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INTRODUCTION

Maths can be wonderful!

The opportunities mathematics present to be creative and to explore and explain the world are truly to be appreciated—like being able to model solid shapes with regular formulae. Look at the way you can play with maths, the way you can model how things actually are and see what happens when you change things—for instance, when you switch interest rates in a school savings bank in a spreadsheet. Don't worry, we'll explain all about spreadsheets later!

Isn't it great the way maths lets you express new and old ideas in a concrete way? Don't you just love the fact that mathematics is a language in its own right? With mathematics you can communicate with other people all over the world, people who have all sorts of experiences different from your own. They all appreciate and use the fact that adding two even numbers or adding two odd numbers, for instance, will always produce an even answer but adding an odd and an even always makes an odd—in any language. There is a very real sense of achievement to be derived from having a problem (like how much wood you'll need to make a home for a rabbit), needing an answer, and using a whole range of strategies to solve the problem. People feel proud that they come to know how to choose which apparatus and which methods are needed for a particular situation. Many people have gotten a whole lot better at just guessing; they know that at times having to estimate something is satisfactory, and they enjoy their increased accuracy.

People like being able to generalise from the way things behave in mathematical situations; they love being able to predict patterns and relationships—like the way every number eventually comes in turn in the ones unit of the nine times table.

Kids love to have a theory, test it properly, and see if it holds up or needs to be modified. They watch themselves learn, and they delight in the way they change as a result. For example, checking their predictions that counting in twos will never land on a number with a seven in the ones place reinforces the learning process.

Many people love the way that you can often check your answers in more than one way—the computer is great for this; it can save a lot of time and effort. Provided it is given the correct task, it can take away many of the chores—especially calculating and computing—freeing the user to create and imagine. It's the computer that also lets us model, lets us express our theories and ideas to others—often quite vividly, visually; it also lets us ask, “What if...?” and see how close we were and what does actually happen as well. Since the computer only does what you tell it to do, it often makes one look again at what one is thinking. It's very clear in showing how things behave and in making models and theories unambiguous. Others can share in one's findings and experiments. Love maths and the computer!

This book is intended to give you and your students the same opportunities to develop this love of mathematics. Enjoy!

SPREADSHEET TABLES

Multiplication tables often cause difficulty because students do not really understand what they are or how they work. Here is one way to use one of the commonest pieces of computer software, the spreadsheet, to demonstrate why these sets of numbers behave as they do. This is also an excellent introduction to spreadsheets, since students of most abilities will be familiar with the multiplication tables. They can use what they know and are comfortable with to explore basic data entry and manipulation of formulas.

Grade Level: 6–8

Software: spreadsheet program (see page 8)

Procedure:

Before the Computer:

- Teachers should discuss with students the idea that the tables they learned in primary school also have logic and are not just a set of figures which have been memorised.

On the Computer:

- Students should open a spreadsheet program and create five columns.
- In the far left column, enter the *multiplier* (usually the finite series 1 to 10 or beyond). Make it clear what this number means.
- The second column is the symbol for “times” or “by” (usually the letter x or an asterisk *).
- The third column contains the *multiplicand* (in this case 2, as it is the two times table).
- The fourth column would normally contain an = sign. This causes confusion in some spreadsheets because it is associated with entering formulas so students should use the text “is” instead.
- Before proceeding, the students should predict what they think will happen and why.
- The fifth column is the most important and most interesting. It contains the formula that multiplies the contents of cell A1 by those of cell C1, etc. (i.e., the multiplier by the multiplicand). Teachers may need to consult the spreadsheet’s manual to check on the exact syntax. Usually it involves the expression SUM or an = sign as in the example here.
- Note that all data and formulas entered in the first row (1) can be copied or replicated to save time and accurately reflect how spreadsheets are used in most real-life situations. (Now might be a good time to discuss financial uses of spreadsheets with students.)

SPREADSHEET TABLES (Cont.)

E1		×	✓	=A1*C1		
	A	B	C	D	E	
1	1	x	2	is	2	
2	2	x	2	is	4	
3	3	x	2	is	6	
4	4	x	2	is	8	
5	5	x	2	is	10	
6	6	x	2	is	12	
7	7	x	2	is	14	
8	8	x	2	is	16	
9	9	x	2	is	18	
10	10	x	2	is	20	
11						
12						
13						
14						
15						

Options and Extensions:

It is important that students understand why the numbers in the fifth column behave as they do. They are the product of a constant (the subject of the multiplication table in question) and the multiplier. This may mask the idea of repeated addition that some students may have come across. Further experimentation with the spreadsheet will help.

1. Students work on other tables (3 to 10 and beyond).
2. Predict what happens with negative numbers.
3. Try to construct multiplication tables with decimal fractions.
4. Some students may need to see that the principle of letting the formula “take the strain” holds true with bigger multipliers than 10. Have them extend this to 20 or beyond. This may help some students see that there is no magic involved.
5. More able students might try and arrive at a formula for generating the multiplier incrementally. Have the spreadsheet manual on hand for this.
6. Decide how far students should go with formatting their spreadsheets. Some students may get carried away with coloured backgrounds and fancy fonts for each column. Others may not even bother centring data in columns. Discuss the appropriateness of each approach and arrive at a class consensus.
7. Students should write up what they did and how it was done in their maths journals.

MULTIPLICATION GRID

Another useful way to use spreadsheets is to construct a complete multiplication square to 100. This exercise has the advantage of reassuring less able students by working with number facts that are regular and with which they will be familiar. It can also act as a useful resource for them later.

Grade Level: 6–8

Software: spreadsheet program

Procedure:

Before the Computer:

- Discuss what a number grid is and does and how it can be used. Look for examples from outside the classroom. These may include timetables, distance between towns (see page 43), or tax tables. Make sure the students appreciate the relationship between the rows and columns. Entering the figures manually this way will reinforce the behaviour of these numbers.

On the Computer:

- Open a spreadsheet with initially 11 columns and 11 rows. Along the top (1) row enter the numbers 1 to 10 to begin. Down the left-hand (A) column do the same. In each case advanced and more confident students might like to derive a formula for this simple sequence.
- The fun part is to generate the product at each intersection. Different spreadsheets will do this differently. It is not always so straightforward as it seems. Using the same formula as in the previous exercise (see pages 12 and 13), may produce surprising results. Have students explain these if they occur. This underlies the importance of encouraging students to predict what will happen and to record their predictions.

Options and Extensions:

Some students are apt to get carried away and may want to construct a grid to one thousand. This in itself may be a useful opportunity to estimate how big such a sheet would be. It may even lead to some discussion about the fact that 100 is a square number and 1000 is not.

Another valid activity at this point is to have the students print out their number grids from the computer and display them for later use. This will encourage another aspect of familiarity with the relevant software: printing to size.

MULTIPLICATION GRID (Cont.)

Options and Extensions: (Cont.)

There are a number of extension activities which teachers may want to pursue.

1. Students challenge one another to spot a mistake deliberately introduced by one or more purposefully, inaccurately entered products.
2. See what happens when negative numbers are used.
3. See what happens when decimals or fractions are used.
4. Try deriving and then listing prime numbers in the grid to 100. The most able students in each group may like to try and find a rule for this. Students who need greater challenges may also like to predict (very hard) and record (less so) how many primes will occur when the grid is extended to 11 by 11, 12 by 12, 13 by 13, etc.
5. Students make a graph of the most common numbers (24 and 36 occur a lot of times, for example). It is important to discuss why this is. It may lead to factor work (see pages 19 and 20) and even remind students of the strange and yet logical way that multiplication works. Look at the end digits, for instance, of the nine times table.
6. Remember that many students and adults fail to appreciate the relationship between 3 lots of 8 and 8 lots of 3. Teachers can explore this by the use of colour.

K6		×	✓	50								
	A	B	C	D	E	F	G	H	I	J	K	L
1		1	2	3	4	5	6	7	8	9	10	
2	1	1	2	3	4	5	6	7	8	9	10	
3	2	2	4	6	8	10	12	14	16	18	20	
4	3	3	6	9	12	15	18	21	24	27	30	
5	4	4	8	12	16	20	24	28	32	36	40	
6	5	5	10	15	20	25	30	35	40	45	50	
7	6	6	12	18	24	30	36	42	48	54	60	
8	7	7	14	21	28	35	42	49	56	63	70	
9	8	8	16	24	32	40	48	56	64	72	80	
10	9	9	18	27	36	45	54	63	72	81	90	
11	10	10	20	30	40	50	60	70	80	90	100	
12												