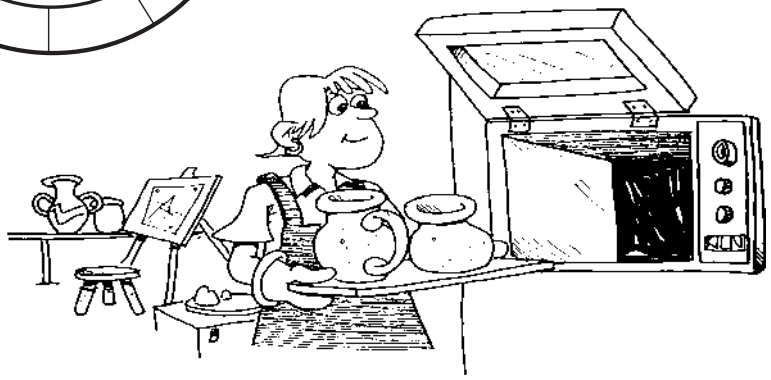


❑ Your teacher tells you to check the dial again in ten minutes and then you will be able to work out where to set the timer for your pots. In ten minutes, the dial looks like this:



❑ Where will you set the timer for your group's pots? Explain.





Desired Outcomes:
Recognizes and sketches the effect of straightforward translations, reflections, rotations and enlargements of figures and objects using suitable grids.

Teachers' Notes: Logical Reasoning

Logical reasoning is a process by which information is noted in a systematic way so that further necessary information can be gained and likewise noted. At times calculations will be necessary during the process in order to give rise to information.

Thus, the information is presented much in the manner of "clues". If the answers to these clues are recorded properly, the solution will show itself.

This strategy has been introduced last, as so often logical problem solving involves the application of the other, previously learned strategies.

By now, the students should be familiar with the idea of organizing their approach and dealing with the problem "little-by-little" in systematic fashion.

Student Information Page

As you have seen throughout this book, the secret to successful problem solving is starting with what you know and then thinking in an organized fashion to fill in what you don't know. Sometimes that organized thinking involves drawing a diagram or making a list and you can also employ strategies such as "Guess and Check" or working backwards in time. Often, more than one strategy is helpful. You should have some idea now of the strategy or strategies which seem to best suit particular kinds of problems.

This strategy, "Logical Reasoning", means noting down clues in an organized way, usually a grid, checking the given information as you go, adding more, and so on until the final check gives you a confident answer. It is just another way of conducting ordered thinking so that your brain doesn't boggle.

Mystery Number

❑ Try finding the following mystery number by following the sequence of clues. You will find it helpful to list the possible answers from the first clue and then cross off numbers as more clues are added:

The number is greater than 50 but less than 100. It is an odd number which is divisible by 3 but not by 9. If you took the value of the second digit in the number from that of the first digit, you would be left with 1.

What is the number? _____

Another Mystery

❑ Here is a more complicated version of the same type of puzzle:

The number has three digits. It is an odd number, which is divisible by three and nine, but not six. The first and last digits are the same. The second digit is a higher number than the other two and is an even number.

What is the number? _____

Desired Outcomes:
Understands the meaning, use and connections between the four operations on whole and decimal numbers and uses this understanding to choose appropriate operations and constructs and completes equivalent statements.

Cartoon Capers

At your class fancy dress party, four of your friends went as cartoon characters. The boy went as Donald Duck and the second tallest girl went as Minnie Mouse. The twin girls went as Tweety (the shorter twin) and Sylvester. Amy and Lisa are from different families and Amy is shorter than Emma, Lisa and Matthew.

❑ Who went as which character?

If you organize the information contained in the clues into a grid, the solution becomes easier. Consider each person for each character and place a check in the box when you have checked the clues and are sure of each one.

	Donald Duck	Minnie Mouse	Tweety	Sylvester
Matthew				
Amy				
Emma				
Lisa				

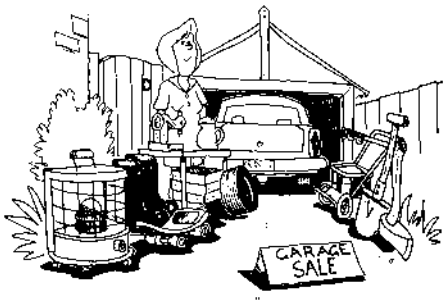
❑ Now try this one. Instead of a grid this time, you may find a diagram is more helpful.

Your teacher has asked you to help work out a seating arrangement for eight students in your class and has given you some information about where they should sit. The desks will be arranged in one row across the room. Jake must sit at one end and Matthew at the other. Thomas can sit next to Luke but must be three places away from Amy. Mai Lin must sit next to Amy and be closer to Matthew than to Jake. Jasmine is to sit next to Thomas and Dylan needs to be five desks away from Amy. Luke should end up next to Dylan.
Put your diagram here:

1. Is Jasmine or Tom closer to Matthew? _____
2. Who sits three places away from Jake? _____
3. Who sits next to Matthew? _____
4. Who sits between Jasmine and Amy? _____

Desired Outcomes:
Reads and understands data given in a story and uses logic to solve a problem.

Garage Sale



You are setting up stalls in your classroom for a garage sale to raise funds for camp and there is space for six stalls, numbered 1 to 6 from the door. You want the drinks stall to be next to the hotdog stall, but you don't want it to be the first stall you come to when you enter. You want people to come to the lucky dip before they get to the raffle stall. You decide the white elephant stall should be two stalls before the hotdog stall and you place the lucky dip four stalls after the books and comics stall.

❑ Draw a floor plan for your garage sale, labeling and numbering each stall.

❑ Which other strategy or strategies did you use to help you solve this problem?

_____

_____

Desired Outcomes:
Identifies the essential features of a location or arrangement needed to suit a purpose and represents in networks and other diagrams.

Looking at Every Angle

Use your protractor to draw five angles in the space below. There must be only one right angle. Two angles must be **acute** and two **obtuse**. The difference between the largest and the smallest angles should be 140° and the smallest angle should be 60° smaller than the right angle. One angle should be 100° smaller than the largest angle and another must be 40° larger than the second smallest angle.

Desired Outcomes:
Students visualize and make models of 3D shapes and arrangements and interpret and produce conventional and mathematical drawings of them.

Measurement

Cross Country Calculations

Six students from your class compete in your school cross-country race. The fastest time for completion was 27 minutes and 34 seconds. Byron went the wrong way and did not finish. Toby scored the slowest time and his friend William beat him by 5 minutes and 21 seconds. The gap between the slowest time and the fastest time was 8 minutes and 15 seconds. The second place winner was Tom, who was beaten by only 23 seconds. Harry, who usually wins, was this time beaten by Jonathan by a margin of 36 seconds.

❑ Draw up a grid showing each boy's placing and score.

Model Models

❑ Use centimeter cubes to build five models according to the following guidelines:

Your largest model must use 24 more cubes than your smallest model. The smallest model has a volume of 20 cubic centimeters (cm^3). The mid-sized model has a volume which is half way between that of the largest and that of the smallest. The second biggest model uses 14 more cubes than the second smallest. The second smallest uses an even number of cubes and its volume is closer to the smallest model than the volume of the second biggest is to the largest model. There is more than 2 cm^3 difference between each model.

Desired Outcomes:
Understands the meaning, use and connections between the four operations on whole and decimal numbers and uses this understanding to choose appropriate operations and constructs and completes equivalent statements.
Understands relationships involving the perimeter of polygons, the area of regions based on squares and the volume of prisms based on cubes, and uses these for practical purposes.

Answers

Guess and Check

Page 7

Girls - 13, Boys - 17; 21 tennis balls.

Page 8

Going Round in Circles: 2.53 km; 2.49 km.
Show Time: 2hrs 15 mins.

Page 9

Answers will vary, but students need to show that they: Determined the scale of the larger map; measured the small and the large paper; determined the size relationship between the two papers - e.g. 8.5x11 paper is approximately size of large paper; adjusted the scale accordingly, e.g. if around size and larger scale 1m:1cm then adjust scale to 4m:1cm; check extent of buildings to make sure it will fit and that there is not excessive space left over; adjust if necessary until optimum scale is reached.

Page 10

Red, White and Blue: You have a 30% chance of a receiving a red vest as 15 out of a total of 50 vests are red. (10 are white and 25 are blue).
Thirsty Pets: Cat: 6.25 liters; Rabbit 12.5 liters; Dog 18.75 liters. Total: 37.5 liters.

Make a List

Page 12

Student Information Page: If tuna sandwiches added: 24 combinations; If nectarines added: 30 combinations.

Page 13

Answers will vary but a minimum of 5 items is needed. The dress is not a good choice as 5 more items are still needed. Using 5 items will give enough combinations for 6 "different" days.

Page 14

Girls could go 21days; boys only 12 (assuming they don't wear dresses or skirts). Also, assuming that no pants or shorts are worn with the skirt for girls.

Page 15

Yes - there are 24 possible orders in which the balloons could be placed.

Page 16

Because he goes first, he has a slightly better chance of winning. He will definitely win if he throws a 2 or a 5, you will definitely win if he throws a 1. You both have an equal chance of winning if he throws a 4 or 6, and if he throws a 3, you have a 5 in 6 chance of winning.

Page 17

Part A: The possibilities are: 1 x 18, 2 x 9, 3 x 6, 4 x 4.5, 5 x 3.6, 6 x 3, 9 x 2, 10 x 1.8, 12 x 1.5, 15 x 1.2, 18 x 1.
Part B: If all 4 sides could be in cm measurements, then the list would have to include all first measurements of all 100 points between each meter mark. There would be 1800 possibilities to check! If other shapes were considered, it would not take as long to check possibilities. For instance, if triangles were included, all the possible rectangles with an area of 36 m^2 could be halved with a diagonal line. A circular garden would have to have a diameter of 2.7 m. Some students **may** be able to investigate hexagonal or octagonal designs by triangulating shape sectors and calculating their areas.

Page 18

Answers will vary and will need to be checked to see if they are logical and satisfy criteria.

Find a Pattern

Page 20

1. 10; 2.
3. Multiply by 2 then add 1; 4. Multiply by 2 then subtract 1, 2, 3,etc.

Page 21

a) The lunch combination pattern: 84.
b) There would be 5,040 possible balloon combinations.

Page 22

Patterns 1: 3:28:30 The watch is losing time at the rate of 2 secs: 3 mins - a 2/3 rate. The lost time over the course of the day must be added on to the two minutes lag at 8:50. Patterns 2: On Day 11 (Sunday) the bulb needs 213.57 ml. The rate increases by half as much again each day: 4; 6; 9; 12.5; 18.75; 28.125; 42.187; 63.28; 94.92; 142.38; 213.57. So on Monday when you come to school it will be dry.

Answers cont.

Find a Pattern cont.

Page 23

Answers will vary but tile tessellations should be checked to ensure rotations are accurate - although this will most likely be apparent from the resulting pattern. Students should be assessed for complexity of design.

Page 25

There are numerous patterns which students may be able to discern; including: All three types show a similar pattern over the course of the year. Sales for women's and men's clothing peak in December, but children's peak in January. Women's clothing shows a mid-year peak which is not as high as the December peak. Men's clothing sales show the least monthly and seasonal variation. The store should advertise in May or June to increase men's sales.

Solve an Easier Version

Page 27

There would be 9 full sheds and the tenth would contain 3,000 bales. There would therefore be room for 5,000 more bales. Another 33 truck loads would bring 4,950 more bales.

Page 28

A Colorful Problem: Each week the teacher uses 14 tablespoons of powder and 7 liters of water; so if each figure is then multiplied by 40 for the school weeks in the year, the totals are: powder - 560 tablespoons; water: 280 liters.

Flying High: There are 6 planes leaving in an hour, therefore 144 planes fly out every 24 hours. There are 365 days in the year so 365 x 144 = 52,560. If you calculate the answer based on how many planes leave in one week, the answer will be 52416. Technically, this second amount is incorrect as it is based on 364 days only.

Page 29

(a) The student needs to find out how many steps they take to cover 350 meters and will need to step this out. Then steps taken multiplied by 2 gives the daily rate. A calendar could be used to discover the accurate total number of school days in the current year, and then the daily number of steps multiplied by that figure. Example: 420 steps x 2 = 840 steps per day x 186 school days = 156,240 steps each year.

(b) Similar process should be used, only students are dealing with units of time and will need to convert seconds/minutes/hours.

Page 30

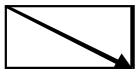
Face Painting: 600 ml.

A Comet for Life: Students need to first calculate how many days the comet should be visible at each visit. 75% of 20 =15, less the average 4 days non-visibility makes 11 days per year. Then the number of visits in the lifetime needs to be calculated – ideally a calculator could be used to enter in 1, then add 5 repeatedly to 81 - 17 visits x 11 days = 187 opportunities.

Draw a Diagram or Table

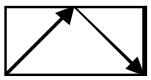
Page 32

Students' diagrams should show variations based on an initial diagonal bisection



(the bisection could be in either direction)

as well as on a triangular bisection. The students' understanding of area should be demonstrated here.

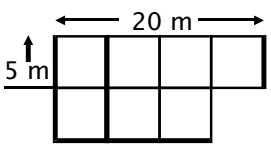


Their diagrammatic "list-making" should show that they have used subsequent bisections of the triangles. Students should create at least six possible puzzles.

Page 33, 34

Students' solutions will vary and should be checked to ensure criteria have been met.

Page 35

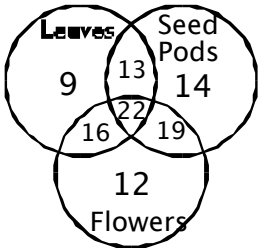


The diagram shows that each square is $5m^2$
The original garden was 100 m^2 so an additional $75m^2$ gives $175m^2$ total.

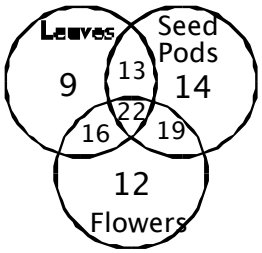
Answers cont.

Page 36

5 have a green and a blue, 2 have only green.
No - 2 have just green and 3 have one of each.



Page 37



22 pieces have leaves, flowers and seedpods; 19 have flowers and seedpods but no leaves; 16 have flowers and leaves but no seedpods; 36 do not have flowers; 14 only have seedpods; 105 pieces were brought in to the classroom.

Work Backwards

Page 39: Number 1

Swimming Laps: He swam 12 laps last Thursday.
Picking Strawberries: $15

Day	1 (Today)	2 (Yest)	3	4	5	6	7	8	9
Amount	$55	$50	$45	$40	$35	$30	$25	$20	$15

Page 40: Number 2

THURS	WED	TUES	MON	SUN	SAT	FRI
$65	$65	$65	$60		$60	$55
$50	$45	$40	$35	$30	$25	$20
$15						

1. You began work on a Thursday; 2. You earned $50 a week ago; on your day off, you went shopping in the city and spent $60 of your earnings; 3. That was a whole day's pay on Monday; 4. You worked 14 days altogether; 5. Yes, your Dad is right.

Page 41

Silkworm Sizes: You made your first graph entry 4 weeks ago.
Three weeks ago the silkworms were 1 cm long.

Amoeba Division: The amoeba in the second jar first began to divide and grow at 11:20 am.
The amoeba in the second jar have been growing 1 hour longer than the culture in the first jar. Students are not asked to calculate the exact answer to the lab assistant's question but the correct answer is 6 hrs 20 mins. Guesses should be reasonable and based on previous information.

Page 42

The dial should be set at the point halfway between the second and third mark between the zero and the one.

Logical Reasoning

Page 44

a) 87 b) 585.

Page 45

a) Matthew - Donald Duck; Amy - Tweety; Emma - Sylvester; Lisa - Minnie Mouse.
b) Order: Jake, Matthew, Tom, Luke, Amy, Mai Lin, Jasmine, Dylan; 1. Tom; 2. Luke; 3. Jake and Tom; 4. Mai Lin.

Answers cont.

Page 46

From the door - 1. Books & Comics 2. White Elephant 3. Drinks 4. Hotdogs 5. Lucky Dip 6. Raffle.

Page 47

Angles should have the following measurements: 30°; 70°; 90°;110°; 170°.

Page 48

Cross Country Calculations:

1st	2nd	3rd	4th	5th	6th
27:34	27:57	28:10	30:28	35:49	N/A
Jonathan	Tom	Harry	William	Toby	Byron

Model Models:

The cubes should have dimensions as follows: 20cm^2; 24 cm^2; 32 cm^2; 38 cm^2; 44 cm^2.

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GRADES 6-7

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