Combating Algebra:

Algebra is one of those areas of maths that scares the pants off most parents. Comments like, "I was good at maths until they started taking out all the numbers" are pretty common. So how do we turn the tide? How do we convince students and their parents that algebra is actually incredibly useful and not really all that tricky? I would like to take this opportunity to share a few ideas and strategies that I have found work really well for helping students to work easily with the algebraic principles, even with support students.

Why would you use letters anyway?

I find that one of the most pivotal points in developing a student's understanding and acceptance of algebra is when it is first introduced in late primary school. Often teachers approach this strand by simply starting to use letters for unknowns. Students are understandably confused and find it difficult to relate what they know to a totally different format. Why not instead try using letters that stand for something in particular? This approach allows students to become comfortable with the concept of using letters to stand for numbers before having to do very much with them.

Example from *Back-to-Front Maths*: Darren is three years older than Mark.

- So if I knew that Darren was 13, how old would Mark be? *10*
- How did you work it out? $13 - 3 = 10$
- Is there a way that we can write that using D for how old Darren is and M for how old Mark is? $D - 3 = M$
- If we knew that Mark was 8, how old would Darren be? *11*
- So how could we write that using D and M? $M + 3 = D$
- How would we write the equation, Mark is twice as old as Darren?

What's with all those apples and bananas?

Most students have difficulty understanding that in algebra you cannot add a to b and get ab, even when expressed as "apples" and "bananas". Combining like terms is a very important concept that once grasped makes most of algebra much simpler. I like to introduce the concept of combining like terms with a game that I call *Circle Swap*. For this game you need to have a number of cut out coloured circles for students to use. Each circle should have a + written on one side and a – written on the reverse side.

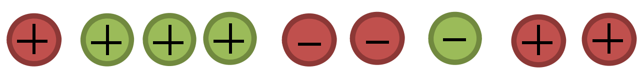
Circle Swap Game:

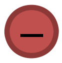
Each student is given a handful of circles from each colour. You then write a sentence on the board that tells the students what to make using their circles (see the example below). They combine circles of the same colour, and can remove a pair of circles (one with a + and one with a –) of the same colour. Pairs like these cancel each other out and can be taken away. Once any circles that can cancel have been removed, students simply work out how many circles of each colour they have.

For example:

The teacher might write: +1red +3green -2red -1green +2red

This looks like:



The students would then cancel out any  with  and any  with 

They would be left with:

Which is written as: +1red +2green

Once students have the hang of the game, it is very simple to say, “Do you mind if I just write r instead of red and g instead of green?” Once they are confident with this, change the letters to something else (e.g. put a y instead of an r). When students ask what y means say, “Yellow?” and then let them know that it is ok to use a different colour if they don’t have any yellow. You can then progress to w (white) and then try for an x. When students ask what x means say, “I don’t know, some colour starting with X. How about we make up a colour called Xavier? Is that ok?”

How can you add negatives of something?

One of the advantages of the *Circle Swap* game is that students can end up with negative numbers and can see that they have a value. I often like to give students a very long and involved equation and then say “any reds are worth $1 and any greens are worth $2. Do I owe you money, or do you owe me money?” Negative amounts of money (e.g. credit cards) are also fun to work with. Check out the example below:

From *Back-to-Front Maths*:
Draw a line across your classroom floor (with chalk) to represent you bank balance. Put a mark in the middle to represent $0 balance. At one end of the line write +$20 and at the other end write -$20. Ask students to explain what they think it means. Then introduce scenarios and ask students to step out what happens to the bank balance:

1. Starting with a bank balance of +$10, I deposit $10. What is my bank balance now?

2. Starting with a bank balance of +$10, I spend $10. What is my bank balance now?

3. Starting with a bank balance of $0, I deposit $10. What is my bank balance now?

4. Starting with a bank balance of $0, I spend $10 using my credit card. What is my bank balance now?

5. Starting with a bank balance of -$10, I deposit or pay back $10. What is my bank balance now?

6. Starting with a bank balance of -$10, I spend $10. What is my bank balance now?

7. Starting with a bank balance of +$10, I do the opposite of spending $10. What is my bank balance now?

8. Starting with a bank balance of +$10, I do the opposite of depositing $10. What is my bank balance now?

9. Starting with a bank balance of -$10, I do the opposite of spending $10. What is my bank balance now?

10. Starting with a bank balance of -$10, I do the opposite of depositing $10. What is my bank balance now?

y = mx + c… Seriously?

For a great series of teaching steps for straight line equations check out sections G and H of the years 6 and 7 *Back-to-Front Maths* books and website, and the year 9 Algebra section at *Essential Maths Investigations Queensland.*

Many real-life situations involving money have a fixed and variable component. These often form exciting straight-line graphs. For example, consider the costs of going on an excursion for a class of students. The total cost (y) of the trip is made up by the fixed cost of the bus (y intercept) and then the price per student (gradient). See the table below:

Excursion costs:

These are made up of a fixed cost of $50 for the bus, and a price per student of $10.

Number of students: (S)	0	1	2	3	4	5	6	7	8	9	10
Total cost including the bus: (T)	50	60	70	80	90	100	110	120	130	140	150

Equation: Total cost = $10 x Number of Students + $50

T = 10S + 50