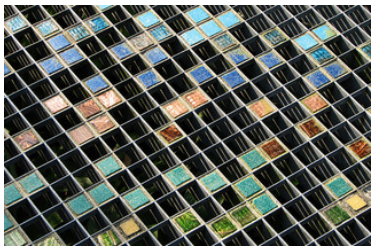
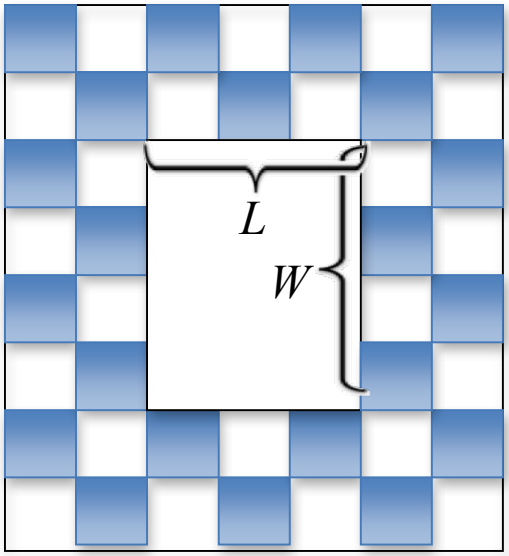
1.2 Building More Checkerboard Borders

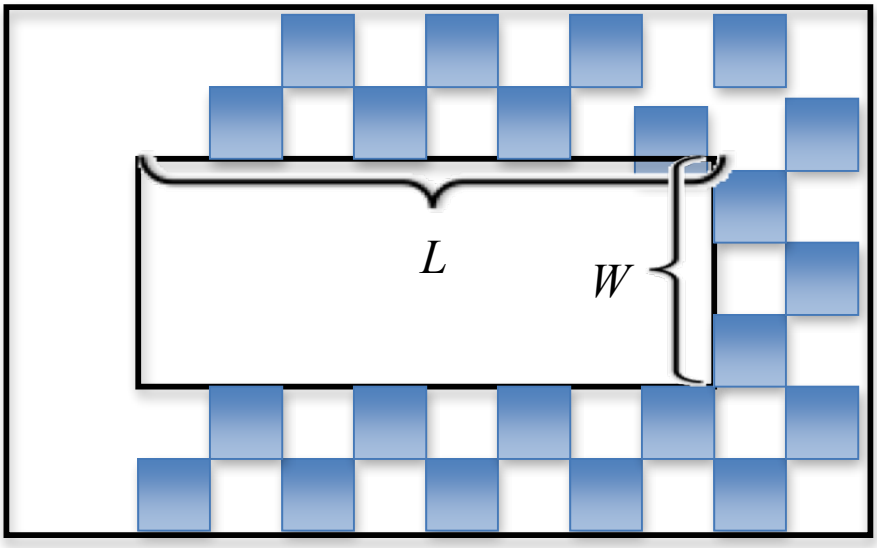
A Develop Understanding Task



As the tile workers started to look more deeply into their work they found it necessary to develop a way to quickly calculate the number of colored border tiles for not just square arrangements but also for checkerboard borders to surround any $L \times W$ rectangular tile center.

Find an expression to calculate the number of colored tiles in the two row checkerboard border for any rectangle. Be prepared to share your strategy and justify your work. Create models to assist you in your work.





1.2 Building More Checkerboard Borders- Teacher Notes

A Develop Understanding Task

Purpose: Building on the previous task, the focus of this task is on the generation of multiple expressions that connect with the visuals provided for the checkerboard borders. These expressions will also provide opportunity to discuss the incorporation of two variables, in this case ***L*** and ***W***. This task could be used the same day as the Checkerboard Borders task or the following day based on students' needs.

Core Standards Focus:

CCSSM Integrated Pathway Math 1: Critical Area 2
". . . interpret given [expressions] graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. "

N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.
A.SSE.1 Interpret expressions that represent a quantity in terms of its context.★
a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity.

Related Standards: A.CED.2, A.REI.1

Launch (Whole Class):
After reading and discussing the "Building More Checkerboard Borders" scenario, challenge students to come up with a way to count the number of colored tiles in the border. Allow students time to work individually for a few minutes to allow them time to reflect on their work in the previous task and develop an algebraic expression.

Explore (Small Group):
For students who don't know where to begin, it may be useful to ask some starter questions like, "How did you find the number of colored tiles in 'Checkerboard Borders'?" or "How do the number of colored tiles along one side of the rectangle compare with the length of that side?"

Press on students to connect their algebraic representations to the visual representation. You might ask, "How does that 2 in your number sentence connect to the visual representation?" Encourage students to mark on the visual or to redraw it so that it shows how they were thinking about it numerically.

Watch for students who calculate the colored border tiles in different ways. Make note of their strategies and the different generalized expressions that are created. The differing strategies and algebraic expressions will be part of the discussion at the end, allowing for students to connect back to prior work from previous mathematical experiences and better understand equivalence between

expressions and how to properly simplify an algebraic expression. Prompt students to calculate the number of tiles for given a length and width using their expression and then to draw the visual model and check for accuracy. Require students to justify why their expression will work for any length ***L*** and width ***W*** for an inner rectangular region. Press them to generalize their justifications rather than just repeat the process they have been using. You might ask, "How do you know that expression will work for any side length?", or "What is it about the nature of the pattern that suggests this will always work?", "What will happen if we look at a side length of six and a width of 9? ten? fifty-three?" Consider this both visually and in terms of the general expression.

Discuss (Whole Class):
As available, select students to present who found different ways of generalizing. Some possible ways students might "see" the colored tiles grouped are provided below. It would be good to have at least three different views to discuss and possibly more.
Possible student strategies: (these can be comparable to those in Checkerboard Borders)

2 (L + 4) + 2 W	2 (L + 4) + 2 (W + 4) - 8
2L + 2W + 8	$\frac{(L+4)(W+4)-LW}{2}$

Aligned Ready, Set, Go: Getting Ready 1.2