NORTHWEST INDIAN COLLEGE

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WSIEA 2024

Algebra patterns developed at NWIC

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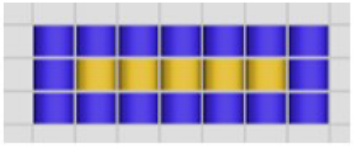
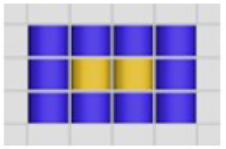
Beaded rectangle

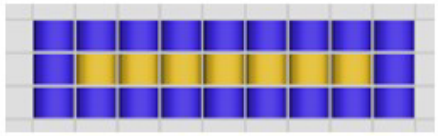
A rectangle with five yellow beads:



A rectangle with two yellow beads:



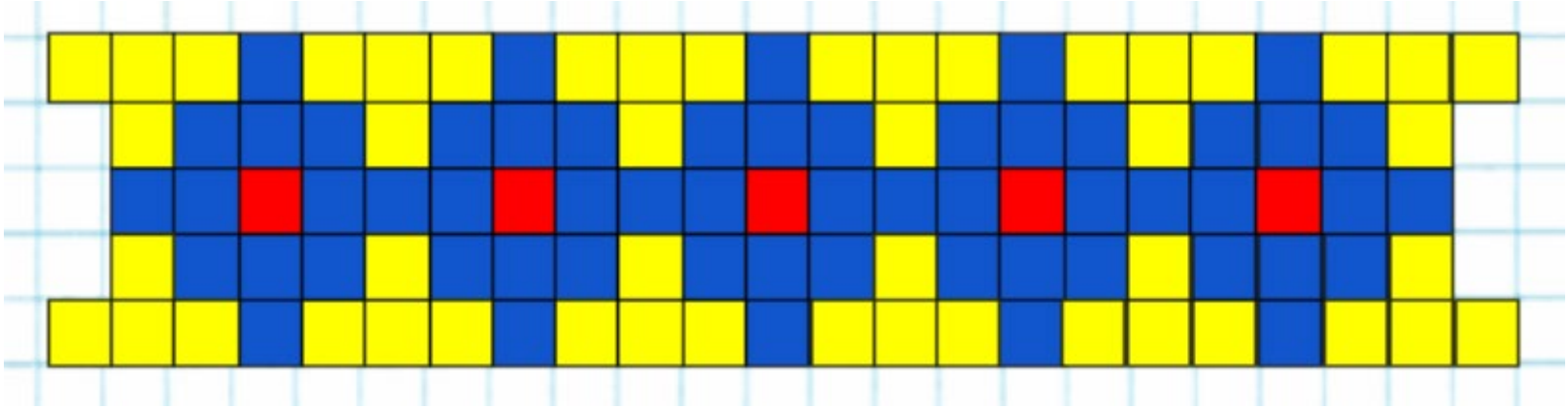
A rectangle with seven yellow beads:



How many blue triangles would you need for a design with thirteen yellow beads?

With ***n*** yellow beads?

Alanna's pattern



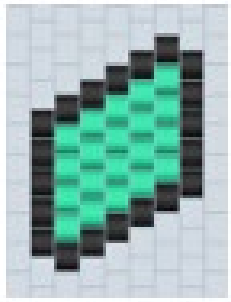
The picture above has 5 diamonds in it.

How many beads does it take to make this pattern if there are 2 diamonds?

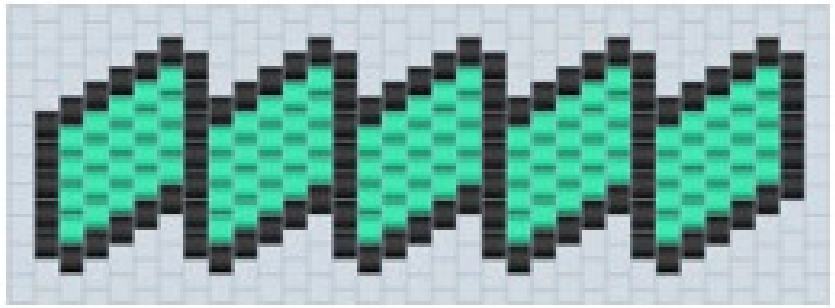
What about <u>any</u> number of diamonds?

I looked at a couple of my grandma's old beading patterns that she had gave me and that's how I came up with this, and 'cause I'm part Comanche I used the Comanche colors which are blue, red and yellow. Alanna Jones, 2021

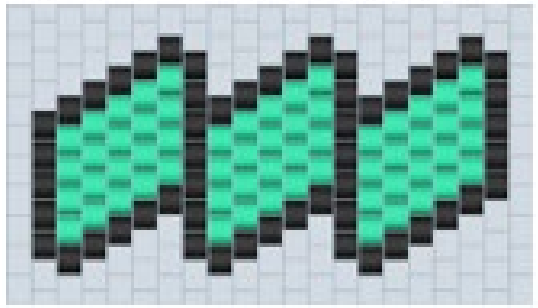
George's prayer fan



One diamond



Five diamonds



Three diamonds

How many black beads would it take to make this pattern if there were 13 diamonds?

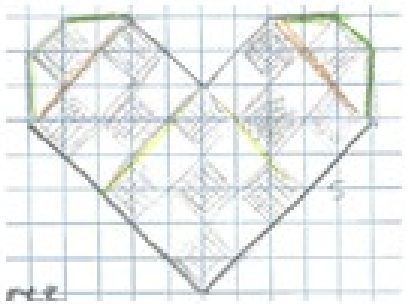
What about <u>any</u> number of diamonds?

Mehoy’

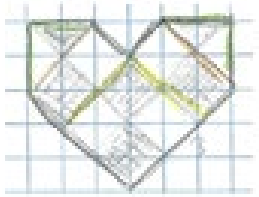
The side of the central square (the bottom of the basket) has a width of 4 strips.
After securing the square, each strip gets cut in half, and two cross-pieces are added.
How many total ‘fingers’ in the picture above?
What if the basket was made with a side of 3 strips? Or 7 strips? Or *n* strips?

Developed by Smak i’ya’ [Matt Warbus] (Lummi) and Matteo Tamburini

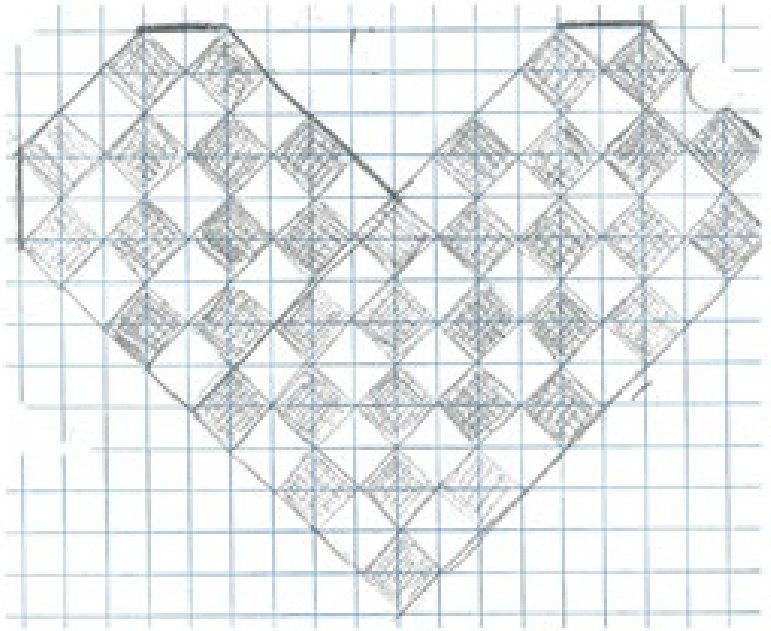
Cedar hearts



Size 2



Size 1



Size 4

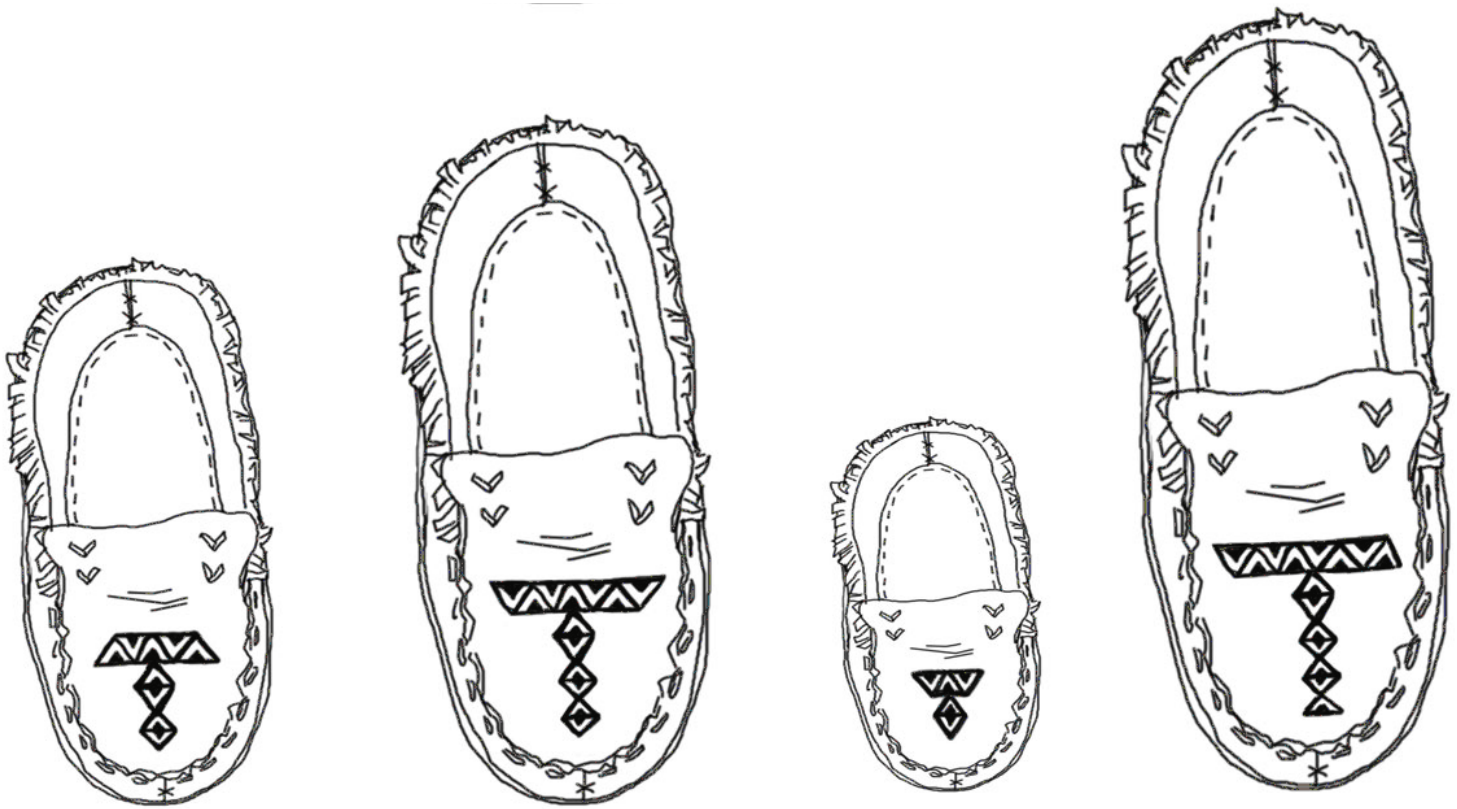
What would the total area of a Size 10 heart?

What about a heart of any size?

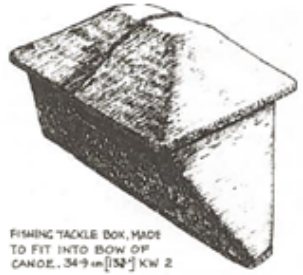
Moccasins

How many ▲ (triangles) will you need to decorate a size 10 moccasin?

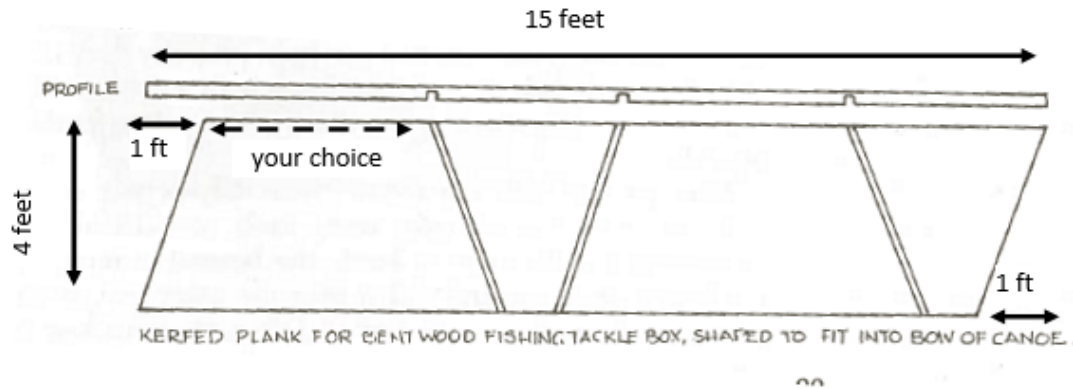
How many triangles will you need for a moccasin of any size?



Size 3 Size 5 Size 1 Size 6



Bentwood box #2



What is the volume of the bentwood box that you would get

if you chose to make the top side 3 feet?

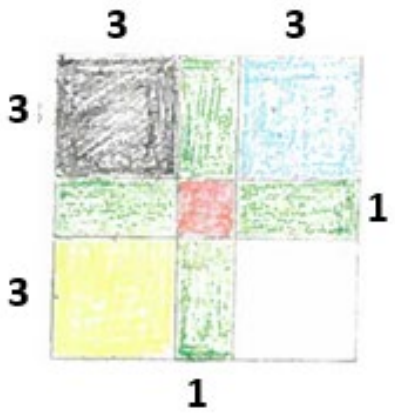
2 feet? 5 feet? *n* feet?

What value of *n* will give the largest volume?

Images taken from ***Cedar***, by Hillary Stewart (1984)

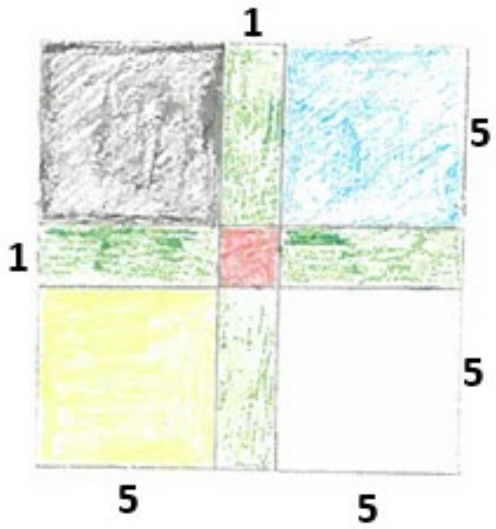
Task developed at NWIC

MedicineBox



Structure 3

Structure 1



Structure 5

NOTE: not drawn to scale

Can you describe the area of the medicine box for ANY structure number?

Challenge: can you visualize the pattern in a <u>different</u> way?

Common Core State Standards codes for the Medicine Box

3.OA.9 Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.

3.OA.7 Relate area to the operations of multiplication and addition.

5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation “add 8 and 7, then multiply by 2” as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.

5.OA.3 Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

6.EE.2c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas V = s3 and A = 6 s2 to find the volume and surface area of a cube with sides of length s = 1/2.

6.EE.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.

6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles.

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that “increase by 5%” is the same as “multiply by 1.05.”

7.G.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output

A-SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-SSE.3a Factor a quadratic expression to reveal the zeros of the function it defines.

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities […] Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries;

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases

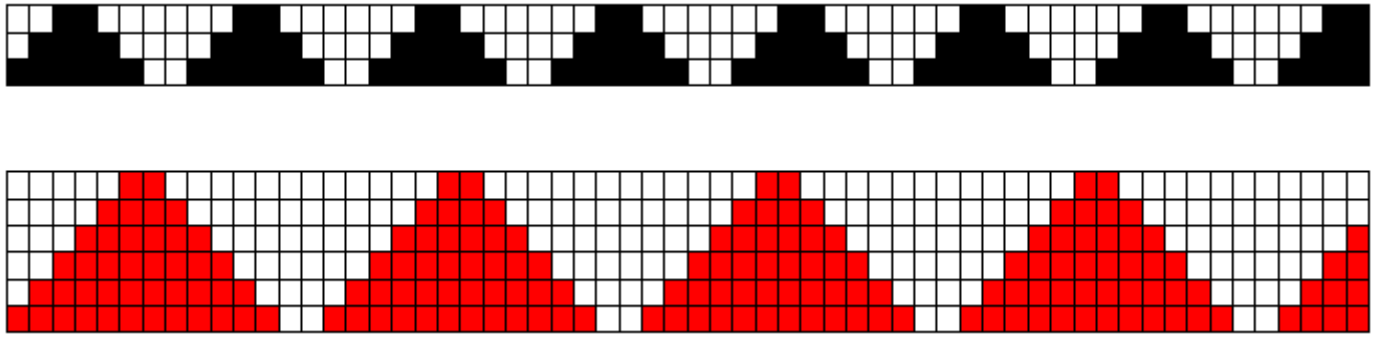
F-IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-BF.1 Write a function that describes a relationship between two quantities

L'henAwtxw
weaving house

WOOL WEAVING PATTERN #1



Your weaving is 60 warps wide.

How many triangles can you fit if you want triangles with a base of 6 stitches?

How many triangles can you fit if you want triangles with a base on 12 stitches?

How about a triangle with any number of stitches?

CHALLENGE: How many 'leftover' squares will there be for any length of base?

Mathematics task developed at NWIC with ***Skwetsimeltxw*** Willard 'Buddy' Joseph and ***Chepximiya Siyam'*** Chief Janice George (Squamish Nation)

Common Core State Standards codes for the Wool Weaving Pattern

4.OA.3 Use the four operations with whole numbers to solve problems. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted.

4.OA.5 Generate and analyze patterns. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.

5.OA.1 Write and interpret numerical expressions. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation “add 8 and 7, then multiply by 2” as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product. Analyze patterns and relationships.

5.G.1 Graph points on the coordinate plane to solve real-world and mathematical problems.

5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation

6.EE.2 Apply and extend previous understandings of arithmetic to algebraic expressions. Write, read, and evaluate expressions in which letters stand for numbers.

6.EE.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for

8.F.3 Define, evaluate, and compare functions. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

A-CED.1 Create equations that describe numbers or relationships. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

A-REI.2 Understand solving equations as a process of reasoning and explain the reasoning Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-BF.1 Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context.