Activity 1

LARGER SHAPES

Discussion

Students will need to physically manipulate the shapes in order to see the pattern involved in extending each shape. The first shape replicates the manner in which the larger square was constructed. The triangles require one of the pieces to be flipped in order to make the larger triangle. Encourage students to continue the patterns to make the next largest shape.

Activity 2

GRID FUN (1)

Discussion

The grids can be organised in a number of ways. However, each different way will have one or two diagonals with four blocks of the same colour. Two grids are provided to enable students to explore and try different possible arrangements.

Activity 4

THE BIG RACE

Discussion

The problems can be solved in several ways. One is to work backwards from the final position, reasoning that the reverse of each condition must be performed. For example, Gina finishes in fourth position and must pass three cars and then be passed by seven cars to get back to her original position.

Some students may need counters to model the process of cars passing and being passed. Students could use 12 counters, with the single-colour counter representing Gina's car, and the other counters (of a second colour) representing the other 11 cars. Other students may prefer to base their solution on a diagram that shows what has happened.

Also, rather than working backwards, some students may prefer to work forward – choosing a position for Gina and working through each of the events in the race. If Gina does not end up in fourth place, an adjustment will need to be made to the original position chosen. In this way, a process of 'try and adjust' can lead to the correct starting position. Note that the positive expression 'try and adjust' is much more helpful than the often used 'guess and check'.

The second problem extends the concept; however, this time the initial position is given and the question is reversed so that students are asked for the number of cars that Jordan needs to pass to take the winning position.

Activity 11

HOW MANY DIGITS?

Discussion

These investigations explore students' ability to solve questions about the number system and to keep track of the possible answers they find. In coming to terms with the question, they must discuss what it means to *say* a digit as opposed to *writing* it. As the problems progress to exploring other numbers, there will be further aspects to consider, such as how '3' or '5' is read in some numbers and how the 'four' in 'fourteen' and 'forty' sound the same even when written differently.

For the first question, students must realise that 'one' is said nine times from 0–99 in the ones places for 1, 21, 31… but not for 'eleven'. There will be another nine of the same form from 100–199, together with the 100 times 'one' is said with each 'one hundred and …'. 'One' is said a total of 118 times. If students need help in organising their solution, they can write or be given a 0–99 board that shows how place value uses tens and ones for two-digit numbers. However, they should be left to explore their own ways of coming to terms with the problem and determining solutions, rather than simply replacing it with an exercise in counting every '1' in the 0–99 board. The digit '1' is written 140 times. Careful consideration must be given to 11 and 111 to see this.

For the second question, 'two' is also said nine times from 0–99, with another nine times from 100–199 and another for '200'. From 1–200, the digit '2' is written 41 times.

If students take the problem further and try other one-digit numbers, as suggested, they will find that 'three' has a similar pattern as 'two'. However, there is a different pattern altogether when saying 'four'. For this to occur, you have to include the pronunciation of the word part 'four' within 'fourteen', 'forty', 'forty-one', etc. The pattern repeats for the digits 6 to 9 (with the pronunciation, for example, of 'six' within 'sixty'). When students notice this they will have really come to terms with the strategic thinking needed to organise and solve problems with several interacting conditions.

Activity 19

WINDOW PANES (1)

Discussion

The panes can be organised in the windows in 24 possible ways. With 25 panes drawn on the page, some students may simply repeat a previous combination in order to fill all of the panes. The problem states that they use one of each colour pane; therefore, each window needs one red pane, one green pane, one blue pane and one yellow pane.

Activity 20

WINDOW PANES (2)

Discussion

This activity builds on and extends the experiences in Activity 19. Twenty possible designs can be made using six panes of glass in two different colours. As there are more windows than needed, some students may simply repeat a previous combination in order to fill all the panes. A systematic process of trying different combination is needed to find all the possibilities and to avoid duplication.

Activity 26

ANIMAL TRAILS

Discussion

Question 1

In this problem, the snail crawls around the paddock more than once. It passes around corners A, B and C twice before coming to rest at corner D after having travelled 315 cm or 3 m 15 cm.

Question 2

For this problem, the addition required to keep track of the centipede's progress is more complex. However, some students may realise that the length of the short and long sides combined is 125 cm and use this to calculate that the distance to reach corner D a second time is 375 cm. When the centipede travels a further 85 cm, it will have travelled 460 cm or 4 m 60 cm and stopped at corner C.

Question 3

This problem is more difficult as not all of the lengths are given and must be calculated first from the information provided on the diagram.

Activity 27

BALANCE THE BOOKS

Discussion

To solve these problems, students explore the relationships among the numbers on each pan of the balance and then compare the weight of one pan to the other. Estimation could be used, or the sum on each side could be used to solve which number needs to be subtracted to make the pans balance.

Activity 28

TAKING TIME

Discussion

This page explores students' understanding of digital time as they investigate the ways the digits can be placed to show different times and read the times to compare which is earliest and latest. The way in which zero is used on a digital clock also needs to be considered. In Problem 2, there are only four possibilities (as there cannot be 90 or 95 minutes), but 0 can be used to show the hour after midnight (if using 24-hour time). In Problem 3, there are more possibilities when 24-hour time is considered and zero can be used in all possible positions. The final question requires interpretation of the possible times. Discuss 24-hour time: For example, why does a new day begin in the middle of the night?