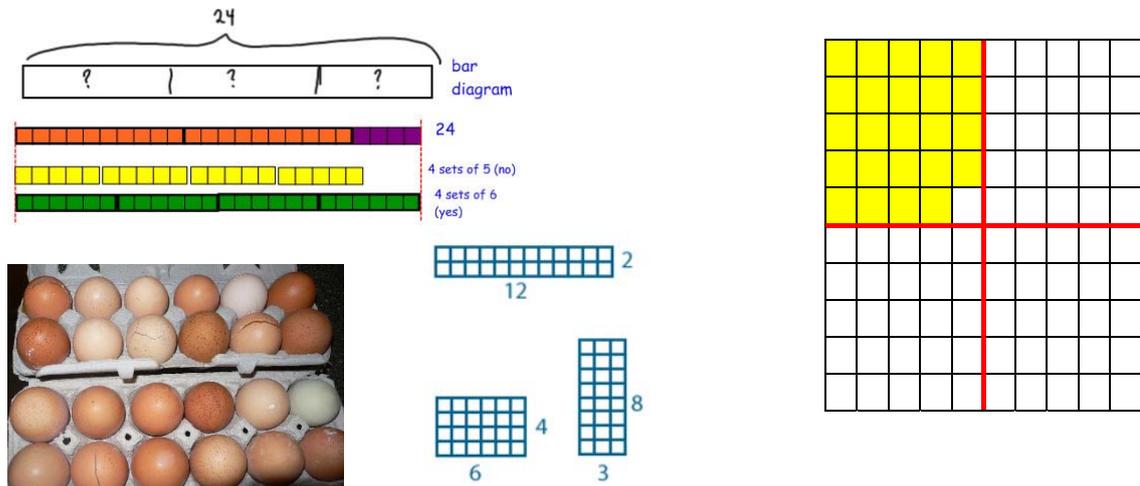


Activity 6

Equivalent expressions

Aim: Appreciate that expressions can be written in different ways. Use CAS to write algebraic expressions in different forms.

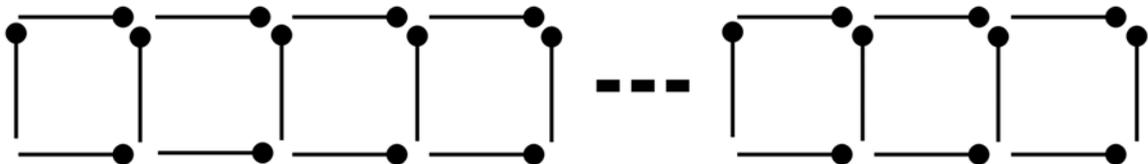
1. Here are some different ways to picture 24.



Being flexible with number can make it easier to do mental calculations.

Which representations make it easier to calculate $24 \div 6$, 24×4 ?

2. Match sticks are used to create a line of squares.



- a) How many matches are required to build this shape if there are

- (i) 4 squares
- (ii) 10 squares
- (iii) n squares?

- b) There are many different ways to see how many matches are used.
E.g. $4 + 3$ times 1 less than the number of squares, i.e. $4 + 3(n - 1)$

Or a row of n matches across the top, a row of n at the bottom and $n+1$ vertical matches, i.e. $n + n + (n + 1)$.

Describe another way (or ways) of seeing the matches and write an expression for the number of matches using your representation.

- c) As they are different ways of counting the same number of matches these expressions must be equivalent. One way of showing this is to see if the expressions simplify to the same thing.

Simplify expressions

- Open $\sqrt{\alpha}$
- Enter the expression
- Press **EXE**
- Tap **Simp**

Note: Standard mode is recommended.

Edit Action Interactive

0.5 1 2 ← → ↶ ↷ ↵ ↶ ↷

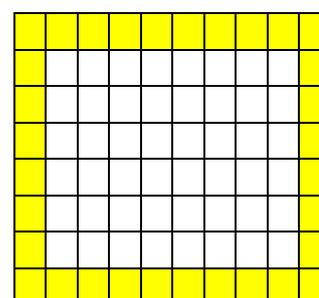
4+3(n-1) 3·(n-1)+4

simplify(4+3(n-1)) 3·n+1

n+n+(n+1) 3·n+1

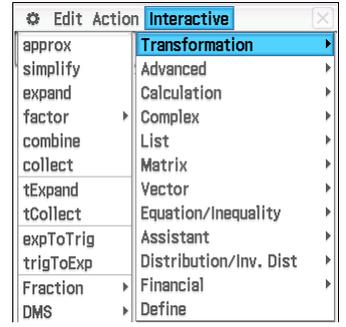
Check your expression(s) in b) to see if they simplify to the same result as shown above.

3. Imagine a rectangular grid of tiles, say 10 tiles wide and 8 tiles wide, with the border being made up of different coloured tiles.



- How many border tiles are there?
 - How did you see this?
 - Find two other ways to count the number of border tiles.
 - Now generalise these methods to calculate the number of border tiles where the grid is m tiles long and n tiles wide.
 - Simplify these expressions to check they are equivalent.
4. Write 4 different expressions for each of the following and verify that your answers are equivalent by simplifying the expressions.
- $2x + 21 - (x + 5)$
 - $3x + 2y - 5$
 - $xy - 4x - 4y + 16$

5. Your ClassPad is CAS calculator. CAS stands for Computer Algebra System. That is your calculator has a built in capacity to do algebraic manipulations. The Transformation menu lists commands designed to transform expressions.

<p>Transform expressions</p> <ul style="list-style-type: none"> • Open $\overset{\text{Main}}{\sqrt{a}}$ • Enter an expression • Highlight the expression • Select from [Interactive Transformation ...] (the action menu has mostly the same options) • Complete the dialog box and tap OK 	
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Perform the following calculations

- a) Expand and simplify

(i) $a^2(4 - 2a) + a$

(ii) $(x + y)^2$

(iii) $(x + y)^2 - (x - y)^2$

- b) Factorise

(i) $4b^2 - 3ab$

(ii) $32a - 8b + 40c$

(iii) $4abc + 2ab - 10bc$

(iv) $(x^2 + 2xy + y^2)$

- c) Combine these fractions:

(i) $\frac{2}{3} + \frac{x}{6}$

(ii) $\frac{y}{2} - \frac{x}{3} + \frac{2z}{5}$

(iii) Write $\frac{2}{z} - \frac{3}{2z}$ with a common denominator

6. Write in your own words what the following terms mean when working with algebraic expressions:

- a) Expand

- b) Factorise

- c) Simplify

Learning notes

This activity is attempting to begin a unit on manipulating algebraic expressions through a functional algebra approach, rather than just a set of rules. That is let's begin by appreciating that expressions can be used to represent concrete situations and there are multiple ways of generating the expression and the results are equivalent expressions.

As students have already been exposed to many of these rules it can be challenging to engage in generating alternatives. However, this can provide a basis for why may wish to manipulate expressions.

Q's 1 – 4 are aimed at appreciating that there are many ways of expressing the same quantity or expression. Q1 is a numerical example, Q's 2&3 are physical situations where expressions are generated with a pattern and Q4 is abstract. It is likely that discussion of the possibilities different students come up with will be required as some students may just look for an answer rather than consider different ways of representing the quantity.

The CAS enables students who get lost in the by-hand manipulation of expressions to be able to access more advanced work. In some cases they will then come back to the by-hand work more successfully, i.e. the ability to get the answer enables more engagement. It also permits teachers to be able to focus more on non-calculation aspects of working mathematically, such as mathematising problems and interpreting the results.