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Using Calculators in the Primary School

Using Calculators in the Primary School

Lyn English – QUT

With extra material from

Tom Cooper – QUT and

Eva de Vries – Independent Schools Queensland

YuMi Deadly Maths
Past Project Resource

Acknowledgement

We acknowledge the traditional owners and custodians of the lands in which the mathematics ideas for this resource were developed, refined and presented in professional development sessions.

YuMi Deadly Centre

The YuMi Deadly Centre is a Research Centre within the Faculty of Education at Queensland University of Technology which aims to improve the mathematics learning, employment and life chances of Aboriginal and Torres Strait Islander and low socio-economic status students at early childhood, primary and secondary levels, in vocational education and training courses, and through a focus on community within schools and neighbourhoods.

“YuMi” is a Torres Strait Islander word meaning “you and me” but is used here with permission from the Torres Strait Island Regional Educational Council to mean working together as a community for the betterment of education for all. “Deadly” is an Aboriginal word used widely across Australia to mean smart in terms of being the best one can be in learning and life.

YuMi Deadly Centre’s motif was developed by Blacklines to depict learning, empowerment, and growth within country/community. The three key elements are the individual (represented by the inner seed), the community (represented by the leaf), and the journey/pathway of learning (represented by the curved line which winds around and up through the leaf). As such, the motif illustrates the YuMi Deadly Centre’s vision: *Growing community through education*.

More information about the YuMi Deadly Centre can be found at <http://ydc.qut.edu.au> and staff can be contacted at ydc@qut.edu.au.

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USING THIS BOOK

Using Calculators in the Primary School has been designed for teachers across all year levels of the primary school.

The book comprises two parts. The first section introduces the role of the calculator and includes guidelines on the selection of a suitable school calculator. The ideas presented in this introductory section form the framework for the activities outlined in the second section. Hence, it is imperative that these introductory notes be studied prior to working the activities.

It is not intended that the activities presented here be taken as a set of '*calculator lessons*'. Rather, they should be seen as a source of ideas for integrating the calculator within the daily mathematics experiences of children. In other words, the calculator should be viewed as a means to an end, not an end in itself. Because the calculator can serve this purpose across all strands of the mathematics curriculum, the activities have been classified by type of learning experience and by year level. This is displayed on the grid on *page 6*. For ease of reference, page numbers have been included in the cells on the grid. They indicate where the activities appropriate for a particular type of learning experience at a particular year level may be found. Two points should be kept in mind when using this grid:

- (a) Not all cells contain page references. This occurs when calculator use would be inappropriate for the learning experience at that particular year level.
- (b) The activities referenced in the cells are only **representative** of the types appropriate for that cell. It is suggested that the reader supplement the given activities with additional examples. (In some cases, space has been left for the inclusion of further activities.)

SECTION A

OVERVIEW

USING CALCULATORS IN THE PRIMARY SCHOOL

As a technological learning aid, the calculator is both attractive and motivating to children in all primary grades. It is inexpensive compared with most other learning materials and requires very few skills to be operated. Furthermore, the calculator does not lose impact as children progress to higher grade levels, nor does it require '*phasing out*' in readiness for a more advanced learning aid. It can also produce maximum output with minimum input — young children can significantly improve their numeral recognition skills simply through depressing the digit keys.

The calculator is also very versatile. Unlike most other learning aids, it can accommodate a broad range of topics in the mathematics curriculum across all grade levels. Calculator use does not contribute to a deterioration of basic facts and skills, rather it can effectively promote the **thinking process** involved in the learning of concepts and skills. As such, the calculator should be an integral component of the primary school mathematics program.

WHY USE CALCULATORS IN THE PRIMARY SCHOOL MATHEMATICS PROGRAM?

◀ INHERENT INTEREST / MOTIVATION

The '*hands-on*' nature of the calculator means it is a powerful source of interest and motivation, and hence, is potentially a highly effective aid in promoting learning.

◀ EXTENSIVE USE / VERSATILE NATURE

The calculator may be used throughout the primary grades and across a broad range of topic areas. Some examples demonstrating this are outlined in this booklet.

The calculator should not be considered just a device for computing or checking answers. Moreover, it should not be used as an end in itself, but rather, as a means to an end. For example, teaching children to use the square root or memory functions should not be the sole objective of a '*calculator lesson*'. Rather, the learning of these functions should occur when the need arises, such as in the exploration of square numbers or in the solving of multi-step word problems.

◀ DEVELOPMENT OF CONCEPT, SKILLS AND PROCESSES

One of the calculator's most powerful uses is in the development and reinforcement of concepts, skills, and processes. For example, it is particularly effective in demonstrating place-value ideas, in exploring number patterns and properties, and in promoting problem-solving skills. Furthermore, when the calculator is used to free children from complex or tedious calculations, more in-depth exploration of a topic can be undertaken. For example, square number patterns can be explored beyond children's number fact knowledge.

Freedom from complex calculations can also enhance process development, such as in discovering the meaning of π , or in estimating the number in a large sample.

◀ COMPLEMENTARY LEARNING AID

The calculator should be recognised as a complementary learning aid as well as an aid in its own right. It can effectively complement the use of other learning aids such as the Unifix cubes or the M.A.B. blocks. For example, the number **27** may be illustrated with these materials and then recorded on the calculator. The calculator can also be used in conjunction with the place-value chart to highlight the place-value relationships inherent in our number system.

◀ SUITABLE FOR ALL ACHIEVEMENT LEVELS

The calculator caters for all achievement levels and is also effective in '*equalising*' achievement levels. For example, children with weak number fact knowledge are not hindered in their exploration of number patterns or in their study of multiples — the calculator can supply the missing knowledge. The result is enhanced process development.

◀ INDIVIDUAL EXPLORATION

Calculator use can motivate individual children to continue the exploration of a particular topic beyond class time. This frequently occurs in the exploration of number patterns where children are keen to discover whether *'the pattern works for other numbers'*.

WHICH CALCULATORS ARE MOST APPROPRIATE FOR USE IN THE PRIMARY SCHOOL?

There are two basic types of calculators available for children:

- Pre-programmed calculators, e.g. **'Dataman'** feature a range of capabilities suitable for young children. Their principal value is for drill and practice of pre-taught basic skills. Immediate feedback rewards the child and hence, releases the teacher (and parent) from the tedious chore of checking answers. Because rapid recall of basic facts is important for mathematics in the middle school, these programmed calculators are worthwhile, but have limited application in other areas of the mathematics program.
- The *'adult version'* of the hand-held calculator naturally provides a broader range of educational opportunities but should be kept simple for primary school children.

Calculators suitable for the primary school should display the following features. These have been categorised as features which are essential and those that are desirable.

ESSENTIAL FEATURES

1. Single function keys

A function key refers to the operation keys (i.e. $+$, $-$, \times , \div , $\sqrt{\quad}$, $\%$). In more sophisticated calculators, these keys often have other functions built into them, e.g. the $+$ key may also have $\cos x$ or another function. On some calculators, one key may be used for three different functions.

Therefore, for primary school children, it is wise to avoid those calculators that have more than one function per key (except for a combined C / CE key).

2. The calculator chosen should have the **six function keys mentioned above:**

$+$, $-$, \times , \div , $\sqrt{\quad}$, $\%$

3. Large key size

The constant function enables children to add, subtract, multiple and divide using a *'short-cut'* code.

e.g. Instead of keying-in this:

$$\boxed{C} \quad 3 \quad \boxed{\times} \quad 3 \quad \boxed{=} \quad 9 \quad \boxed{\times} \quad 3 \quad \boxed{=} \quad 27 \quad \boxed{\times} \quad 3 \quad \boxed{=} \quad 81$$

You could key-in this: $\boxed{C} \quad 3 \quad \boxed{\times} \quad \boxed{=} \quad \boxed{=} \quad \boxed{=}$

or

$$\boxed{C} \quad 3 \quad \boxed{\times} \quad \boxed{\times} \quad \boxed{=} \quad \boxed{=} \quad \boxed{=}$$

Not all calculators have a constant function for all four operations and of those that do, the way in which the constant function is used can vary from model to model. The manufacturer's instructions that are included with the calculator usually indicate whether the calculator has a constant function and if so, how to use it.

5. Satisfactory keyboard layout

The keys should be arranged in an orderly fashion, and all be of the same size. Most calculators conform to this.

DESIRABLE FEATURES

The following features, whilst not essential, are highly desirable in a calculator for primary school children:

6. Liquid Crystal Display

Almost all calculators have this. It is the type of display used on digital watches, i.e. black numerals on a grey translucent background. The reason for choosing such a display is that it uses very small quantities of power. The result is long battery life (8 000 — 10 000 hours).

7. Auto Off

Many calculators now have this feature. It simply switches off the calculator if it has not been used for 5 – 10 minutes.

8. A separate CE Key (i.e. a CLEAR ENTRY key)

(On some calculators [e.g. *Casio*] this key is just labelled C)

This key allows you to clear the last entry without losing any other inputs you have made (a saviour if you are at the end of a lengthy calculation).

e.g. You wish to key in $4 + 2 + 7 + 5$, but you key in $4 + 2 + 7 + 3$. By pressing the \boxed{CE} key and then keying in 5, you have erased the 3 and replaced with 5. When you press the $\boxed{=}$ key, 18 should appear on the display.

9. A single memory (Most calculators have this.)

10. Manufacturer's Instructions**11. Floating decimal point** (Most calculators have this.)**12. Automatic rounding**

This rounds numbers with recurring decimals, e.g.

2 $\boxed{\div}$ 3 Will show 0.6666667 if it rounds or 0.6666666 if it doesn't.

Test Your Calculator

\boxed{C} 2 $\boxed{\div}$ 3 $\boxed{=}$ $\boxed{\times}$ 3 $\boxed{=}$ Your answer should be 2.

13. Function Indicator

Some calculators have a section in the display which indicates which operation is being used and when the memory is in action. This can be a useful feature. Some calculators display both the operation and memory functions, whereas some only display the memory function.

SECTION B**OVERVIEW OF ACTIVITIES**

The grid below contains page references for the types of learning experiences which may be presented across the year levels. The activities are outlined in the remaining pages.

Learning Experience	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
A. Initial experiences	7	7	7	7	7	7	7
B. Place value: - concepts - relationships	8	9 – 10	11 – 12 13	14 – 15 16 – 17	18 – 19 20 – 23	24 – 25 26	27 – 29 30
C. Counting and patterning	31 – 32	33	34 – 35	36 – 38	39 – 40	41	41
D. Concept / skill development	42	43 – 44	43 – 44	45	46	47 – 52	47 52
E. Number pattern exploration	53	53	54	55	56	57	57
F. Measurement / Space					58	59 – 61	59 – 61
G. Estimation			62	63	64	65 – 66	65 – 66
H. Problem Solving - process - application	67	68	69	70 – 72 73	70 – 72 73	74 – 75 76 – 77	74 – 75 76 – 77

INITIAL EXPERIENCES WITH THE CALCULATOR

ALL YEAR LEVELS

At each year level children should be given initial experiences with the calculator where they are able to freely explore its features and functions. Like all learning aids, the calculator must be *played with* prior to being used to specific purposes. If children are denied this informal discovery period, they will compensate for it by exploring the calculator whenever the opportunity arises. As a result, the calculator itself becomes the focus of attention, rather than the activity at hand. This will also occur if the calculator is used infrequently — its novelty aspect will overshadow its teaching potential.

During the exploration period, children can be directed towards certain features of the calculator. The extent of direction would depend on the year level and on children's prior experiences with the aid, and would occur only after children have had the opportunity to make discoveries themselves.

A suggested guideline for calculator exploration at each year level is set out below:

CALCULATOR KEYS

Year	C	CE	Digits	+	-	x	÷	=	$\sqrt{\quad}$	%	Decimal Point	Memory
1*	✓		✓	✓	✓			✓				
2	✓		✓	✓	✓			✓				
3	✓	✓	✓	✓	✓	✓		✓				
4	✓	✓	✓	✓	✓	✓	✓	✓			✓	
5	✓	✓	✓	✓	✓	✓	✓	✓	(informal)		✓	
6	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	Optional
7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

* Children in the early year levels should be given experiences in matching the calculator digits with the familiar written numerals.

NUMBER CONCEPTS

YEAR ONE

At the Year One level, number recognition can be enhanced by instructing children to enter various numbers into the calculator. These numbers should be presented in a variety of ways to ensure all components are explored. These include the oral name, concrete representation, comparing and sequencing.

Oral Name

Show number seven on your calculator.

Press any number key you like. Read aloud your number. Is it the same as (different from) your friend's?

Concrete Representation

Look at the counters I have in my hand. Show on your calculator how many I have. Read aloud the number you've shown.

(Children may also be asked to show a given number on their calculator, then to represent it with their counters.)

Comparing and Sequencing

Look at the counters I have in my hand. On your calculator, show the number which is one more than (one less than) the number I have. Read aloud your number.

Look at the number card I'm holding up. On your calculator, show a number that is less than (greater than) this number. Read aloud your number. Is it different from your friend's number? How is it different? (The number card may display a written numeral or pictorial representation.)

On your calculator show the number which comes just before (after) the number six.

Show the number which comes between five and seven.

Show any number between three and nine. Is your number greater than / less than / the same number as your friend's?

Listen while I count, then show on your calculator the number which comes next:

four, five, six, seven

Listen while I could, I am going to leave out a number. On your calculator show the number that I leave out:

two, three, four, six, seven

By using the constant function (see *page 31*) children can use their calculator to count by ones:

C

 1

+

 1

=

=

=

 ...

PLACE VALUE CONCEPTS

YEAR TWO

Place value concepts can be reinforced simply through instructing children to enter various numbers into their calculator.

The numbers should be represented in a variety of ways, including oral name, concrete representation, place-value components, comparing and sequencing, and renaming:

Oral Name

Show the number forty-five on your calculator.

Show the number seventeen. Read it aloud. What would your number be if you entered the 7 first?

Show any number you like by pressing two number keys. Read aloud your number. Is it the same as (different from) your friend's? How is it different?

Concrete Representation

Look at the bundling sticks (3 bundles of ten and 2 ones) I have in my hand. Show on your calculator how many I have. Read aloud the number you have shown.

(Children can also be asked to show a given number on their calculator, then to represent it with their bundling sticks.)

Place-value Components

On your calculator show the number made of 5 tens and 2 ones. Read aloud your number.

Show the number made of 1 ten and 2 ones. Read aloud your number.

Show the number fifty-three on your calculator. Using your key, make the five disappear. (Children must know the place value of the digit five before they can remove it. That is, they must subtract five tens or fifty.)

Comparing and Sequencing

Look at the bundling sticks (7 bundles of ten and 9 ones) I have in my hand. On your calculator, show the number which is one more than (one less than) the number I have. Read aloud your number.

Look at the number card I'm holding up. On your calculator, show a number that is less than (greater than) this number. Read aloud your number. How is it different from your friend's number? (The number card may display a written numeral or pictorial representation.)

On your calculator show the number which comes just before (after) sixty. Show the number which comes between fifty-nine and sixty-one. Read aloud your number.

Show any number between thirteen and thirty. Is your number greater than / less than / the same number as your friend's?

Listen while I count, then show on your calculator the number which comes next:

fourteen, fifteen, sixteen, seventeen, eighteen, nineteen

Listen while I count. I am going to leave out a number. On your calculator show the number that I leave out:

eleven, twelve, thirteen, fourteen, sixteen, seventeen

By using the constant function (see *page 32*) children can use their calculator to count by ones, twos and fives:

C	25	+	1	=	=	=	... (counting forwards)
C	25	—	1	=	=	=	... (counting backwards)
C	12	+	2	=	=	=	...
C	25	+	5	=	=	=	...

Renaming

On your calculator show the number made of **23** ones. Read aloud your number.

(Have displayed fifteen loose sticks.) On your calculator show the number of sticks there are. Read aloud your number.

PLACE-VALUE CONCEPTS

YEAR THREE

Place-value concepts can be reinforced simply through instructing children to enter various numbers into their calculator. The calculator should serve as a complementary aid, that is, it should be used in conjunction with other materials such as the M.A.B blocks, the place-value chart, and number expander

Numbers to be entered into the calculator should be presented in a variety of ways, including oral name, concrete representation, place-value components, comparing and sequencing, and renaming.

Oral Name

Show the number three hundred and seventy-six on your calculator.

Show the number five hundred and two. Read aloud your number.

Show any number you like by pressing three digit keys. Read aloud your number. Is it different from your friend's? How is it different?

Concrete Representation

(Have displayed **3** flats, **7** longs, and **2** smalls.) Show this number on your calculator. Read aloud the number you have shown.


(Children can also be asked to show a given number on their calculator, then to represent it with their blocks.)

Place-value Components

On your calculator show the number made of **5** hundreds, **2** tens and **2** ones. Read aloud your number.

Show the number made of **7** hundreds and **2** ones. Read aloud your number.

Look at the number on the place-value chart (or number expander ... **5** hundreds, **0** tens, **9** ones). Show this on your calculator. Read aloud the number.

Show the number five hundred and seventy on your calculator. Using your  key, make the five disappear. (Children must know the place value of the digit five before they can remove it. That is, they must subtract five hundred.)

Comparing and Sequencing

Look at these blocks (**7** flats, **1** long, and **9** smalls). On your calculator, show the number which is one more than (one less than) this number. Read aloud your number. (This can be repeated using **10** more / less, **100** more / less etc.)

Look at the number card I am holding up. On your calculator, show a number that is less than (greater than) this number. Read aloud your number. Is it greater than (less than) your friend's number? (The number card may display a written numeral or pictorial representation).

On your calculator show the number which comes just before (after) six hundred.

Show the number which comes between five hundred and ninety-eight, and six hundred. Read aloud your number.

Show any number between three hundred, and three hundred and ten. Is your number greater than / less than / the same number as your friend's?

Listen while I count, then show on your calculator the number which comes next:

Four hundred and seven, four hundred and eight, four hundred and nine

Renaming

On your calculator show the number made of **223** ones. Read aloud your number.

Show the number made of **20** tens and **3** ones. Read aloud your number.

(Have displayed **11** longs). Show this number on your calculator. Read aloud your number.

PLACE VALUE RELATIONSHIPS

YEAR THREE

The calculator is most effective in demonstrating the 'odometer' feature of our numeration system. By using the constant function of the calculator (refer *page 32*), children can readily see the creation of each new place — $9 \rightarrow 10$; $99 \rightarrow 100$.

This should complement the understanding established with the M>A>B blocks and the Place-value Chart:

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PLACE VALUE CONCEPTS

YEAR FOUR

Place-value concepts can be reinforced simply through instructing children to enter various numbers into their calculator. The calculator should serve as a complementary aid, that is, it should be used in conjunction with other materials such as the M.A.B blocks, the place-value chart, and number expander.

Numbers to be entered into the calculator should be presented in a variety of ways, including oral name, concrete representation, place-value components, comparing and sequencing, and renaming:

Oral Name

On your calculator show the number five thousand, three hundred and seventy-six.

Show the number five thousand and two. Read aloud your number.

Show any number you like by pressing four digit keys. Read aloud your number. Is it greater than (less than) your friend's number?

Show the number two and five tenths. Read aloud your number.

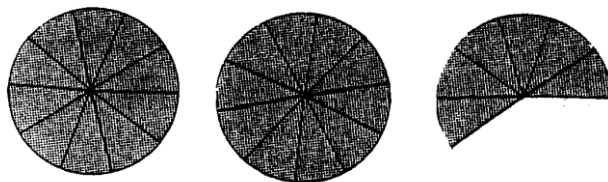
Show the number seven hundredths. Read aloud your number.

Concrete Representation

(Have displayed, 2 blocks, 3 flats, 7 longs and 2 smalls). Show this number on your calculator. Read aloud the number you have shown.

(Children can also be asked to show a given number on their calculator, then to represent it with their blocks.)

Look at the pizzas left over from the party.



On your calculator show how much was left over.


Place-value Components

On your calculator show the number made of five thousands, two hundreds, two tens and two ones. Read aloud your number.

Show the number made of **7** thousands and **2** tens. Read aloud your number.

Show the number of **2** ones, and **2** hundredths. Read aloud your number.

Look at the number on the place-value chart (or number expander . . . **5** thousands, **1** hundred, **0** tens, **9** ones). Show this on your calculator. Read aloud the number.

Show the number two and five tenths on your calculator. Using your  key, make the **5** disappear. (Children must know the place-value of the digit before they can remove it. That is, they must subtract five tenths.)

Comparing and Sequencing

(Have displayed, **2** blocks, **2** flats, **9** longs, and **9** smalls). On your calculator show the number which is one more than (one less than) this number. Read aloud your number. (This can be repeated using **10** more / less, **100** more / less etc.)

Look at the number card I am holding up. On your calculator, show a number that is less than (greater than) this number. Read aloud your number. Is it different from your friend's number? How is it different? (The number card may display a written numeral or pictorial representation.)

On your calculator show the number which comes just before (after) six thousand, five hundred.

Show the number which comes between five thousand, nine hundred and ninety-eight, and six thousand. Read aloud your number.

Show any number between three thousand, and three thousand and fifty. Is your number greater than / less than / the same number as your friend's?

Listen while I count, then show on your calculator the number which comes next:

four thousand and seven, four thousand and eight, four thousand and nine . . .

four and seven hundredths, four and eight hundredths, four and nine hundredths . . .

Renaming

On your calculator show the number made of two thousand ones. Read aloud your number.

Show the number made of twenty hundreds. Read aloud your number.

(Have displayed **11** flats). Show this number on your calculator. Read aloud your number.

Show the number made of twenty-three hundredths. Read aloud your number.

PLACE-VALUE RELATIONSHIPS

YEAR FOUR

- A. The calculator is most effective in demonstrating the 'odometer' feature of our numeration system. Using the constant function of the calculator (see *page 32*), children can readily see the creation of each new place:

$$9 \rightarrow 10; \quad 99 \rightarrow 100; \quad 999 \rightarrow 1000; \quad 9999 \rightarrow 10\,000 \text{ etc}$$

This should complement the understanding established with the M.A.B blocks and the Place-Value Chart:

	<table border="1"> <thead> <tr> <th>Thousands</th> <th>Hundreds</th> <th>Tens</th> <th>Ones</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>9</td> <td>4</td> </tr> <tr> <td></td> <td></td> <td>9</td> <td>5</td> </tr> <tr> <td></td> <td></td> <td>9</td> <td>6</td> </tr> <tr> <td></td> <td></td> <td>9</td> <td>7</td> </tr> <tr> <td></td> <td></td> <td>9</td> <td>9</td> </tr> <tr> <td></td> <td></td> <td>9</td> <td>9</td> </tr> <tr> <td></td> <td>1</td> <td>0</td> <td>0</td> </tr> </tbody> </table>	Thousands	Hundreds	Tens	Ones			9	4			9	5			9	6			9	7			9	9			9	9		1	0	0	<p>994</p> <table> <tr> <td>+</td> <td></td> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>=</td> <td>995</td> </tr> <tr> <td>=</td> <td>996</td> </tr> <tr> <td>=</td> <td>997</td> </tr> <tr> <td>=</td> <td>998</td> </tr> <tr> <td>=</td> <td>999</td> </tr> <tr> <td>=</td> <td>1 000</td> </tr> </table>	+		1		=	995	=	996	=	997	=	998	=	999	=	1 000
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- B. The following activity demonstrates that when a digit increases ten times in value, it is moved one place to the left in our numeration system:

$$\boxed{\text{C}} \quad 5 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 50 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 500 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 5000$$

This activity should be used in conjunction with a Place-Value Chart:

		Thousands	Hundreds	Tens	Ones
start with					5
x	10 →			5	0
x	10 →		5	0	0
x	10 →	5	0	0	0

* With some calculator models, you might have to enter **10** first, and / or press the $\boxed{\times}$ key twice.

- C. Activities based on the understandings include:

How many times greater is $\overset{\text{a}}{6}$ than $\overset{\text{b}}{6}$ in $\overset{\text{ab}}{266}$?

a
6 = 6 tens (60 ones)

b
6 = 6 ones

The child must know the meaning of each digit in order to use the calculator appropriately.

$$60 \quad \boxed{\div} \quad \boxed{6} \quad \boxed{=} \quad \boxed{10}$$

Check:

$$\boxed{\text{C}} \quad 6 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 60$$

and

$$\boxed{\text{C}} \quad 60 \quad \boxed{\div} \quad 10 \quad \boxed{=} \quad 6$$

PLACE-VALUE CONCEPTS

YEAR FIVE

Place-value concepts can be reinforced simply through instructing children to enter various numbers into their calculator. The calculator should serve as a complementary aid, that is, it should be used in conjunction with other materials such as the M.A.B blocks, the place-value chart, and number expander.

Numbers to be entered into the calculator should be presented in a variety of ways, including oral name, concrete representation, place-value components, comparing and sequencing, and renaming:

Oral Name

On your calculator, show the number:

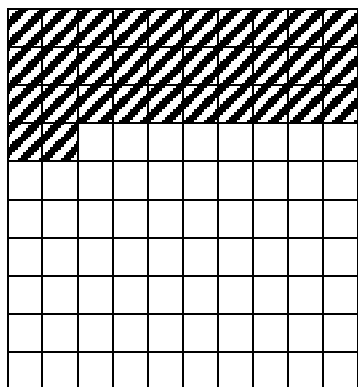
- fifty thousand, three hundred and seventy-six
- five thousand and two
- two and fifty-five hundredths. Read aloud your number.
- seven thousandths. Read aloud your number.

Concrete / Pictorial Representation

(Have displayed, **2** blocks, **3** flats, **7** longs, and **2** smalls). Show this number on your calculator. Read aloud the number you have shown.

(Children can also be asked to show a given number on their calculator, then to represent it with their blocks.)

What fraction of the paddock has been ploughed? Show the amount on your calculator.



Place-Value Components

On your calculator show the number made of five ten-thousands, two thousands, seven hundreds, and two ones. Read aloud your number.

Show the number made of **7** thousands and **7** tens. Read aloud your number.

Show the number made of two ones, two hundredths, and three thousandths. Read aloud your number.

Look at the number on the place-value chart (or number expander . . . **5** ten-thousands, **7** thousands, **1** hundred, **0** tens, **9** ones). Show this on your calculator. Read aloud the number. (This can be repeated using **7** ones, **7** tenths, **8** hundredths, **9** thousandths).

Show the number two and five thousandths on your calculator. Using your key, make the five disappear. (Children must know the place value of the digit five before they can remove it. That is, they must subtract five thousandths).

Comparing and Sequencing

(Have displayed, **2** blocks, **2** flats, **9** longs, and **9** smalls). On your calculator show the number which is one more than (one less than) this number. Read aloud your number.

Show the number which is one more than (less than) thirty thousand. (This can be repeated using **10** more / less; **100** more / less etc.)

Show the number which is one greater than (less than) five and forty-nine thousandths.

Look at the number card I am holding up. On your calculator, show a number that is less than (greater than) this number. Read aloud your number. Is it greater than (less than) your friend's number? (The number card may display a written numeral or pictorial representation).

On your calculator show the number which comes just before (after) sixty thousand, and fifty-nine. Read aloud your number.

Show the number which comes between fifty-nine thousand, nine hundred and ninety-eight, and sixty thousand. Read aloud your number.

Show any number which comes between thirty thousand, nine hundred and three, and forty thousand. Is your number greater than / less than / the same number as your friend?

Listen while I count, then show on your calculator the number which comes next:

Forty thousand, seven hundred and seventy-seven; forty thousand, seven hundred and seventy-eight; forty thousand, seven hundred and seventy-nine . . .

Renaming

On your calculator show the number made of twenty thousand ones. Read aloud your number.

Show the number made of twenty-five thousands and twenty-five tens. Read aloud your number.

Show the number made of twenty-three thousands. Read aloud your number.

PLACE-VALUE RELATIONSHIPS

YEAR FIVE

- A. The calculator is most effective in demonstrating the 'odometer' feature of our numeration system. By using the constant function of the calculator (see page 32), children can readily see the creation of each new place:

$$9 \rightarrow 10; \quad 99 \rightarrow 100; \quad 999 \rightarrow 1\,000; \quad 9999 \rightarrow 10\,000 \text{ etc}$$

This should complement the understanding established with the M.A.B blocks in earlier grades and the Place-Value Chart:

					9994	
					+	
T Th	Th	H	T	Ones	1	
	9	9	9	4		
	9	9	9	5	=	9995
	9	9	9	6	=	9996
	9	9	9	7	=	9997
	9	9	9	8	=	9998
	9	9	9	9	=	9999
1	0	0	0	0	=	10 000

A similar activity to the above may be worked with decimal fractions.

- B. The following activity demonstrates that when a digit increases ten times in value, it is moved one place to the left in our numeration system:

Enter the number five thousandths. Multiply it by ten. What do you notice? Continue to multiply each number by ten, using the constant function. (With some calculator models, you might have to enter **10** first, and / or press the \times key twice.)

What do you notice?

$$\boxed{C} \quad 0.005 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 0.05 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 0.5 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 5 \quad \boxed{\times} \quad 10 \quad \boxed{=} \quad 50$$

The above activity should be used in conjunction with a Place-Value Chart:

Start with:

x
x
x
x

10 →

10 →

10 →

10 →

T	Ones .	t	h	th
	0 .	0	0	5
	0 .	0	5	
	0 .	.	5	
	5			
5	0			

C. Activities based on the above understandings include:

How many times greater than $\overset{b}{6}$ is $\overset{a}{6}$ in the number, $\overset{a}{6}\overset{b}{2}\overset{a}{6}\overset{b}{3}$?

$\overset{a}{6} = 6 \text{ thousands (6 000 ones)}$

$\overset{b}{6} = 6 \text{ tens (60 ones)}$

The child must know the value of each digit in order to use the calculator correctly.

$$6\ 000 \div 60 = 100$$

Check:

$$60 \times 100 = 6\ 000$$

and

$$6\ 000 \div 100 = 60$$

Decimal fraction examples include:

How many times larger is $\overset{a}{4}$ than $\overset{b}{4}$ in $\overset{ab}{9.044}$?

$\overset{a}{4} = 4 \text{ hundredths (0.04)}$

$\overset{b}{4} = 4 \text{ thousandths (0.004)}$

$$0.04 \div 0.004 = 10$$

Check:

$$\boxed{C} \ 0.004 \ \boxed{\times} \ 10 \ \boxed{=} \ 0.04$$

and

$$\boxed{C} \ 0.04 \ \boxed{\div} \ 10 \ \boxed{=} \ 0.004$$

- D.** The value of zero when it occurs in various places within a number can be effectively demonstrated using activities of the type:

Whole Numbers

What is the value of 0009?

Try to enter this number in your calculator. What happens? What number is displayed?

Did you find that $0009 = 9$? Try this with other numbers.

Did you realise this

Zeros in front of a whole number do not change the value of the number.

Examples:

- (a)** Enter each of the following numbers in your calculator. What number is displayed?

(a) 006 (b) 03 (c) 006

(d) 000 005 (e) 00 009 (f) 08

- (b)** Cross out any unnecessary zeros in each of the following numbers:

(a) 06 (b) 008 (c) 0 009 (d) 00423 (e) 089

(f) 0 406 (g) 00 360 (h) 01 020 (i) 000 500 000

Decimal Fractions

What is the value of 9.600?

Enter 9.600 in your calculator and then push the equals key.

What number is displayed?

9.600

Try this with other numbers.

Did you realise this:

Zeros at the end of a decimal number do not change the value of the number.

(c) Enter each of the following in your calculator. Write the number displayed. Don't forget to push the key.

(a) 2.500 = (b) 4.200 = (c) 5.670 =

(d) 8.140 = (e) 9.050 = (f) 0.040 =

(g) 0.200 = (h) 0.060 = (i) 0.900 =

(d) Cross out any unnecessary zeros in each of the following numbers:

(a) 2.600 (b) 3.540 (c) 9.070 (d) 10.020 (e) 0.500

(f) 0.260 (g) 0.090 (h) 0.100

The above ideas assist in developing an understanding of metric measures expressed in decimal form, e.g.

3.6 km = 3.600 km (3 km and 600 m)

6.5 L = 6.500 L (6 L and 500 mL)

1.25 kg = 1/250 kg (1 kg and 250 g)

PLACE-VALUE CONCEPTS

YEAR SIX

Place-value concepts can be reinforced simply through instructing children to enter various numbers into their calculator. The calculator should serve as a complementary aid, that is, it should be used in conjunction with other materials such as the place-value chart, number expander, and decimal fraction grids.

Numbers to be entered into the calculator should be presented in a variety of ways, including oral name, pictorial / concrete representation, place-value components, comparing and sequencing, and renaming. (For revision activities incorporating the M.A.B blocks, refer to previous year levels).

Oral Name

On your calculator, show the number:

- five hundred thousand and fifty. Read aloud your number.
- six hundred and sixty thousand and six.
- two and fifty-five hundredths. Read aloud your number.
- seventeen thousands. Read aloud your number.

Pictorial / Concrete Representation

(Have displayed three 10 x 10 grids representing, **2** and **27** hundredths).

Farmer Brown has 3 paddocks.

The shaded parts show how much he has ploughed.

Show this amount on your calculator.

Read aloud the number you have shown.

Place-value Components

On your calculator show the number made of **5** hundred-thousands, and **4** ten-thousands. Read aloud your number

Show the number made of **7** ten-thousands and **7** tens. Read aloud your number.

Show the number made of two ones, two hundredths, and three thousandths. Read aloud your number.

(Have displayed on an opened number expander, **5** hundred-thousands, **4** ten-thousands, **0** thousands, **0** hundreds, **9** tens, **9** ones). Show this number on your calculator. Read aloud your number

(This can be repeated with a decimal number e.g. **7** ones, **7** tenths, **8** hundredths, **9** thousandths).

Show the number two and fifty thousandths on your calculator. Using your \pm key, make the five disappear. (Children must know the place-value of the digit five before they can remove it. That is, they must subtract five hundredths).

Comparing and Sequencing

(Have displayed on a place-value chart, **5** hundred-thousands, **9** ten-thousands, **0** thousands, **9** hundreds, **0** tens, **5** ones). On your calculator show the number which is one hundred more (less) than this number. Read aloud your number. What would your number be if you had made it one thousand more (less)?

Show your friend any number between five hundred thousand and six hundred thousand. Now change only **one** of the digits in your number. See if your friend can tell you what you did to change the digit. (The digit would be changed by adding or subtracting a multiple of one, ten, hundred etc.)

On your calculator show the number which comes just before (after) six hundred thousand. Read aloud your number.

Show the number which comes between five hundred thousand and nine, and five hundred thousand and eleven.

Show any number which comes between three hundred and thirty thousand, and three hundred and fifty thousand. Is your number greater than / less than / the same number as your friend's?

Listen while I count, then show on your calculator the number which comes next:

Four hundred thousand, seven hundred and seventy-seven; four hundred thousand, seven hundred and seventy-eight; four hundred thousand, seven hundred and seventy-nine ...

(All of the above comparing and sequencing activities can be repeated with decimal fractions).

Renaming

On your calculator show the number made of:

- two hundred and seventy tens. Read aloud your number.
- thirty-five hundreds and thirty-five ones.
- twenty-five thousands and twenty-five tens. Read aloud your number.
- forty thousand tens. Read aloud your number.
- one and twenty-three thousandths. Read aloud your number.

PLACE-VALUE RELATIONSHIPS

YEAR SIX

- A. The calculator is most effective in demonstrating the 'odometer' feature of our numeration system. Using the constant feature of the calculator (see *page 32*), children can readily see the creation of each new place:

$$9 \rightarrow 10; \quad 99 \rightarrow 100; \quad 999 \rightarrow 1\,000; \quad 9999 \rightarrow 10\,000 \text{ etc}$$

This should complement the understanding established with the Place-Value Chart (and M.A.B blocks in earlier grades):

						99 994	
						+	
						1	
						=	99 995
						=	99 996
						=	99 997
						=	99 998
						=	99 999
						=	100 000
H Th	T Th	Th	H	Tens	Ones		
	9	9	9	9	4		
	9	9	9	9	5		
	9	9	9	9	6		
	9	9	9	9	7		
	9	9	9	9	8		
	9	9	9	9	9		
1	0	0	0	0	0		

A similar activity to the above may be worked with decimal fractions.

- B. The calculator can also demonstrate that when a digit increases ten times in value, it is moved one place to the left in our numeration system. (Refer *Page 21*).
- C. The value of zero when it occurs in various places within a number can be effectively demonstrated using activities of the type illustrated on *page 23*.

PLACE-VALUE CONCEPTS

YEAR SEVEN

Place value concepts can be reinforced simply through instructing children to enter various numbers into their calculator. The calculator should serve as a complementary aid, that is, it should be used in conjunction with other materials such as the Place-Value Chart, number expander, and decimal fraction grids. (For revision activities incorporating the M.A.B blocks, refer to previous year levels).

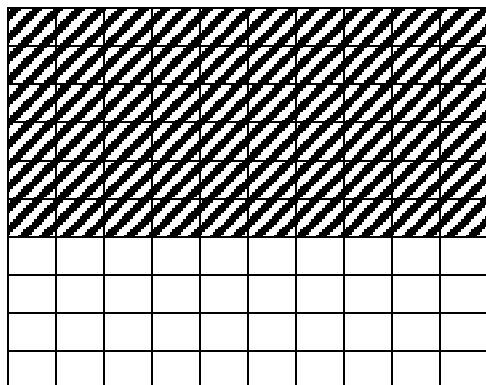
Numbers to be entered into the calculator should be presented in a variety of ways, including oral name, pictorial representation, place-value components, comparing and sequencing, and renaming.

Oral Name

On your calculator, show the number:

- three million, fifty-five thousand, seven hundred and seventy.
- five million and seven. Read aloud your number.
- twelve and fifty-five thousandths. Read aloud your number.

Pictorial Representation



This picture represents a page in a stamp album. Each shaded square represents a stamp. On your calculator, show the fraction of the page which is filled with stamps. How many ways can you show the fraction on your calculator?

Place-value Components

On your calculator show the number made of **5** millions, **3** hundred-thousands, and **4** ten-thousands. Read aloud your number.

Show the number made of **7** millions and **7** tens. Read aloud your number.

Show the number made of two ones, two hundredths, and three thousandths. Read aloud your number.

(Have displayed on an opened number expander, **6** millions, **5** hundred-thousands, **4** ten-thousands, **0** hundreds, **9** tens, **9** ones). Show this number on your calculator. Read aloud your number.

(This can be repeated with a decimal number e.g. **7** ones, **7** tenths, **8** hundredths, **9** thousandths).

Show the number two and five hundred thousandths on your calculator. Using your key, make the five disappear. (Children must know the place of the digit five before they can remove it. That is, they must subtract five tenths).

What is the largest number you can show on your calculator? Read aloud this number.

Comparing and Sequencing

(Have displayed on a Place-Value Chart, **7** millions, **9** hundred-thousands, **9** ten-thousands, **0** thousands, **9** hundreds, **0** tens, **5** ones). On your calculator show the number which is ten thousand more (less) than this number. Read aloud your number. What would your number be if you had made it one hundred thousand more (less)?

Show your friend any number between five million and six million. Now change only **one** of the digits in your number. See if your friend can tell you what you did to change the digit. (The digit would be changed by adding or subtracting a multiple of one, ten, hundred, thousand etc.)

On your calculator show the number which comes just before (after) six million. Read aloud your number.

Show the number which comes between five million, nine thousand and one, and five million, eight thousand, nine hundred and ninety-nine. Read aloud your number.

Show any number which comes between three million, three hundred thousand, and three million, five hundred thousand. Is your number greater than / less than / the same number as your friend's?

Listen while I count, then show on your calculator the number which comes next:

Four hundred thousand, seven hundred and seventy-seven; four hundred thousand, seven hundred and seventy-eight; four hundred thousand, seven hundred and seventy-nine ...

(All of the above comparing and sequencing activities can be repeated with decimal fractions).

Renaming

On your calculator show the number made of:

- two hundred and seventy tens. Read aloud your number.
- thirty-five hundreds and thirty-five ones.
- twenty-five thousands and twenty-five tens. Read aloud your number.
- forty thousand tens. Read aloud your number.
- five million, two hundred and twenty ones.
- one, and two hundred and twenty-three thousandths. Read aloud your number.

PLACE-VALUE RELATIONSHIPS

YEAR SEVEN

- A. The calculator is most effective in demonstrating the 'odometer' feature of our numeration system. By using the constant function (see *page 32*), children can readily see the creation of each new place:

$9 \rightarrow 10$; $99 \rightarrow 100$; $999 \rightarrow 1\,000$; $9999 \rightarrow 10\,000$ etc

This should complement the understanding established with the Place-Value Chart (and the M.A.B blocks in previous grades):

M	H Th	T Th	Th	H	T	Ones	999 994	
	9	9	9	9	9	4	<div>+</div>	
	9	9	9	9	9	5	1	
	9	9	9	9	9	6	<div>=</div>	999 995
	9	9	9	9	9	7	<div>=</div>	999 996
	9	9	9	9	9	8	<div>=</div>	999 997
	9	9	9	9	9	9	<div>=</div>	999 998
1	0	0	0	0			<div>=</div>	999 999
							<div>=</div>	1 000 000

A similar activity may be repeated with decimal fractions.

- B. The calculator can also demonstrate that when a digit increases ten times in value, it is moved one place to the left in our numeration system. (Refer *page 21*)
- C. The value of zero when it occurs in various places within a number can be effectively demonstrated using activities of the type illustrated on *page 23*.

COUNTING and PATTERNING

YEAR ONE

Counting Sequences (use of the constant function)

The calculator can assist children in completing counting sequences as well as demonstrate interesting patterns within these sequences. **The constant function** of the calculator is essential here, as it enables a counting sequence to be clearly shown. If the constant function is not used, the sequence is interrupted by the depressing of an operator key such as $+$ or $-$

To count by ones, beginning with one, the following code would be used. This code varies with the calculator brand.

C 1 $+$ 1 $=$ $=$ $=$ $=$

- A. Rational counting skills can be reinforced when children depress the $=$ key each time they count an object within a group of objects.

C 1 $+$ 1 $=$ $=$ $=$ $=$ 5

first object counted second object counted

- B. Multiple counting skills can be reinforced in the early years by using the calculator to count by twos, fives, tens:

C 2 $+$ $=$ $=$ $=$ $=$

The sequence 2, 4, 6, 8, 10 should appear on the screen.

C 5 $+$ $=$ $=$ $=$ $=$

The sequence 5, 10, 15, 20, 25 should appear on the screen.

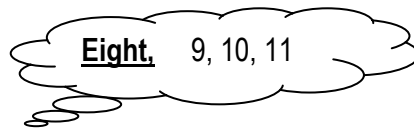
- C. The constant function can also be used to demonstrate counting backwards, eg:

C 20 $-$ 1 $=$ $=$ $=$ $=$

The sequence 20, 19, 18, 17, 16 should appear on the screen.

- D. The basic fact strategies of counting on and counting back from a given number can be consolidated:

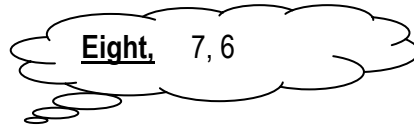
$$\begin{array}{r} 8 \\ + 3 \\ \hline 11 \end{array}$$



C	8	+	1	=	=	=
				9	10	11

counting on three

$$\begin{array}{r} 8 \\ - 2 \\ \hline 6 \end{array}$$



C	8	-	1	=	=
				7	6

counting back on two

COUNTING and PATTERNING

YEAR TWO

Counting Sequences (use of the constant function)

The calculator can assist children in completing counting sequences as well as demonstrate interesting patterns within these sequences. **The constant function** of the calculator is essential here, as it enables a counting sequence to be clearly shown. If the constant function is not used, the sequence is interrupted by the depressing of an operator key such as $+$ or $-$

To count by ones, beginning with one, the following code would be used. This code varies with the calculator brand.

\boxed{C} 1 $\boxed{+}$ 1 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Refer to *pages 31 and 32* for suggested activities.

COUNTING and PATTERNING

YEAR THREE

Counting Sequences (use of the constant function)

The calculator can assist children in completing counting sequences as well as demonstrate interesting patterns within these sequences. **The constant function** of the calculator is essential here, as it enables a counting sequence to be clearly shown. If the constant function is not used, the sequence is interrupted by the depressing of an operator key such as $+$ or $-$

To count by ones, beginning with one, the following code would be used. This code varies with the calculator brand.

\boxed{C} 1 $\boxed{+}$ 1 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

- A. Refer to *pages 32 and 33* for suggested introductory activities.
- B. With pattern exploration activities, children should be encouraged to **discover** the pattern within each of the tens and ones places, **predict** the next number in the sequence, and then **check** with the calculator. By using the calculator to **generate** the sequence, children's exploration of the pattern is not hampered.

2*	25	4	6	9
4	30	8	12	18
6	35	12	18	27
8	40	16	24	36
10	45	20	30	45
12	50	24	36	54
14	55	28	42	63
16	60	32	48	72
18	65	36	54	81
20	70	40	60	.
22	75	44	66	.
24	80	48	.	.
26	.	52	.	.
28	.	.	.	.
30	.	.	.	.
.
.
.

What pattern can you see in the ones place?
What will be the next ones digit?

What pattern can you see in the tens place?
What will be the next tens digit?

What will be the next number in the sequence? Check with your calculator.

* \boxed{C} 2 $\boxed{+}$ 2 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Children should also be encouraged to discover what happens to the pattern when a given sequence is restructured eg:

CHANGE	TO
4	5
8	9
12	13
16	17
20	21
24	25
28	29
32	33
36	37
40	41
44	45
48	49

Original pattern in the ones digits:

4, 8, 2, 6, 0, 4, 8, 2, 6, 0,

New pattern in the ones digits:

5, 9, 3, 7, 1, 5, 9, 3, 7, 1,

Original pattern in the tens digits:

1, 1, 2, 2, 2, 3, 3, 4, 4, 4,

New pattern in the tens digits (unchanged):

1, 1, 2, 2, 2, 3, 3, 4, 4, 4,

COUNTING and PATTERN EXPLORATION

YEAR FOUR

Counting Sequences (use of the constant function)

The calculator can assist children in completing counting sequences as well as demonstrate interesting patterns within these sequences. **The constant function** of the calculator is essential here, as it enables a counting sequence to be clearly shown. If the constant function is not used, the sequence is interrupted by the depressing of an operator key such as $+$ or $-$

To count by ones, beginning with one, the following code would be used. This code varies with the calculator brand.

\boxed{C} 1 $\boxed{+}$ 1 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

A. Refer to *pages 32 — 33* for suggested activities, in addition to the following:

B. Further counting sequences

Counting by fives

Start at 642

\boxed{C} 642 $\boxed{+}$ 10 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Children should identify which digits change and which remain constant. That is, when counting by tens, the tens digits change while the ones digits never change.

Start at 3256

\boxed{C} 3256 $\boxed{+}$ 10 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Counting by hundreds

Start at 4519

\boxed{C} 4519 $\boxed{+}$ 100 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Start at 2304

\boxed{C} 2304 $\boxed{+}$ 100 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Counting by tenths

Start at 5.4

C	5.4	+	0.1	=	=	=	=
---	-----	---	-----	---	---	---	---	------

Start at 15.94

C	15.94	+	0.1	=	=	=	=
---	-------	---	-----	---	---	---	---	------

Counting by hundredths

Start at 5.24

C	5.24	+	0.01	=	=	=	=
---	------	---	------	---	---	---	---	------

The above sequences can be reversed (counting backwards) eg:

Start at 5.24 and count backwards by tenths

C	5.24	—	0.1	=	=	=	=
---	------	---	-----	---	---	---	---	------

C. The patterns explored in year 3 may be extended to include:

514*	223
518	229
522	235
526	241
530	247
534	253
.	259
.	365
.	371
.	377
.	.
	.
	.

etc

What pattern can you see in the ones place?

What will be the next ones digit?

What pattern can you see in the tens place?

What will be the next tens digit?

What pattern can you see in the hundreds place?

What will be the next number in the sequence?

Check with your calculator.

*	C	514	+	4	=	=	=
---	---	-----	---	---	---	---	---	------

COUNTING and PATTERNING

YEAR FIVE

Counting Sequences (use of the constant function)

The calculator can assist children in completing counting sequences as well as demonstrate interesting patterns within these sequences. **The constant function** of the calculator is essential here, as it enables a counting sequence to be clearly shown. If the constant function is not used, the sequence is interrupted by the depressing of an operator key such as $+$ or $-$

To count by ones, beginning with one, the following code would be used. This code varies with the calculator brand.

\boxed{C} 1 $\boxed{+}$ 1 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

- A. Refer to the previous year levels for introductory activities which may be extended / adapted to suit Year 5 level. Such activities include:

B. Counting by thousands

Start at 5698

\boxed{C} 5698 $\boxed{+}$ 1 000 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Children should identify which digits change and which remain constant. That is, when counting by thousands, the thousands digits change while the hundreds, tens and ones digits remain constant.

Counting by thousandths

Start at 5.043

\boxed{C} 5.043 $\boxed{+}$ 0.001 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Start at 4.96

\boxed{C} 4.96 $\boxed{+}$ 0.001 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Counting backwards by tens

Start at 40 030

C	2304	—	10	=	=	=	=
---	------	---	----	---	---	---	---	------

Counting backwards by thousandths

Start at 7.54

C	7.54	—	0.001	=	=	=	=
---	------	---	-------	---	---	---	---	------

C. Patterns within counting sequences should be explored:

1 125

1 250

1 375

1 400

1 525

1 650

1 775

.

.

.

What is the pattern
in the ones digits?
In the tens digits?
In the hundreds digits?

Predict the next number,
then check with your
calculator.

COUNTING and PATTERNING

YEARS SIX AND SEVEN

Counting Sequences (use of the constant function)

The calculator can assist children in completing counting sequences as well as demonstrate interesting patterns within these sequences. **The constant function** of the calculator is essential here, as it enables a counting sequence to be clearly shown. If the constant function is not used, the sequence is interrupted by the depressing of an operator key such as $+$ or $-$

To count by ones, beginning with one, the following code would be used. This code varies with the calculator brand.

\boxed{C} 1 $\boxed{+}$ 1 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

The activities presented in the previous year levels should be explored as introductory experiences.

Counting forwards and backwards can be extended to include ten-thousands, hundred-thousands, and millions. Counting forwards and backwards by tenths, hundredths, and thousands should be continued. Appropriate activities include:

Counting forwards by ten-thousands

Start at 562 389

\boxed{C} 562 389 $\boxed{+}$ 10 000 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Counting backwards by thousandths

Start at 9.141

\boxed{C} 9.141 $\boxed{-}$ 0.001 $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$

Children should be encouraged to generate their own counting sequences for their friends to continue.

Exploration of counting patterns should extend the activities done in previous years, e.g.

5 210

5 331

5 452

5 573

5 694

5 815

5 936

6 057

6 178

.

.

.

Find the pattern, **predict** the next number, then check with your calculator. Talk about how the pattern changes. Find what happens to the pattern **before** the number, 5 210.

C	5 210	+	121	=	=	=	=
---	-------	---	-----	---	---	---	---	------

CONCEPT / SKILL DEVELOPMENT**YEAR ONE**

Refer to *pages 9, 32, 33* for activities designed to develop number concepts and counting skills.

CONCEPT / SKILL DEVELOPMENT

YEARS TWO and THREE

In addition to the activities outlined on pages 10 – 12, 34 – 53, the calculator may be used in the development of concepts such as:

A. Commutativity and Associativity

The calculator can effectively demonstrate:

3	+	4	=	4	+	3
5	x	4	=	4	x	5

Children should be encouraged to use their calculator to test these ideas with larger numbers.

B. Odd and Even Numbers

Using the constant function (refer to page 32), sequences of odd and even numbers can be generated:

C	2	+	2	=	=	=	=
C	1	+	2	=	=	=	=

Exploration of the addition and subtraction of odd and even numbers can also be undertaken:

Use your calculator to find out what happens when you:

(a) *add two even numbers*

EVEN + EVEN = ?

4 + 6 = ?

(b) *add an even number and an odd number*

EVEN + ODD = ?

4 + 7 = ?

(c) *add two odd numbers*

ODD + ODD = ?

7 + 9 = ?

(d) **subtract an even number from an even number**

$$\text{EVEN} \quad - \quad \text{ODD} \quad = \quad ?$$

$$8 \quad \boxed{-} \quad 6 \quad \boxed{=} \quad ?$$

(e) **subtract an odd number from an odd number**

$$\text{ODD} \quad - \quad \text{ODD} \quad = \quad ?$$

$$9 \quad \boxed{-} \quad 5 \quad \boxed{=} \quad ?$$

(f) **subtract an even number from an odd number**

$$\text{ODD} \quad - \quad \text{EVEN} \quad = \quad ?$$

$$9 \quad \boxed{-} \quad 4 \quad \boxed{=} \quad ?$$

(g) **subtract an odd number and an even number**

$$\text{EVEN} \quad - \quad \text{ODD} \quad = \quad ?$$

$$8 \quad \boxed{-} \quad 3 \quad \boxed{=} \quad ?$$

Is each case of the above always true? Use your calculator to test larger numbers.

C. Basic Facts

Children's basic fact skills can be reinforced through activities such as:

(a) *'Beat the Calculator'*

Children play in pairs — one with a calculator, the other without. The teacher presents (orally) basic facts to be answered. Children compete against each other by attempting to be the first to have correctly answered all facts. It should be evident that the child who is using the calculator to work each fact is not as efficient as the child using basic fact knowledge.

(b) *Number Fact Drill*

As an alternative to pencil and paper recording, children can record (**not calculate**) their answers by depressing the appropriate calculator key (s).

CONCEPT / SKILL DEVELOPMENT**YEAR FOUR**

- A. Refer to the activities outlined on pages 14 – 17, 36 – 38 for ideas which may be used and extended.

B. Multiples

The concept of a **multiple**, together with the generation of multiples, can be readily demonstrated with the calculator. Children only have to focus on the concept being developed instead of also trying to recall basic facts. Hence, those children with weak basic fact knowledge are not hindered in their acquisition of the concept. The calculator may be used as follows:

1st Multiple

Given Number		Counting Number		Multiple
7	<input type="text" value="x"/>	1	<input type="text" value="="/>	7

(use of constant function)

2nd Multiple 2 **14** *2nd multiple of 7*

3rd Multiple 3 **21** *3rd multiple of 7*

4th Multiple 4 **28** *4th multiple of 7*

5th Multiple 5 **35** *5th multiple of 7*

Similarly, the first four multiples of 3 can be found as follows:

<input type="text" value="C"/>	3	<input type="text" value="x"/>	1	<input type="text" value="="/>	3	2	<input type="text" value="="/>	6
					<i>1st multiple of 3</i>			<i>2nd multiple of 3</i>
	3	<input type="text" value="="/>	9	<input type="text" value="="/>	4	<input type="text" value="="/>	12	
			<i>3rd multiple of 3</i>				<i>4th multiple of 3</i>	

(The above use of the constant function will vary with calculator brand.)

Children can complete activities such as:

(a) Use your calculator to find the first five multiples of:

(i) 4 ; ; ; ; ;

(i) 6 ; ; ; ; ;

(b) Use your calculator to find out which numbers below are **not** multiples of 7:

63; 49; 91; 82; 126; 134

CONCEPT / SKILL DEVELOPMENT**YEAR FIVE**

A. Refer to the activities in previous year levels for ideas which may be used and extended.

B. Multiplying by multiples of 10, 100, 1 000

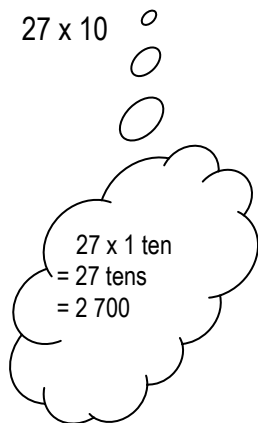
The pattern for multiplying by multiples of ten, hundred, and thousand, can be demonstrated with activities such as:

Use your calculator to complete each of the following:

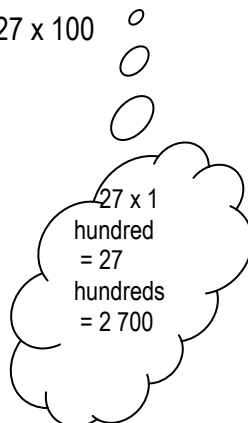
7 x 10 =	7 x 100 =	7 x 1 000 =
37 x 10 =	37 x 100 =	37 x 1 000 =
40 x 10 =	40 x 100 =	40 x 1 000 =
523 x 10 =	523 x 100 =	523 x 1 000 =
804 x 10 =	804 x 100 =	804 x 1 000 =
700 x 10 =	700 x 100 =	700 x 1 000 =
What do you notice?	What do you notice?	What do you notice?

Subsequently, children can be shown that multiplication by 10, 100 or 1 000 does not require calculator use:

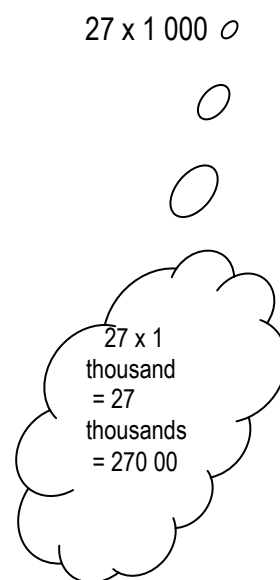
$$27 \times 10$$



$$27 \times 100$$



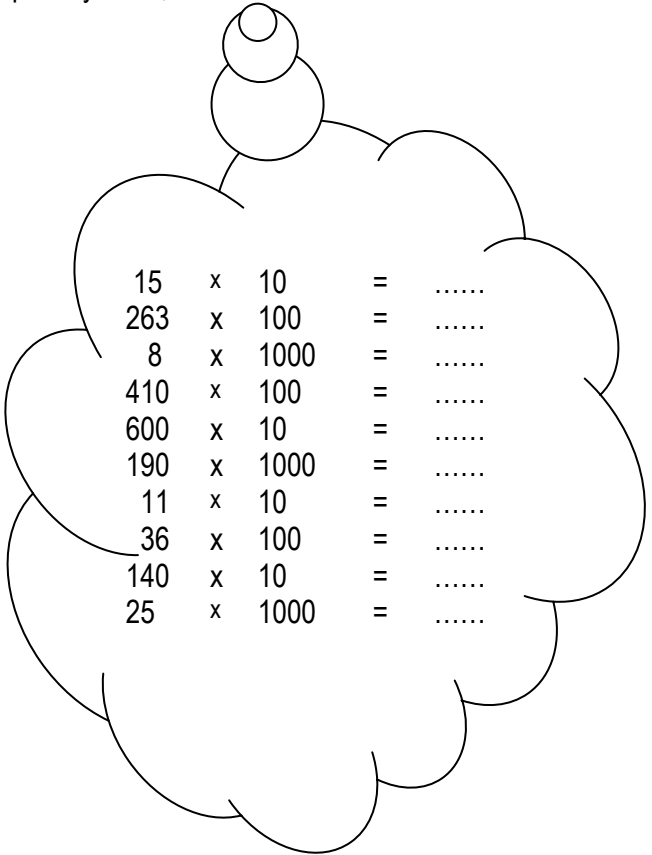
$$27 \times 1\,000$$



To reinforce this concept, a game such as *'Beat the Calculator'* can be played:

One child completed the examples by hand, the other uses a calculator.

The winner is the
first to finish
with all ten
products correct.



15	x	10	=	.....
263	x	100	=	.....
8	x	1000	=	.....
410	x	100	=	.....
600	x	10	=	.....
190	x	1000	=	.....
11	x	10	=	.....
36	x	100	=	.....
140	x	10	=	.....
25	x	1000	=	.....

CONCEPT / SKILL DEVELOPMENT

YEARS SIX and SEVEN

A. Refer to the activities in previous year levels for ideas which may be used and extended.

B. Multiplication Patterns

tens	x	ones	→	tens
tens	x	tens	→	hundreds
tenths	x	ones	→	tenths
tenths	x	tenths	→	hundredths

Children can use their calculator to complete examples of the type:

2	tens	x	3	=	6
20		x	3	=	.....
2	tens	x	3 tens	=	6
20	20	x	30	=	.....
2	tenths	x	3	=	6
0.2		x	3	=	.....
2	tenths	x	3 tenths	=	6
0.2		x	0.3	=	.....

Once the above understandings have been established, the calculator can be used to show the relationship between the number of decimal places in the factors and the number of decimal places in the product of a decimal multiplication.

1. Use your calculator to find each product below:

a			b			c		
16	x	24 = ...	16	x	1.4 = ...	1.6	x	1.4 = ...
47	x	23 = ...	47	x	2.3 = ...	4.7	x	2.3 = ...
29	x	25 = ...	29	x	2.5 = ...	2.9	x	2.5 = ...
36	x	18 = ...	36	x	1.8 = ...	3.6	x	1.8 = ...
19	x	53 = ...	1.9	x	53 = ...	1.9	x	5.3 = ...
42	x	24 = ...	4.2	x	24 = ...	4.2	x	2.4 = ...
59	x	11 = ...	5.9	x	11 = ...	5.9	x	1.1 = ...
24	x	33 = ...	2.4	x	33 = ...	2.4	x	3.3 = ...

How many decimal places in each product
Why?

How many decimal places in each product
Why?

How many decimal places in each product
Why?

What do you notice about the number of decimal places in each product and the total number of decimal places in the factors?

2. Insert the decimal point to make each product correct. Check each product with your calculator.

(a) $2.7 \times 3.9 = 1\ 053$ (c) $5.61 \times 1.8 = 10\ 091$
 (b) $1.24 \times 2.6 = 3\ 224$ (d) $0.72 \times 0.3 = 0\ 216$

C. Square Numbers

The concept of a **square number** can be demonstrated and various features of square numbers can be explored with the calculator.

Its use enables children to focus on the square numbers without the hindrance of complex calculations, thus facilitating more in-depth exploration. Furthermore, in order to correctly code the calculator, children must have a sound understanding of square numbers, particularly when they are expressed in exponential form. A variety of activities can be worked with square numbers. One activity explores square numbers in terms of the nature of the factors producing them:

1. Use your calculator to complete each set:

Set A	Set B	Set C	Set D	Set E
$0^2 =$ -----	$1^2 =$ ----	$2^2 =$ ----	$3^2 =$ ----	$4^2 =$ ----
$10^2 =$ -----	$11^2 =$ ----	$12^2 =$ ----	$13^2 =$ ----	$14^2 =$ ----
$20^2 =$ -----	$21^2 =$ ----	$22^2 =$ ----	$23^2 =$ ----	$24^2 =$ ----
$30^2 =$ -----	$31^2 =$ ----	$32^2 =$ ----	$33^2 =$ ----	$34^2 =$ ----
$40^2 =$ -----	$41^2 =$ ----	$42^2 =$ ----	$43^2 =$ ----	$44^2 =$ ----

Set F	Set G	Set H	Set I	Set J
$5^2 =$ -----	$6^2 =$ ----	$7^2 =$ ----	$8^2 =$ ----	$9^2 =$ ----
$15^2 =$ -----	$16^2 =$ ----	$17^2 =$ ----	$18^2 =$ ----	$19^2 =$ ----
$25^2 =$ -----	$26^2 =$ ----	$27^2 =$ ----	$28^2 =$ ----	$29^2 =$ ----
$35^2 =$ -----	$36^2 =$ ----	$37^2 =$ ----	$38^2 =$ ----	$39^2 =$ ----
$45^2 =$ -----	$46^2 =$ ----	$47^2 =$ ----	$48^2 =$ ----	$49^2 =$ ----

2. Use your answers from 1. to complete the following:

Only the factors that end in:

- (a) 4 or ----- can produce a square number that ends in 6.
- (b) ----- or ----- can produce a square number that ends in 1.
- (c) ----- or ----- can produce a square number that ends in 4.
- (d) ----- or ----- can produce a square number that ends in 9.
- (e) ----- can produce a square number that ends in 5.
- (f) ----- can produce a square number that ends in 0.

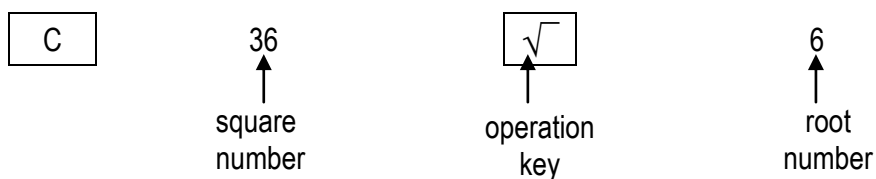
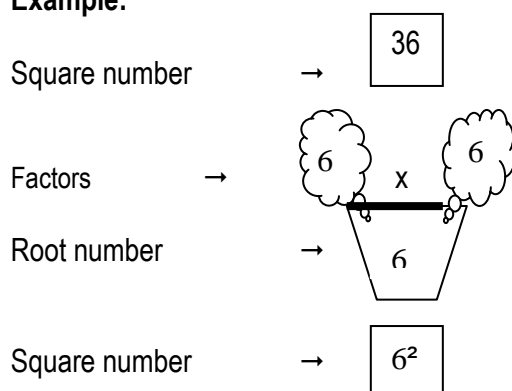
3. Select the factor which, when **squared**, produces the given square number. Tell why you selected the particular factor and then check your answer with a calculator.

Square Numbers	Factors	Square Numbers	Factors
(a) 729	27^2 ; 36^2 ; 15^2	(f) 4 624	66^2 ; 67^2 ; 68^2
(b) 3 481	64^2 ; 70^2 ; 59^2	(g) 1 849	43^2 ; 45^2 ; 34^2
(c) 961	31^2 ; 42^2 ; 38^2	(h) 3 136	56^2 ; 58^2 ; 60^2
(d) 5 625	75^2 ; 74^2 ; 73^2	(i) 6 724	89^2 ; 75^2 ; 82^2
(e) 6 400	91^2 ; 80^2 ; 67^2	(j) 1 936	43^2 ; 44^2 ; 45^2

D. Square Numbers and Root Numbers

The inverse relationship between a square number and its root number can be demonstrated using the $\sqrt{\quad}$ key. (This does not necessitate a formal study of square roots.)

Example:



Children can then use the calculator to find the root number of larger square numbers such as 361, 841, 2 209.

E. Exponential Notation

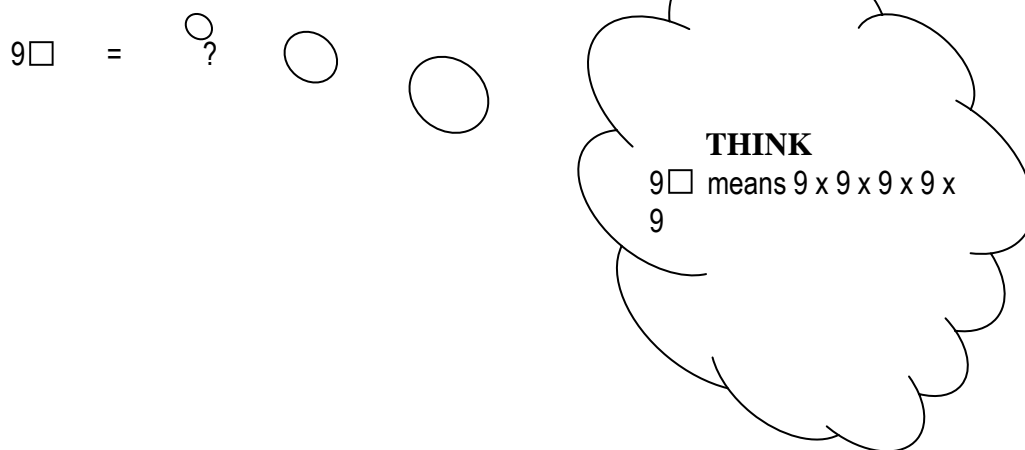
The meaning of numbers expressed in **exponential notation** can be strengthened through calculator use.

A common response to 3^{\square} is 12. However, when children solve this using the calculator, they are compelled to consider the relationship between the exponent and the number of factors to be used. Because children have to stop and **think** about what they are doing, their understanding of exponential notation is reinforced.

For example:

9^{\square} ← The exponent tells **how many** factors to use.
 ↑ It is **not** a factor.

The base number tells **what factor** to use.



<div style="border: 1px solid black; padding: 5px; display: inline-block;">C</div>	9	<div style="border: 1px solid black; padding: 5px; display: inline-block;">x</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">=</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">=</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">=</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">=</div>
			9^2 ↓	9^3 ↓	9^{\square} ↓	9^{\square} ↓
			(81)	(729)	(6 561)	(59 049)

The constant function is used because the operation is the same throughout

Activities include:

- Find the value of: (a) 8^{\square} ----- (b) 7^6 -----

- ✓ the correct answer: 6^6 equals (a) 36 (b) 7 776 (c) 46 656

F. The Golden Ratio

Exploring the ratios of consecutive Fibonacci Numbers to demonstrate the '*Golden Ratio*' is more effectively completed when a calculator is used for the computations:

Ratio of Consecutive Fibonacci Numbers	Result after dividing first number by second number
1 : 1	
1 : 2	
2 : 3	
3 : 5	
5 : 8	
8 : 13	
13 : 21	
21 :	

- What did you notice happened each time you divided?
- What do you think will happen if you keep dividing in the sequence?
- The number that the Fibonacci sequence is '*getting close to*' is called the '*Golden Ratio*'. It is considered to be the ideal ratio. Measure some rectangular (or near rectangular) objects in your classroom. Record them in a table like the one below, and write a ratio that compares the shorter dimension to the longer dimension. Then divide to compare the two numbers to see if they are near the golden ratio.

Object & Dimensions	Ratio	Division Comparison
Large Table		
Smaller Table		
Door		

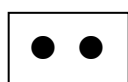
NUMBER PATTERN EXPLORATION

In the exploration of number patterns, the calculator should complement the use of concrete materials such as pegboards, counters, plastic tiles.

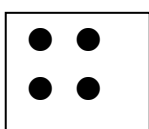
The pattern can be demonstrated with counters, etc. and then with the calculator. Questioning should focus on the number relationships as the pattern is formed, e.g. *'What did you put out each time? What would you put out next?'*

YEARS ONE and TWO

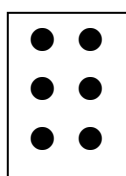
Refer to pages 32-34



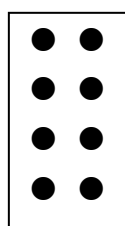
2



4



6



8

C

2

+

=

=

=

=

.....

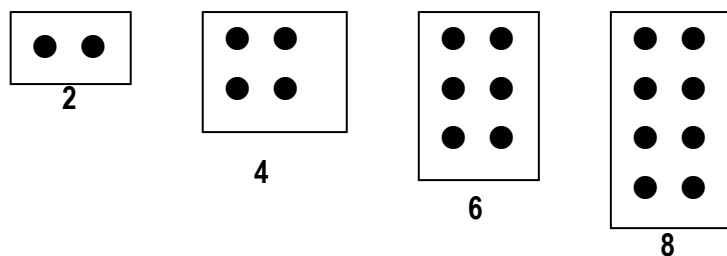
NUMBER PATTERN EXPLORATION

YEAR THREE

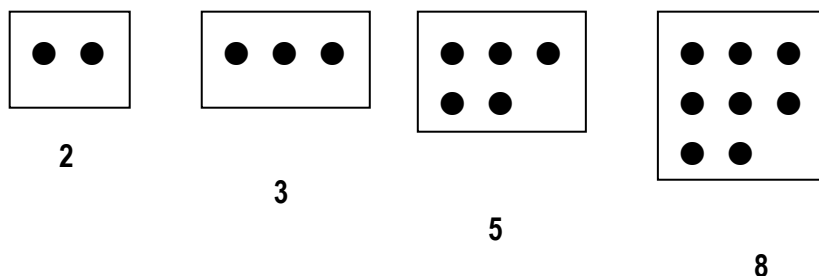
In the exploration of number patterns, the calculator should complement the use of concrete materials such as pegboards, counters, plastic tiles.

The pattern can be demonstrated with counters, etc. and then with the calculator. Questioning should focus on the number relationships as the pattern is formed, e.g. 'What did you put out each time? What would you put out next?'

- A. Refer to pages 35 and 36 for activities.
- B. Further examples include using concrete / pictorial materials in conjunction with the calculator:



C 2 + = = =



C 2 + 1 = 3 + 2 = 5 + 3 = 8

(Note: The constant function of the calculator is not appropriate here as the number being added each time is not constant).

NUMBER PATTERN EXPLORATION

YEAR FOUR

In the exploration of number patterns, the calculator should complement the use of concrete materials such as pegboards, counters, plastic tiles.

The pattern can be demonstrated with counters, etc. and then with the calculator. Questioning should focus on the number relationships as the pattern is formed, e.g. *'What did you put out each time? What would you put out next?'*

A. Refer to pages 37-39 for activities. Further examples include:

B. Exploring the 'nines' pattern beyond 9 x 9:

$$9 \times 1 = 9$$

$$9 \times 2 = 18 \quad (1 + 8 = 9)$$

$$9 \times 3 = 27 \quad (2 + 7 = 9)$$

$$9 \times 4 = 36 \quad (3 + 6 = 9)$$

$$9 \times 5 = 45 \quad (4 + 5 = 9)$$

$$9 \times 6 = 54 \quad (5 + 4 = 9)$$

$$9 \times 7 = 63 \quad (6 + 3 = 9)$$

$$9 \times 8 = 72 \quad (7 + 2 = 9)$$

$$9 \times 9 = 81 \quad (8 + 1 = 9)$$

$$9 \times 10 = 90 \quad (9 + 0 = 9)$$

$$9 \times 11 = 99 \quad (9 + 9 = 18; 1 + 8 = 9)$$

$$9 \times 12 = 108 \quad (1 + 0 + 8 = 9)$$

$$9 \times 13 = \dots$$

$$9 \times 14 = \dots$$

$$9 \times 15 = \dots$$

$$9 \times 16 = \dots$$

$$\cdot$$

$$\cdot$$

$$\cdot$$

$$\cdot$$

$$9 \times 21 = \dots$$

NUMBER PATTERN EXPLORATION

YEAR FIVE

A greater variety of interesting number patterns can be explored when the calculator is used to free the child from any complex or tedious computations. The calculator can be used to generate the pattern, then to check the child's prediction of the next number in the pattern.

A. Refer to pages 39 and 40 for activities. Further examples include:

B. Find a pattern in each set of numbers and then give the missing numbers.

(a) $12 \times 11 = 132$	(b) $13 \times 11 = 143$	(c) $14 \times 11 = 154$
$12 \times 111 = 1332$	$13 \times 111 = 1443$	$14 \times 111 = \dots$
$12 \times 1111 = 13332$	$13 \times 1111 = \dots$	$14 \times 1111 = \dots$

Does the pattern work for 15, 16, 17 and 18? **Use your calculator** to find out.

C. For each of the following, use your calculator to find the answers until you can see a pattern. Use the pattern you discover to complete the set, then check your answers with your calculator.

(a) $1 \times 9 = \dots$	(b) $2 \times 8 = \dots$	(c) $(9 \times 0) + 1 = \dots$
$11 \times 19 = \dots$	$12 \times 18 = \dots$	$(9 \times 1) + 2 = \dots$
$21 \times 29 = \dots$	$22 \times 28 = \dots$	$(9 \times 2) + 3 = \dots$
$31 \times 39 = \dots$	$32 \times 38 = \dots$	$(9 \times 3) + 4 = \dots$
$41 \times 49 = \dots$	$42 \times 48 = \dots$	$(9 \times 4) + 5 = \dots$
$51 \times 59 = \dots$	$52 \times 58 = \dots$	$(9 \times 5) + 6 = \dots$
$61 \times 69 = \dots$	$62 \times 68 = \dots$	$(9 \times 6) + 7 = \dots$
$71 \times 79 = \dots$	$72 \times 78 = \dots$	$(9 \times 7) + 8 = \dots$
$81 \times 89 = \dots$	$82 \times 88 = \dots$	
$91 \times 99 = \dots$	$92 \times 98 = \dots$	

NUMBER PATTERN EXPLORATION

YEAR SIX and SEVEN

A greater variety of interesting number patterns can be explored when the calculator is used to free the child from any complex or tedious computations. The calculator can be used to generate the pattern, then to check the child's prediction of the next number in the pattern.

- A. Refer to *page 41* for activities. Further examples include:
- B. Use your calculator to calculate the first three answers in each exercise. Look for a pattern in the results and then use this pattern to complete the exercise. Where possible, check your prediction with your calculator.

$$\begin{array}{lll}
 1. & \begin{array}{l} 1 \times 1 = \dots \\ 11 \times 11 = \dots \\ 111 \times 111 = \dots \\ \dots \\ 1111 \times 1111 = \dots \\ 11111 \times 11111 = \dots \\ 111111 \times 111111 = \dots \\ 1111111 \times 1111111 = \dots \end{array} & \begin{array}{l} 2. \quad 37 \times 3 = \dots \\ 37 \times 6 = \dots \\ 37 \times 9 = \dots \\ \dots \\ 37 \times 12 = \dots \\ 37 \times 15 = \dots \\ 37 \times 18 = \dots \\ 37 \times 21 = \dots \end{array} & \begin{array}{l} 3. \quad 15873 \times 7 = \dots \\ 15873 \times 14 = \dots \\ 15873 \times 21 = \dots \\ \dots \\ 15873 \times 28 = \dots \\ 15873 \times 35 = \dots \\ 15873 \times 42 = \dots \\ 15873 \times 42 = \dots \end{array}
 \end{array}$$

$$\begin{array}{ll}
 4. \text{ a } & (0 \times 9) + 1 = \dots \\
 \text{ b } & (1 \times 9) + 2 = \dots \\
 \text{ c } & (12 \times 9) + 3 = \dots \\
 \text{ d } & (123 \times 9) + 4 = \dots \\
 \text{ e } & \dots = \dots \\
 5. \text{ a } & (1 \times 9) - 1 = \dots \\
 \text{ b } & (21 \times 9) - 1 = \dots \\
 \text{ c } & (321 \times 9) - 1 = \dots \\
 \text{ d } & (4321 \times 9) - 1 = \dots \\
 \text{ e } & \dots = \dots
 \end{array}$$

$$\begin{array}{lll}
 6. \text{ a } & 9 \times 9 = \dots & 7. \text{ a } \quad 99 \times 1 = \dots \\
 \text{ b } & 99 \times 9 = \dots & \text{ b } \quad 99 \times 2 = \dots \\
 \text{ c } & 999 \times 9 = \dots & \text{ b } \quad 99 \times 3 = \dots \\
 \text{ d } & 9999 \times 9 = \dots & \text{ d } \quad 99 \times 4 = \dots \\
 \text{ e } & \dots = \dots & \text{ e } \quad \dots = \dots \\
 8. \text{ a } & (99 \times 1) + 1 = \dots \\
 \text{ b } & (99 \times 2) + 2 = \dots \\
 \text{ c } & (99 \times 3) + 3 = \dots \\
 \text{ d } & (99 \times 4) + 4 = \dots \\
 \text{ e } & \dots = \dots
 \end{array}$$

$$\begin{array}{lll}
 9. \text{ a } & 1 \times 9 = \dots & 10. \text{ a } \quad (9 \times 9) = \dots \\
 \text{ b } & 12 \times 9 = \dots & \text{ b } \quad (98 \times 9) = \dots \\
 \text{ c } & 123 \times 9 = \dots & \text{ b } \quad (987 \times 9) = \dots \\
 \text{ d } & \dots = \dots & \text{ d } \quad \dots = \dots \\
 11. \text{ a } & (99 \times 1) + 1 = \dots \\
 \text{ b } & (99 \times 2) + 2 = \dots \\
 \text{ c } & (99 \times 3) + 3 = \dots \\
 \text{ d } & \dots = \dots
 \end{array}$$

- C. Use your calculator to find the sum of each cube below. What do you notice about the pattern that is forming?

Consecutive Cubes		Sum
1^3	1	1^2
$1^3 + 2^3$	$(1 + 2^3)$	3^2
$1^3 + 2^3 + 3^3$	$(9 + 3^3)$	\dots
$1^3 + 2^3 + 3^3 + 4^3$	$(36 + 4^3)$	\dots
$1^3 + 2^3 + 3^3 + 4^3 + 5^3$	$(\dots + \dots)$	\dots

Use the pattern you discovered to predict the sum of each of these. Check with your calculator.

(a) $1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 +$ (b) $1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3$

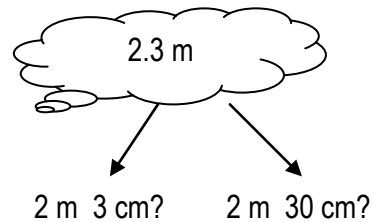
MEASUREMENT / SPACE

YEAR FIVE

The calculator can be used in conjunction with a Place-Value Chart to establish an understanding of metric measures expressed in decimal fraction form, e.g.

Metres		Centimetres
Ones	Tenths	Hundredths
2	3	0

2 metres and 30
hundredths of a metre



$$\boxed{C} \ 2.3 \boxed{=} 2.3$$

Both the Place-Value Chart and the calculator can be used to demonstrate that 2.3 and 2.30 are of equal value. This can facilitate an understanding of the meaning of 2.3 m — 2 m 30 cm.

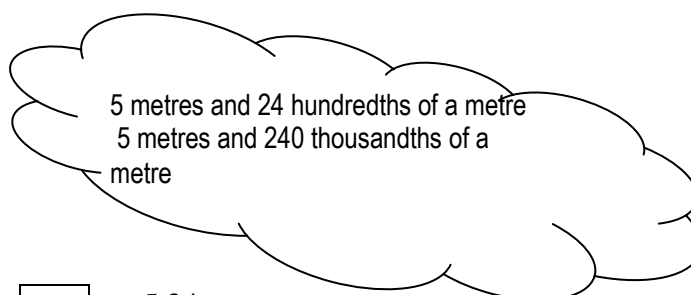
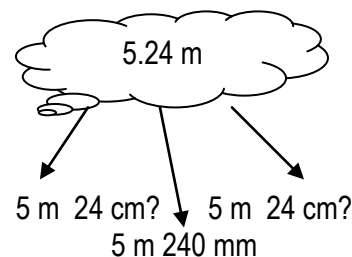
MEASUREMENT / SPACE

YEAR SIX AND SEVEN

A. Metric Measures

The calculator can be used in conjunction with a Place-Value Chart to establish an understanding of metric measures expressed in decimal fraction form, e.g.

Metres		Centimetres	Millimetres
Ones	Tenths	Hundredths	Thousandths
5	2	4	



$$\boxed{C} \quad 5.240 \quad \boxed{=} \quad 5.24$$

Both the Place-Value Chart and the calculator can be used to demonstrate that 5.240 and 5.24 are of equal value. This can facilitate an understanding of the two meanings of 5.24 m — 5 m 24 c, and 5 m 240 mm.

B. Relationships in measurements of plane shapes

Use of the calculator can facilitate exploration of relationships existing in the measurements of plane shapes:

1. *The relationship between the circumference of a circle and its diameter. (Pi)*

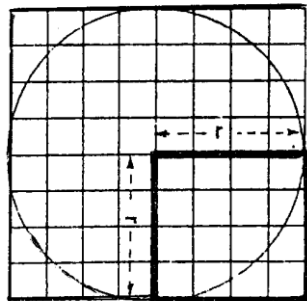
When children explore circles of various sizes to determine the value of Pi, they often meet awkward calculations. The calculator can free the children from the computational aspects and allow them to focus solely on the processes involved:

Measure the circumference and diameter of each of your circles, then use your calculator to complete $C \div D$.

	Circle A	Circle B	Circle C	Circle D	Circle E
Circumference (C)
Diameter (D)
$C \div D$

2. *The relationship between the area of a circle and the square formed on the radius of the circle.*

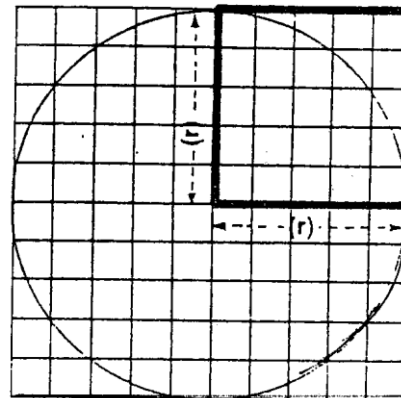
Children can use their calculator to find the answers to the following:



Area of circle = 51 squares (approx)
Area of square = 16 squares ($r \times r$)

How many times larger than the area of the square on the radius is the area of the circle?

C	51	÷	16	=	... approx
---	----	---	----	---	------------



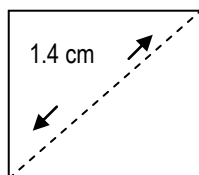
Area of circle = 78 squares (approx)
Area of square = 25 ($r \times r$)

How many times larger than the area of the square on the radius is the area of the circle?

C	78	÷	25	=	... approx
---	----	---	----	---	------------

3. *The relationship between the perimeter and the diagonal of regular polygons with an even number of sides.*

SQUARE



1 cm

Perimeter = 4 cm
Diagonal = 1.4 cm

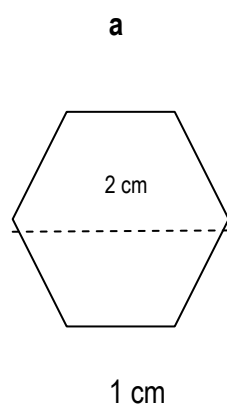
The perimeter of the square is almost 3 times longer than the diagonal

C	4	÷	1.4	=	2.8571428
---	---	---	-----	---	-----------

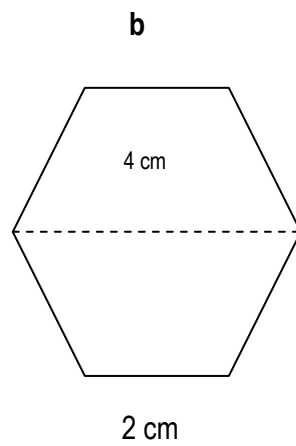
Children may explore this relationship with other squares.

HEXAGON

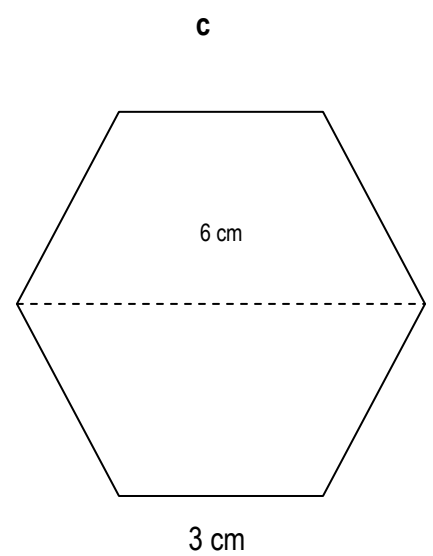
Children can use their calculator to find the relationship between the perimeter of a hexagon and its diagonal:



Perimeter =
 Diagonal =
 Perimeter = Diagonal x



Perimeter =
 Diagonal =
 Perimeter = Diaagonal x



Perimeter =
 Diagonal =
 Perimeter = Diagonal x

ESTIMATION

YEAR THREE

Calculator use enables the **processes** of estimation to be developed without hindrance from any calculations which must be performed. Examples of activities include:

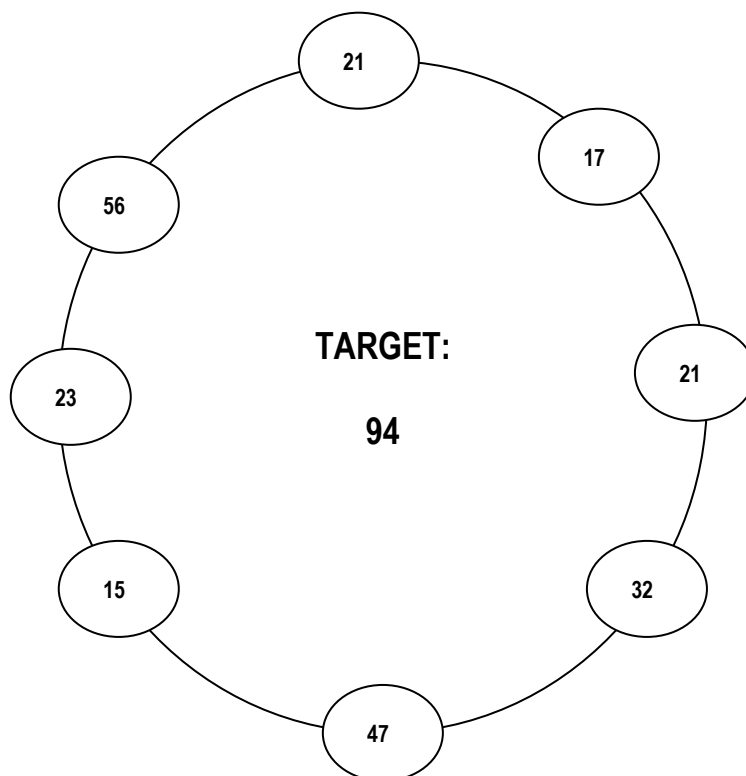
- A. Estimate first, then use your calculator to check your estimates:

Sue bought 3 items from the menu and paid \$1.39. What did she buy?

If you had \$2.00 to spend, what could you buy?

Menu	
Thickshake	29c
Big Fries	48c
Dairy Whip	37c
Big Burger	62c

- B. Estimate first, then draw a ring around any 3 adjacent numbers which add up to the target number. Check with your calculator.



ESTIMATION

YEAR FOUR

Calculator use enables the **processes** of estimation to be developed without hindrance from any calculations which must be performed. Examples of activities include:

- A. The answers to the following addition operations are all incorrect. By using your estimation skills, together with your calculator, cross out one number in each operation to make the answer correct.

$$\begin{array}{r} \text{(a)} \quad 21 \\ 12 \\ 51 \\ + 63 \\ \hline 96 \end{array}$$



$$\begin{array}{r} \text{(b)} \quad 29 \\ 73 \\ 18 \\ + 91 \\ \hline 182 \end{array}$$

$$\begin{array}{r} \text{(c)} \quad 214 \\ 307 \\ 219 \\ + 117 \\ \hline 740 \end{array}$$

B. Best Estimate Wins!

Play this game with a partner.

(a) 486 + 329	(f) 1425 + 389
(b) 761 + 455	(g) 2782 + 1441
(c) 278 + 596	(h) 1296 + 3084
(d) 888 + 734	(i) 5772 + 6505
(e) 904 + 766	(j) 4819 + 5684

- For each sum, both players are to enter the first number into a calculator, push the  key, and then enter the second number.
- Each player is to write an *estimate* of the answer *before* pushing the  button.
- Each player then compares their estimate with the actual answer.
- The player whose *estimate is closer to the actual answer* underlines their estimate.
- The player who has the greater number of underlined estimates is the winner.

ESTIMATION

YEAR FIVE

Calculator use enables the **processes** of estimation to be developed without the hindrance from any calculations which must be performed.

Furthermore, calculator use itself, requires children to apply estimation skills to determine the **sensibleness of their answers**. For example, if the calculator were to give an answer of 1372 for the operation, 4.9×28 , the children's estimation skills should be such that an error could be readily detected.

Activities such as the following encourage children to consider the appropriateness of answers given by the calculator.

Find an *approximate answer* for each of the following to decide whether the given calculator answer is sensible, then work each operation on your own calculator.

(a)

41 270

$$28\,874 + 12\,396$$

(e)

868

$$28 \times 31$$

(b)

4662.296

$$452.4 + 138.296$$

(f)

344.4

$$49.2 \times 7$$

(c)

51 076

$$36\,200 - 14\,876$$

(g)

991

$$3964 \div 4$$

(d)

456.51

$$496.2 - 39.69$$

(h)

331

$$29\,793 \div 9$$

ESTIMATION

YEAR SIX and SEVEN

Calculator use enables the **processes** of estimation to be developed without the hindrance from any calculations which must be performed. Furthermore, calculator use itself, requires children to apply estimation skills to determine the **sensibleness of their answers**.

For example, if the calculator were to give an answer of 1372 for the operation, 4.9×28 , the children's estimation skills should be such that an error could be readily detected.

Activities such as the following encourage children to consider the appropriateness of answers given by the calculator.

- A.** Find an *approximate answer* for each of the following to decide whether the given calculator answer is sensible, then work each operation on your own calculator.

(a)

86.428

2.108×41

(e)

7321

$36.605 \div 5$

(b)

722.68

$49.387 + 22.881$

(f)

132.599

$82.999 + 49.6$

(c)

0.455

$40.95 \div 9$

(g)

288.1

$385.21 - 97.11$

(d)

366.003

3.697×99

(h)

175.79

$1875.3 - 117.4$

- B.** Each underlined number below should contain a decimal fraction. Estimate how many ones each underlined number should contain, insert the decimal point accordingly, and then check with your calculator.

(a) $236.81 + \underline{4926} = 286.07$

(b) $\underline{4152} - 19.6 = 396.04$

(c) $\underline{7225} \times 4 = 289$

(d) $\underline{2348} \times 72 = 1690.56$

(e) $\underline{42\ 612} \div 6 = 710.2$

PROBLEM SOLVING

YEAR ONE

Numbers to be entered into the calculator can be presented in a problem solving setting, e.g.

- A. On your calculator show a number which is greater than 3 but not greater than 6.
- B. Show any number which is not less than 5. Read aloud your number.
- C. Have displayed three cards showing these numbers in word form:

nine

five

seven

Explain to the children they are to enter **one** of these numbers into their calculator, but must work out which number it is from the clues given:

CLUES

The number to be entered is:

- more than five
- between four and eight

PROBLEM SOLVING

YEAR TWO

- A. Numbers to be entered into the calculator can be presented in a problem solving setting, e.g.
- On your calculator show a number which is greater than 23 but not greater than 30.
 - Show any number which is not less than 15 and not greater than 25. Read aloud your number.
 - Have displayed three cards showing these numbers in word form:

twelve

fifteen

nineteen

Explain to the children they are to enter **one** of these numbers into their calculator, but must work out which number it is from the clues given:

CLUES

The number to be entered is:

- greater than eleven
- less than eighteen
- between twelve and sixteen

- B. The inverse relationship between addition and subtraction can be reinforced with problem activities of the type:
- I entered a starting number into my calculator. I then added 6. My answer (finishing number) was 18. What was my starting number?
 - I entered a starting number into my calculator. I added 9, then subtracted 3. My answer was 16. What was my starting number?

PROBLEM SOLVING

YEAR THREE

- A. Numbers to be entered into the calculator can be presented in a problem solving setting, e.g.
- On your calculator show a number which is less than 120 but greater than 90. Read aloud your number.
 - Show any number which is not less than 300 and not greater than 400. Read aloud your number.
 - Have displayed three cards showing these numbers in word form:

one hundred and sixty	one hundred and eighty	one hundred and forty
-----------------------------	------------------------------	-----------------------------

Explain to the children they are to enter **one** of these numbers into their calculator, but must work out which number it is from the clues given:

CLUES

The number to be entered is:

- is between one hundred and fifty, and two hundred
- has less than nineteen tens and more than sixteen tens

(Children could create similar problems to the above for their friends to solve.)

- B. The inverse relationship between addition and subtraction, and multiplication and division can be reinforced with problem activities of the type:
- I entered a starting number into my calculator. I then added 8 and then subtracted 12. My answer (finishing number) was 56. What was my starting number?
 - I entered a starting number into my calculator. I multiplied it by 3 and then divided it by 6. My answer was 2. What was my starting number?

PROBLEM SOLVING

YEARS FOUR and FIVE

- A. Numbers to be entered into the calculator can be presented in a problem solving setting, e.g.
- On your calculator show a number which is greater than 2560 but greater than 2600. Read aloud your number.
 - Show any number between 7 hundredths, and 7 tenths. Read aloud your number. What other numbers is your number between?
 - Show any number between 5 and 6. Read aloud your number. What other two numbers is your number between?
- B. The concept of a multiple can be reinforced through problem solving activities such as:
- Enter any number which is a multiple of 4 but not a multiple of 3.
 - Enter any number which is a multiple of 5 **and** a multiple of 3.
 - Have displayed these number cards:

twelve

twenty- seven

thirty - six

twenty- one

Explain to the children they are to enter **one** of these numbers into their calculator, but must work out which number from the clues given:

CLUES

- The number is a multiple of 3.
 - It is **not** a multiple of 4.
 - It is a multiple of 9.
- C. The inverse relationship between addition and subtraction, and multiplication and division can be reinforced through problem activities of the type:
- I entered a starting number into my calculator. I then added 19, and then subtracted 22. My answer (finishing number) was 369. What was my starting number?
 - I entered a starting number into my calculator. I multiplied it by 4 and then divided it by 8. My answer was 2. What was my starting number?

- D. Sequences of operations represented in a flowchart form also serve to reinforce the relationships between the operations:

Find the missing number

enter
498
↓
add
306
↓
subtract
?
↓
776

Find the missing numbers.

There are more than two answers

enter
?
↓
add
432
↓
subtract
?
↓
divide
by 3
↓
44

- E. The calculator should be used in any problem solving activity where the computations involved might hinder the problem solving processes being developed. When children are freed from complex or tedious calculations they are able to focus solely on the process of solving the problem.

Activities in which the calculator can serve this purpose include:

- a. *A set of sheets costs \$34 and a set of pillow cases costs \$12. Sara bought a total of 6 sets and altogether spent \$160. How many sets of sheets and how many sets of pillow cases did Sarah buy?*

The above problem is readily solved when a table of facts is constructed, with the calculator performing the necessary calculations:

No. of sets of sheets	No. of sets of pillow cases	Total No. of sets	Total Cost
0	6	6	
1	5	6	
2	4	6	
3	3	6	
4	2	6	
5	1	6	
6	0	6	*

$$* 6 \times \$34 = \$204$$

- b. *Tracey has twice as much money as Richard. Altogether they have \$1 296. How much money do they each have?*

The above problem is most effectively solved when a 'guess and check' strategy is employed. A reasoned guess should be made and then checked with the calculator. If the guess does not produce the required answer, it should be improved until the required answer is obtained. The calculator facilitates the problem solving process because it removes the distraction of computation and enables the child to focus on the improvement of each guess:

Tracy	Richard	Sum
\$700	\$350	\$1 050
\$800	\$400	\$1 200
.....

← 1st guess

← 2nd guess

← 3rd guess

PROBLEM SOLVING

APPLICATIONS

YEARS FOUR and FIVE

- A. The calculator can assist in the solving of problems in which an operation must be applied. Because of the traditionally strong emphasis on computational accuracy, children tend to view problem solving as being associated only with awesome computation. Using the calculator to do the required computation can free children from the overriding concern of obtaining the correct answer, and hence, enable them to concentrate on the **process** of solving the problem.

One way in which this may be achieved is to have children write a calculator code for a given problem (rather than a number sentence), **explain** why the code is appropriate, and then solve the problem by feeding the code into the calculator. The calculator answer should be evaluated in light of the original problem — that is, whether the answer is a sensible one. The application of estimation skills is crucial here.

- Write a **calculator code** for each problem;
 - Tell **why** you think your code is correct;
 - Feed the code into your calculator;
 - Look at your answer — does it make sense? Is it what you would expect?
1. Cyril and Adam Ant decided to paint their boat. They bought 9 cans of paint which cost \$27 a can. How much did the paint cost altogether?
 2. Their boat also needed new sails which cost \$896. What was the difference in price between the paint and the sails?

- B. Other applied problems in which calculator use enhances the processes being developed include:
1. How many breaths do you take into one minute? In 1 hour? In 1 week?
(Before you use your calculator, write an approximate answer.)
 2. How many times does your pulse beat in 1 minute? In 1 hour? In 1 day? In 1 week?
 3. How many words can you read in 30 seconds? In 1 minute? In 30 minutes? In 1 hour?

PROBLEM SOLVING

YEARS SIX and SEVEN

- A. Numbers to be entered into the calculator can be presented in a problem setting, e.g:
- On your calculator, show a number which is not greater than 160 000, but not less than 150 000. Read aloud your number.
 - Show any number between 9 thousandths, and 8 tenths. Read aloud your number.
 - Show any number between 9 and 10. Read aloud your number. What other two numbers is your number between?
- B. The concept of a multiple can be reinforced through problem solving activities such as:
- Enter any number which is a multiple of 6 but not a multiple of 4.
 - Enter any number which is a multiple of 9 **and** a multiple of 8.
 - Have displayed these number cards:

Seventy - two	fifty- seven	Twenty - seven	eighteen
------------------	-----------------	-------------------	----------

Explain to the children they are to enter one of these numbers into their calculator, but must work out the number from the clues given:

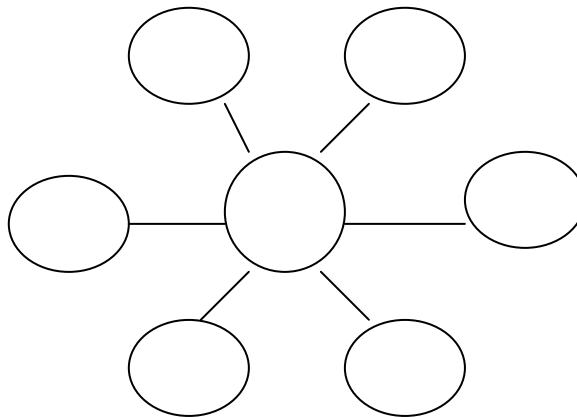
CLUES

- The number is a multiple of 9 **and** a multiple of 2.
 - It is **not** a multiple of 4.
- C. The calculator should be used in any problem solving activity where the computations involved might hinder the problem solving processes being developed. When children are freed from complex or tedious calculations, they are able to focus solely on the process of solving the problem.

Activities in which the calculator can serve this purpose include:

- When Sue opened her piggy bank, she found that she had ten coins altogether — some were 10c coins, some were 20c coins, and some were 50c coins. The total value of the coins was \$3.70. How many of each type of coin did Sue have?

- b. Place the numbers 14, 21, 28, 35, 37, 42 and 49 in the circles so that each arm totals 100.



- c. 73 is 37 backwards

$$\begin{array}{r} 73 \\ + 37 \\ \hline 110 \end{array}$$

Which is divisible by 11

- 1472 is 2741 backwards

$$\begin{array}{r} 1472 \\ + 2741 \\ \hline 4213 \end{array}$$

Which is divisible by 11

Try this with other numbers.

Does it work for six-digit numbers?

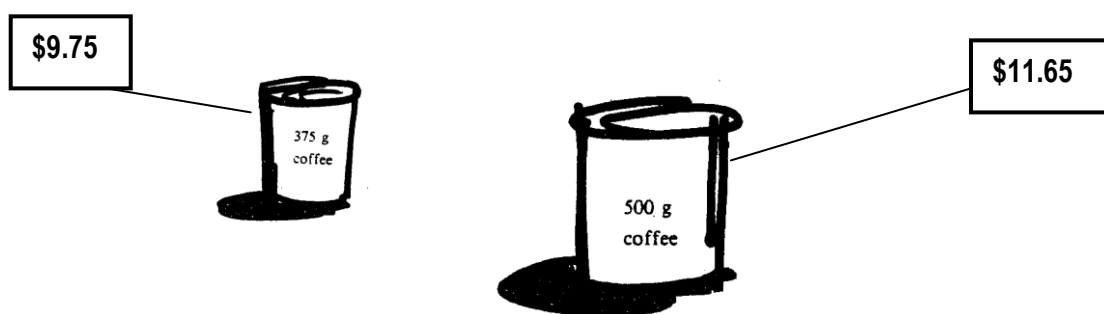
Does it work for three-digit numbers?

Can you discover a rule that will tell you which numbers this will work for?

PROBLEM SOLVING**APPLICATIONS****YEARS SIX and SEVEN**

- A. Refer to the activities presented on pages —
- B. Calculator use is most appropriate in working rate and ratio examples where the 'Best Buy' must be found. When children are freed from the tedious calculations involved, they are able to focus solely on the process of solving the problem (finding each unit cost and comparing the two amounts).

Which is the better buy?



Small jar: \$9.75 for 375 g →

$$\begin{array}{ccccccc} \boxed{C} & 975 & \boxed{\div} & 375 & \boxed{=} & 2.6 & \\ & \uparrow & & \uparrow & & \uparrow & \\ & \text{cents} & & \text{grams} & & \text{cents per gram} & \end{array}$$

Large jar: \$11.65 for 500 g →

$$\begin{array}{ccccccc} \boxed{C} & 1165 & \boxed{\div} & 500 & \boxed{=} & 2.33 & \\ & \uparrow & & \uparrow & & \uparrow & \\ & \text{cents} & & \text{grams} & & \text{cents per gram} & \end{array}$$

The large jar of coffee is the better buy because it is cheaper per gram.

- C.** Problems involving discount, simple interest, hire purchase, etc are also more effectively solved with the aid of the calculator:

A firm selling video recorders is offering customers two ways of purchasing the item — Payment in cash (\$499), or payment in weekly instalments (\$3.79) over a period of 4 years.

- a.** Which offer would save you money?
- b.** How much extra do you end up paying if you choose the other offer?

$$\boxed{C} \quad 3.79 \quad \boxed{\times} \quad 52 \quad \boxed{\times} \quad 4 \quad \boxed{=} \quad \$788.32$$

\uparrow instalment \uparrow 52 wks = 1 year \uparrow 4 years \uparrow the amount Actually paid

Extra amount to pay: $\boxed{C} \quad 788.32 \quad \boxed{-} \quad 499 \quad \boxed{=} \quad \289.32

- c.** What % interest would you be charged if you were to choose the weekly instalments?

$$\boxed{C} \quad 289.32 \quad \boxed{\div} \quad 499 \quad \% \quad 57.915831$$

\uparrow extra amount paid \uparrow cash price (60% approx)

APPENDIX

CALCULATOR GAMES

- A. An ancient game requiring logical thinking is **NIM**.

Any number of players can play this game. Only one calculator is needed.

1. Prepare the calculator by entering a number, e.g. 21
2. In turn, each player must subtract 1, 2 or 3 by pressing

$\boxed{\text{—}}$ 1 $\boxed{=}$ or $\boxed{\text{—}}$ 2 $\boxed{=}$ or $\boxed{\text{—}}$ 3 $\boxed{=}$

3. The loser is the first player forced to leave zero or less in the display.

- B. **Decimal wipe-out**

Any number of players can play this game (one calculator per player).

1. One player calls a number involving decimal fraction places, e.g. 137.63, to be entered by all other players, and a digit, e.g. 3, to be removed by subtraction. The other digits are not to be altered.
2. All players then subtract one number, e.g. 0.03, to wipe out the required digit.

- C. **Reverse**

Only one player is needed for this game.

Have a friend enter a three digit number into the calculator. Your goal is to get as close as possible to the number formed, by reversing the digits of this starting number. If the starting number is smaller than the goal number, the operation you may use is addition; if it is larger, the operation is subtraction. The numbers you may use must be *two-digit numbers formed from the digits currently on display*.

Example: Starting number is 246
 Goal is therefore 642
 Operation is addition
 Digits to be used are 2, 4 or 6

Suppose you add 62. The display becomes 308 and for your next move you can add any two-digit number using 3, 0 or 8.

D. The Lucky Seven Puzzle

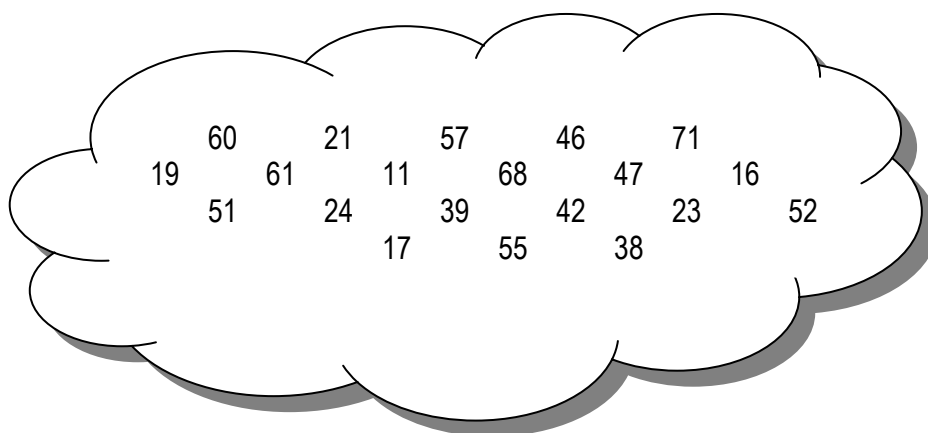
Only one player is needed for this game.

1. Push only the 4, +, x, -, ÷, and = buttons until you get 7 on the display.
2. You may push the buttons in any order and repeat them when and how often you wish.
3. What is the least number of keys you can push to accomplish this?

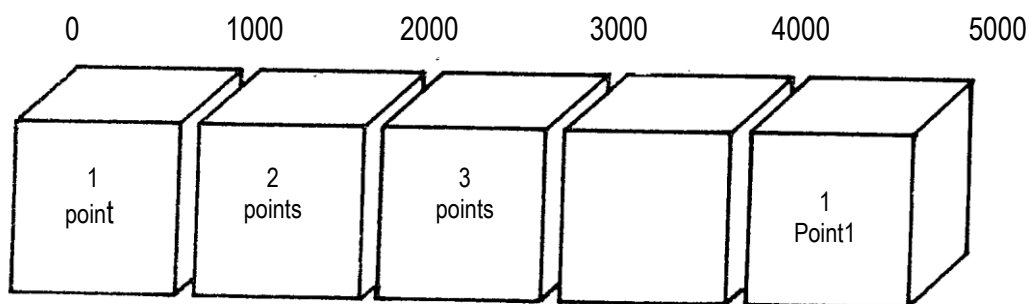
E. Estimating Multiplication

This game is suitable for two players.

1. Take turns in selecting any two numbers. Circle them. (They can be used only once.)



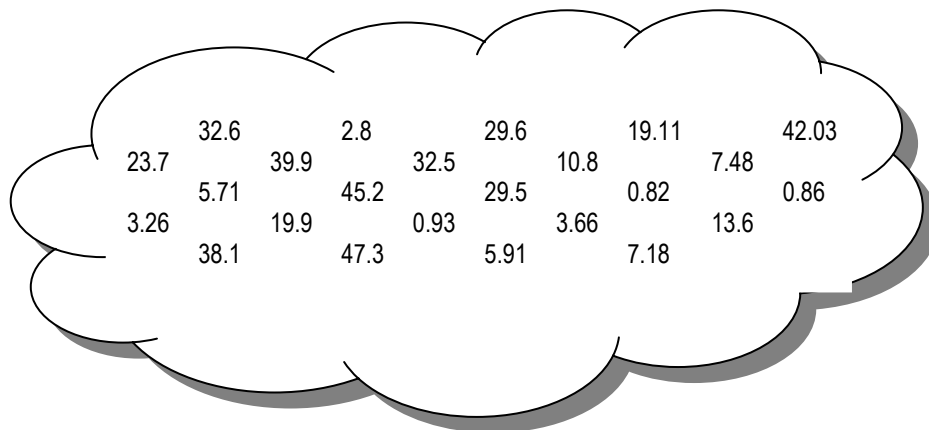
2. Using a calculator, multiply the numbers you circled. Find the box for your answer. Keep track of your points.
3. The winner is the player with the greater number of points after all numbers have been used.



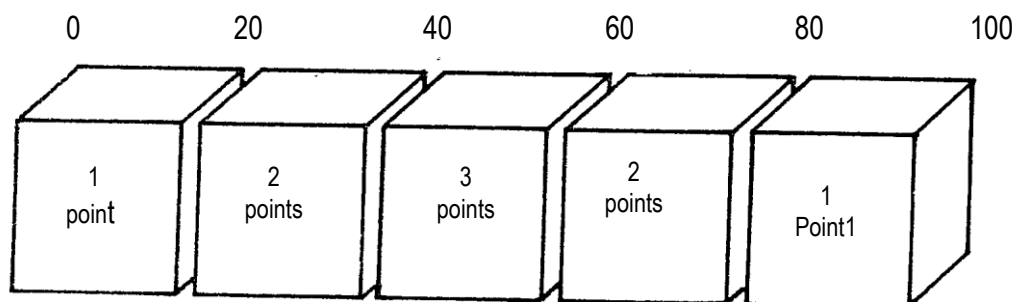
F. Estimating Decimal Sums

This game is suitable for two players.

1. Take turns in selecting any two numbers. Circle them. (They can be used only once.)

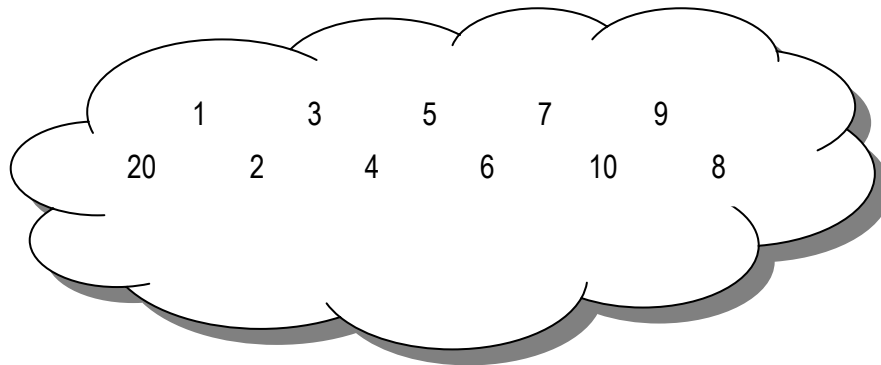


2. Using a calculator, add the numbers you circled. Find the box for your answer. Keep track of your points.
3. The winner is the player with the greater number of points after all numbers have been used.



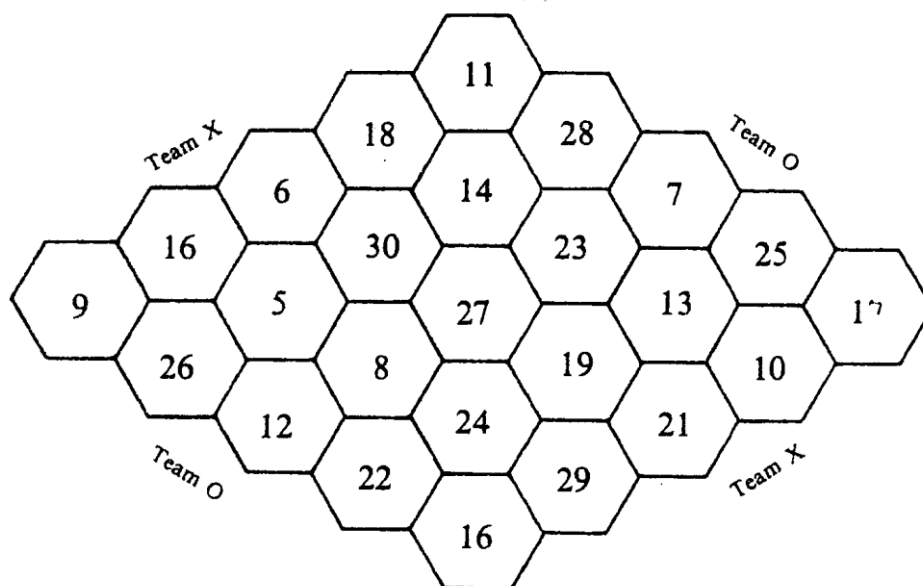
G. Addition Game for 2 Teams

1. The teams take turns in selecting any two of these numbers:



2. Add the numbers selected.
3. If the answer is on the game board below, mark it with an X or O.
4. The first to get a path across the game board wins.

Game Board



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