Algeblocks

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"All students should learn algebra."

profound...I know
(NCTM Principles and Standards, 2000 ed. P37)

A strong knowledge of algebra and the problem solving strategies used in algebra is essential to a student's success in future high school and college math courses as well as in life. As we all know, each student learns differently. For students who learn visually, abstract thinking involved in algebra can be extremely challenging.

Algeblocks provide a visual approach to learning procedures involving polynomials and integers. Learning how to combine like terms, add, subtract multiply, divide, and factor polynomials can be a tedious process for students when the procedures they encounter are taught using only a symbolic representation. Using Algeblocks allows many students, especially visual learners, to gain a better understanding of what algebraic procedures accomplish.

Warming up to Algeblocks

On a blank workspace (white sheet of paper), represent the following quantities.

(a) 6
(b) an odd whole number between 4 and 7
(c) a factor of both 4 and 6
(d) 4 more than 5
(e) value of three nickels
(f) total price of 2 action figures that cost 4 dollars each and a matchbox car that cost 3 dollars.
(g) your age
(h) total price of two oranges, a lemon, and a lime

Learning to use Algeblocks

Before working with Algeblocks, we had better determine or DEFINE what we are working with.

1. Let's consider the green cubes to be 1 x 1 x 1 units. So any dimension of the cube is considered 1 unit.

   If each dimension of the cube is 1, what is the area of one face of the cube?

Area for green cube = _______

2. Knowing what we know about the green blocks, let's see what we can figure out about the "yellow bars." Compare the length of one rectangular face of a yellow bar with green cubes. What can you conclude about the dimensions of this face?

   Considering the dimensions, what is the area of one rectangular face?

Area for yellow bar = _______

3. Knowing about green squares and yellow bars, what can you conclude about the dimensions of the yellow square?

   Using those dimensions, what is the area of one of the square faces of this block?

Area for yellow square = _______

4. Use the same process to decide on dimensions of the orange bar and orange square.

   Using those dimensions, give the area of the appropriate faces for each.

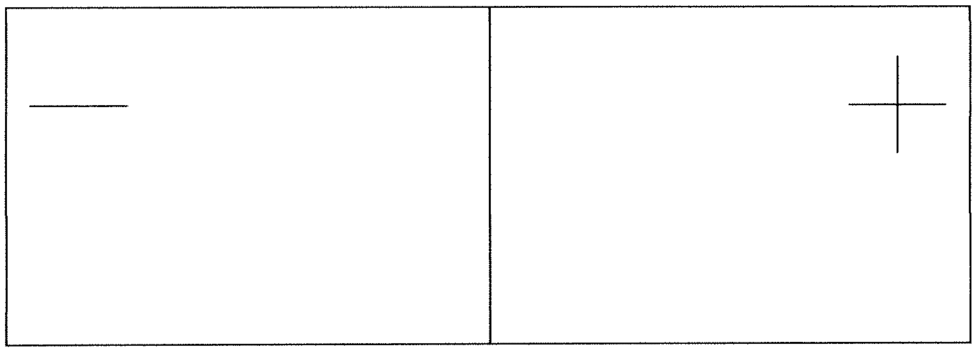
Area for orange bar = ______	Area for orange square = ______

5. Use what you know to determine the area of the large rectangular faces of the pumpkin colored blocks.

Area for pumpkin blocks = _______

Adding and Subtracting

The diagram below illustrates a workspace for addition and subtraction.



Represent the following expressions on your workspace.

INTEGERS:

(a) $3 + 4$

(b) $2 + 1$

(c) $6 + -3$

(d) $8 - 5$

(e) $7 - -4$

VARIABLES:

(a) $2x + x$

(b) $3y + 2y + y$

(c) $2y - y + 3y - y$

(d) $x^2 - 3x^2 + 2x^2$

Multiplying Polynomials

Recall that the formula for the area of a rectangle is A = b * h. In other words, we can multiply the dimensions of a rectangle to find its area, just as we did to find names for the blocks. Now let's consider the dimensions of our rectangles to be polynomials. Keeping that in mind, let's discuss our final tool...the workspace.

(Rather than writing in length about how to set up the workspace, we'll simply discuss it as a class. You may wish to make a sketch here on your paper as a reminder.)

Now that we have our workspace, complete the following problems/exercises. For each answer, be sure to make a sketch of your blocks **AND** **<u>note the symbolic representation</u>**.

#1. x*x

#2. x * (x + 2)

#3. 2 * (2x - 3)

Now let's try some binomial multiplication.

#4. (x + 1) * (2x + 1)

#5. $(2x + 3) * (x - 2)$

Division is only slightly different. In multiplication, we use the polynomials as dimensions of a rectangle to find the area. Now, we must use the area and one dimension of the rectangle to find the other dimension. So construct a rectangle with the given area and dimension and area as given, then simply find the other dimension.

#6. $(x^2 + 4x + 4) / (x + 2)$ ***Notice the connection between the shape you created, its dimensions, and how you would indicate this shape symbolically.***

Factoring Polynomials

This is perhaps the most interesting use of Algeblocks that I have discovered so far. If, for multiplication, we multiplied the dimensions of a rectangle to find the area of that rectangle, factoring shouldn't be too different.

How can we use Algeblocks to factor polynomials? (Hint: factoring ≈ un-multiplying)

Factor x^2 completely using your method. Draw a diagram illustrating your method.

Completely factor the polynomials below. Be sure to sketch the blocks and show a symbolic solution to the problem.

#7. $x^2 + 2x$

#8. $x^2 + 6x + 9$

#9. $x^2 - 4$

#10. $2x^2 + 6x +4$