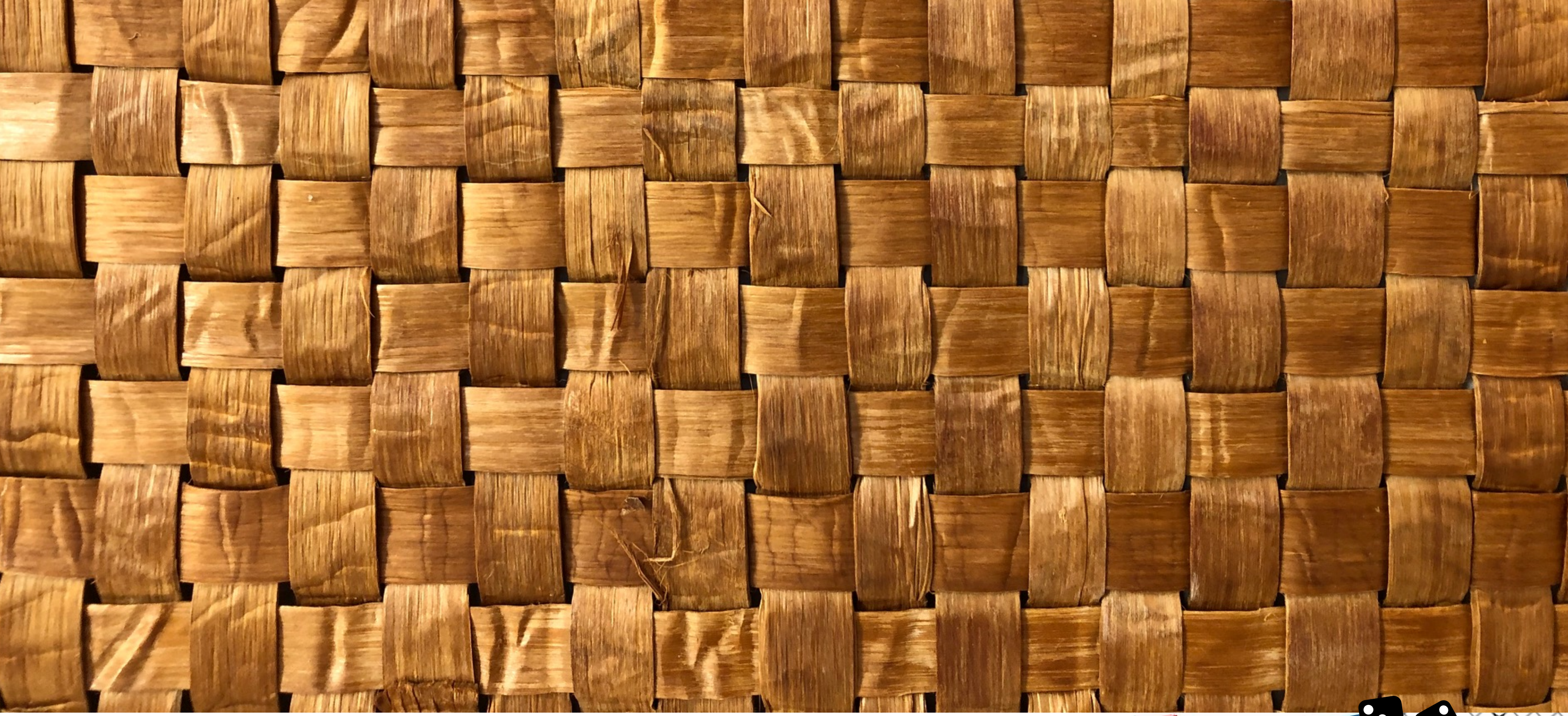

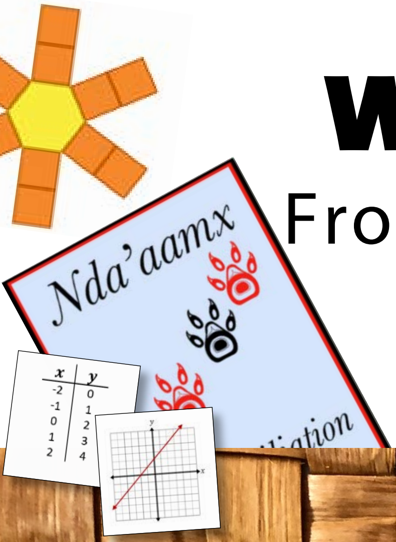

Weaving Our Way

From Patterns to Linear Relations in a Ts'msyen Context

Tannis Calder

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From Patterns to Linear Relations in a Ts'msyen Context

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SD52 (Prince Rupert)

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The Adaawx (Ts’msyen True Tellings) used within this resource belong to the Ts’msyen people.

I would like to thank all of the educators and Ts’msyen cultural advisors who have helped to make this set of lessons possible. A special thanks the District Principal of Aboriginal Education, SD52 for encouraging this project and three fluent speakers from the Ts’msyen Sm’algya̱x Language Committee (Velna Nelson, Beatrice Robinson, and Theresa Lowther) for their cultural contributions. I’d also like to thank Fanny Nelson whose collaboration and contributions related to the cedar weaving section was very much appreciated. Without their collaboration and support, this project would not have been possible.

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Thank you also to my teacher colleagues who collaborated with me on this project. In particular I’d like to thank Tina Demings who helped me make Ts’msyen cultural connections, acted as a soundboard for my lesson concepts and also helped to bring the lessons to life in the classroom with students and in workshops with other educators.

Most Importantly, I would like to express my gratitude to the Ts’msyen people upon who’s unceded territory I have had the privilege to work and live for the past 15+ years. I would like to impress the significance of my privilege to work as a Curriculum Specialist Teacher at Wa̱p Sig̱atgyet, home to the Aboriginal Education Department of SD52 as well as a meeting place for the Ts’msyen Sm’algya̱x Language Authority and the Ts’msyen Aboriginal Education Council. It is here, in this place, where I have had the opportunity to meet frequently with Ts’msyen knowledge holders, fluent Sm’algya̱x speakers and cultural advisors - sometimes formally, but more often casually over a cup of tea. It is through these daily interactions that the sparks and seeds of these lesson ideas grew. *Wa̱p Sig̱atgyet* means *House of Building Strength* in the language of the Ts’msyen People, and that strength is built upon the people and community found inside of it.

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Introduction

The unit uses Ts'msyen cultural practices, adaawx (true tellings), and language to explore the prescribed mathematical concepts of BC's curriculum in grades 4 – 9 with a particular emphasis on the patterning as it progresses from recognizing regular changes in patterns to identifying continuous linear relationships. Because the prescribed concepts flow with a gradual increase in complexity in each grade, teachers are encouraged to choose activities that best meet the needs of their students no matter where they are on this continuum of learning. Some activities that are tailored to meet the prescribed learning goals at the grade 4 level may also be useful for older students who would benefit from review and some of the activities tailored to meet the learning goals at the secondary level may pique the interest of younger students who have mastered the concepts prescribed to their grade level.

Grade	Number	Computational fluency	Patterning	Geometry and measurement	Data and probability
4	• Fractions and decimals are types of numbers that can represent quantities.	• Development of computational fluency and multiplicative thinking requires analysis of patterns and relations in multiplication and division.	• Regular changes in patterns can be identified and represented using tools and tables.	• Polygons are closed shapes with similar attributes that can be described, measured, and compared.	• Analyzing and interpreting experiments in data probability develops an understanding of chance.
5	• Numbers describe quantities that can be represented by equivalent fractions.	• Computational fluency and flexibility with numbers extend to operations with larger (multi-digit) numbers.	• Identified regularities in number patterns can be expressed in tables.	• Closed shapes have area and perimeter that can be described, measured, and compared.	• Data represented in graphs can be used to show many-to-one correspondence.
6	• Mixed numbers and decimal numbers represent quantities that can be decomposed into parts and wholes.	• Computational fluency and flexibility with numbers extend to operations with whole numbers and decimals.	• Linear relations can be identified and represented using expressions with variables and line graphs and can be used to form generalizations.	• Properties of objects and shapes can be described, measured, and compared using volume, area, perimeter, and angles.	• Data from the results of an experiment can be used to predict the theoretical probability of an event and to compare and interpret.
7	• Decimals, fractions, and percents are used to represent and describe parts and wholes of numbers.	• Computational fluency and flexibility with numbers extend to operations with integers and decimals.	• Linear relations can be represented in many connected ways to identify regularities and make generalizations.	• The constant ratio between the circumference and diameter of circles can be used to describe, measure, and compare spatial relationships.	• Data from circle graphs can be used to illustrate proportion and to compare and interpret.
8	• Number represents, describes, and compares the quantities of ratios, rates, and percents.	• Computational fluency and flexibility extend to operations with fractions.	• Discrete linear relationships can be represented in many connected ways and used to identify and make generalizations.	• The relationship between surface area and volume of 3D objects can be used to describe, measure, and compare spatial relationships.	• Analyzing data by determining averages is one way to make sense of large data sets and enables us to compare and interpret.
9	• The principles and processes underlying operations with numbers apply equally to algebraic situations and can be described and analyzed.	• Computational fluency and flexibility with numbers extend to operations with rational numbers.	• Continuous linear relationships can be identified and represented in many connected ways to identify regularities and make generalizations.	• Similar shapes have proportional relationships that can be described, measured, and compared.	• Analyzing the validity, reliability, and representation of data enables us to compare and interpret.

The First Peoples Principals of Learning

The First Peoples Principals of Learning are a guiding element of this resource and have informed the lessons and activities contained within it. The following aspects are highlighted in relation to this resource:

"Learning involves generational roles and responsibilities."

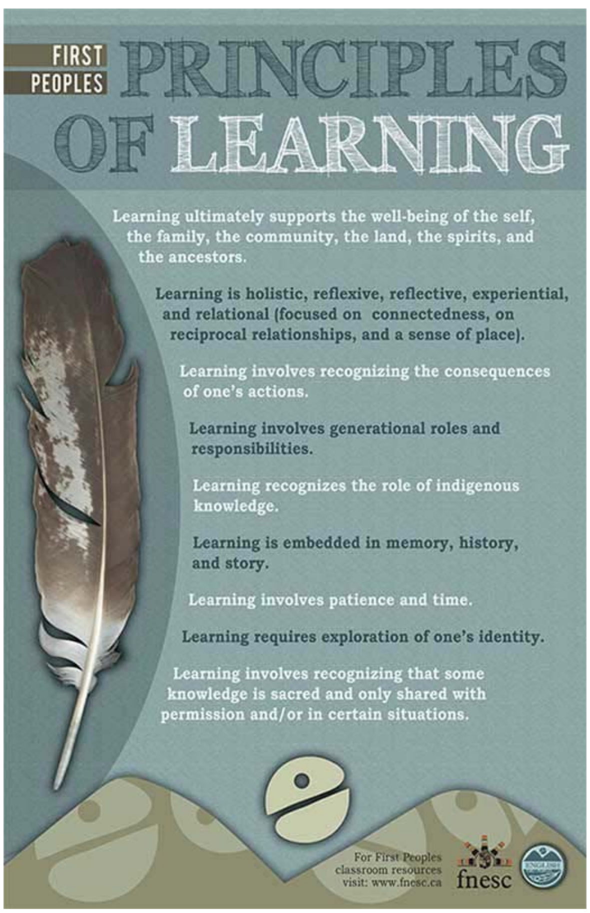
- Teachers are encouraged throughout the resource to connect with elders. Sm'algya̱x speakers, and Ts'msyen role models. in the community to share their experiences and expertise.

"Learning recognizes the role of indigenous knowledge."

- Each lesson in this resource attempts to make use of expertise from Ts'msyen knowledge keepers

"Learning is imbedded in memory, history and story."

- Lessons are connected to Ts'msyen adaawx (true tellings) that have been passed down from generation to generation as well as narratives of contemporary Ts'msyen people participating in authentic cultural practices.



"Learning requires exploration of one's identity."

- This unit focuses on Ts'msyen students and students living on Ts'msyen territory and aims to help students understand their connection to the land and culture of the Ts'msyen people.
- For teachers accessing this resource from other areas it is highly recommended that adaptations be made to meet the unique needs of your own students and develop resources through coordination with Indigenous knowledge holders in your own locality.

"Learning involves recognizing that some knowledge is sacred and only shared with permission and /or certain situations."

- Many adaawx are sacred and or owned by particular house groups and not available to the public.
- The adaawx and other stories used in this resource have gone through appropriate protocol to be been released for public use.

Adaawx Backgrounder

What is an Oral Tradition?

The Ts'msyen have always been a society based on oral traditions. Knowledge, skills and history have been passed on orally (by speaking and listening). In the past, certain people had memory training. They were trained to learn and remember the history of their family, house and clan. These people received special training over many years to make sure that they remembered the history perfectly. These trained historians passed on information from many generations through special stories or narratives called adaawx.

What is an adaawx?

The word *adaawx* is translated as "true tellings" or "sacred history." They are special kinds of stories which hold important information about Ts'msyen culture, the land and society. They are a big part of Ts'msyen identity. Adaawx have been passed down from generation to generation for hundreds and even thousands of years.

Many adaawx have a special importance for the history of an extended family called a *Waap* (House Group). These narratives often tell of heroic ancestors from long ago who had amazing encounters with na̠xnox (supernatural beings).

These stories usually connect to the territories of the Waap and often tell how they came to own special symbols called crests which only they and their descendants would have the right to display.

Here are some of the types of important information told in adaawx:

- origins of House Groups
- migrations of House Groups
- territories owned by House Groups
- natural disasters like floods or avalanches
- battles

Transformation

Transformation, changing from one form into another, is a key element in most adaawx. Adaawx often tell of events which happened when the world was different from what it is today. Animals and na̠xnox lived in parallel worlds. Under special circumstances, humans could visit these parallel worlds of animals or na̠xnox, sometimes to be taught an important lesson. Often this is a warning to respect nature and the land which provides the resources that people need to survive.

> *It is the adaawx, which are each owned, told, and perpetuated by the lineage leaders, that tell the history of their lineage and together these histories tell the history of the tribe, the region, the nation and other nations. They tell, among other things, the lineage's place of origin, its migrations, the villages it has populated, its trade alliances, its rise to prominence or its fall, and its experiences of war and natural disasters.*
>
> \- Susan Marsden

Exploring Trade Bead Patterns:
Using divisibility rules to extend patterns

Materials:

- Video clip from *The Journey of Trade Beads*: **http://bit.ly/tradebeads**
- Large Visual representation of trade beads in 3 colour pattern (see electronic resource)
- Printed Bead Mathemagic sheet for each pair of students.

Assumptions:

Prior to this activity, students should:

- be able to count by threes
- be familiar with the multiplication facts for 3's
- It would be helpful if students know divisibility rules for 3, but if they are not familiar with it, students can use the activity as an opportunity to practice.

Lesson:

Part 1: Trade Beads Story

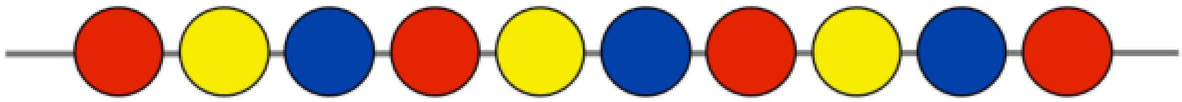
Begin by asking students if they have ever heard of old trade beads. Explain that they are quite rare and difficult to find now, but long ago, beautiful beads travelled across the world and were traded for all sorts of valuable items here with the Ts'msyen and other west-coast peoples. You can buy the antique beads from collectors but they are very expensive. Sometimes if you are very lucky and have a sharp eye, you can still find an old trade bead washed up on the shore of a sandy beach.

You may want to also include additional learning opportunities about early trade and relationships both pre-contact and after European contact. See Wap Sigatgyet for further activities on this concept.

Show them the 5 min clip from *The Journey of Trade Beads*: **http://bit.ly/tradebeads**

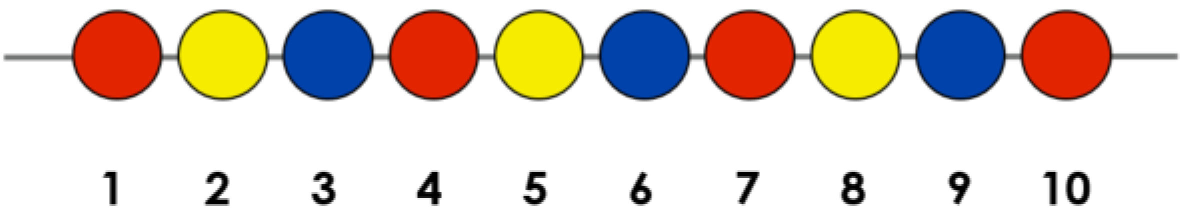
Part 2: Bead Pattern

Show students a three-color bead pattern:



What colour comes next? (yellow)
How do you know? (There is a repeating pattern)
What is the pattern root? - the part that is repeated over and over? (Red, yellow, blue).

Assign numbers to the position of the beads.



Ask students the following questions and have them answer silently on their dry-erase boards.

- What do you notice about the position numbers of all of the blue beads? (They are all multiples of three.)
- What will the next blue bead position number be? *(12)*
- What about the one after that? *(15)*
- How do you know? *(They are the next multiples of 3)*
- How many blue bead numbers can you list in one minute?

Think/Pair/Share

Have students discuss with a partner a rule that will determine if a bead in any given position number will be blue. Suggest using one or more of the following words or phrases when writing your rule: ***multiple, divisible, divide by, factor, remainder***

A bead will be blue if________.

After discussion, have each student write their rule for all blue beads on a dry-erase board, then share with the class. Some rule variations may include:

- *A bead will be **blue** if its position number is **divisible** by 3*
- *A bead will be **blue** if its position number is a **multiple** of 3*
- *A bead will be **blue** if you **divide** its position number **by** three and get a **remainder** of 0.*
- *A bead will be **blue** if one of the **factors** of its position number is 3.*

The Blue Beads: ***Reviewing Divisibility Rules for 3***

Give students a selection of numbers between 1 and 300 and ask them if a bead in that position number will be blue.

It may be helpful to review the divisibility rule of 3 with students:

> ***Any number with a digital sum (or digital root) of 3, 6 or 9 is divisible by 3.***

For example: 312 is divisible by 3 because the sum of the digits (digital sum) is divisible by three:

312 → 3+1+2 = 6

Another example: 930 is divisible by 3 because its' digital root (3) is divisible by 3:

429 → 4+5+9 = 18 → 1+8 = 9

The Yellow and Red Beads: ***Variations on the rule***

What colour will 302 be? How do you know? (yellow – it is two after 300 which is blue)

Name some other position numbers with *yellow* beads.

What do you notice about the position number of the yellow beads in comparison to the position number of blue beads? *(They are always two more – or 1 less - than a multiple of three.)*

Think/Pair/Share

Complete the activities as above, but this time have students create a rule for the *yellow* beads.

After discussion, have each pair write the rule for all yellow beads on a dry-erase board, then share with the class. Some rule variations may include:

- *A bead will be yellow if its position number is* ***two more*** *than a number divisible by 3*
- *A bead will be yellow if its position number is* ***one less*** *than a number divisible by 3*
- *A bead will be yellow if its position number is* ***one less*** *than a multiple of 3*
- *A bead will be yellow when you divide its position number by three and get a* ***remainder of 2****.*

What do you notice about the position number of the *red* beads? *(They are always one more – or 2 less - than a multiple of three.)*

Think/Pair/Share

Complete the rule activity as above, but this time have students create a rule for the ***red*** beads.

After discussion, have each student write the rule for all yellow beads on a dry-erase board. Some rule variations may include:

- *A bead will be red if it's position number is **one more** than a number divisible by 3*
- *A bead will be red if it's position number is **two less** than a number divisible by 3*
- *A bead will be red if it's position number is **two less** than a multiple of 3*
- *A bead will be red when you divide its position number by three and get a **remainder of** 1.*

Testing our rules:

Will the 20th bead be blue? *(No because it is not a multiple of 3.)*
Will the 27th bead be blue? *(Yes, 27 is a multiple of 3)*
What colour will the 28th bead be? *(Red)*
How do you know? *(Red comes after blue and 28 is one more than 27 which is a multiple of 3).*
What colour will the 162th bead be? *(blue)*
What colour will the 173th bead be? *(red)*
What colour will the 38th bead be? *(yellow)*

Extention

Large number tip for checking divisibility by 3:

For assessing whether a very large number is a multiple of 3, you can eliminate digits that are multiples of 3 and then eliminate digits that together make a sum that is a multiple of 3.
For example:

Is the following number divisible by three? **304 567 234 199**

~~3~~~~0~~4 5~~6~~7 2~~3~~4 1~~9~~~~9~~ First cross out digits that are multiples of 3 and zeros

4 ~~5~~ ~~7~~ ~~2~~ 4 ~~1~~ Next, cross out groups of numbers that together have a sum of a multiple of 3 (5+1=6 and 7+2=9)

4 4 Add any remaining digits: 4+4=8

The sum is 8 which is not a multiple of three so 304 567 234 193 is not divisible by 3.

Practice: Mathemagic

Now that they know the “trick” to predicting the bead colour, explain that they can use it to perform a seemingly magical trick on their friends and family. You can amaze everyone with your incredible brain power! Practice using the bead chart to predict the colour of bead with a partner. Partner 1 (the audience) can pick any number on the chart, then, without looking, the Partner 2 (the mathemagician) can predict the colour of the bead.

The mathemagician gives the Bead chart to Partner B (the audience) and states:

> **I have memorized the colour of all 300+ beads on this chart! Pick any number between 1 and 300 and I will tell you its colour!**

The audience, picks a number. Example:

> **251**

The mathemagician adds the digits of the number (on a scrap piece of paper or mentally.)

> **2+5+1 = 8**

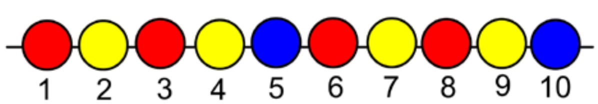
The mathemagician thinks: *8 is one less than a multiple of three (9) so it must be the colour that comes before blue.*

> **The colour of bead number 251 is Yellow!**

Students can switch roles and play again.

Beading other patters

Bring beads to the classroom for students to create their own pattern bracelets. Create other repeating patterns and find rules for them. A pattern with a repeating root of 5 beads will have rules based on multiples of five. A repeating pattern with rules based on a root of 2 beads will have rules based on multiples of 2. Practice divisibility rules by examining patterns with different repeating roots. See the electronic resource for a list divisibility rules.



A Feast of Many Crab Legs:

Charting Simple Linear Growing Patterns without Constants

Materials:

- A copy of the book *Küül, Gup'l, Kwlii* or the video of the song: http://bit.ly/kuulsong
- Crab leg manipulatives (cut out or electronic resource)
- *Gabada K̲'almoos* practice sheet for each student
- Clear Dry-erase pockets and marker for each student
- 6 sided die for each student (10 or 12 sided dice for students requiring challenge)

Lesson Part 1:

Making Connections: A Hungry Brother

Start by showing the story Küül, Gup'l, Kwlii to the students. Ideally have a Sm'algya̲x teacher or Aboriginal Role Model with Sm'algya̲x knowledge come into the class to share it with the students. There is also a video of the song that can be used if a Sm'algya̲x speaker is unavailable. Explain that it is a simple rhyming song to remember the abstract counting numbers in Sm'algya̲x that shows a brother eating up all of the crab that was meant for the whole family.

Proposing the Problem:

The story doesn't tell exactly how much crab was on each plate, but here is one example of what may have happened in the story:

After the first plate, the brother had eaten **4** crab legs.
(drag a group of four legs together)

After the second plate, he had eaten **8** crab legs.
(drag 4 more legs over in a group
– avoid dragging one-by-one)

After the third plate, he had eaten **12** crab legs.
(drag another group of 4 legs over)

Ask the students, “If he ate one more plate of crab legs, how many would he have eaten? Do you see a pattern? Explain how you know.”

(He will eat 16 crab legs, It is going up by 4s, there must be four crab legs on each plate. 4 more than 12 is 16.)

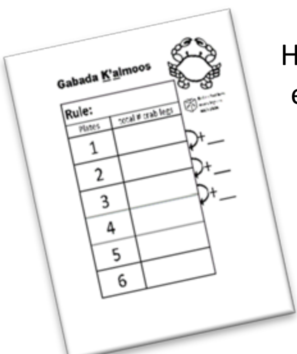
If there were enough plates of crab, and he kept following the same pattern, how many crab legs would he have eaten after **6 plates**?

Plates (p)	Crab legs
1	4
2	8
3	12
4	16
5	20
6	24

Give students a moment to think about the problem and try to work it out with a white board and a marker. Ask them to draw diagrams, numbers and pictures to prove their answer. Have students share their ideas. Show various methods on the board. Be sure to include an example of a chart like the one to the left.

Explain the rule in words: *(The crab legs are increasing by four with each plate)*

Organizing our thinking with a chart



Hand out a copy of the game chart for *Gabada K̲’a̲lmoos* to be used in a dry-erase folder for each student.

As a class explain that you are going to use the chart to organize their ideas. The students can copy the chart from the board, copying can be a good way for students to attend to the components of the chart before having to use it independantly.

Discuss what the change or difference in the total # of crab legs is each time another plate of crab is eaten. Show how you can chow the change along the side of the chart.

Plates (p)	Crab legs	
1	4	+4
2	8	+4
3	12	+4
4	16	+4
5	20	+4
6	24	

Next, ask them what would happen to the chart if instead of 4 crab legs on each plate there was a different number. Erase the number and roll a die to determine how many crab legs are on each plate.

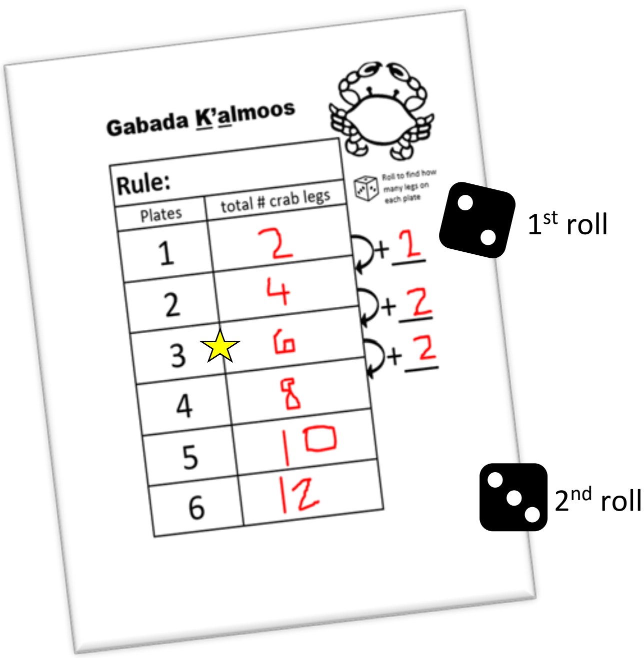
Fill out the chart as a class.

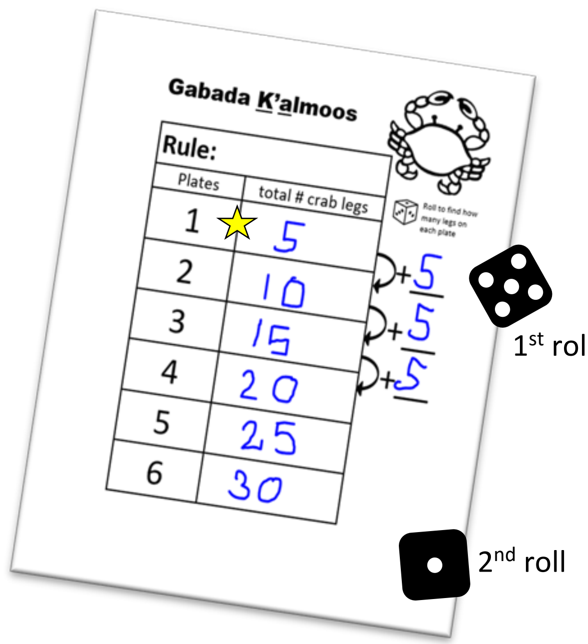
Repeat and have the students fill out the chart independantly with a new number. Explain the rule in words each time.

Practice: Gabada ⇨a̭lmoos (Eating Crab) Game

Play the game to practice with a partner. The partner with the most crab legs wins!

- Roll a die to determine how many crab legs are on a plate. Write the number below the crab, next to each + sign. (In the example below, red rolled a 2, blue rolled a 5.)
- Complete the chart.
- Roll the die again (2nd time) to see which number of plates you will compete against your partner with.
    - Red rolled a 3, so they will compete with 3 plates of 2 crab legs which is 6 crab legs.
    - Blue rolled a 1, so they will compete with 1 plate of 5 crab legs which is 5 crab legs.
- The most crab legs wins!
    - 6 > 5 so red wins!





Lesson Part 2:

Writing the Rule with math symbols:

Challenge the Students to figure out how many crab legs he would have eaten if there had been a big feast and he had been hungry enough to eat **100 plates of crab**!

Ask them: ***What is the rule for <u>any</u> number of plates?***

Have students share their thinking. Tell them they are thinking like mathematicians when they express a pattern rule in the form of a generalization that works for <u>any</u> number of plates.

Show them their chart from the last class.

Input	Output	
Plates (p)	Crab legs	
1	4	+4
2	8	+4
3	12	+4
4	16	+4
5	20	+4
6	24	

Ask them to note the change between each output (4).

Remind them of their rule in words: *The crab legs are increasing by **four** with each plate.*
Ask them to note the word four in there written-word rule.

Steer them toward thinking about what **operation** (adding, subtracting, multiplying or dividing) can get them from the # of plates to the # of total crab legs **using the number 4**.

Input	Operation	Output
1	◯ 4	= 4
2	◯ 4	= 4
3	◯ 4	= 4
4	◯ 4	= 4

Ask the students to test different **operators (+, -, x, ÷)** where the circles are located in the chart. Which one works? (Multiplication)

Point out that this makes sense because four crab legs were being added over and over. Repeated addition of the same number can be written as multiplication.

Write on the board:

	Plates (p)	Crab legs	
1 x 4 = 4	1	4	+4
2 x 4 = 8	2	8	+4
3 x 4 = 12	3	12	+4
4 x 4 = 16	4	16	+4
5 x 4 = 20	5	20	+4
6 x 4 = 24	6	24	

Rule: **# of plates x 4**

or **p x 4**

Explain that p = the number of plates. This letter is called a ***variable.*** A variable is a symbol for a number we don't know yet. It stands for ***any*** number. It is called a variable because it can ***vary*** or change. You can use any letter for the variable, but it is a good idea to use a letter that helps you remember what you counting, so we are going to use **p for plates**.

Another common letter choice is **n** which is easy to remember because it stands for "**n**-y" (any) number

Note: p x 4 is an **expression** that stands for a single number. It's like half of an equation. An equation is a statement of two expressions that are equal.

We can swap the variable in the expression with any number of plates to find out how many crab legs there will be in total. To find out how many crab legs on 100 plates, **p = 100**

p x 4

100 x 4 *(swap out the p for 100)*

400

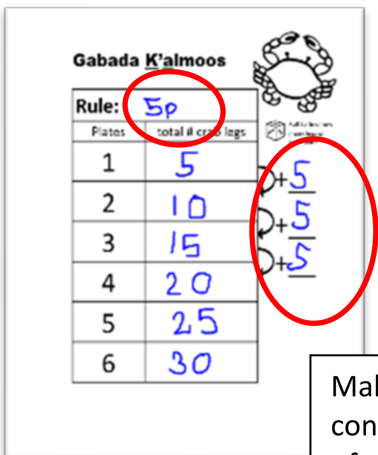
Ask students if they get a different answer if they switch around the p and the 4. (No, the p x 4 = 4 x p). Explain that this is because of the ***commutative*** property. When two numbers are multiplied together, the product is the same regardless of the order of the multiplicands.

Explain that they can find the amount of crab for any number of plates for this number. Explain that mathematicians usually leave out the multiplication sign and write the expression like this:

Expression Rule: 4p

hidden **multiplication** symbol

Mathematicians always write the number being multiplied by the variable before the variable. The number multiplied by the variable is called the ***coefficient*** or numerical coefficient. Variables with no number have a coefficient of 1 (*p* is really *1p*).



Practice: Game with a Rule

Play the game again, but roll the dice to find the coefficient. Add the rule at the top of the chart. Use a 12 or 20 sided die for the 1st roll for student pairs needing an extra challenge.

Make sure they note the connection between the numbers of crab on each plate on the side and the number in the expresson rule.

Whole Class Practice

On the board, fill in a chart with a pattern without the rule. Have the students use their own dry-erase charts to figure out what the rule is by first finding the pattern of increase, then finding the rule. Start with an input other than 1 for extra challenge. See examples below:

Input	Output
1	2
2	4
3	6
4	8

Rule: 2n

Input	Output
3	9
4	12
5	15
6	18

Rule: 3n

Input	Output
1	
2	10
3	
4	20

Rule: 5n

Show students how to verify their rule by substituting the variable for an input to see if they get the given output.

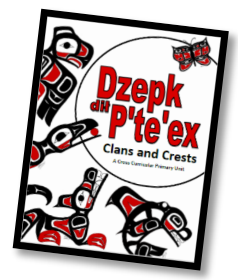
Poster Exploration -Crests for Everyone!

Additional linear relations without constants

Materials:

- The 5 bilingual posters by Ts'msyen artist Kelli Clifton
- Dry-erase pockets and markers

Lesson:



Show the students the 5 bilingual posters created by Ts'msyen artist Kelli Clifton in a partnership with the Ts'msyen Sm'algyax̱ Language Authority and the French Program at CHSS. Each poster reflects a value written in both Sm'algyax̱ and French and one of the 4 main crests of the Ts'msyen P'te'ex (clans), Raven, Eagle, Killer-whale, and Wolf. The 5th one has a butterfly which is used as a substitute for a crest for newcomers and visitors to Ts'msyen territory who do not have a crest. For more information on Ts'msyen Clans and Crests, see the resource *Dzepk dił P'te'ex* available at Wap Sig̱atgyet.

The Problem: The school wants to put up enough Nda'aamx (Reconciliation) posters so that every student that is a member of the Wolf clan will be represented. There are 4 wolf paws on every poster (enough to represent 4 students).

Create a chart to find the ***expression*** rule that tells how many wolf paws will be found for ***any number*** of duplicate posters:

Show the students the ***Nda'aamx*** poster with the Wolf paws.
How many wolf paws are on 1 poster, 2 posters 3 posters, etc?
Draw up a chart to show the pattern
What is the expression rule? – How many ravens for any number of posters? *(4p)*

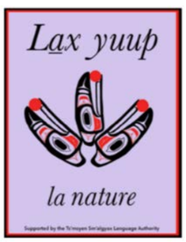
Posters (p)	Wolf paws
1	4
2	8
3	12
4	16
5	20
p	**4p**

Substitute p for any number of posters: If you had 100 posters, how many wolves could be represented? 32 posters? 56 posters? How many posters will you need for every wolf in your classroom/family/school/community? How could you gather the data?

Note: You may want to discuss how you could find the number of posters if you know the how many wolves there are, but not how many posters you would need. (division is the opposite of multiplication, so we divide: if there are 11 wolves, 11 ÷ 4= 2 r3, so we need 3 posters because we don't want to cut up a poster).

Practice:

As additional practice or as an assessment piece have students write expression rules for the other 4 posters.



How many killer whale flukes for n posters? *(8p)*
How many butterflies for n posters? *(2p)*
How many Raven heads for n posters *(3p)*
How many wolf prints for n posters? *(4p)*

Project:

Have your students design a survey to send out to each classroom in the school to find out what their p'te'ex (clan) is. Use the info to determine how many copies of each poster should be printed so that each student's name can be written next to each crest.

- How many posters of each would need to be printed?
- What is the most common and leas common clan in the school?
- Which poster do you need the least of?

The Brightening Sun Exploration:
Charting Linear Expressions with constants

Materials:

- A copy of *Txamsm Brings Light to the World*:
- A bin of pattern blocks for each pair or group of students
- Clear Dry-erase pockets and marker for each student
- Rule T Chart (or blank page) for each student
- *Keep or Toss* Game BLM

Lesson:

Significance of Adaawx

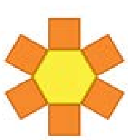
- Explain to the students the significance of Adaawx. See Introduction and Teacher Resources.

Raven Steals the Sun Story

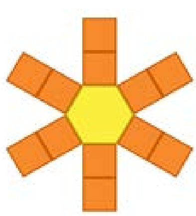
- Discuss with the students the stories told among many West Coast First Nations of how Raven brought light to the world. This story is told among many West-coast Forst Nations. In the Ts'msyen version of the story, the trickster Txamsm (transformed into Raven) released the moon and stars into the sky. In some variations of the story he releases the sun in to the sky. It is interesting to note that in the Ts'msyen Language Sm'algya̱x, the word for sun and moon is the same word (gyemk).
- Read *Txamsm Brings Light to the World,* to the students before moving on to the rest of the lesson.

Modeling the Sun's growth:

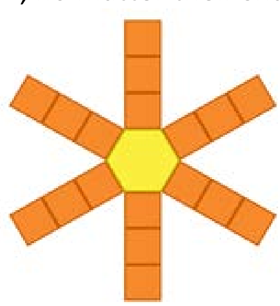
After the students are familiar with the story. Explain to them that they will be building a model of the sun after Raven placed it in the sky. Each hour the sun grew brighter as the rays extended down to the land. Demonstrate how to represent the sun using pattern blocks. Record the first three hours using a T chart. Count all blocks as 1, no matter their shape or size.



hour 1
(7 blocks)



hour 2
(13 blocks)



hour 3
(19 bocks)

hour	Bocks
1	7
2	13
3	19

Invite the students to replicate the sun with blocks in partners and fill in the T chart. Give each pair about 25 blocks and encourage them to look for a pattern in the numbers to chart when they run out of blocks.

Discuss the findings as a class. Highlight the change in the number of blocks each hour (see red text). And ask students if they can find the **generalization** (the rule) for the pattern for any number of hours (h).

Hours (h)	Bocks	
1	7	
2	13	+6
3	19	+6
4	25	+6
5	31	
6	37	

Students will probably remember from the previous lesson that when the number increases by the same amount, they can use it to find the rule by multiplying.

If students suggest that **6h** is the generalization, check as a class to **validate** your generalization by substituting ***h*** in the expression for the # of weeks. Does the output match the # of blocks? (no). Does it work for all hours? (no).

6 x 1 ≠ 7
6 x 2 ≠ 13
6 x 3 ≠ 19

Ask the students, **"What can we add to each number to get it to the correct number?"** (add 1)

As mathematicians we write the expression:

6h+1

Check again to **validate** your new generalization by substituting ***h*** in the expression for the # of weeks. Does the output match the # of blocks? (yes) Does it work for all figures? (yes)
Check to validate your generalization. Does it work for all figures? (yes)

(6 x 1) + 1 = 7
(6 x 2) + 1 = 13
(6 x 3) + 1 = 19

Ask the students to record the generalization (rule) at the top of their chart. Explain that the rule is like a code and now that they know it, they could find out how bright the sun will be after ***any*** number of hours.

Vocabulary
Explain that there is a special name for the part added on after multiplying the coefficient and the variable. It is called the constant.

Ask students to look at the 3 sun figures they built with blocks. Can they see which part was growing by a factor of 6? (the 6 orange rays of the sun)
Which part is constant or staying the same? (The 1 yellow block in the center).

Chant the generalization a few times and invite the students to join you:

The Expression Rule Chant

It's growing by ***six*** *so it's* ***6h,***
One *stays the same, so we* ***add 1,***
6h plus 1.

Challenge them with some large but simple to calculate numbers:

For example: 10 hours:

Guide the students through the calculations with the following questions:

What's the rule? (students answer 6 x h +1 or 6h+1)

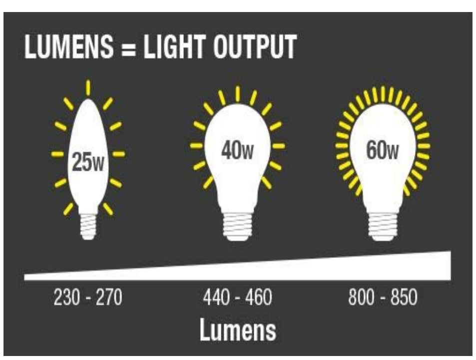
How many hours? (point to the h in the rule) (10)
What's 6 x 10? *(60)*

Are we done yet? *(no, we need to add one more)*

Write on the Board:

6h + 1 =
6 x 10 + 1 =
60 + 1 = 61 blocks

Try also other easy number such as 20 hours, 50 hours and 100 hours.



Science Connection: Lumens

Assume each block represents one lumen (a unit for measuring light output). Count lumens instead of blocks.

You may want to discuss the pattern of light and day (a repeating pattern in nature) and how it is probably good that night eventually comes and that the sun does not grow eternally brigher.

Practice Game: Keep or Toss!

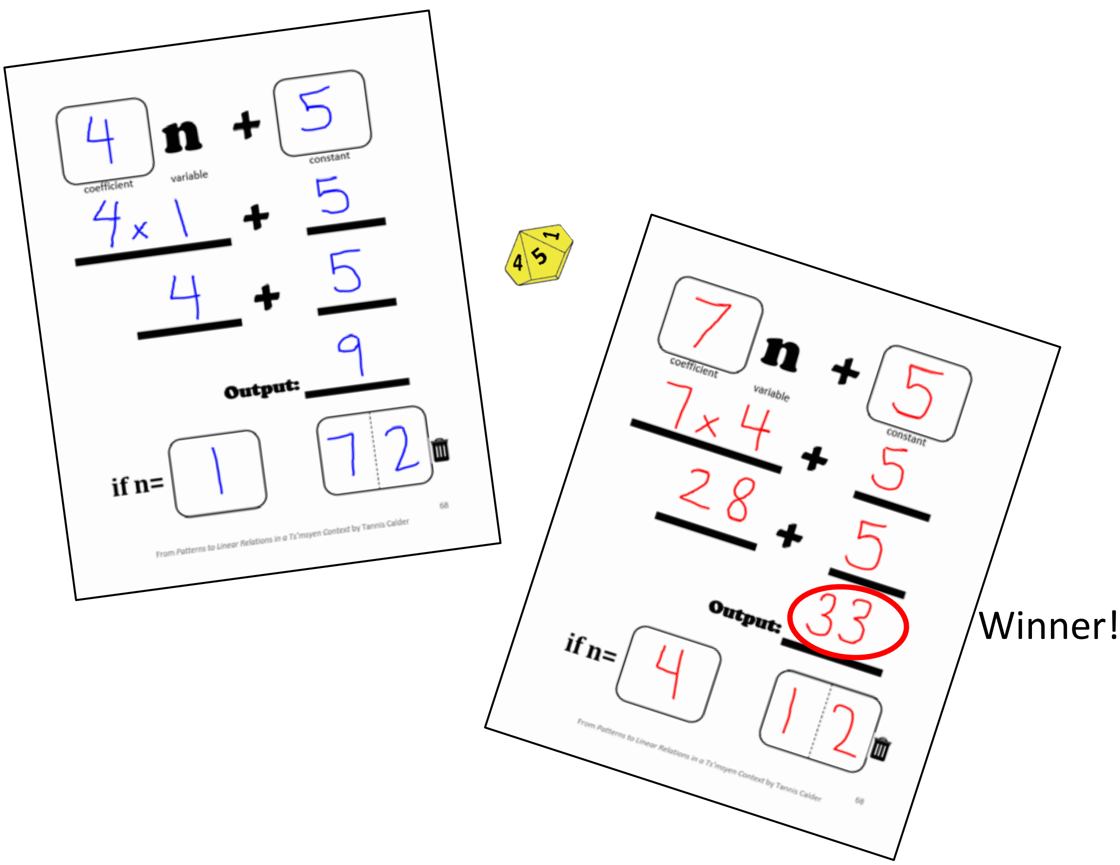
Object of the game is to get the largest output number by strategically placing rolled digits into various places in the expression. Students will have an opportunity to practice substituting values for the variable and simplifying expressions while also practicing new math vocabulary.

This game can be played in a small group or in pairs. Each group will need a ten-sided die to share and a game sheet for each player.

The first player rolls the die and each player individually decides where to place the digit, as the **coefficien**t, the **constant**, the **value for n** (the variable) or in one of the garbage bins.

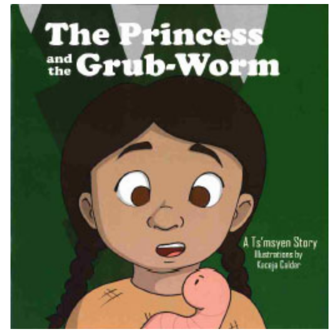
Repeat taking turns until the die has been rolled 5 times and all blanks have been filled.

Each player evaluates (finds the value of) their own expression. The largest value wins a point!



A Grub-Worm Exploration:

Building Your Own Linear Growing Pattern



Materials:

- A copy of *The Princess and the Grub-Worm*: A Ts'msyen Story (Available from Wa̱p Sigatgyet, SD52)
- A set of pattern blocks for each pair or small group of students
- Dry-erase pocket and marker for each student
- *Rule T Chart* (or blank page) for each student to put in the dry-erase pocket
- *Na̱xnox Gallery Walk* BLM

Lesson Intro:

Significance of Adaawx

- Explain to the students the significance of Adaawx. See page 2 for more info.

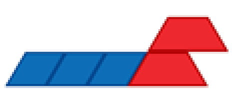
Introducing the Na̱xnox

Explain to students that in Ts'msyen culture, a *na̱xnox* (nahk-NOHK) is a type of supernatural being that can take on the form and attributes of more than one kind of animal at the same time including sometimes human attributes. Read the story of the *Princess and the Grub-Worm* to the class. It tells of a small grub-worm that was actually a na̱xnox that kept growing and growing until it became gigantic and ate all of the food in the village. This story comes from an adaawx (true-telling) that tells the story of events that happened long, long ago.

Note: The full adaawx in Sm'algya̱x with line by line translation is available online at www.smalgyax.ca

Modeling the Growing Grub-Worm

Build a grub-worm using pattern blocks like the first example below. Ask the students to copy your example and build one just like it with a partner. Explain that this is a model of how large the na̱xnox is at Week 1 and enter the # of blocks in the T chart on the board.

Week 1: 

Make another model (don't just add on to the first model) like the one below. Enter the # of blocks in the T chart on the board.

**Note, acknowledge that although the blocks are different sizes and colours, each block is counted as 1 in this activity.

Week 2: 

Build a third figure, like the one below. Enter the # of blocks in the T chart on the board.

Week 3: 

figure	blocks
1	5
2	8
3	11

+3 +3 +3

Ask the students if they see a pattern (it is growing by 3 each week). Indicate the growth by writing +3 next to each arrow like in the example above.

Have them predict the # of blocks in the 4th figure without building it. (14)

Ask them to see if they can figure out the generalization (the rule) for any number (n).

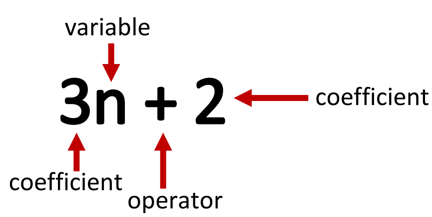
What is the rule (generalization)?

They may suggest that 3n is the generalization, but find that the numbers do not work when verifying.

$3 \times 1 \neq 5$
$3 \times 2 \neq 8$
$3 \times 3 \neq 11$

Ask the students, **"What can we add to each number to get it to the correct number?"** (add 2)

As mathematicians we write the expression:

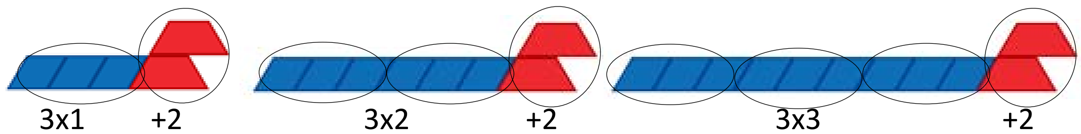


Check to **verify** your generalization by substituting the variable in the expression for the # of weeks. Does the output match the # of blocks? Does it work for all figures? (yes)

$(3 \times 1) + 2 = 5$
$(3 \times 2) + 2 = 8$
$(3 \times 3) + 2 = 11$
$(3 \times 4) + 2 = 14$

Weeks (n)	blocks
1	5
2	8
3	11
4	14
n	3n+2

Ask the students if they can see the numbers in the grub-worm figures. Which part is the 3n (the coeficient and variable)*? (the blue diamond blocks – the 3 show group of 3, and the variable tells us how many groups))*



Which part is the + 2 (the constant)? *(The Red blocks)*
Pose the question to the students: Our first model shows the na̠xnox at the age of 1 Week. Using our rule, how many blocks big would it be at birth (0 Weeks)? *(Just the 2 red blocks)*

The Expression Rule Chant

Chant the generalization a few times and invite the students to join you:

> *It's growing by* ***three,*** *so it's* ***3n,***
> *We started with* ***two,*** *so we* ***add 2,***
> ***3n plus 2****.*

Build Your Own Growing Creature Activity

Have students work in pairs or individually to create their own pattern creature by building their own creature at three stages of regular growth using pattern blocks or coloured tiles:

- Make a creature:
    - Start with a body (this will be the constant), then add blocks to to make your first figure at week 1.
    - Build the creature again, exactly like the first. Then add on again with the same kind and same number of blocks as before. This will be the creature at week 2.
    - Build a copy of the creature as it looked at week 2 again, then add on again whith the same kind and same number of blocks as before. Students should now have 3 separate figures, each one bigger than the last.

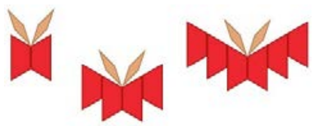
Examples:

> *It's growing by* ***one,*** *so it's* ***1x****,*
> *We started with* ***six,*** *so we* ***add 6****,*
> ***1x plus 6****.* *(x +6)*

Stage (x)	Size (y)
1	7
2	8
3	9

It's growing by ***one****, so it's* ***1x****,*
We started with ***six****, so we* ***add 6****,*
1x plus 6*.* *(x+6)*

Stage (x)	Size (y)
1	5
2	8
3	11



It's growing by ***two****, so it's* ***2x****,*
We started with ***two****, so we* ***add 2****,*
1x plus 6*.* *(2x+6)*

Stage (x)	Size (y)
1	4
2	6
3	8

- Invite students record the number of blocks used for each figure number in a T chart
- Using the T chart, have students extend the pattern up to 4 or more figures.
- Generalize to find expression rule for any figure number (the **n**th term)
- When the T chart is complete, flip it upside down or cover it so that that their mathematical thinking is hidden when other students visit in next part of lesson.

Informal Assessment

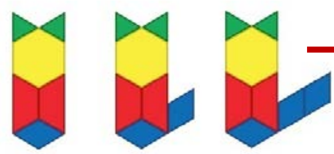
Have a quick informal conference with students prior to the gallery walk to ensure that their figures and expressions are accurate.

Ask them what their creature looked like at birth (when weeks = 0). Only the constant will be visible. Take pictures of each student's work to record for their portfolio if desired.

Gallery Walk

1. Invite students to write the generalization for any number of weeks for their creature on the underside of a sticky note on their desk. Stick it to their desk with the writing facing down so that it is not visible. Label or name each creature so that it can be identified later on the sheet. Invite students to move around room with a clipboard and the *Gallery Walk* BLM to view, extend and generalize the patterns that the other students created.
    a. Choose a creature pattern to view
    b. Label and Complete a T chart on your sheet
    c. Flip over the sticky note made by the original creator of the pattern and compare it to the one you made to see if they are the same
2. If students are not ready to do this on their own, travel as a class for the first few examples and model it with the chant, adjusting as needed.

***Note, if students are having difficulty matching their charts to the models, check to see if their first model is actually a model at **week zero (birth)** rather than week 1 and have them adjust their charts or models if needed. See the cat figures below.



*It's growing by **one,** so it's **1x**,*
*We started with **6,** so we **add 6**,*
***1x plus 6**.   (x +6)*

Verification shows this does not Work!

Stage (x)	Size (y)	
1	6	(1)+6 ≠ 6
2	7	(2)+6 ≠ 7
3	8	(3)+6 ≠ 8

Verification works after changing first stage to 0 (birth).

Stage (x)	Size (y)	
0	6	(0)+6 = 6
1	7	(1)+6 = 7
2	8	(1)+6 = 8

The Grub-Worm Exploration Part 2:
Graphing a Linear Expression

Materials:

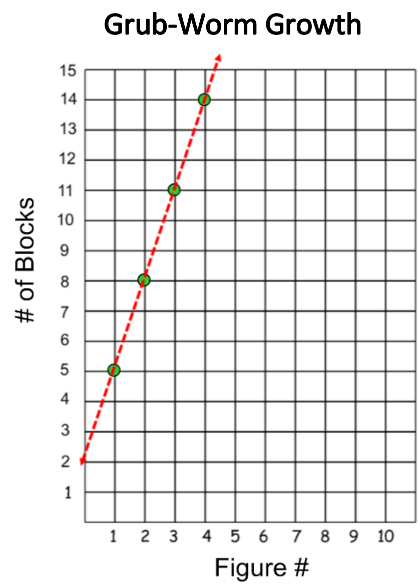
- Large graph paper for front of the class (or use www.desmos.com projected.
- Graphing paper and pencil or *Graphing* BLM for each student in dry-erase pocket with marker
- *For each pair or group of 3:*
    - *Get the Grub-Worms!* Game BLM
    - *Marker and dry-erase pocket*
    - 2 six-sided dice (assortment of dice for variation)

Lesson: It makes a line

Review the lesson and chart of the growing grub-worm from the lesson on page 21.

You can introduce graphing once students are confident in finding the rule or generalization. Explain that sometimes Mathematicians like to show how numbers are changing by ploting it on a chart or graph.

Show how the chart can also be shown in a graph if you turn the expression into an equation where y is equal to the output of the expression (in this case, the number of blocks).



$y = 3x + 2$

x Figure	y Blocks
1	5
2	8
3	11
4	14

Demonstrate how to plot points on the graph where the x and y values intersect. Show how the plotted coordinates for each stage of growth for the grub-worm connect together to make a straight line. Because it makes a straight line, we call this a ***linear relation***.

Ask students to look at the chart and see if they can see where the repeating 3's exist (the line goes up by three between each plotted coordinate). When graphing, the coefficient is also called the **slope**. This graph has a slope of 3.

Next encourage them to find where the +2 exists. (the line crosses y axis at +2). When graphing, the constant is also called the **y intercept**. This graph has a y intercept of + 2.

Transforming the Grub-worm

Transformation is a common part of stories involving na̱xnox. Rebuild the grub-worm, but this time add a green block on the end of the grub-worm to transform it into a rattle snake for each figure. How will this change the equation and the graph?

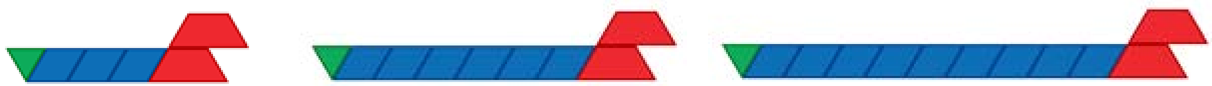


Figure 1 Figure 2 Figure 3

Complete the T Chart. Check to validate your generalization. Does it work for all figures?

x age	y blocks
1	6
2	9
3	12
4	15

The new equation is

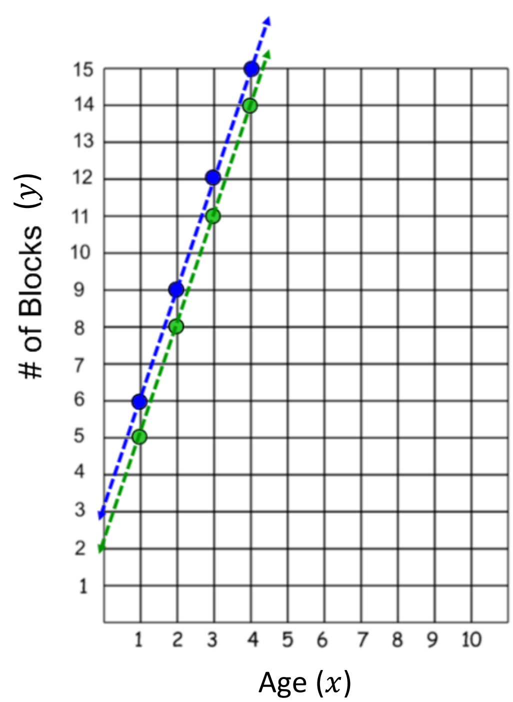
$y = 3x + 3$

Pass out graph templates in dry-erase pockets.

Graph the Rattle Snake on the same chart as the first snake to compare the slope. Ask the students what they notice about the two lines. (they are parallel).

Ask if they can find where the y intercept is in the expression rule.

Experiment with different ways of changing the grub-worm (have it grow at a different rate, or start it off with a different number of blocks) and have the students predict how it will change the graph.



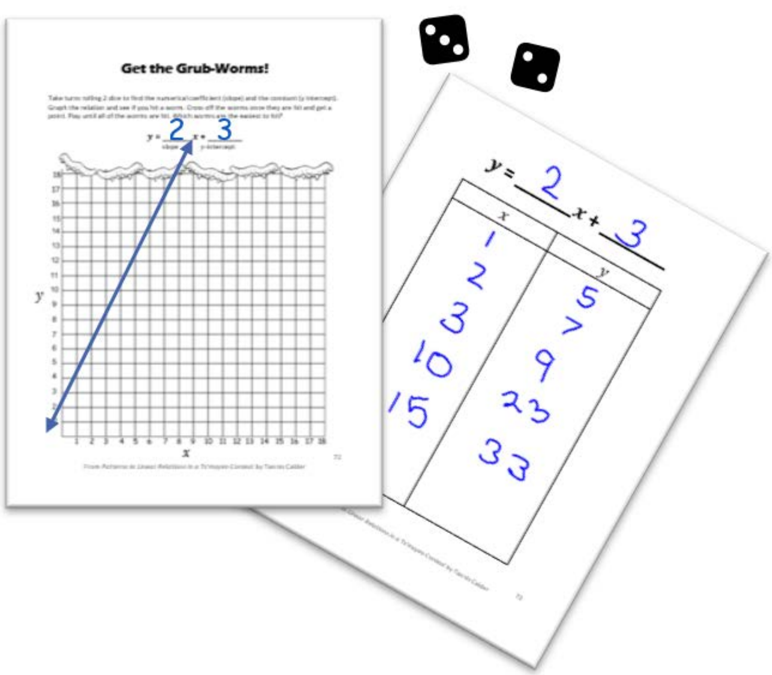
Practice Game: Get the Grub-Worms!

The purpose of this game is to graph a line on a chart to hit all of the monstrous grub-worms; they have multiplied! If you are the first to hit one of the grub-worms you win a point! Play until they are all hit.

Materials:

- One game chart in a dry-erase pocket per group of 2 or 3 players
- A T-chart BLM and dry-erase sleeve for each player (optional)
- One double die or two 6-sided dice.
- 1 dry-erase marker

1. Roll to see who goes first.
2. Roll the dice. Choose one number to be your slope (coefficient) and the other to be the y-intercept (constant).
3. If using the T-chart, choose three or more values for x and simplify to find y. *(Once players have a good understanding of how to graph the line using the slope and y intercept, they can skip this step.)*
4. Graph the expression on your chart.
5. If you hit a grub-worm, cross it off, you win a point!
6. Pass the dice to the next player and continue taking turns until all of the worms are hit or each payer has had 3 turns each. If all of the worms are hit, you all win (the village is saved!). If you feel like playing a competitive game, each worm earns a point to the player who hits it.



Questions to ponder while playing the game:

- Which Grub-worms are the hardest to hit?
- Is there a good strategy for winning the game?
- Would using a 4-sided die or a 10-sided die change your chances in winning the game? Play again but this time select any two dice to roll.

Patterns in Weaving – Rainbow Pattern:
Visual Increasing Patterns in Cedar Weaving

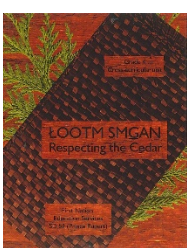
Materials:

- square coloured tiles (2 colours of approx. 30 of each colour for each pair of students)
- Cedar weaving example slide show (see electronic resource)
- Cedar rainbow pattern (electronic resource or printed copy for each pair)

Background:

Cedar is considered the tree of life by the Ts'msyen people. In Sm'algya̱x, the name for cedar is ***smg̱an*** which means *real* or *true tree.* Traditionally it provided materials needed for everyday living for the Ts'msyen people as well as many other coastal First Nations such as clothing, shelter, transportation, storage and tools. The inner bark of cedar was used to create clothing that met many needs, soft and warm or tightly woven and waterproof when needed for the wet coastal climate. It was also used for spiritual, and ceremonial purposes. Woven cedar is used as an essential component of regalia (ceremonial dress) and can take the form of hats, capes, bracelets and headbands. Woven cedar mats were also sometimes used in the past to wrap loved ones after death.

There are two native species of cedar trees that grow in the temperate rainforests of coastal British Columbia: Yellow Cedar and Western Red Cedar. Yellow Cedar typically grows at subalpine elevations in damp coastal forests ranging from Vancouver Island to Alaska, but is rarely found in inland regions. Red Cedar is common both on the coast and on moist slopes and valleys of the interior. The inner bark of both red cedar and yellow cedar is used for weaving. Yellow cedar was usually used for clothing worn next to the skin because it is softer. Red cedar was used for outer clothing such as rain hats and capes. Red cedar was also most commonly used for baskets and mats. In the examples shown in the photos, some of the cedar strips were dyed to a darker colour to make interesting patterns.



For more information on cedar, see the cross-curricular unit *Łootm Smgan: Respecting the Cedar* available at Wa̱p Sig̱atgyet.

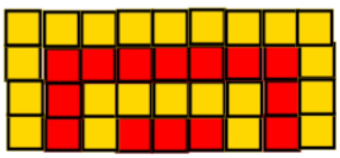
Lesson:

Patterns we can see in Cedar weaving

Show students a number of examples of cedar weaving (if not available, see electronic resources). Ask them to identify any patterns they can see. Discuss the types of patterns that they see. Are they repeating patterns? Growing patterns? Shrinking patterns?

Finding the Numbers in a Visual Pattern

Show the class the rainbow pattern and challenge them to recreate it with coloured tiles and chart each new layer or term, starting with 3 dark tiles at the bottom-centre.



Record their findings with in the T chart.

term (n)	blocks
1	3
2	7
3	11
4	15
n	?

What is the expression rule?

4n + ???

In this case multiplying the coefficient by the variable gives you an output that is larger than the actual number of blocks.

Can we add a constant to make it work?

- *No (unless we add a negative number, but most students will find it a little abstract to think in negative number so it is easier to explain it as subtracting the constant instead.*

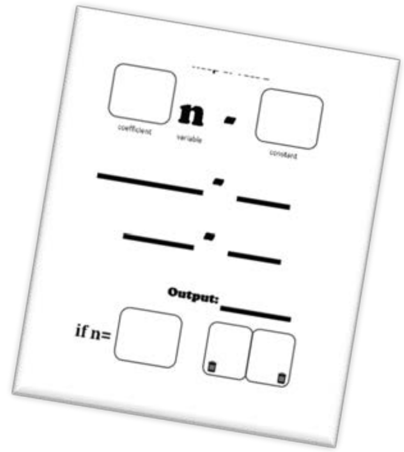
Instead we have to subtract. The constant is **-1**

The expression rule is:

4n – 1

Practice Game: Keep or Toss 2! 

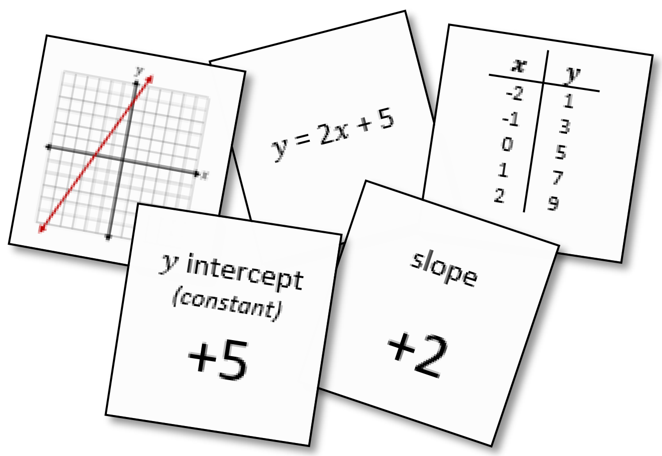
Object of the game is to get the largest output number by strategically placing rolled digits into various places in the expression. In this variation of the game the constant is subtracted rather than added.



Linear Relations Card Games

A variety of matching card games can be played with the card sets on pages 94 – 98 (Pages 99 – 100 contain advanced cards). There are 12 linear relations represented in the cards. Each linear relation has 5 cards associated with it:

- linear relation equation
- slope
- y- intercept (constant)
- coordinate pairs
- graph



$y = 2x + 5$ Set A	$y = x + 2$ Set B	$y = 3x + 4$ Set C
$y = 4x + 1$ Set D	$y = 0x + 3$ Set E	$y = 5x$ Set F
$y = 3x - 5$ Set G	$y = x - 3$ Set H	$y = 2x - 4$ Set I
$y = 4x - 1$ Set J	$y = 0x - 2$ Set K	$y = 5x$ Set L

When selecting cards appropriate to your students' level, note the layout on the page is the same for each page so that the card on the top right of each page will belong to the same set.

Try the following games:

Find your Group:

Shuffle the cards and hand one card out to each student. Invite students to stand up and find other students with cards from the same set (note some slope cards will fit with more than one group)

Memory:

Choose 2 types of cards (for example: equation and coordinate pairs) and print a set for each small group. Shuffle and place face down on the table. Take turns flipping 2 over at a time. If the cards match, keep as points, if they don't match return to face down in same spot.

Uum Hoon (Go Fish):

- Print out the equation, slope and y-intercept (constant) cards for each small group. Shuffle and hand out 5 cards to each player.
- On each turn a player asks another player for a y-intercept or slope. For example: "Do you have a y intercept of +5?"
- If the other player has any Y-intercept card or the equation card with the correct number, they must hand them over and the player asking places it in their hand (hand over both if they have 2 matching cards). If they do not have a match, the say "Uum hoon! (Go fish!)."
- When all three cards in a set are in a player's hand, they place them face down as a set for points.

The Cedar Chevron Pattern Exploration:
More Visual Decreasing Patterns in Cedar Weaving

Materials:

- square coloured tiles (2 colours of approx. 30 of each colour for each pair of students)
- Cedar chevron pattern (electronic resource or printed copy for each pair)

Lesson:

Show the Chevron (Upside down L shape) pattern: and discuss the types of patterns you see (alternating or repeating pattern moving from the centre outwards, growing from the corner outwards.

Distribute coloured tiles to the students and invite them to remake the largest upside-down L using square tiles of 1 colour (11 high and 11 wide)

Record the number of tiles used in the L which is the first Term (21). Note that students might suggest that there are a totat of 22 tiles reasoning that 11+11 =22. Be sure to point out that the tile in the corner is part of both the vertcal line and the horizontal line, so the total is only 21. Record the class findings in a chart (see below):

Building inside of the L shape, add Term 2 (the next L, nested inside the first L) using the other colour of tiles. Record the number of tiles used (19)

Term	Tiles
1	21
2	19
3	17

Add term 3 and record the # of blocks (17). At this point stop and ask the class if they can see a pattern in the number of tiles. (Are the numbers increasing or decreasing? Do you think it is a growing pattern or a shrinking pattern? Draw arrows and minus symbols to show that the numbers are decreasing.

Ask the students, How much is it shrinking each term? (write 2 next to the minus sign. How many tiles do you predict will be needed for the the next term? Invite the class to use the tiles and complete the chart. Regroup as a class and check: Were their predictions correct?

Term	Tiles	
1	21	−2
2	19	−2
3	17	?
4		
5		

Write a rule for this numeric pattern: Start at 21 and decrease by two each term until you pass zero. We can write this as *Term – 2 = next term*.

Ask the class, How many terms will be needed to complete the design? Encourage them to find out by building with tiles and recording the results. Students who need an extra challenge should be provided with too few tiles to complete the pattern and be encourages to solve the problem using the chart for the last terms.

Can they figure out the generalization?

23 - 2n or **-2n + 23** (discuss how both expressions are the same)

Have them note that because the pattern is a ***shrinking*** pattern, the coefficient will be negative -2, not 2 (or +2).

1. How many tiles are used in total? How many of each colour?

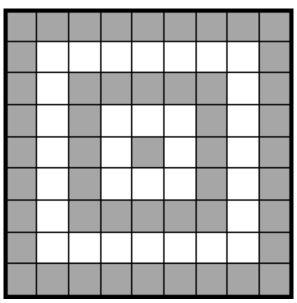
The Nested Box Cedar Pattern Exploration:
Investigating Pattern Irregularities

Materials:
- square tiles in two different colours (you will need approximately 30 tiles of each colour for each pair of students)
- Dry-erase pockets and markers
- graph paper

Lesson:
1. Show the square Bullseye pattern and discuss the types of patters you see (alternating or repeating patern moving from the centre outwards, growing from the middle outwards.

2. Demonstrate how to recreate the first 3 terms using square tiles. (use elecectronic resource or demo on the floor using blocks).

3. Hand out T charts in dry-erase pockets with markers to each pair. Ask them to record the number of blocks in each term on the chart. Each time count how many tiles are used to add on to the design.



Term	Blocks
1	1
2	8
3	16

4. Ask the students to build only the first Invite the students in pairs to replicate the pattern using square coloured blocks, starting at the centre. Remind them to record the number of blocks used in each term. Ask them to stop after the 5th term.

5. After students have finished building their designs and counting the blocks for the first 5 terms, discuss as a class what is happening to the number of blocks in each term (they are getting bigger each time, this tells us it is a growing pattern) Show this on the board by adding an arrow and a plus sign as shown.

Term	Blocks
1	1
2	8
3	16
4	32
5	40

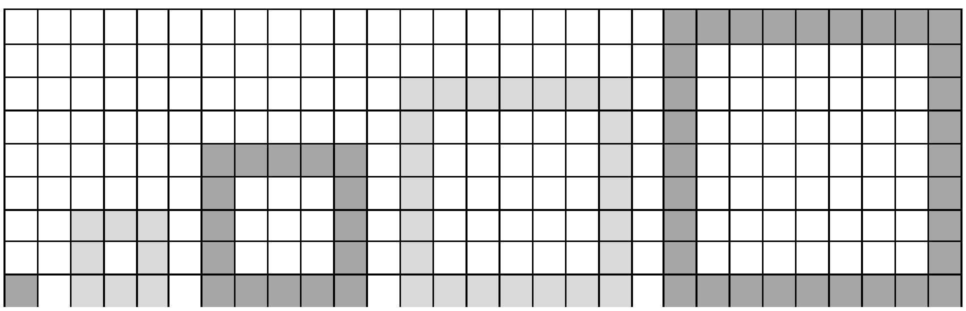
6. Examine the numbers closer to see how much they are increasing (find the difference between the terms). Discuss strategies to find the difference (counting on - hold the first number in your head and count with fingers until you get to the next

number (the jump from 1 to 8 is a difference of 7, the rest are a difference of 8. Add to your chart to show the difference).

7. Invite students to predict how many more blocks will be needed for the 6th and 7th terms by looking at the pattern. Build on to the pattern to find out if their predictions are correct. (48 and 56 becase each term the number increases by 8).

Term	Blocks	
1	1	+7
2	8	+8
3	16	
4	32	+8
5	40	+?
		+?

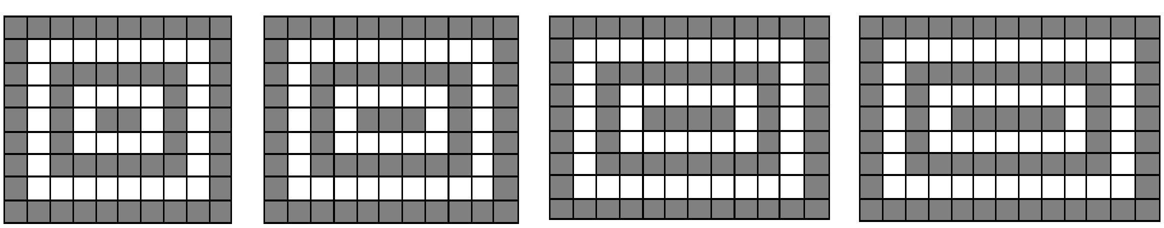
8. Ask students why the first jump between term term 1 and two is different than the rest. (+7 rather than +8). It might be helpful to reorganize the blocks in each term so that they are side by side. Ask them to look at term one and two and to check if there is anthing about either of them that is unlike he others. (Term 1 has a different shape, it is not hollow like the rest)



Investigation:

Part A:

Do all nested box patterns with a solid centre have anomalies in the linear pattern? Use tiles or graphing paper to build variations of the nested boxes pattern with different sized centers. Is there a pattern to which ones have anomalies in their growth and which ones don't? Make a hypothesis and test it.



Solution: Nested box patterns are only linear starting with the first term that surrounds the centre (not including the centre). The centre is not part of the pattern. A nested box pattern with a two square centre may appear to follow the linear pattern but this is coincidental. This can be examined closer – all nested box patterns have rings that grow by a factor of 8, but the growth from the solid centre to the first ring does not remain constant.

Solid centre	1st ring	
1	8	
		+2
2	10	
		+2
3	12	
		+2
4	14	
5	?	

Part B:

After checking all 5 of the nested box patterns, see if you can find a pattern in the relationship between the number of solid centre squares and the number of boxes it takes to surround the centre with the first ring. Fill in this chart to see if the pattern is linear. (Yes, it is!)

Weaving Pattern Fish with Imitation Cedar

Using Algorithmic Patterns

Materials:

- Imitation cedar weaving strips (alternating colours) 2 per student
- Growing Chevron Pattern Fish Weaving Algorithm BLM
- Masking tape
- scissors

Background:

Algorithmic thinking is a way of getting to a solution through clearly defined steps. A common type of algorithm you may have seen before is a recipe. Computer programmers also use algorithms to tell computers how to do things. Sometimes algorithms have repeated steps forming patterns. Usually, skilled cedar weavers learn how to weave patterns by watching and learning from master weavers. Some weavers may create new patterns using prior knowledge, experimentation and creativity. Many weavers use clearly defined steps to recreate patterns that have been passed down for generations.

An **algorithm** is a clearly defined set of instructions that, when closely followed, will result in replicating a desired result. A common type of algorithm you may have used before is a recipe. Computer programmers often use algorithms to tell computers how to do things because computers are very good at following directions, but are not good at being creative. Sometimes algorithms have repeated steps forming patterns.

Weavers can use algorithms to recreate patterns others have taught them or to help describe to others how they weave their designs and patterns. The algorithm to complete the chevron pattern is made up of rules, or instructions that repeat, making it easier to continue the design once you know the pattern.

The algorithm to complete the pattern fish repeats over and over, which makes it easier once you figure out the steps that are being repeated.

Lesson:

Show students a completed example of the woven pattern fish with the growing chevron pattern. Explain that today they will learn how to use an algorithm to weave a fish that looks just like the one you are showing them.

Cut out 2 sets of Imitation cedar strips and tape them to the table (one vertical, the other horizontal overlapping). Explain to the class that you are going to demonstrate how to weave fish with a growing pattern of chevrons.

Explain that you will be using a rule while weaving so that the pattern emerges. The rule is: If it is the same, fold the strip below it back before laying them both down. Or simplified: same colour, put it under. (see video http://bit.ly/cedarfish or Algorithm page BLM in teacher resources for further guidance.)

Hand out 2 copies of the Imitation Cedar Strips with alternating light and dark strips to each student. Invite students to cut them out as directed on the sheet and overlap and tape to the desk along the "Do Not Cut" strip to secure in place.

Weave as demonstrated in the video or as described in the algorithm.

Pattern Fish Part 2

Investigating Numbers in the Woven Pattern & Graphing

Materials:

- Chevron Pattern fish woven previously
- Dry erase pockets and marker (or pen and paper)
- Graphing BLM
- Games: Keep or Toss 2, Cedar Mat Graphing Game

Lesson:

Show the Chevron pattern that you created earlier
and discuss the types of patterns you see (alternating, repeating, pattern moving from the corner outwards, growing from the corner outwards, etc)

Record the number of tiles used in each layer (chevron shape) before switching colours in a T Chart like the one below. Record the class findings for the first 4 chevrons.

chevron	squares	
1	5	+5
2	10	+5
3	15	+5
4	20	
5	?	

At this point stop and ask the class if they can see a pattern in the number of tiles. (Are the numbers increasing or decreasing? How mmuch is it incresing with each chevron?) Draw arrows and + 2 symbol to show that the numbers are increasing.

How many tiles do you predict will be needed for the the next chevron? Invite the class to use the tiles and complete the chart. Regroup as a class and check: Were their predictions correct?

Ask the class, if a weaver wanted to make a very large mat with 100 chevrons in the design, but first wanted to model the design on paper, how many squares will be needed to complete the

100th chevron (chevron)? Assuming the squares were 1cm wide, how long should the strips of cedar be?

How much extra do you think would be needed to finish the edges properly?

Ask them: ***What is the rule for <u>any</u> chevron number?***

Have students share their thinking. Tell them they are thinking like mathematicians when they express a pattern rule in the form of a generalization that works for <u>any</u> number.

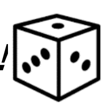
	chevron	squares	
(1 x 2) -1	1	1	
			+2
(2 x 2) -1	2	3	
			+2
(3 x 2) -1	3	5	
			+2
(4 x 2) -1	4	7	
(5 x 2) -1	5	9	
	(chevron# x 2) - 1 = squares		

Steer them toward thinking about what **operations** (adding, subtracting, multiplying or dividing) must be used. Ask if they can see the **relationship** between the # of terms and the number of squares. (multiply by 2, then subtract 1).

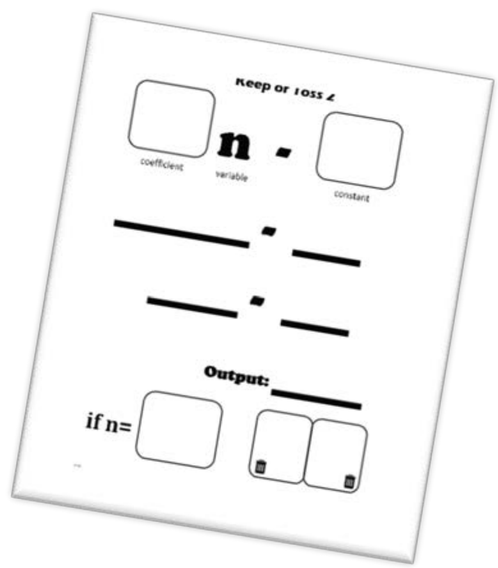
Write out each equation next to chart to help solidify the idea. (see diagram on the left).

Rule: chevron x 2 - 1
or 2c - 1

Practice Game: Keep or Toss 2!



Object of the game is to get the largest output number by strategically placing rolled digits into various places in the expression. In this variation of the game the constant is subtracted rather than added.

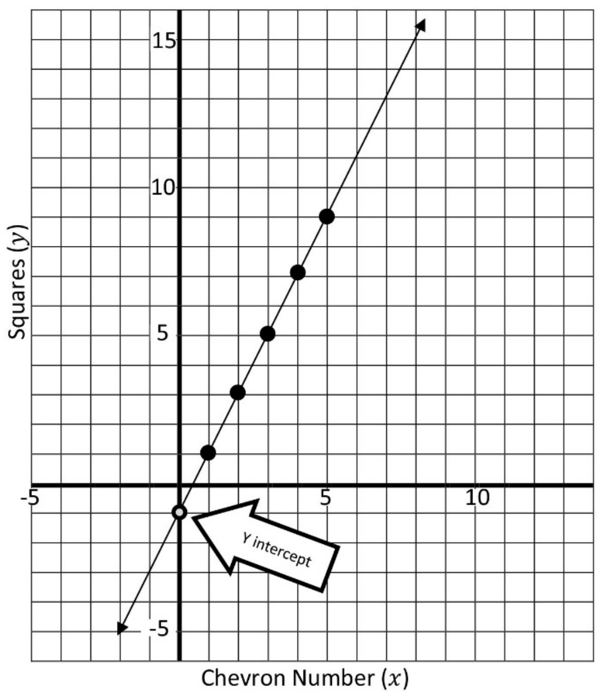


Graphing the Cedar Chevron Pattern:

You can introduce graphing once students are confident in finding the rule or generalization. Explain that sometimes mathematicians like to show how numbers are changing by ploting it on a chart or graph.

Review the chart of the cedar chevron pattern. Show how the chart can also be shown in a graph. Graph the expression with the variable x standing for the chevron number (term number or input) and y as the number of squares in the chevron (output): $\boldsymbol{y=2x-1}$

Show how the plotted dots for each stage of growth connect together to make a straight line. Because it makes a straight line, we call this a ***linear relation***. This is called a 'relation' because there is a relationship between x and y.



y = 2x - 1

x chevron	y squares
1	1
2	3
3	5
4	7
5	9

Explain that the place where the line crosses the y axis is called the **y intercept** (where x = 0). Ask the students if they can find where the y intercept is in the expression rule. (the constant: -1)

The **slope** of the line shows the line increasing by a factor of 2 (It goes up 2 y every increment of x). Ask the students if they can find where the slope is in the expression rule. (the numerical coefficient: 2)

Practice Game: Cedar Mat Graphing Game

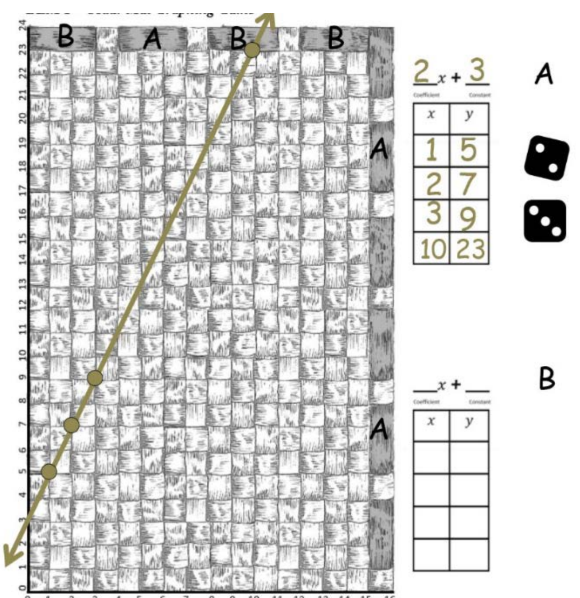
The purpose of this game is to graph a line on a chart to hit a target. If the line touches the your edge piece, you win a point!

Materials:

- Copy of BLM Cedar Mat Graphing Game in a dry-erase pocket
- A dry-erase marker for each player
- 2 dice (6 sided or ten sided)

Game play:

- Taking turns, players A and B choose 2 or three dark border pieces each and mark with initials.
- Player A rolls both dice. Choose one number to be your coefficient and the other to be the constant. Write above a T Chart on the right side of the page. Repeat for Player B
- Player A chooses values for x and then simplifies to find the value of (y) for each x value, completing one of the T charts on the right side of the BLM. Repeat for Player B (Once players have a good understanding of how to graph the line using the slope and y intercept, they can skip this step.)
- Player A plots points and graphs the expression on the chart. Repeat for Player B
- Any lines crossing through a clamed border section wins a point for the player that claimed it. (In the example below, Player B gets a point from player A's Line).



Questions to ponder while playing the game:

- Where does the line cross the Y axis and how is it related to the expression?
- Which border pieces are the hardest to hit? Are some impossible to hit?
- Try making the coefficient a fraction in the form of $\frac{1}{?}$ With the rolled number taking the place of the question mark.

Weaving patterns with Real Cedar:
Inviting an Indigenous weaver into your Class

Materials:
- Prepared cedar weaving strips - discuss with your weaver on how these may be provided. They may want to prepare their own.
- Self-guided activity for class while small groups weave with real cedar.

Lesson:

Invite a cedar weaver to the classroom (through the Aboriginal Role Model Program at Wap Sigatgyet in SD52). Due to the cost of cedar bark, you may want to consider making just one larger piece as a class by taking turns working in small groups with the role model.

While students are waiting for their turn, they can play the games from earlier lessons, or continue working on their imitation cedar weaving.
- Additional examples for weaving other patterns are also in available in the BLM section. Note that some require solid strips while others require alternating strips.

Assessing the Worth of Cedar:
Connections to financial literacy

Materials:

- Access to the internet and a projector or smartboard for viewing a video.

Background:

In the late spring or early summer, when the sap is running and the bark is easier to peel off, Ts'msyen weavers go out to collect cedar bark. They select a tall, straight tree with few branches at the base. They thank the tree for sharing its bark and only take a small strip of bark so that it doesn't harm the tree.

After making a cut at the base of the tree using an axe or adze, the bark is peeled off the tree by grabbing the loosened part in both hands and pulling up in a rocking motion back and forth. Afterwards, the inner bark has to be carefully separated from the outer bark. This is done immediately, so it won't harden. The inner bark is later soaked in hot water to soften and then split into three or more "thin-nesses." Skilled artists can split the bark so that it is paper-thin. The bark is then cut into the desired width for weaving and hung or rolled up to dry. When it is almost dry, the bark is bundled and tied until it is needed. Then, when it is time to use it, the bark is soaked in water until it is pliable. If it will be used for clothing, the bark will be separated, pounded and shredded, to make it soft. The shreds are rolled together to specific thicknesses for weaving into clothing. Bark used for weaving hats, baskets and mats is split into thin strips.

Lesson:

Show the video of Harvesting Cedar with weaver Fanny Nelson by Lonnie Wishart.
https://vimeo.com/128505634

Discuss with the class how the cedar takes some time to prepare before it is ready to weave and that Fanny can not just go out to a store to purchase her supplies. It takes time, effort and expertise to properly gather and prepare the cedar. She also must have **permission** and **the right** to harvest cedar.

Culturally modified trees or CMTs are usually defined as a tree which has been intentionally modified by aboriginal peoples as part of their traditional use of the forest. Take your class outside for a walk to an area that has culturally modified trees or show them examples in the electronic resource if local examples are not accessible. For more information see https://davidsuzuki.org/wp-content/uploads/2019/01/sacred-cedar-cultural-archaeological-significance.pdf

Some interesting facts about cedar bark preparation:

- Cedar bark can only be gathered during a certain time of the year, usually in late spring
- Only a small amount of bark can only be harvested from each tree and each year, new trees must be found for harvesting
- The bark must be properly dried before storing it to prevent spoilage
- Only the inner bark is used, the outer bark must be stripped away
- The inner bark must be split in to 3 or 4 layers and cut into strips

Discussion Points:

- Have you ever earned money from selling something you have made?
- How much is prepared cedar bark worth?
- If it takes a full 3 days of work to prepare enough bark for 8 hats, what should the prepared bark be worth?
- How much should expertise and artistry add to the price of something?
- Who should have the right to earn money from cedar weaving?

Cedar Hat Sales and Market Place Brochures:
Financial literacy continued – profits and upfront costs

Materials:

- Dry erase pockets and markers or paper and pencils for each student
- Brochure making materials (Paper, pencils graph paper and markers) or computers

Lesson Part 1: Hat Sales Example:

Hanna has an aunt that weaves hats from Cedar bark. Her aunt charges $500 per hat. Draw up a T chart that shows how much money she will earn after selling 1, 2 or 3 hats and find the generalization for any number of hats.

hats	money earned
1	$500
2	$1000
3	$1500
h	$500h
10	$5000

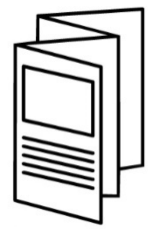
Her aunt would like to purchase a cutting tool that will help her cut the bark into even strips. The tool costs $100, but it would only need to be purchased only once. How will this affect her profits?

hats	money earned
1	$400
2	$900
3	$1400
h	$500h – $100
10	$4900

What if Hanna's aunt decided to price her hats based on the number of hours it takes to weave them. She would like to charge $60 an hour for her weaving skills. How much would a hat cost that takes 5, 6 or 7 hours to weave? Find a generalization that would express how much she would charge for a hat that takes ANY number of hours to weave. (60n)

If Hanna's aunt also charges a one-time sitting fee of $50 to gather measurements from her customers, how will that change the generalization for price of a hat that takes ANY number of hours to weave? (60n + 50)

Brainstorm other items that might be made with cedar and their potential sale prices (cedar rose, headband, full robe, cedar mat, etc)



Lesson Part 2: Artisan Market Brochure

The mall has decided to open a storefront featuring local indigenous artists and artisans. Artists will be able to rent table space to sell their items.

Discussion Points:

- How much should the mall charge to rent a table?
- Should the tables be rented by the hour or by the day? What would be a fair price?
- Should there be a separate set up fee?
- Will they offer deals for long term rentals?
- What other costs need to be considered (maintenance, custodian fees, heating, etc).
- Example: How much would it cost if they decide on a setup fee of $20 and each day will cost an additional $50?
    - How much will it cost to rent the table for 1, 2, or 3 days? For any number of days?
    - Is this a reasonable cost?
    - What other things should be considered?

Assignment: Design a Brochure

- **Option A:** Design a brochure that includes a chart, and graph that shows costs of an item that might be sold by an artist or artisan.
- **Option B:** Design a Fee brochure that you could make available to artists interested in renting market space and support your decision with the math behind it. Include a chart, graph and a generalized expression that the Mall could use to easily calculate earnings from the table rental.

The Pine Needle Exploration:

Gentle slopes with fractional coefficients

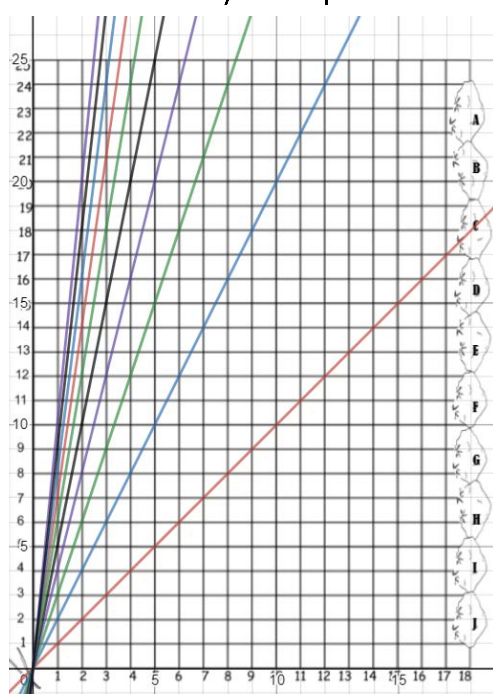
Materials:

- A Copy of Txamsm brings Light to the world (available at Wa̱p Sigatgyet)
- Large graph paper for front of the class (or use www.desmos.com projected.) https://www.desmos.com/calculator/jpjobdwg8y has the image preloaded
- For each student:
    - BLM *Graphing Chart* for each student in dry-erase pocket
    - Dry-erase marker

Lesson:

Ask students to remember the story of ***Txamsm/Raven Bringing Light*** to the world and how he had transformed himself into a pine needle. Ask them to imagine that the chart is a stream. The right bank of the stream is lined with rocks. The Princess likes to sit by the rocks when she goes to get a drink from the stream. Txamsm is on the left river bank, and wants to flow along the river to the other side. Help him get to the other side of the river by graphing a line to show the slope or angle of his direction. Find a line to mark the path of the *Txamsm/the pine needle* as he floats across the river to where the princess is sitting on the rocks. She could be sitting on any of the rocks, so make sure they have practice hitting each one.

Conduct this activity as a class demo with the students providing the varying data. Use a large graphing sheet on chart paper or projected so that all students can see the results of the graphing on one sheet. Hand out blank ***Graph the Slope BLM*** sheets in dry-erase pockets and a marker to each student.



Explore:

- Tell students that everyone will start with 0 (zero) as the constant. (Txamsm will be starting at (0,0) in the form of a pine needle)
- Ask each student to pick *any* number between 1-10 for the coefficient (or roll a d10) then complete the chart substituting each input for x to find the output.
- As a class, plot each expression on the same graph (use a graphing chart paper or project to the class.) Ask students what they notice. (*The bigger the coefficient, the steeper the slope.*) Only the C rock is hit.

The Challenge:

- Next challenge students to find a number that creates a gentle slope that does not go beyond a 45° angle. (Try to hit rocks D – J)
- Students may notice that using a slope of zero produces a flat slope. If needed, prompt them to think of what numbers lie between zero and 1. (The trick is to use a coefficient that is a fraction or decimal, but don't tell then that right away, let them figure it out!)
- Try with constants other than zero as well and see how the graph changes.

The Pine Needle Exploration Part 2:

Finding the slope using rise over run

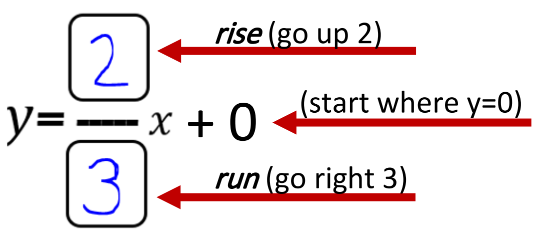
Materials

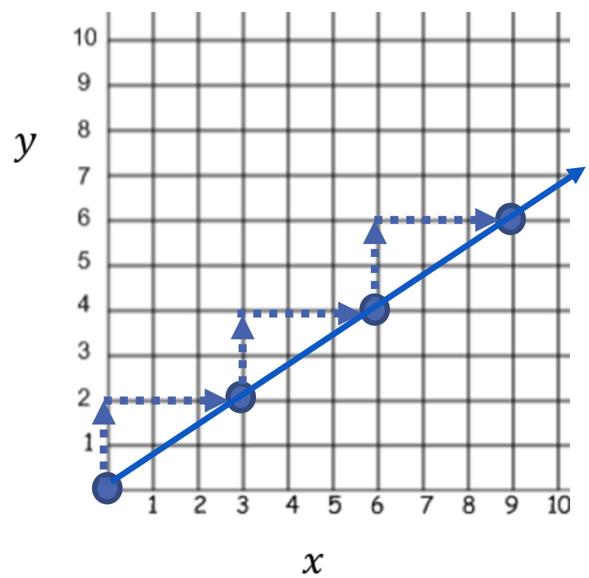
- Large graph paper for front of the class (or use www.desmos.com projected.)

Lesson

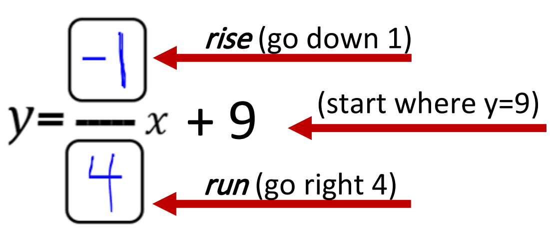
Explain to the students how the denominator and numerator of a coefficient in the form of a fraction can be used to find the slope of a line.

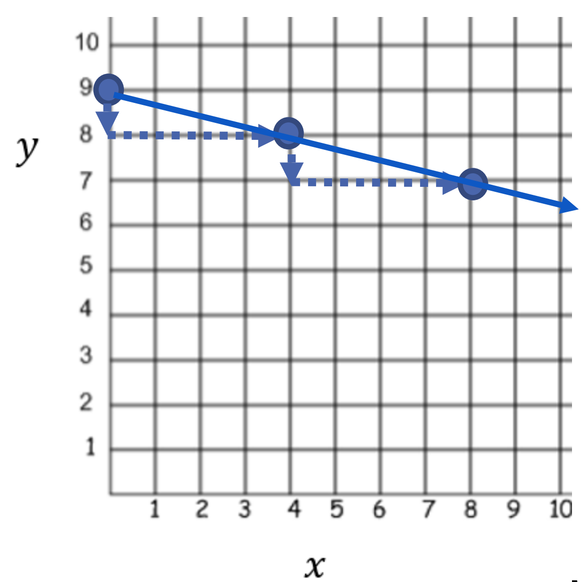
Hand out Graphing Charts to all students and demonstrate on large graphing paper or on desmos. For example:





Explain that negative numbers go the opposite direction. A negative numerator will direct the next point to go down instead of up, a negative denominator will direst the next point to go left rather than right. (4 quadrants will be needed to demonstrate)





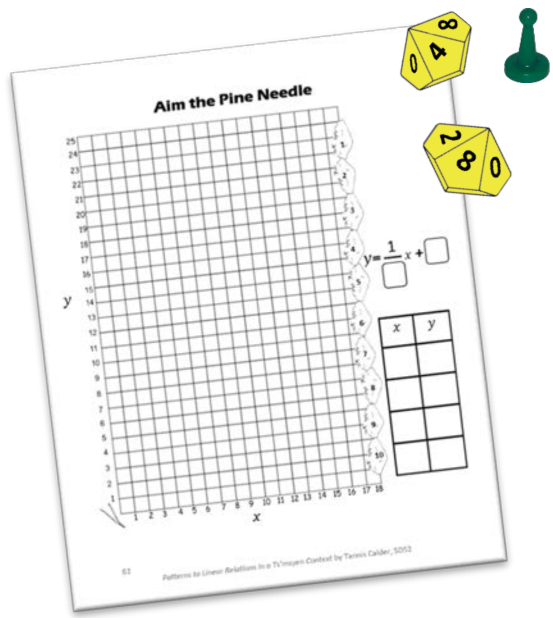
Practice: Aim the Pine Exploration

Txamsm needs your help to practice getting across the river. He wants to be ready the next time the Princess comes out to the stream, but he doesn't know which rock she will be standing next to. He needs to be ready no matter where she is!

$$y = \frac{\square}{\square} x$$

Experiment by placing different numbers as the numerator and the denominator in the coefficient (the y intercept is always zero). Find an expression that will work to hit each rock and list them all.

Practice: Aim the Pine Needles Game



Materials Needed:

- 2 ten-sided dice
- Game board in dry-erase pocket
- Dry-erase marker
- Game piece

Take turns aiming the pine needle. The purpose of this game is to graph a line on a chart to guide the pine needle (Raven Transformed) "across the river" to the Chief's Daughter.

1. To Start the game, roll one die and move the game piece to the rock with the number rolled. This is where the Chief's daughter is located.
2. At the start of each player's turn, roll 2 dice (ten sided). Choose one number to be the denominator in your slope and the other to be the y intercept.
3. Use the slope and y intercept to graph (or plot using the T-chart).
5. If you hit your rock (where the princess is drinking), she swallows the pine needle (Txamsm) and you win the round! Play again!

Aim the Pine Needle Game Variants

Students can play Aim the Pine Needle as explained in the previous activity with the following variations:

Aim the Pine Needle (Fractional Coefficients)

- focus: graphing gentle slopes with fractional coefficients
- use 1 quadrant and **6-sided dice**

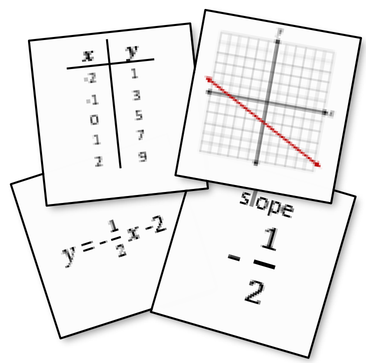
Up and Down the River (Positive and Negative Fractional Coefficients)

- focus: graphing fractional coefficients with negative constants
- use 2 quadrants and **10-sided dice**

Around the Riverbend (Positive and Negative Fractional Coefficients)

- focus: extending graph lines all three quadrants
- Each player chooses any rock at the start of each round or spins to select one.
- **6 sided dice** – roll the dice and use the grid to select your coefficient. When 2 options are available, chose the one you think is most likely to score a point. 6's are wild, choose any number to replace a 6.

Practice: Linear Relations Card Games



See page 22 for instructions. Pages 99 – 100 contain advanced cards that include negative and fractional slopes. Y-intercepts for advanced cards can be selected form the regular deck.

Find your Group:

- Shuffle the cards and hand one card out to each student. Invite students to stand up and find other students with cards from the same set (note some slope cards will fit with more than one group).

Memory:

- Choose 2 types of cards (for example: equation and graphs) and print a set for each small group. Shuffle and place face down on the table. Take turns flipping 2 over at a time. If the cards match, keep as points, if they don't match return to face down in same spot.

Go Fish:

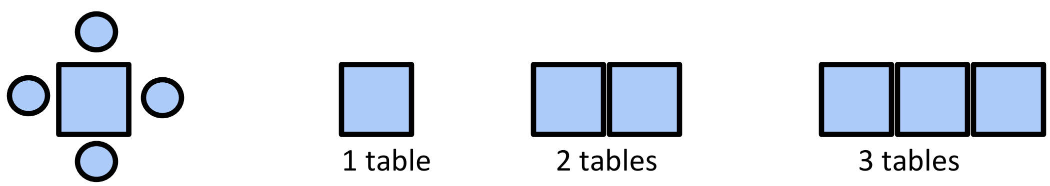
- Print out the equation, graph, slope and y-intercept (constant) cards for each small group. Shuffle and hand out 5 cards to each player. Place the rest of the deck face down on the table.
- On each turn a player asks another player for a y-intercept or slope. For example: "Do you have a y intercept of +5?" If the other player has any Y-intercept card or the equation card with the correct number, they must hand it over and the player asking places it in their hand. If the player does not have a described card, they announce "Go fish" and the asking player draws a new card from the deck.
- When all four cards in a set are in a players hand, they place them face down as a set for points.

The Feast Hall Seating Exploration:
Patterns in perimeters

Invite a Ts'msyen role model or guest speaker to come into the class to talk about what a contemporary feast *(luulgit)* looks like and what happens. If you have questions about potential role models contact the role model coordinator at the Aboriginal Education Department at Wap Sigatgyet.

Each year CHSS has a student led feast and invites all of the grade 8 classes to the school for a *Learning Feast* prepared by the high school students. In addition to cultural responsibilities, explain that when planning a feast there is a lot of math that needs to be considered during the planning, including how to seat everyone.

Suppose that the hall where the feast is to take place has only square tables that typically seat four. One person is able to sit at each side of the table. But this is not the only way that the tables could be arranged. If the tables are lined up buffet style, how will the number of people grow as tables are added to the line? Check the ***perimeter*** of each rectangle to determine the number of people that could be seated each time a table is added.

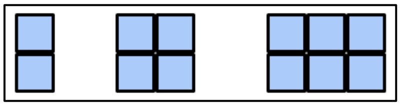


Tables	People	
1	4	+2
2	6	+2
3	8	+2
4	10	
n	2n+2	
100	202	

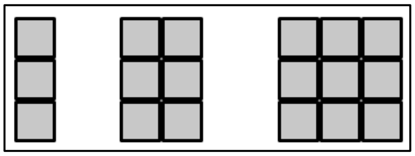
Investigation: Use the generalzation to find out what buffet table set up would sit 150 people. Would this be practical? Would it be better to have more than 1 buffet table? How many would be sensible?

Define the dimentions of the room and tables to figure out the longest buffet table possible.

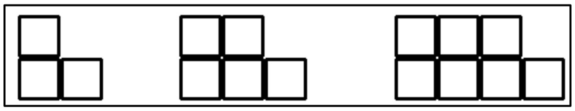
Try other variatons as well such as:



or



or

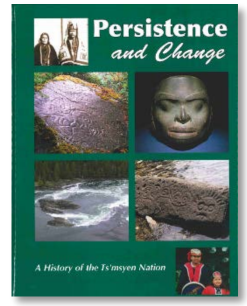
 (assume a post is in the corner)

More Practice with Charts and Growing patterns

Put an example of a simple growing pattern up for students to view: Modeling with images of visual patterns like examples from **http://www.visualpatterns.org/**

Print out provided cards (made from **http://www.visualpatterns.org/**)

- Give each student a T Chart and have them fill out for figures 1, 2, 3, 4
- Generalize for nth term
- Check the expression by substituting n with 43 to check.



Charting the Stars:

Extra practice graphing linear expressions

Materials:

- Games as listed below
- *Persistence and Change* Text for cultural reference (Available from Wap Sigatgyet)

Lesson:

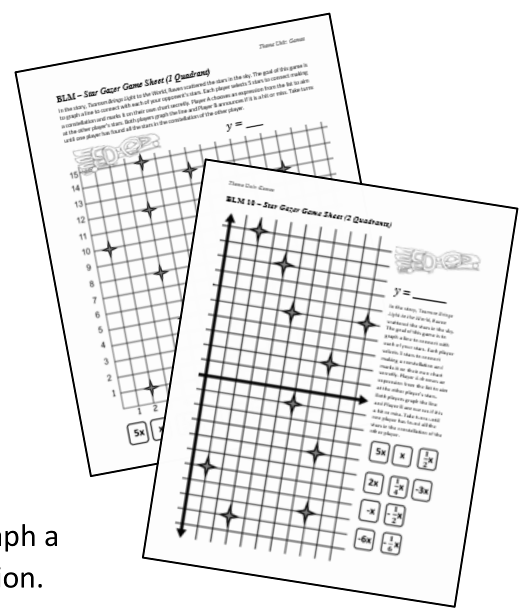
One of the most specialized areas of knowledge in Ts'msyen society was understanding the seasons (the moons) and the stars. These people were the *Gwildmniits*, the moon readers. Sometimes this is translated as astronomers.

The *Gwildmniits* watched the tides, the seasons, the stars, sun and moon very carefully. They could predict what the weather was going to be like for the upcoming season and could tell how successful fishing or other food harvests might be.

They had special observation sites where they marked the passage of the sun and moon. The house of the Gits'ilaasü Chief Gaum's house at Gitlaxdzawk had a door built into it that led out to a point overlooking the Skeena River. From there the Gwildmniits observed the sun as it set behind the Kitselas Mountains. When the setting sun lined up with a certain notch in the mountains, it was the end of salmon season.

There were two or three such people in each tribe. They were taught the special knowledge by elder *Gwildmniits*.

From *Persistence and Change*, p 70



Practice:

In this activity, students will practice graphing skills and develop a better understanding of how the coefficient in an expression effects the slope of a line. As stars move across the night sky, their position to each other remains fixed but their position in relation to the landmarks play an important role in understanding the change in seasons and knowing when certain seasonal food is expected or ready to harvest.

In the story, *Txamsm Brings Light to the World*, Raven scattered the stars in the sky. The goal of this game is to graph a line to find each of your opponent's stars in their constellation.

The game is similar to the game Battleship, but rather than calling coordinates, the players call an equation that is then graphed on the chart. Any stars in the path of the line are hit.

Choose the appropriate game board for your students 1 quadrant, 2 quadrans or all 4 quadrants .

- Each player selects 3- 5 stars to connect (players need to agree on the number), making a constellation and marks it on their own chart secretly (they should not show the other player).
- Player A chooses an expression from the list and inserts it into the equation y = ____ to aim at the other player's stars.
- Both players graph the line and Player B announces if it is a hit or miss.
- Take turns until one player has found all the stars in the constellation of the other player, winning the game.

Variation: Each plater can use 2 sheets, one for their own constellation and the other to keep track of hits and misses for the other player's constellation.

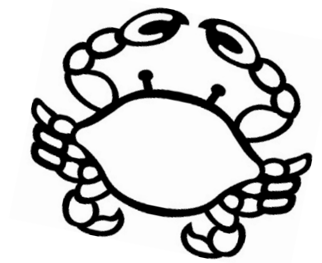
Student Practice and Activity Pages

Bead Mathemagic

Bead Mathemagic

R	1	B	36	R	71	R	106	B	141	Y	176	R	211	B	246	Y	281
Y	2	R	37	Y	72	Y	107	R	142	B	177	Y	212	R	247	B	282
B	3	Y	38	R	73	B	108	Y	143	R	178	B	213	Y	248	R	283
R	4	B	39	Y	74	R	109	B	144	Y	179	R	214	B	249	Y	284
Y	5	R	40	B	75	Y	110	R	145	B	180	Y	215	R	250	B	285
B	6	Y	41	R	76	B	111	Y	146	R	181	B	216	Y	251	R	286
R	7	B	42	Y	77	R	112	B	147	Y	182	R	217	B	252	Y	287
Y	8	R	43	B	78	Y	113	R	148	B	183	Y	218	R	253	B	288
B	9	Y	44	R	79	B	114	Y	149	R	184	B	219	Y	254	R	289
R	10	B	45	Y	80	R	115	B	150	Y	185	R	220	B	255	Y	290
Y	11	R	46	B	81	Y	116	R	151	B	186	Y	221	R	256	B	291
B	12	Y	47	R	82	B	117	Y	152	R	187	B	222	Y	257	R	292
R	13	B	48	Y	83	R	118	B	153	Y	188	R	223	B	258	Y	293
Y	14	R	49	B	84	Y	119	R	154	B	189	Y	224	R	259	B	294
B	15	Y	50	R	85	B	120	Y	155	R	190	B	225	Y	260	R	295
R	16	B	51	Y	86	R	121	B	156	Y	191	R	226	B	261	Y	296
Y	17	R	52	B	87	Y	122	R	157	B	192	Y	227	R	262	B	297
B	18	Y	53	R	88	B	123	Y	158	R	193	B	228	Y	263	R	298
R	19	B	54	Y	89	R	124	B	159	Y	194	R	229	B	264	Y	299
Y	20	R	55	B	90	Y	125	R	160	B	195	Y	230	R	265	B	300
B	21	Y	56	R	91	B	126	Y	161	R	196	B	231	Y	266	R	301
R	22	B	57	Y	92	R	127	B	162	Y	197	R	232	B	267	Y	302
Y	23	R	58	B	93	Y	128	R	163	B	198	Y	233	R	268	B	303
B	24	Y	59	R	94	B	129	Y	164	R	199	B	234	Y	269	R	304
R	25	B	60	Y	95	R	130	B	165	Y	200	R	235	B	270	Y	305
Y	26	R	61	B	96	Y	131	R	166	B	201	Y	236	R	271	B	306
B	27	Y	62	R	97	B	132	Y	167	R	202	B	237	Y	272	R	307
R	28	B	63	Y	98	R	133	B	168	Y	203	R	238	B	273	Y	308
Y	29	R	64	B	99	Y	134	R	169	B	204	Y	239	R	274	B	309
B	30	Y	65	R	100	B	135	Y	170	R	205	B	240	Y	275	R	310
R	31	B	66	Y	101	R	136	B	171	Y	206	R	241	B	276	Y	311
Y	32	R	67	B	102	Y	137	R	172	B	207	Y	242	R	277	B	312
B	33	Y	68	R	103	B	138	Y	173	R	208	B	243	Y	278	R	313
R	34	B	69	Y	104	R	139	B	174	Y	209	R	244	B	279	Y	314
Y	35	R	70	B	105	Y	140	R	175	B	210	Y	245	R	280	B	315

Gabada <u>K</u>'<u>a</u>lmoos – Eating Crab



Rule:	
Plates	total # crab legs
1	
2	
3	
4	
5	
6	

Roll to find how many legs on each plate

+___

+___

+___

Rule T Chart

Rule: ______________________________

Keep or Toss

[ ] **n** **+** [ ]

coefficient variable constant

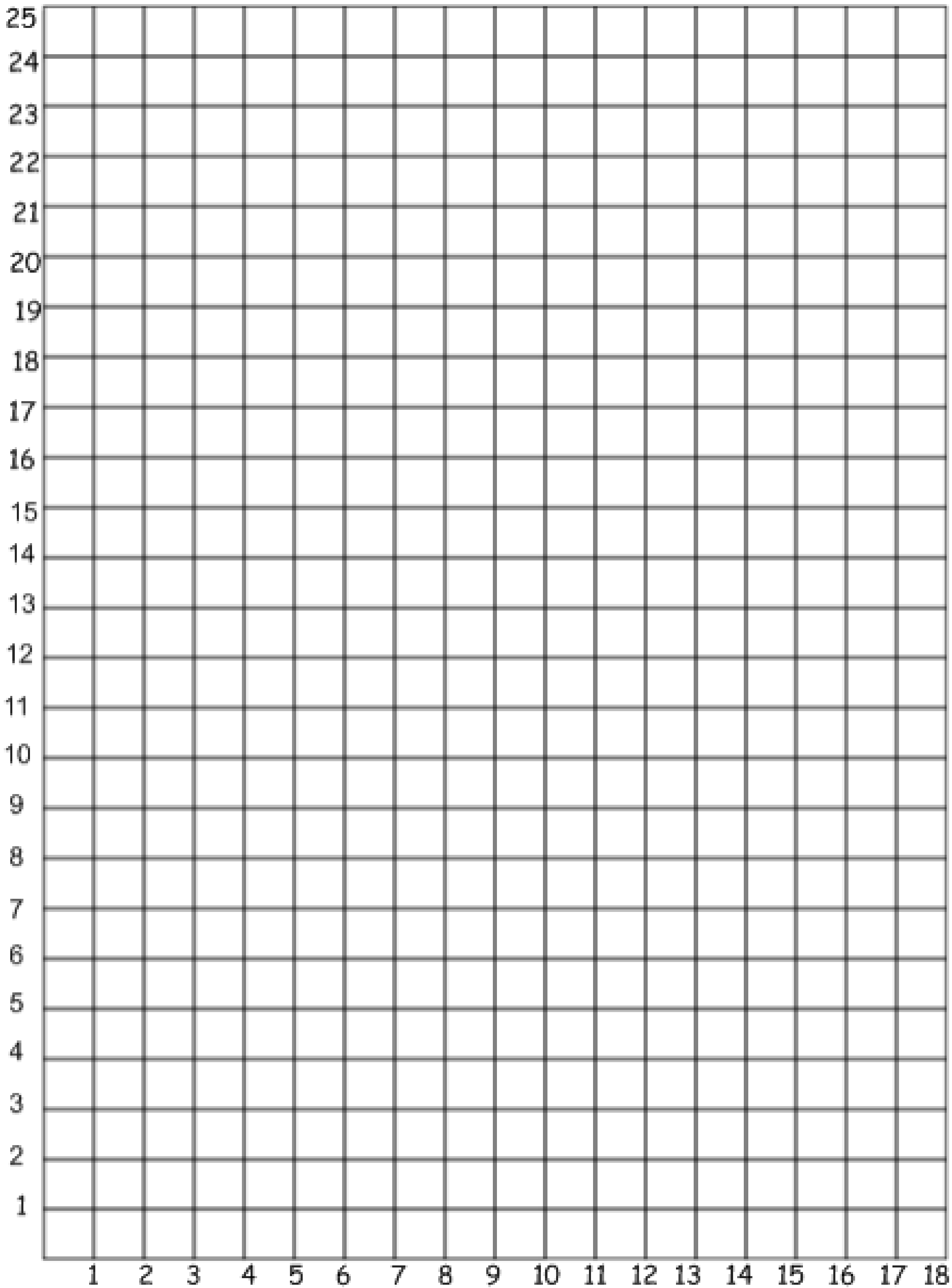
__________ **+** ______

________ **+** ______

Output: ________

if n= [ ]

Graphing Chart

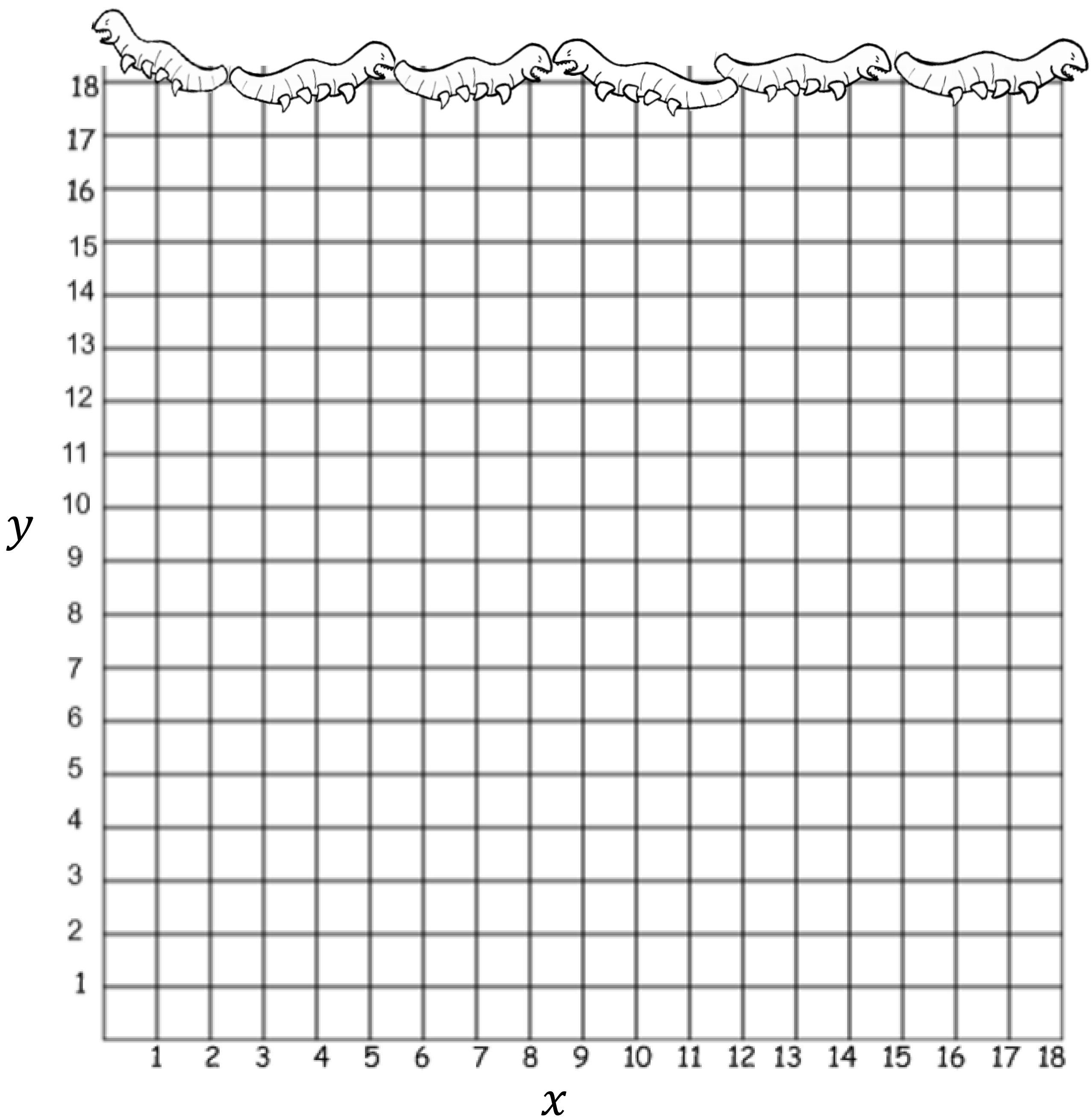


Get the Grub-Worms!

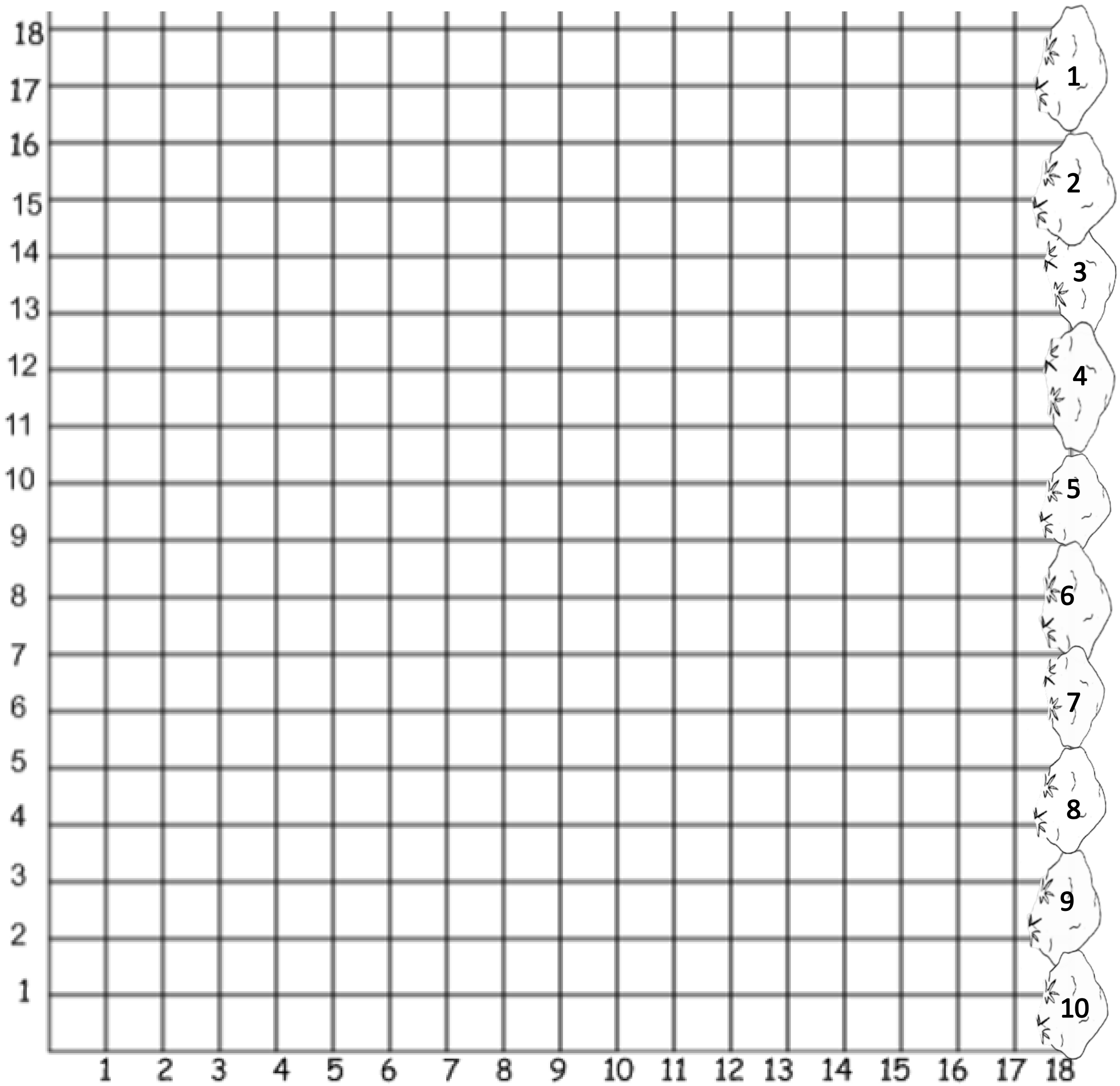
Choose any 2 dice. Take turns rolling 2 dice to find the numerical coefficient (slope) and the constant (y intercept). Graph the relation and see if you hit a worm. Cross off the worms once they are hit and get a point. Play until all of the worms are hit. Which worms are the easiest to hit?

y = ______ x + _______

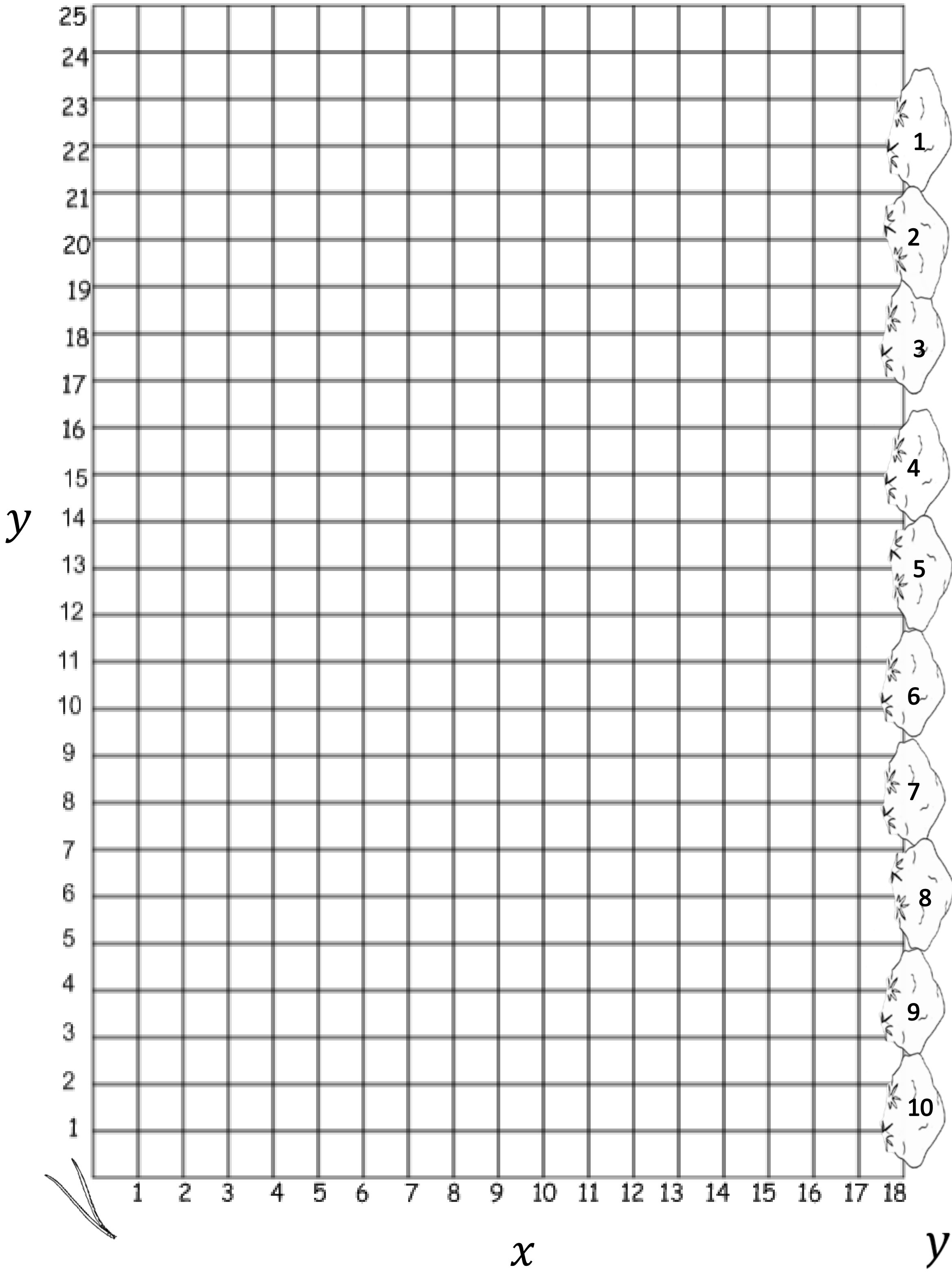
slope y-intercept



Aim the Pine Needle Exploration

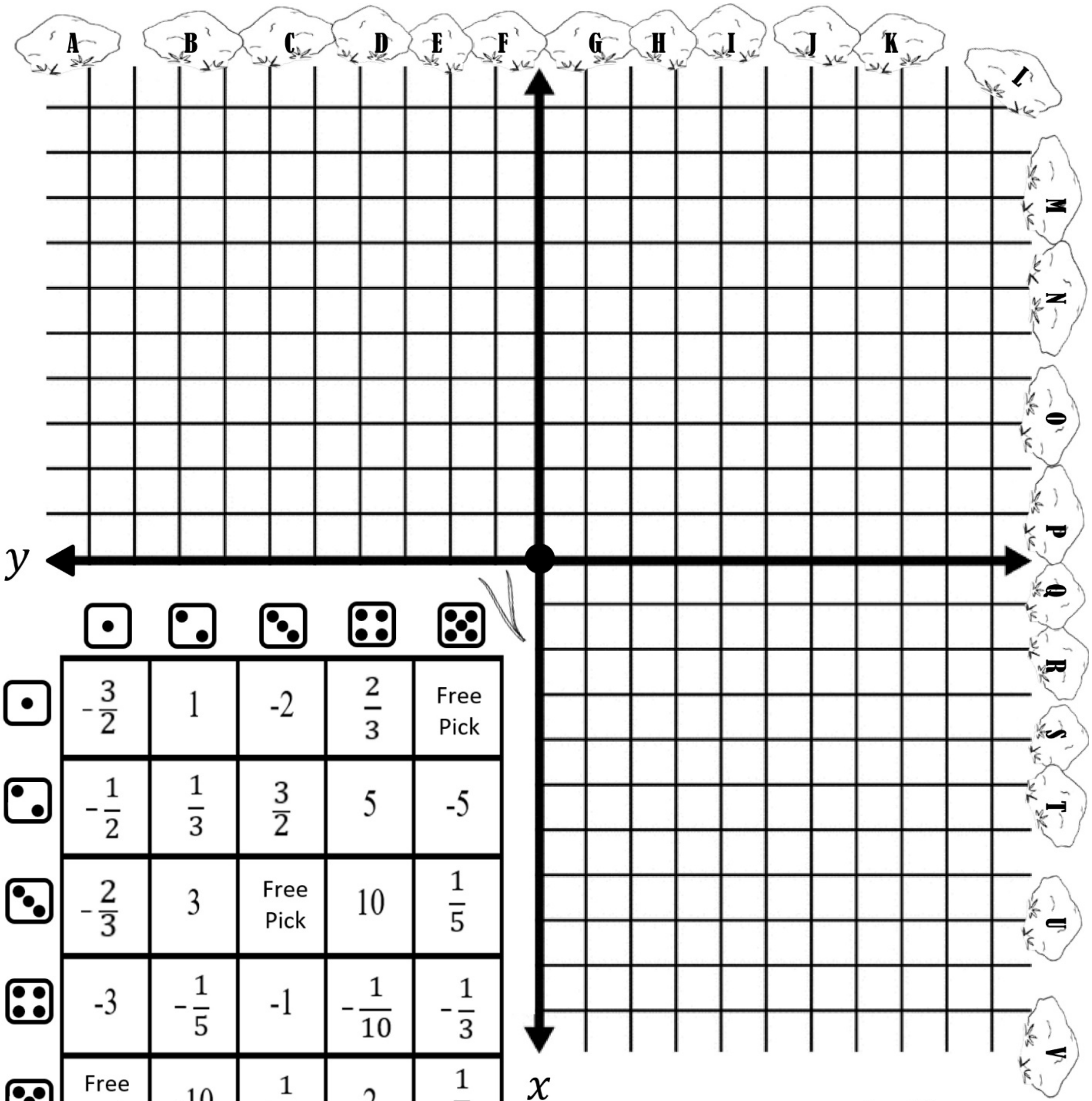


Aim the Pine Needle



$$y = \frac{1}{\square}x + \square$$

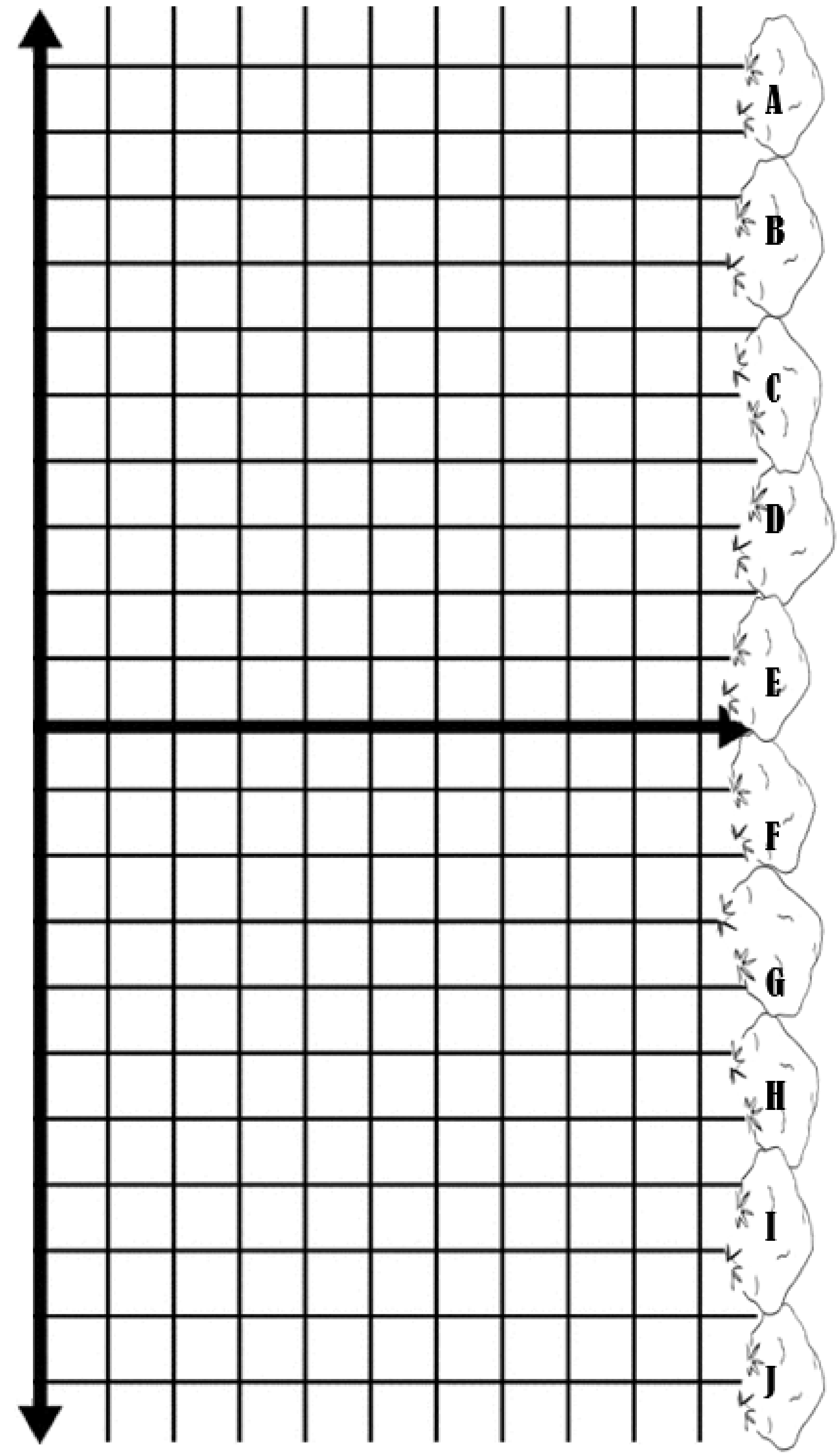
Around the River Bend

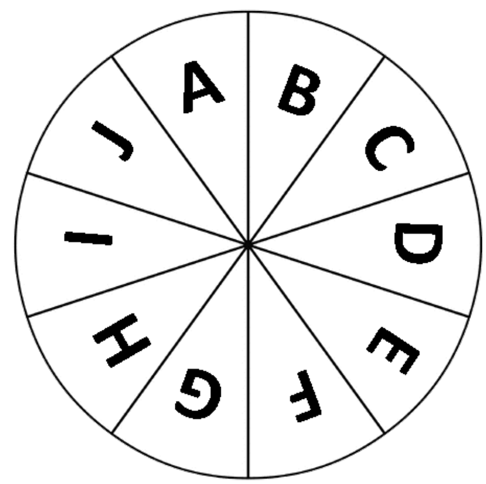


	⚀	⚁	⚂	⚃	⚄
⚀	$-\frac{3}{2}$	1	-2	$\frac{2}{3}$	Free Pick
⚁	$-\frac{1}{2}$	$\frac{1}{3}$	$\frac{3}{2}$	5	-5
⚂	$-\frac{2}{3}$	3	Free Pick	10	$\frac{1}{5}$
⚃	-3	$-\frac{1}{5}$	-1	$-\frac{1}{10}$	$-\frac{1}{3}$
⚄	Free Pick	-10	$\frac{1}{10}$	2	$\frac{1}{2}$

$y = \_\_\_ x + 0$

Up and Down the River





$$y = \frac{1}{\square}x - \square$$

Graphing T Chart

y = ________x + ________

x	y

Keep or Toss 2

[ ] **n** - [ ]

coefficient variable constant

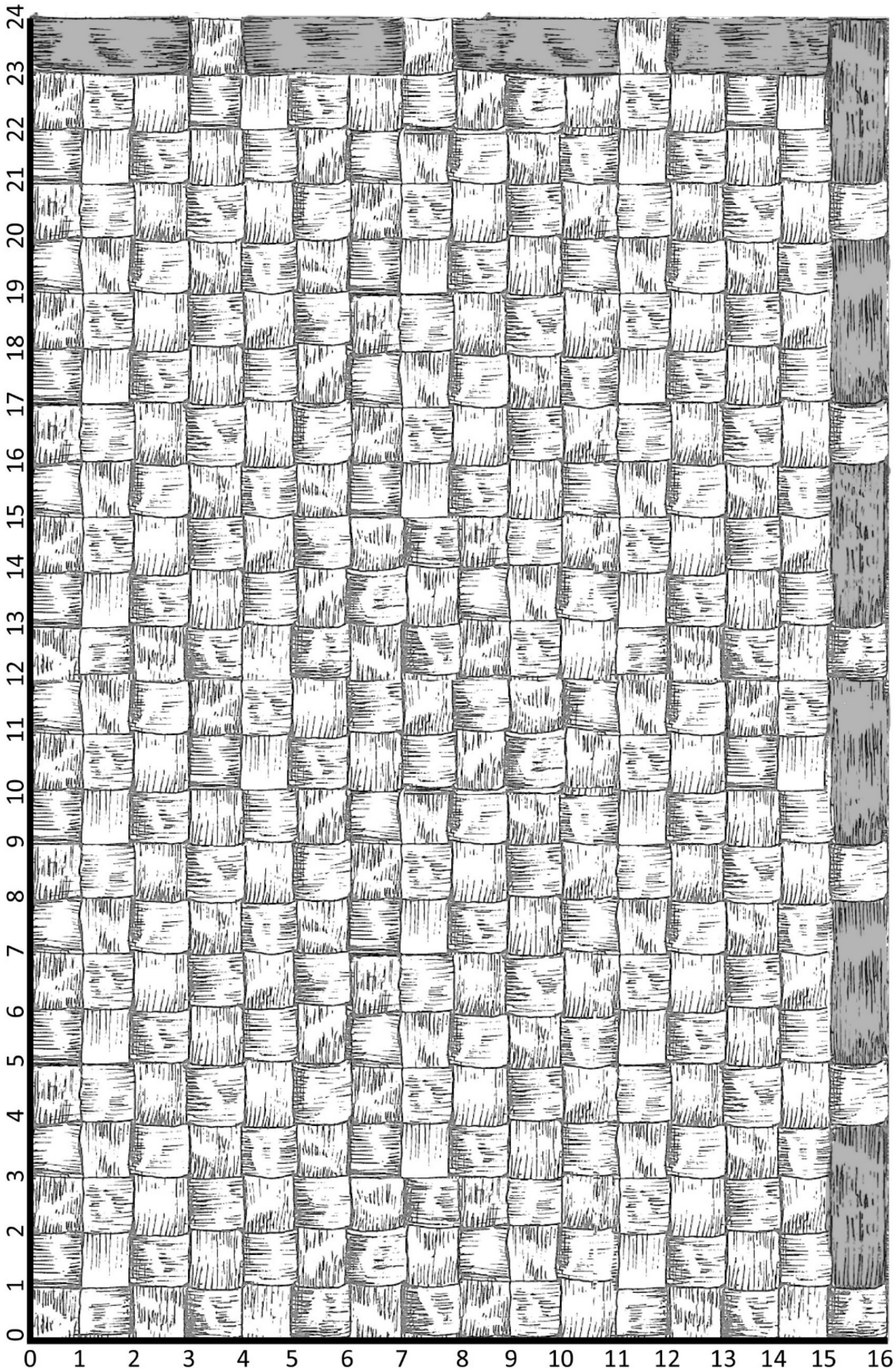
________ - ________

________ - ________

Output: ________

if n= [ ] [ ] [ ]

Cedar Mat Graphing Game



___x + ___

Coefficient Constant

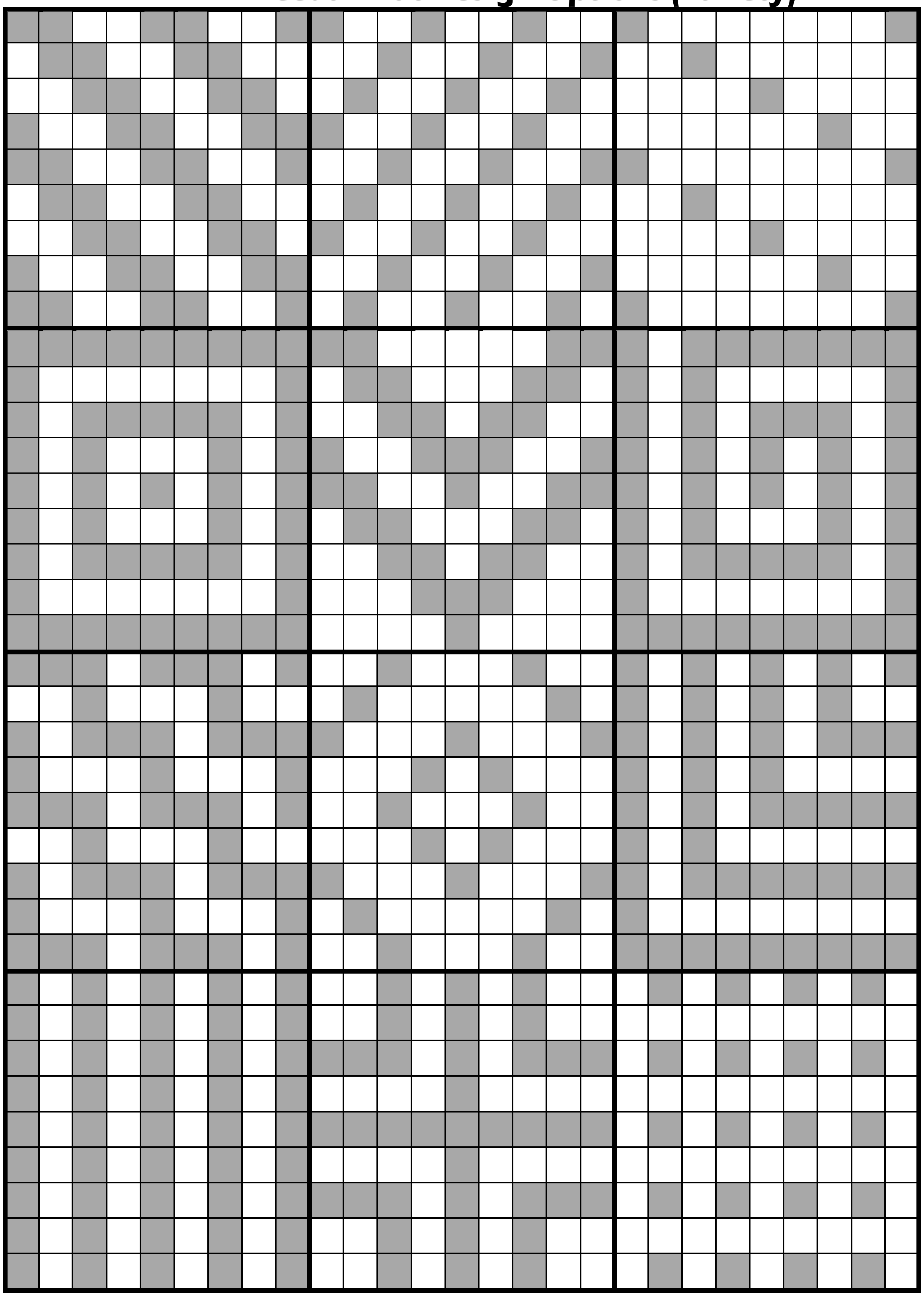
x	y

___x + ___

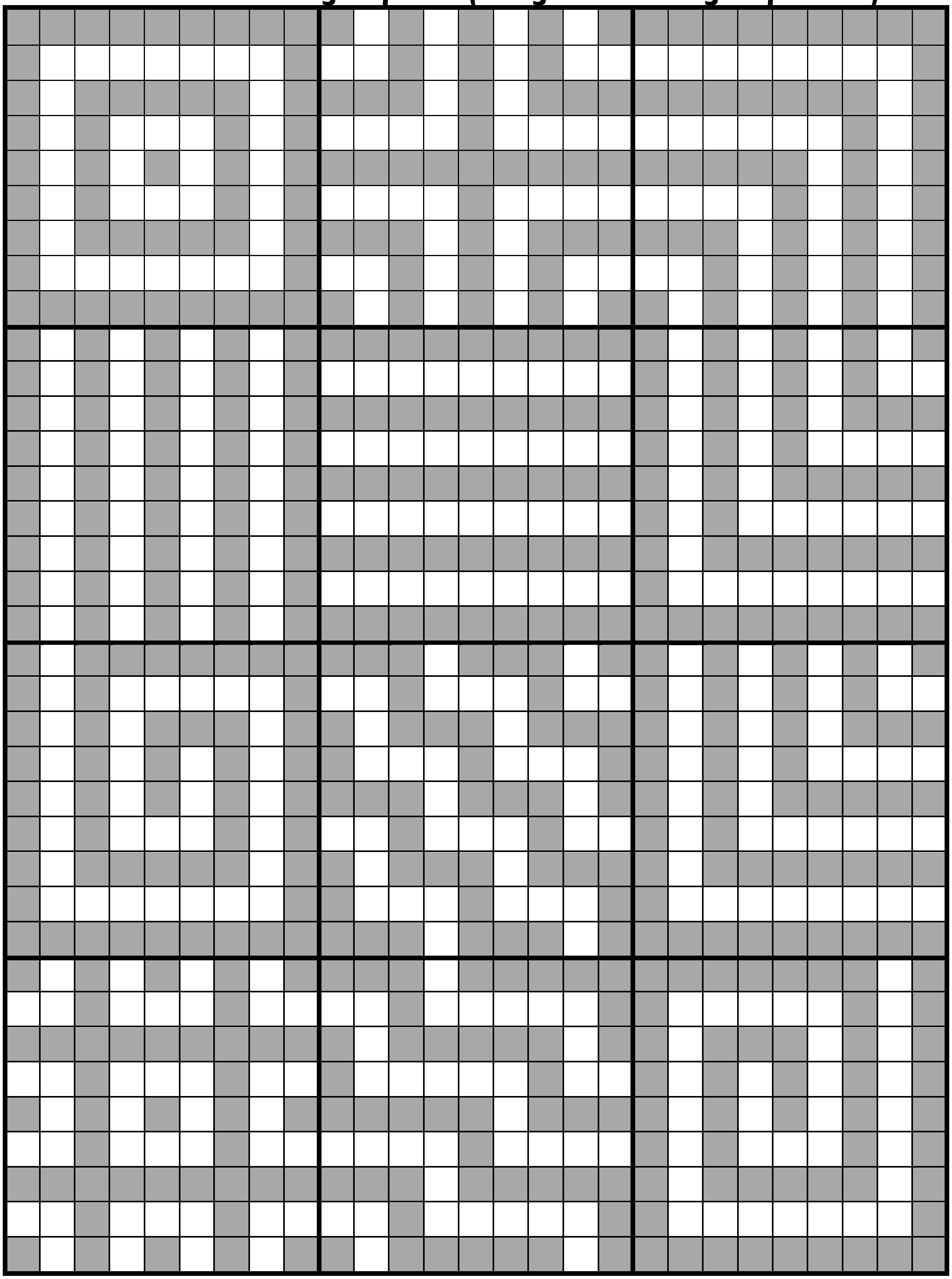
Coefficient Constant

x	y

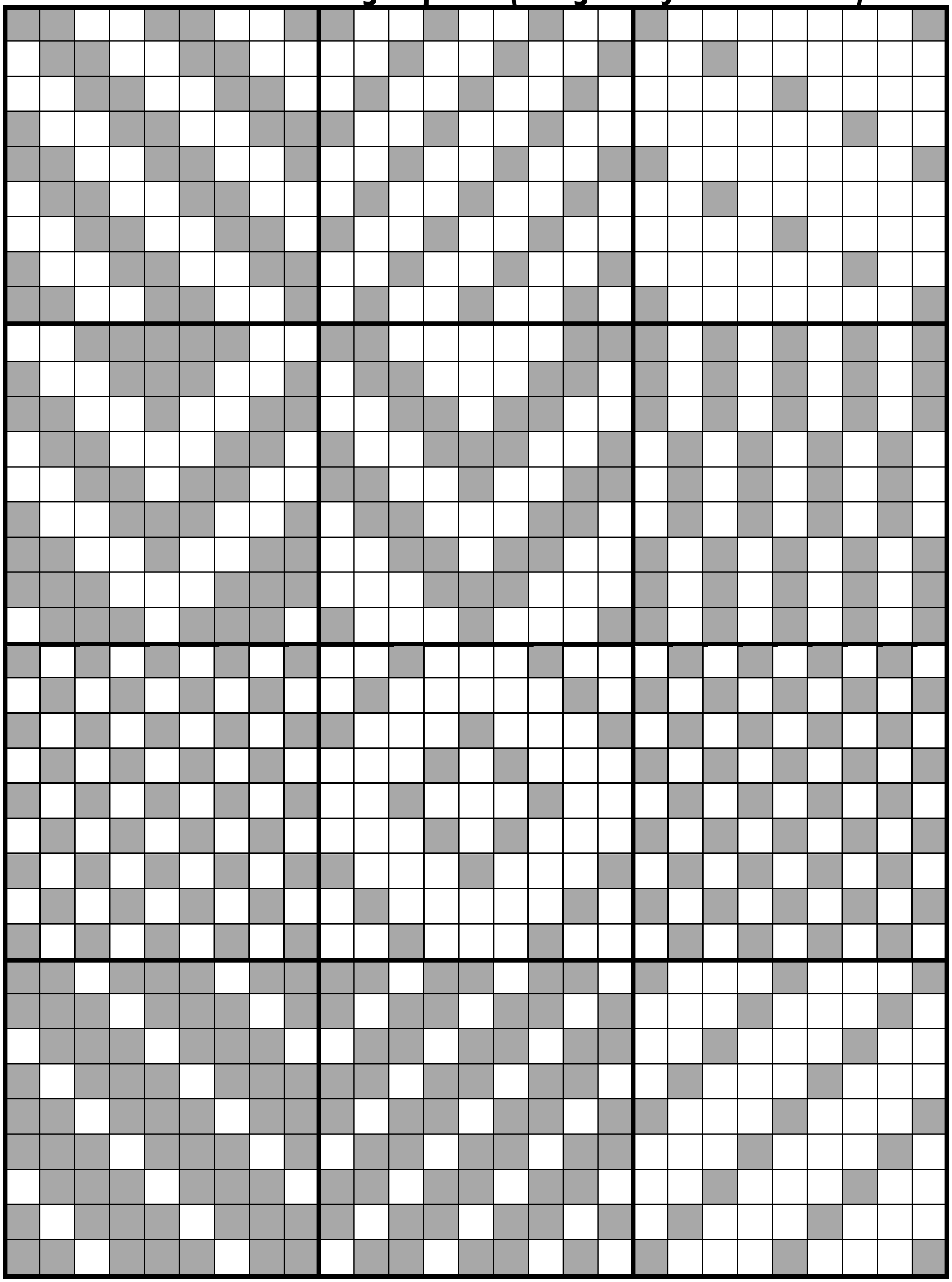
BLM – Cedar Mat Design Options (variety)



BLM Cedar Mat Design Options (using 2 alternating strip sheets)

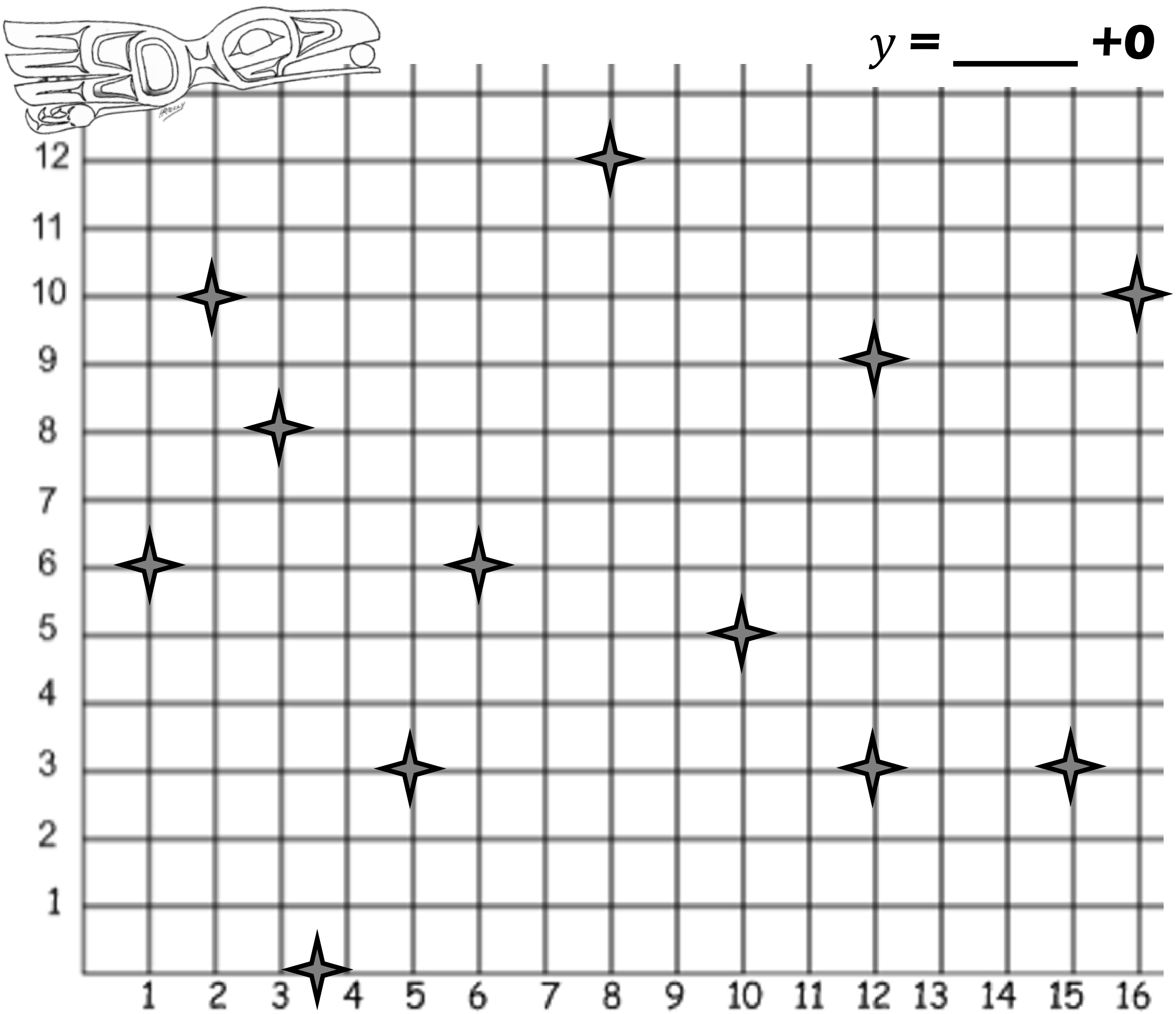


***BLM* – Cedar Mat Design Options (using solid yellow and red)**



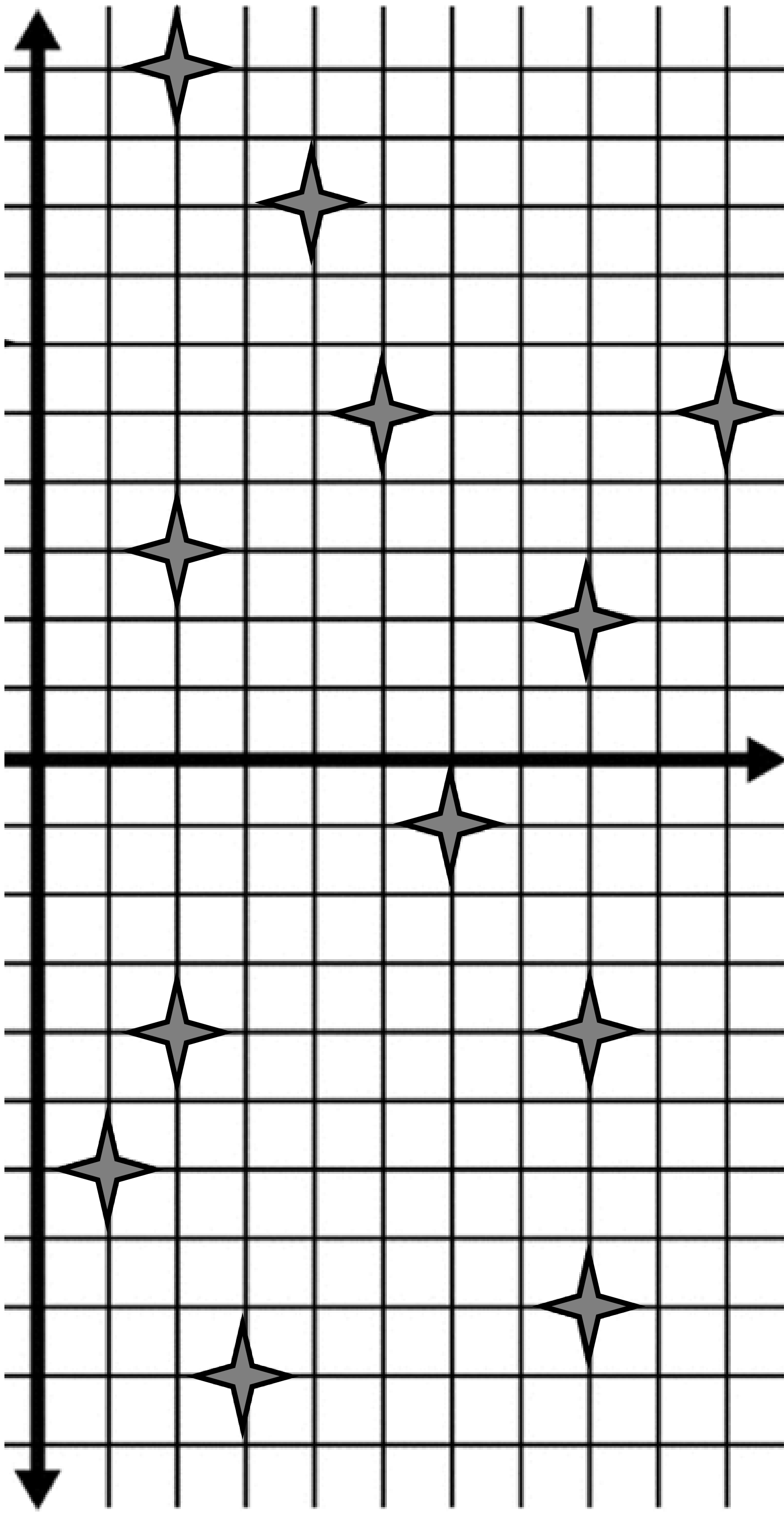
Star Gazer (1 Quadrants)

In the story, *Txamsm Brings Light to the World*, Raven scattered the stars in the sky. The goal of this game is to graph a line to connect with each of your opponent's stars. Each player selects 5 stars to connect making a constellation and marks it on their own chart secretly. Player A chooses an expression from the list to aim at the other player's stars. Both players graph the line and Player B announces if it is a hit or miss. Take turns until one player has found all the stars in the constellation of the other player.



$5x$ | x | $\frac{1}{2}x$ | $2x$ | $\frac{1}{4}x$ | $3x$ | $0x$ | $\frac{5}{8}x$ | $6x$ | $\frac{1}{5}x$ | $\frac{3}{4}x$ | $\frac{3}{5}x$

Star Gazer (2 Quadrants)



In the story, *Txamsm Brings Light to the World*, Raven scattered the stars in the sky. The goal of this game is to graph a line to connect with each of your opponent's stars. Each player selects 5 stars to connect making a constellation and marks it on their own chart secretly. Player A chooses an expression from the list to insert into the equation to aim at the other player's stars. Both players graph the line and Player B announces if it is a hit or miss. Take turns until one player has found all the stars in the constellation of the other player.

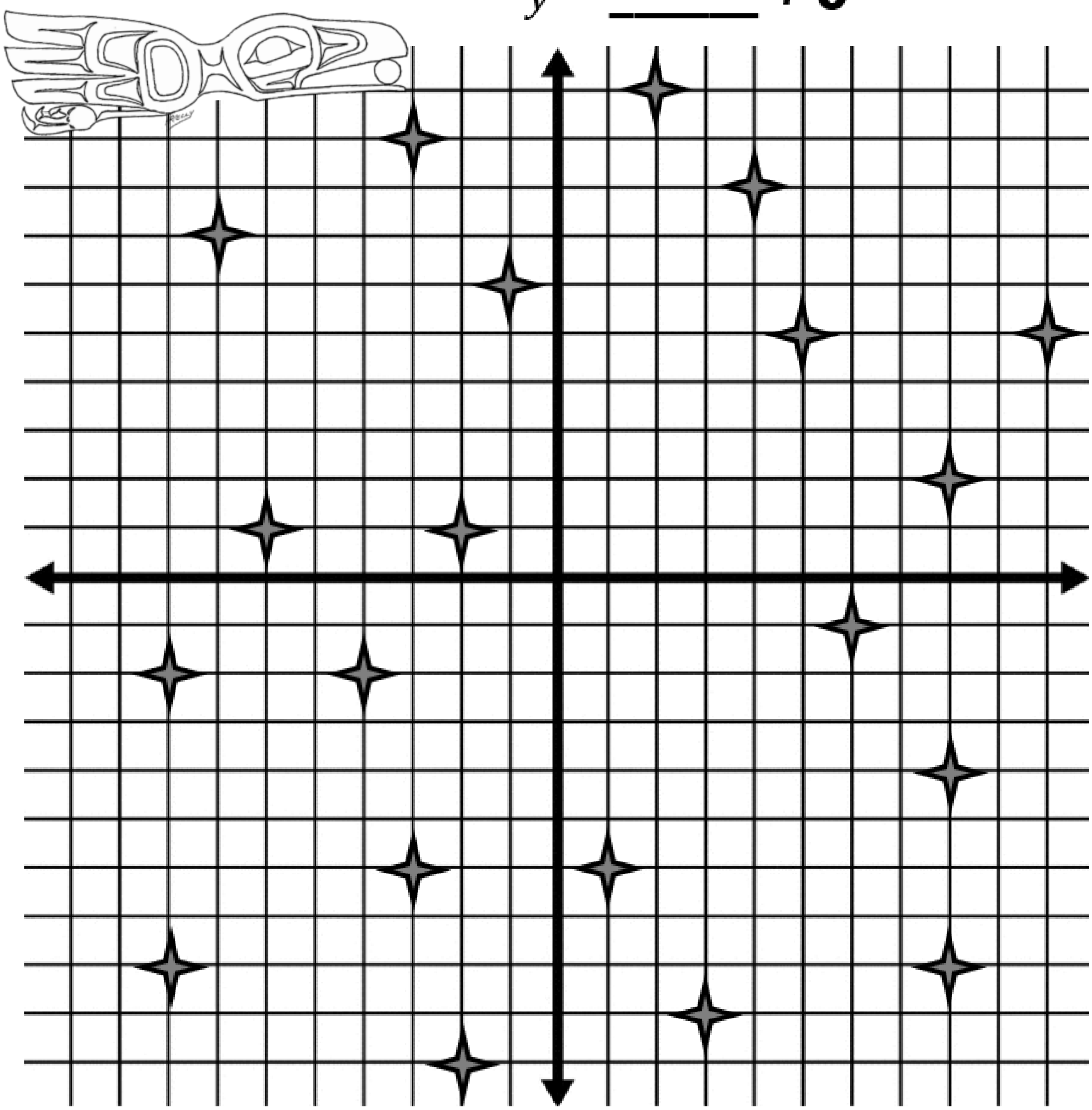
$5x$	x	$\frac{1}{2}x$
$2x$	$\frac{1}{4}x$	$-3x$
$-x$	$-\frac{1}{2}x$	$3x$
$-6x$	$-\frac{1}{6}x$	$-2x$

$y =$ ______ $+ 0$

Star Gazer (4 Quadrants)

In the story, *Txamsm Brings Light to the World*, Raven scattered the stars in the sky. The goal of this game is to graph a line to connect with each of your opponent's stars. Each player selects 5 stars to connect making a constellation and marks it on their own chart secretly. Player A chooses an expression from the list to insert into the equation to aim at the other player's stars. Both players graph the line and Player B announces if it is a hit or miss. Take turns until one player has found all the stars in the constellation of the other player.

$y =$ ______ $+ 0$



$5x$	x	$\frac{1}{2}x$	$2x$	$\frac{1}{4}x$	$-3x$	$-x$	$-\frac{1}{2}x$	$-6x$	$-\frac{1}{6}x$

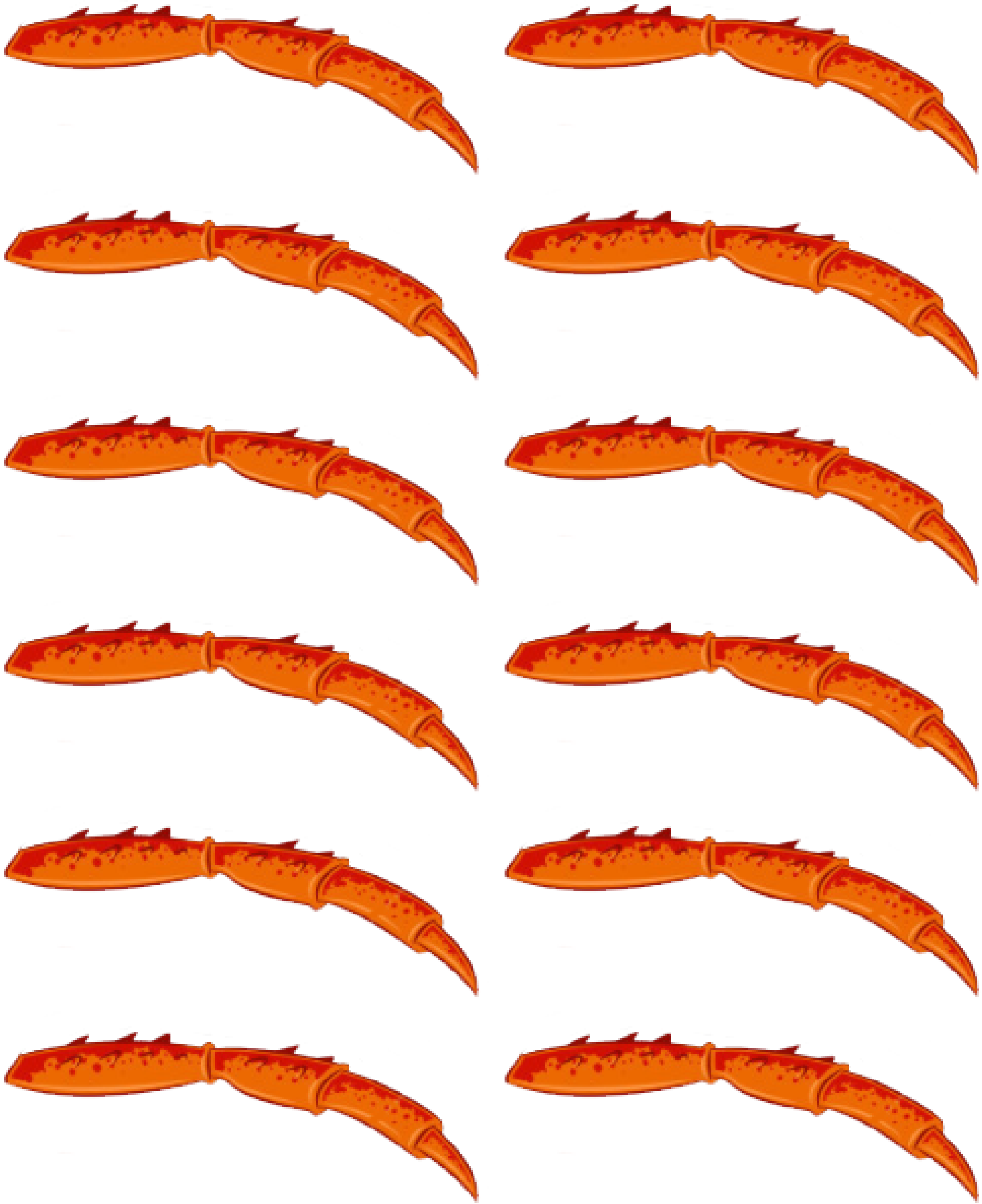
Teacher Resources

K'üül, Gup'l, Kwilii

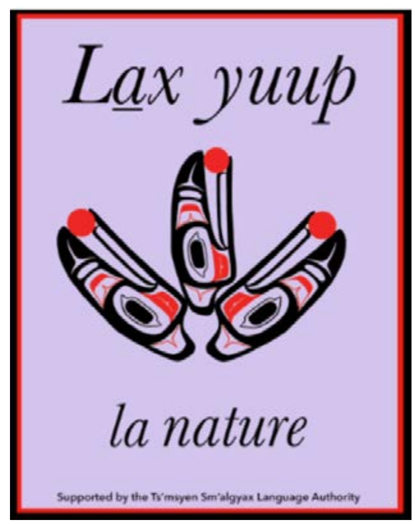
K'üül, gup'l, kwilii
Kwdii łmkdii.
Txaapx, ksduuns, k'oolt
Dawila t'apxoolt.
'Yikwdelt, ksdamoos
Gabida k'almoos
Dawila kpiil
Likleeksa wuliilt

One, two, three,
Brother's hungry as can be.
Four, five, six,
Seven comes next.
Eight and nine,
Crab tastes so fine.
Next come ten,
He ate it all again!

Crab Legs



Bilingual Posters by Artist Kelli Clifton




Nda'aamx
la réconciliation
Supported by the Ts'msyen Sm'algyax Language Authority

La̱x yuup

la nature

Supported by the Ts'msyen Sm'algyax Language Authority


Łoomsk
le respect
Supported by the Ts'msyen Sm'algyax Language Authority

Wilwilaaysk

la famille

Supported by the Ts'msyen Sm'algyax Language Authority

Ama g̲oot

la bonté

Supported by the Ts’msyen Sm’algyax Language Authority

Gallery Walk

Pattern:

Stage (x)	Size (y)
1	
2	
3	
4	
x	
10	

Pattern:

Stage (x)	Size (y)
1	
2	
3	
4	
x	
10	

Pattern:

Stage (x)	Size (y)
1	
2	
3	
4	
x	
10	

Pattern:

Stage (x)	Size (y)
1	
2	
3	
4	
x	
10	

Pattern:

Stage (x)	Size (y)
1	
2	
3	
4	
x	
10	

Pattern:

Stage (x)	Size (y)
1	
2	
3	
4	
x	
10	

Cedar Rainbow Pattern

Cedar Chevron Pattern

Imitation Cedar Weaving Strips

DO NOT CUT

Instructions:

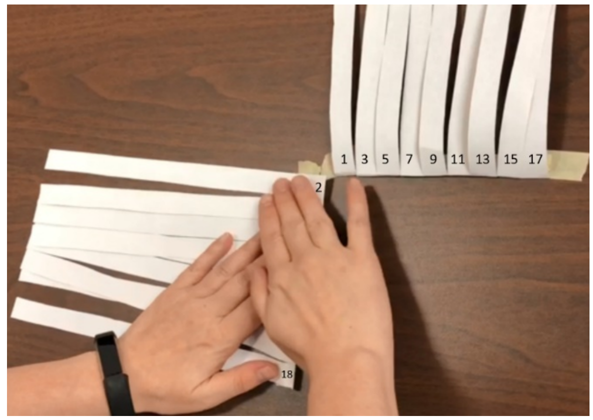
1) Cut off the white on left side of strips (do NOT cut off the white on the right side).

2) Cut off white area containg the title and instructions.

3) Cut between the strips leaving the DO NOT CUT strip attached.

Pattern Fish Algorithm

1. Cut apart the strips from one end, leaving the *Do Not Cut* tab attached
2. Tape down 1 set of strips vertically and the other strips horizontally so they overlap.
3. Fold back all of the strips

   Number the underside of the vertical strips from left to right with odd numbers (1,3,5,7,etc)

   Number the underside of the horizontal strips from top to bottom with even numbers (2, 4, 6, 8, etc)

   Flip down strip #1,
4. Check the colour of the next numbered strip and see where it will lay when flipped forward (colour side showing) and check (see below) then flip back again.

   a) Fold back (under side showing) any strips the new strip will cross over if they are the *same colour* as the new strip.
   b) Flip the new strip forward so it crosses over any strips that are a *different* colour. (strips of the same colour will be folded back)
   c) Flip forward (colour side showing) any strips you just folded back (in step a) so that they now cross on top of the most recently placed strip.
5. Repeat #4 until done, alternating vertical and horizontal strips as numbered.
6. Fold "Do not cut" tabs under and tape or use glue stick to secure. Trim edges to look like a fish if desired, use scraps to make an eye and glue or tape on.

Simplified Rule: Flip back matching colours.

http://bit.ly/cedarfish

Imitation Cedar Weaving Strips

DO NOT CUT

Instructions:

1) Cut off the white on left side of strips (do NOT cut off the white on the right side).

2) Cut off white area containg the title and instructions.

3) Cut between the strips leaving the DO NOT CUT strip attached.

Imitation Red Cedar Weaving Strips

DO NOT CUT

Instructions:

1) Cut off the white on left side of strips (do NOT cut off the white on the right side).

2) Cut off white area containg the title and instructions.

3) Cut between the strips leaving the DO NOT CUT strip attached.

Linear Relations Game Cards

$y = 2x + 5$	$y = x + 2$	$y = 3x + 4$
$y = 4x + 1$	$y = 0x + 3$	$y = 5x$
$y = 3x - 5$	$y = x - 3$	$y = 2x - 4$
$y = 4x - 1$	$y = 0x - 2$	$y = 5x$

Linear Relations Cards – (slope)

slope +2	slope +1	slope +3
slope +4	slope 0	slope +5
slope +3	slope +1	slope +2
slope +4	slope 0	slope +5

Linear Relations Cards (y-intercept)

y intercept *(constant)* +5	y intercept *(constant)* +2	y intercept *(constant)* +4
y intercept *(constant)* +1	y intercept *(constant)* +3	y intercept *(constant)* 0
y intercept *(constant)* -5	y intercept *(constant)* -3	y intercept *(constant)* -4
y intercept *(constant)* -1	y intercept *(constant)* -2	y intercept *(constant)* 0

Linear Relations Cards – (coordinate pairs)

x	y
-2	1
-1	3
0	5
1	7
2	9

x	y
-2	0
-1	1
0	2
1	3
2	4

x	y
-2	-2
-1	1
0	4
1	7
2	10

x	y
-2	-7
-1	-3
0	1
1	5
2	9

x	y
-2	3
-1	3
0	3
1	3
2	3

x	y
-2	-4
-1	-2
0	0
1	2
2	4

x	y
-1	-8
0	-5
1	-2
2	1
3	4

x	y
2	-1
3	0
4	1
5	2
6	3

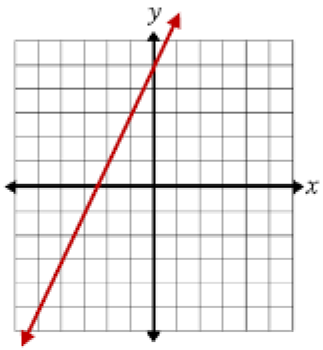
x	y
0	-4
1	1
2	6
3	11
4	16

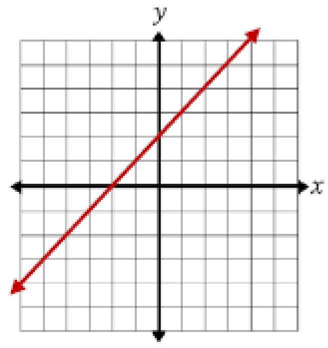
x	y
0	-1
1	3
2	7
3	11
4	15

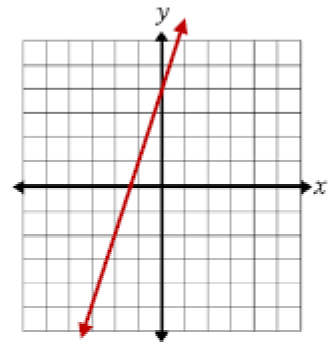
x	y
-1	-2
0	-2
1	-2
2	-2
3	-2

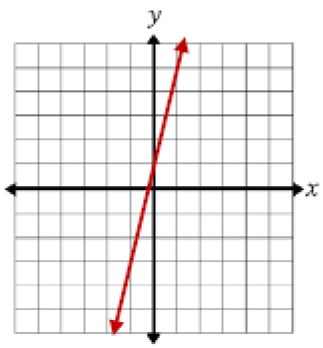
x	y
-2	-10
-1	-5
0	0
1	5
2	10

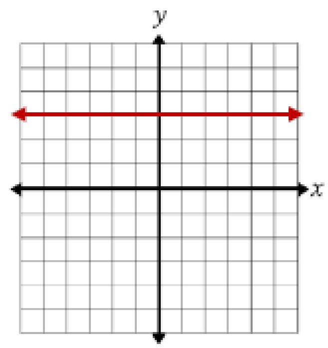
Linear Relations Cards (graph)

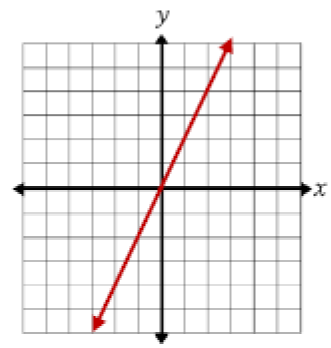


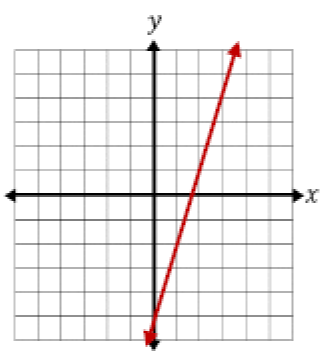


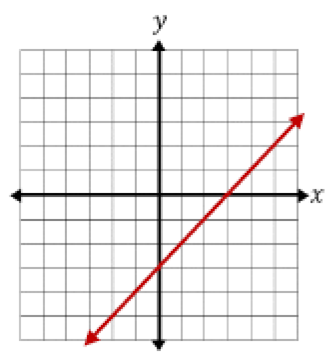


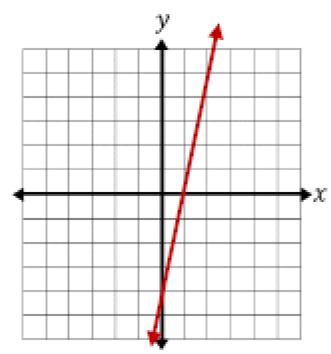


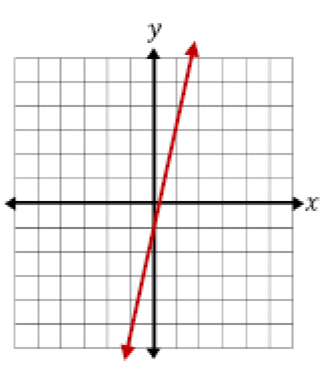


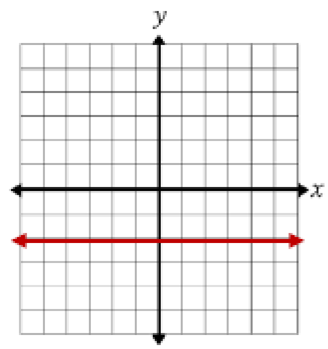


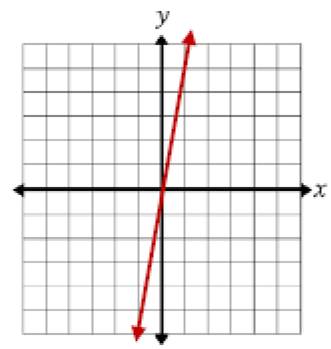












Advanced Linear Relations Cards – 1

$y = -2x + 1$	$y = \frac{1}{2}x$	$y = \frac{2}{3}x + 3$
$y = -x + 2$	$y = -\frac{1}{2}x - 2$	$y = -3x$
slope -2	slope $+\frac{1}{2}$	slope $+\frac{2}{3}$
slope -1	slope $-\frac{1}{2}$	slope -3

Advanced Linear Relations Cards – 2

x	y
-2	5
-1	3
0	1
1	-1
2	-3

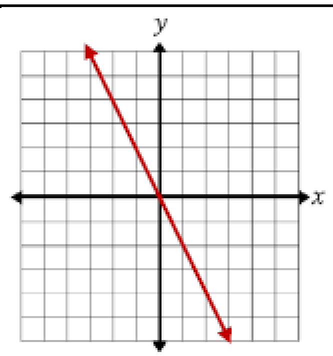
x	y
-4	-2
-2	-1
0	0
2	1
4	2

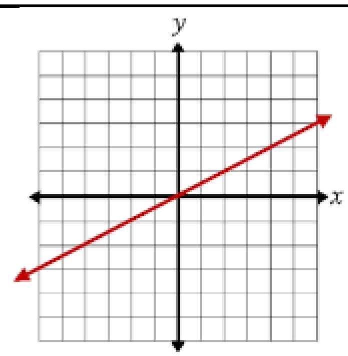
x	y
-6	-1
-3	1
0	3
3	5
6	7

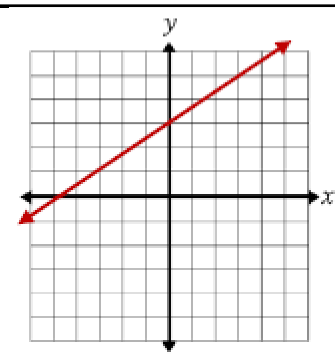
x	y
-2	1
-1	3
0	5
1	7
2	9

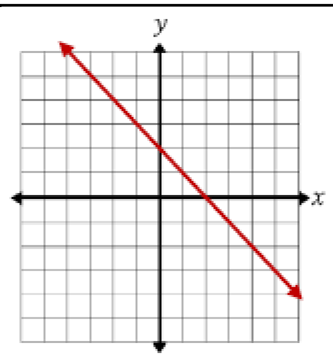
x	y
-2	1
-1	3
0	5
1	7
2	9

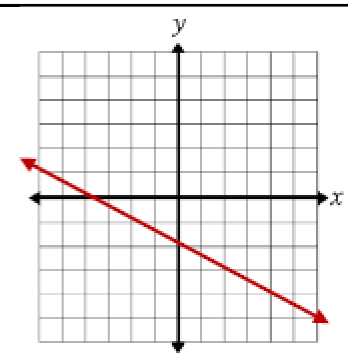
x	y
-2	1
-1	3
0	5
1	7
2	9

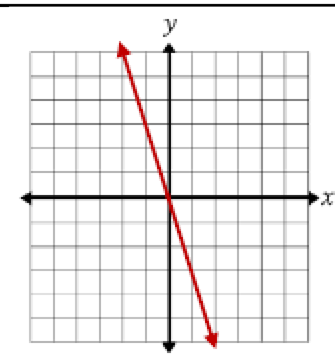






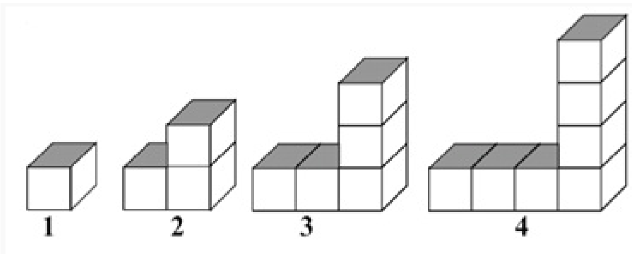




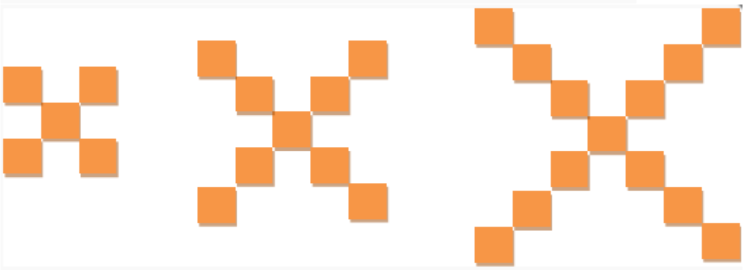


Examples from www.visualpatterns.org

Linear Patterns

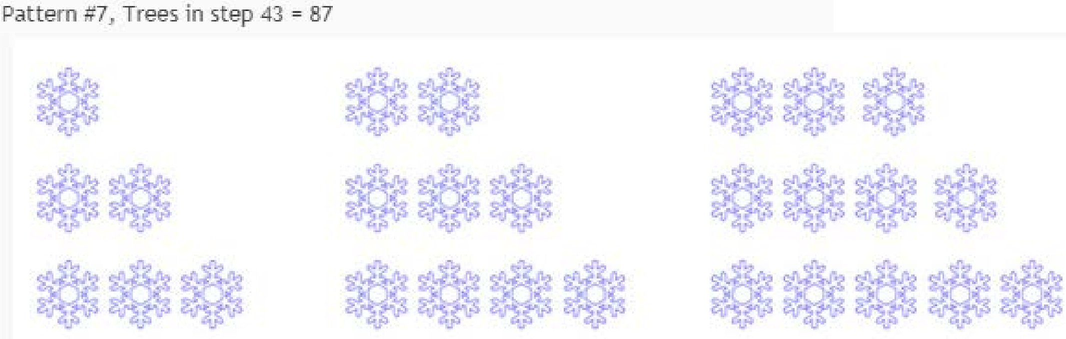


Pattern #2, Blocks in step 43 = 85



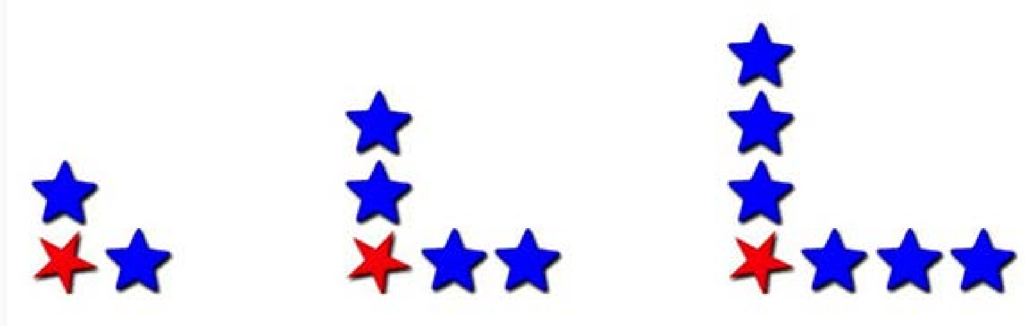
Pattern #4, Squares in step 43 = 173

Pattern #7, Trees in step 43 = 87

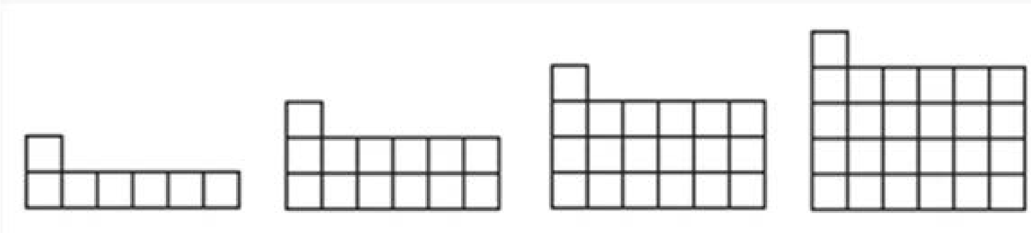


Pattern #9, Snowflakes in step 43 = 132

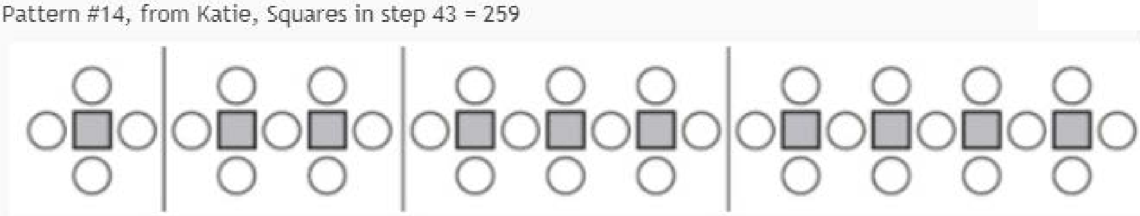
Pattern #10, Puppies in step 43 = 85



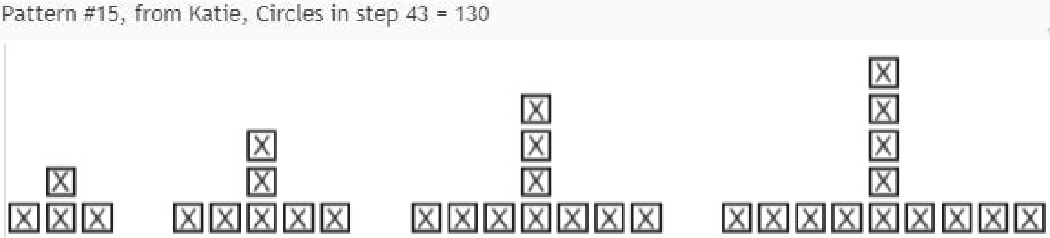
Pattern #11, Stars in step 43 = 87



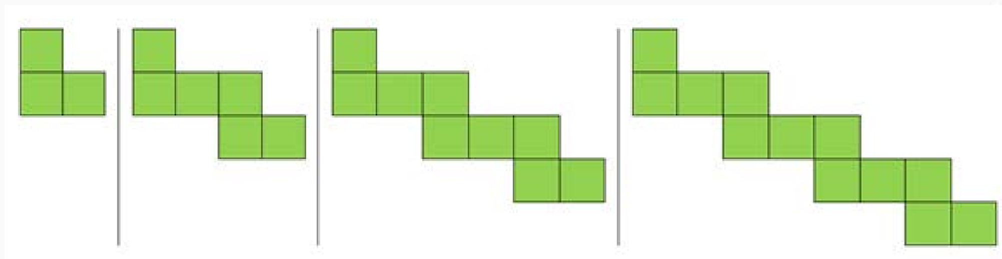
Pattern #14, from Katie, Squares in step 43 = 259



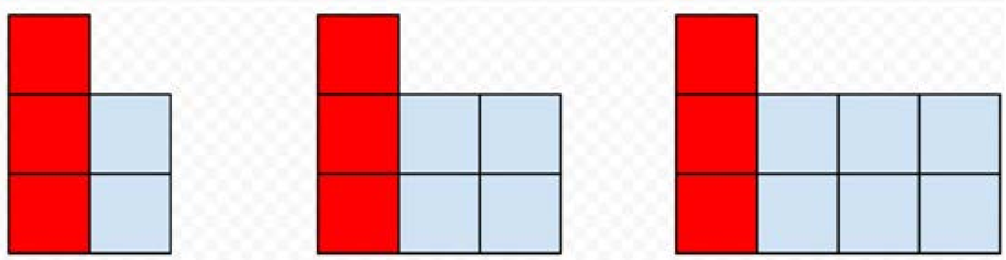
Pattern #15, from Katie, Circles in step 43 = 130



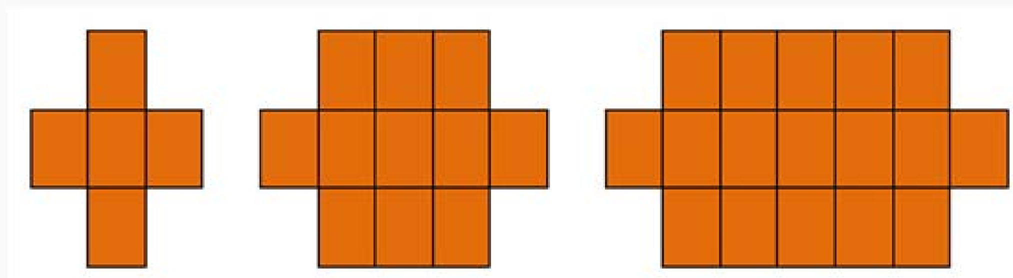
Pattern #17, from Katie, Squares in step 43 = 130



Pattern #18, from Justin Lanier, Squares in step 43 = 129, Perimeter in step 43 = 260



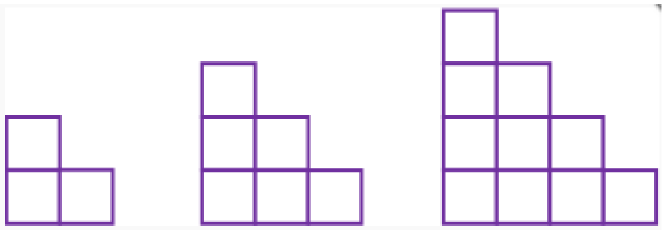
Pattern #24, from David Wees, Squares in step 43 = 89



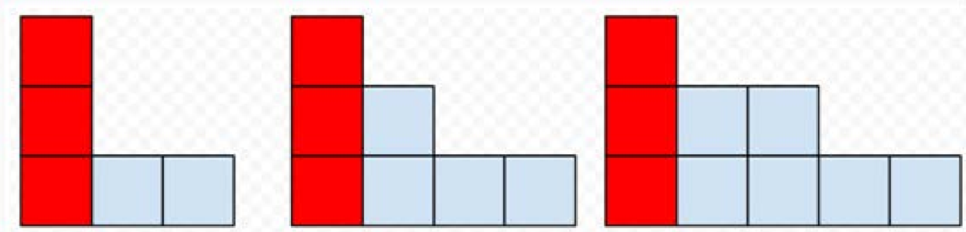
Pattern #31, from John Golden, Rectangles in step 43 = 257

Pattern #29, from John Golden, If you purchased 43 $25-gift cards, you'd get a $425-cash card.

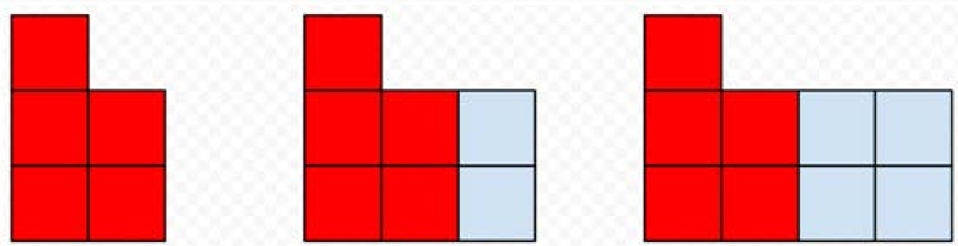
Triangular patterns (to do after hand shaking problem)



Pattern #3, Squares in step 43 = 990



Pattern #25, from David Wees, Squares in step 43 = 89

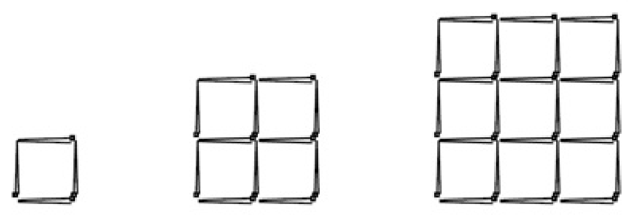


Pattern #26, from David Wees, Squares in step 43 = 89

Pattern #16, from Katie, Triangles in step 43 = 1849

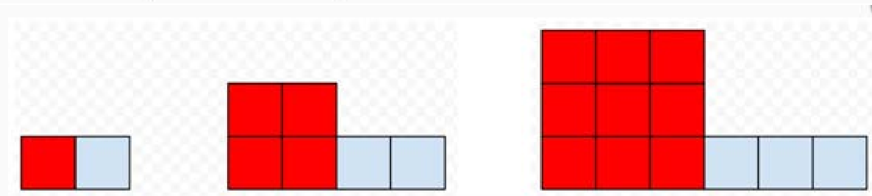
Pattern #8, Penguins in step 43 = 947

Square Number Patterns

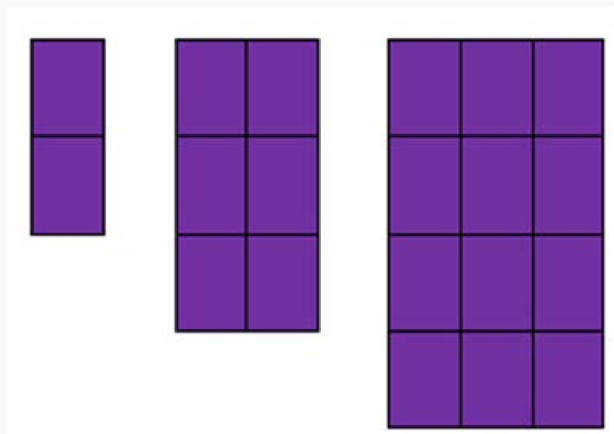


Pattern #1, Squares in step 43 = 1849, Toothpicks in step 43 = 3784

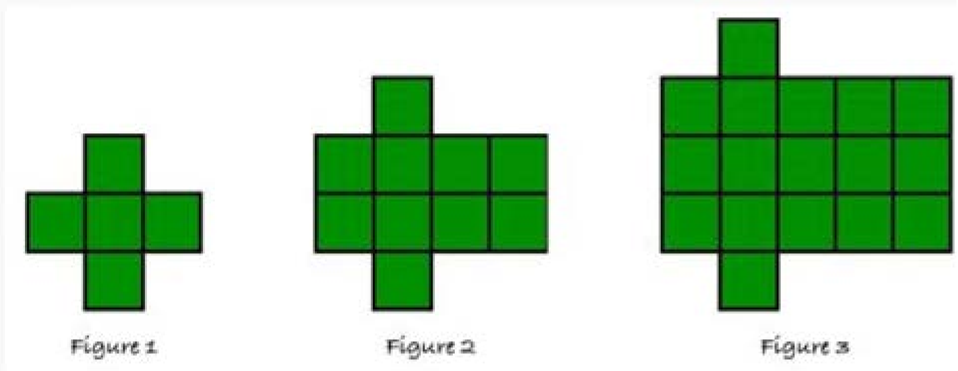
Pattern #12, Diamonds in step 43 = 1936



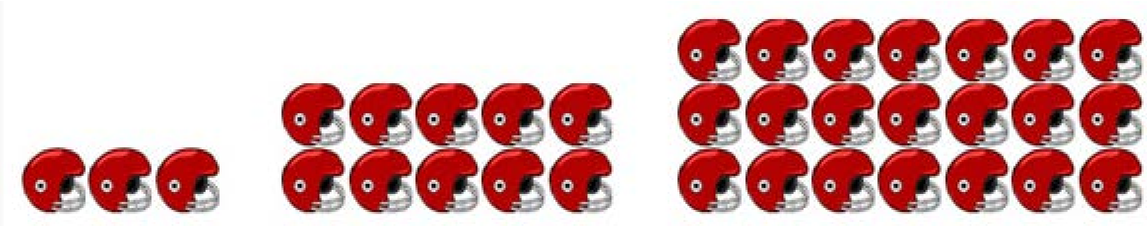
Pattern #27, from David Wees, Squares in step 43 = 1892



Pattern #32, from John Golden, Rectangles in step 43 = 1892



Pattern #19, from Chris Hunter, Squares in step 43 = 1937



Pattern #20, Helmets in step 43 = 3741

Locally Developed Resources

This resource as well as all locally developed resources referenced in this resource are available through the SD52 Aboriginal Education Department at Wap̱ Sig̱atgyet.

https://sd52wap.wixsite.com/abed/resources

T'oyaxsut 'nüüsm.