Early Algebra

Preliminary
What is arithmetic?
What is algebra? algebra is a way of showing patterns in arithmetic

Student and Teacher
first with words
gradually introduce variables
introduce implied multiplication and fraction bar as division
different rules that give the same answer - discuss
advantage of giving numbers in order, e.g. making a table.
scatterplots and graphs of rules.
constant function
introduce powers

Exploring Number Patterns
don't use implied multiplication yet!
trestle tables
toothpicks
Bob Dengate's example - email AAMT.
revise: repeated addition --> multiplication and repeated subtraction --> division
English expressions to algebra; e.g. three times a number plus one, four times a number minus three.
XXXX - needs more work

Function Machines
find output for different inputs, including fractions and integers (evaluate)
tables, functions, graphs
guess the rule
given output, find input (solve)
regression - given table, find equation.
applications - direct proportion, fixed and variable costs, supply and demand, perimeter formula.
evaluating functions exercises.

Expanding - Distributive Law
often same thing can be expressed in more than one way
introduce bags and stones
* = unknown number of stones in a bag. * * * represents number of stones in 3 bags, or 3 x * or 3*.
* + 5 represents a bag with an unknown number of stones + 5 more stones.
*-2 represents a bag with an unknown number of stones initially, with 2 stones removed.
use bags and stones to show that 2(* + 3) = 2* + 6
use bags and stones to represent 2(* - 3) = 2* - 6.
use patterns, tables and graphs to confirm that 2(* - 3) = 2(* + -3) = 2* + -6 = 2* - 6. confirm with table and graph.

Simplifying expressions - Adding and subtracting like terms
3 + 4 + 5 = 3 + (4 + 5) = 3 + 5 + 4 = 3 + (5 + 4) = 4 + 3 + 5 = 4 + 5 + 3 = 5 + 3 + 4 = 5 + 4 + 3. you can add in any order.

example: 14 + 89 + 86 = (14 + 86) + 89 = 189; 13 + 39 + 57 = (13 + 57) + 39. Commutative law of addition.

XXXX However (10 - 6) - 3 and 10 - (6 - 3). You must subtract in the order specified.

revise 3y = 3 x y = y + y + y

3y + 4y = y + y + y + y + y + y + y = 7y

3 x 2 * 4 + 4 x 2 * 4 = 7 x 2*4 --> 3xy + 4xy = 7xy

3 x x^2 + 4 x x^2 = 7 x x^2

which all lead to the rule for adding and subtracting like terms..

3 x a + 4 x b = a + a + a + b + b + b+ b = 3a + 3b, etc.

which leads to the rule: you can't add or subtract unlike terms.

word problems: 3 times some number +4 times some number; b = no of boys, g = no of girls, expression for number of

students.

Simplifying expressions - multiplying and dividing

2 * 3 * 4 = 2 * 4 * 3 = 4 * 2 * 3; abc = acb = bca = cba = bac = cab.

example: 4 x 17 x 25 = (4 x 25) x 17 = 1700; 2 x 45 x 50 = (2 x 50) x 45 = 4500. Commutative law of multiplication.

(2 x 3) * 4 = 2 * (3 * 4) = 24.

(a * b) * c = a * (b * c) = abc

multiplying with powers - a^2b * a*b^3

dividing algebraic expressions - e.g. 6 / 3 = 2 * 3 / 3 = 2, ab / b = a, 2(a+b) / (a + b) = 2, 2(a + b) / 2 = a + b.

Notes programming a GC is a great way to reinforce the concept of a variable.

Assignment - Crossing the River