USING STUDENTS' CREATIVE PROBLEM SOLVING TO BUILD ALGEBRAIC FLUENCY FROM CONCEPTUAL UNDERSTANDING

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Slides and handouts available after the session through the NCTM app/website

Overview

1. Variables! Whee!
2. (Linear) Process Columns
3. (Quadratic) Process Columns
4. Representations and Card Sorts
5. Conjectures & claims

Trick-or-Treating

Aidan

Candy Per Bag	Work	Total Amount of Candy
1	1 x 4 = 4	9
2	2 x 4 = 8	13
3	3 x 4 = 12	17
4	4 x 4 = 16	21
5	5 x 4 = 20	25
10	10 x 4 = 40	45

Blanca

Candy Per Bag	Work	Total Amount of Candy
1	4 * 1 = 4 4 + 5 = 9	9
2	+4	13
3	+4	17
4	+4	21
5	+4	25
10	+4	29

Casey

Candy Per Bag	Work	Total Amount of Candy
1	4 * 1 = 4 + 5	9
2	4 * 2 = 8 + 5	13
3	4 * 3 = 12 + 5	17
4	4 * 4 = 16 + 5	21
5	4 * 5 = 20 + 5	25
10	4 * 10 = 40 + 5	45

Declan

Candy Per Bag	Work	Total Amount of Candy
1	$4 \cdot 1 + 5$	9
2	$4 \cdot 2 + 5$	13
3	$4 \cdot 3 + 5$	17
4	$4 \cdot 4 + 5$	21
5	$4 \cdot 5 + 5$	25
10	$4 \cdot 10 + 5$	45

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Candy Per Bag	Work	Total Amount of Candy
1	4 • 1 + 5	9
2	4 • 2 + 5	13
3	4 • 3 + 5	17
4	4 • 4 + 5	21
5	4 • 5 + 5	25
10	4 • 10 + 5	45

We Notice…

- It’s always multiply by 4 and then add 5
- The total amount of candy goes up by 4s
- The last row is different
- The total amount of candy is always odd
- You can write x or * or • for multiplication (or parentheses)
- The amount of candy in the bags changes

We Wonder…

- Can we have some candy?
- Where did you get those big candy bars?
- How much candy is really in the bags?

Trick-or-Treating Again

Max got 5 bags of candy and 3 loose candy bars when he went trick-or-treating.

Annie got 6 bags of candy and 2 loose candy bars when she went trick-or-treating.

If each bag has 20 pieces of candy in it, how much candy do they have all together?

5(ish) Practices

Max got 5 bags of candy and 3 loose candy bars when he went trick-or-treating.

Annie got 6 bags of candy and 2 loose candy bars when she went trick-or-treating.

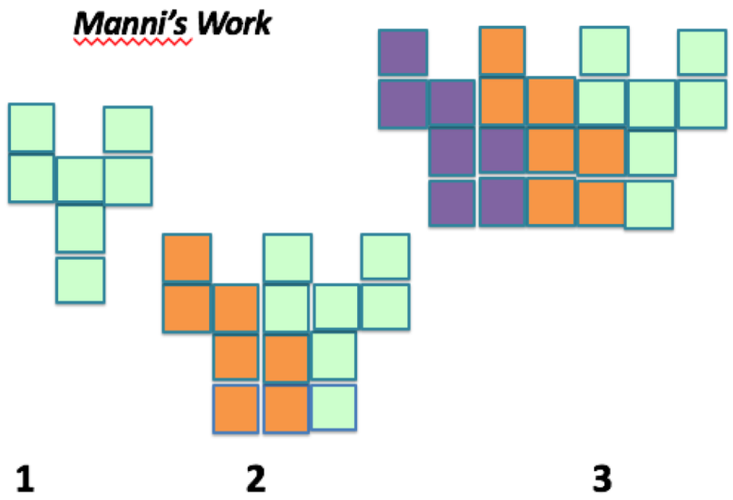
If each bag has 20 pieces of candy in it, how much candy do they have all together?

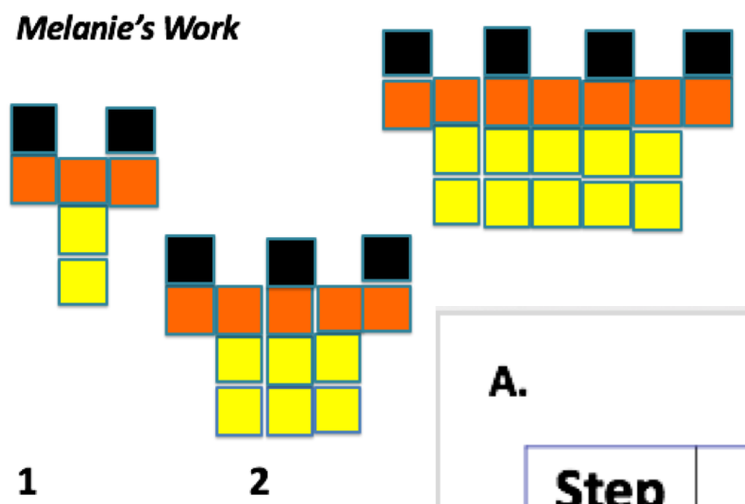
What approaches do you anticipate?

What connections could students make between approaches?

How could you select and sequence students to share to help make connections explicit?

Matching Task Demo





A.

Step #	Process	Total # of Tiles
1	2(1) +1(3) + 2	7
2	2(3) + 1(5) +3	14
3	2(5) + 1(7) + 4	21
…	…	…
10	2(19) +1(21) + 11	70
x		

B.

Step #	Process	Total # of Tiles
1	7	7
2	7 + 7	14
3	7 + 7 + 7	21
…	…	…
10	7 + 9(7)	70
x		

There’s a Desmos version!

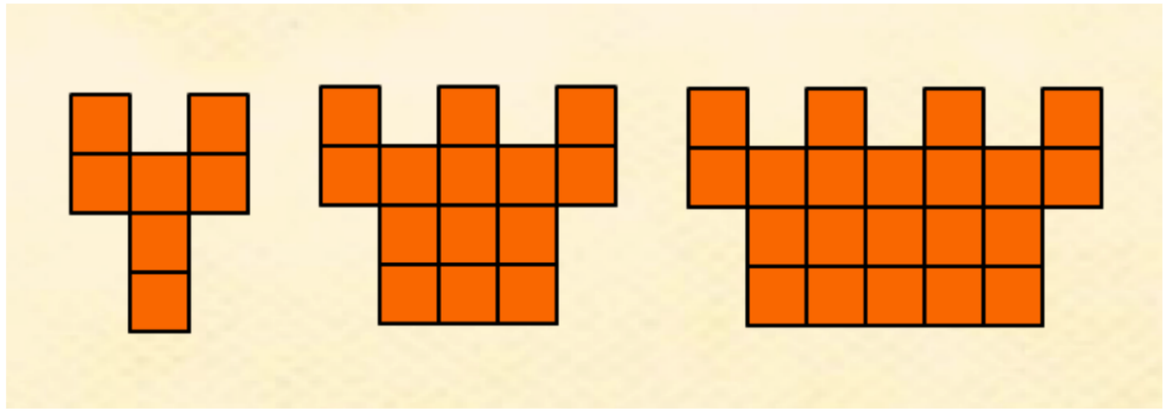
Go to student.desmos.com
and type in:

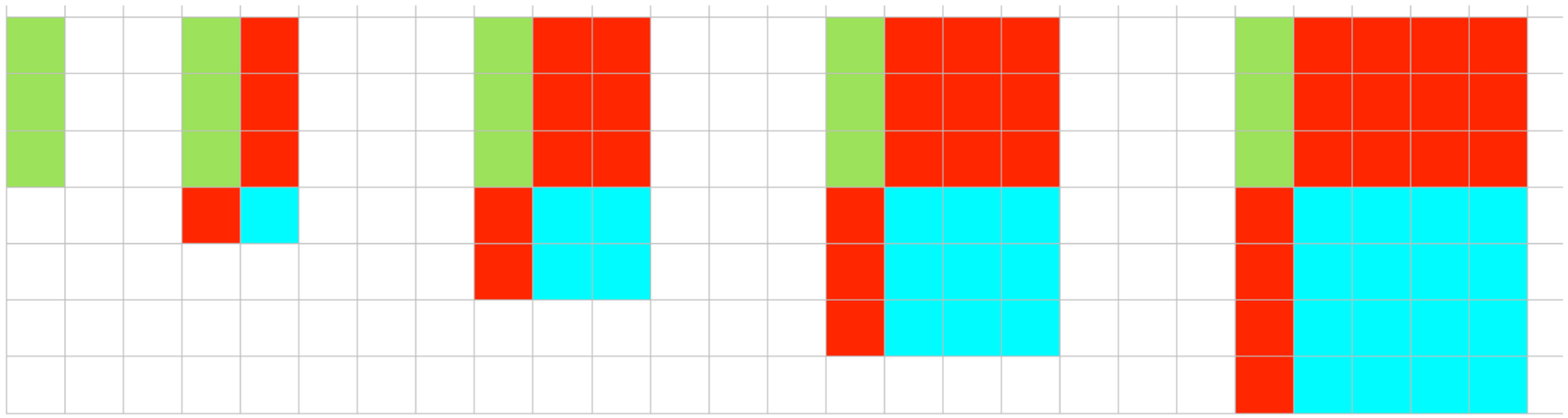
8XXW2K

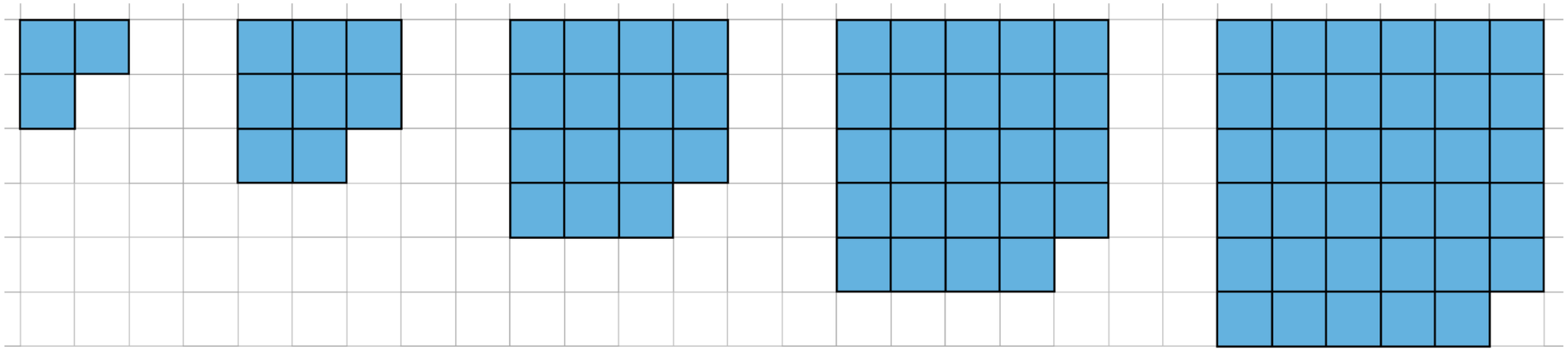
Matching Task Instructions

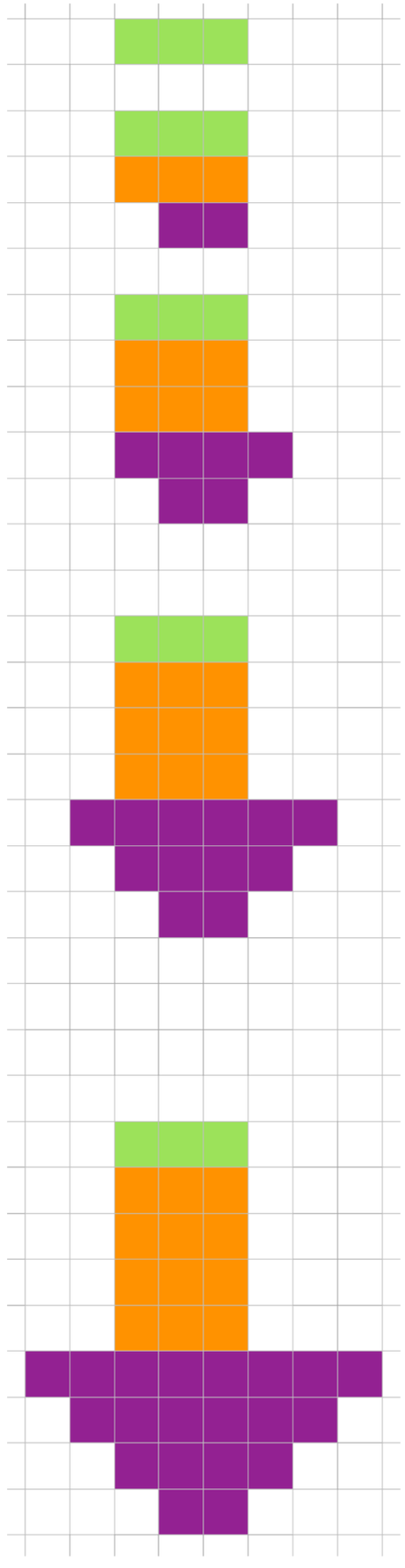
1. Work in groups of ≤5. Look at the cards. What do you notice?
2. Sort the cards into sets. Each set should have a table, a story, and some visual patterns.
3. Each of the cards should be in a set.
4. When you can explain how you chose your sets, compare with the other group at your table. Explain your reasoning.
5. If time, complete the tables & solve the problems

Compare and Contrast









Conjectures

What makes a quadratic quadratic?

Conjectures

What makes a quadratic quadratic?

- It grows in 2 dimensions
- It can be formed into a rectangle
- It can be formed into a square with a constant part added
- It can be formed into a rectangle with a constant part added
- It has constantly changing change (the increase changes by the same amount each step)
- It has constant acceleration
- It has a constant part, a linear growth part, and a quadratic part
- Even if it has linear parts added/subtracted it is still quadratic
  - If the part that is changing the most is quadratic and not cubic or some other kind of function

Whole Group Discussion

1. What are the essential features of quadratic functions that we want students to notice across representations?

2. How do we attend to what students are noticing, and help them notice what mathematicians notice?

Additional Quadratics Resources

https://nctm.org/more4u