CLIP 1: Simple Linear Growing Patterns
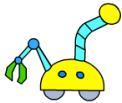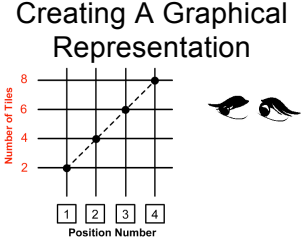
Critical Learning:
♦ **representing** a pattern, created using a rule of the form Number of Tiles = (Position Number) × (multiplier), as a graph;
♦ **making connections** among the rate of growth in the pictorial representation, the steepness of the trend line in the graphical representation, and the multiplier in the pattern rule representation;
♦ **reasoning** about a change in the multiplier of the pattern rule representation and the effect on the steepness of the trend line in the graphical representation;
♦ **communicating** comparisons among trend lines for patterns given in either a pictorial or pattern rule representation.

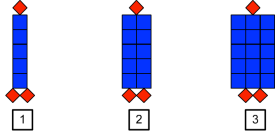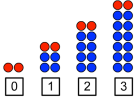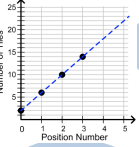| Activity Number/Type	Activity Title	Math content
1.1 Minds On	Robot Transformer	Students will: • investigate pattern rules that use only multiplication by a constant • reflect on the validity of a proposed pattern rule given a set of input and output data • determine a pattern rule given a pictorial representation using pattern tiles • connect the terms 'input numbers' to 'position numbers' in a growing pattern • define the term multiplier
1.2 Action	Creating A Graphical Representation	Students will: • investigate a graphical representation of a simple linear growing pattern using the pictorial representation as a starting point • define the term 'trend line' • reflect on how various representations give information about the number of tiles in each position • investigate the importance of choosing an appropriate scale for a graphical representation
1.3 Action	Comparing Trend Lines	Students will: • describe the differences in trend lines for different pattern rules using the words 'steeper' and 'flatter' and connect these differences to the value of the multiplier in the pattern rule to recognize that a larger multiplier creates a steeper trend line and a smaller multiplier creates a flatter trend line • investigate how changing the scale on a graph affects the steepness of the trend lines
1.4 Consolidate	Check Your Understanding	Students will: • practice creating a graphical representation of a pattern rule given a pictorial representation • justify why a graph represents a linear growing pattern • practice determining which pattern rule has a steeper trend line, flatter trend line, smaller multiplier, larger multiplier, same multiplier or same steepness

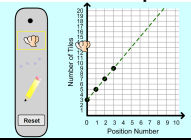| 1.5 Show What You Know		
1.5.1 Assessment Demonstration	Linear Growing Patterns Representations Sorting Activity (printable)	Students will: • sort different representations of linear growing patterns into matching groups
1.5.2 Assessment Demonstration	Linear Growing Patterns Representations Pattern Building (printable)	Students will: • represent linear growing patterns using manipulatives • graph their growing pattern using different scales
1.5.3 Assessment Game	Who's With Whom? (printable)	Students will: • play a game where they roll pattern cubes to match 3 representations of a linear growing patterns
1.5.3 Assessment Game	Robot Rule Game	Students will: • determine the pattern rule that the robot uses to give output values for each given input value

CLIP 2: Linear Growing Patterns

Critical Learning:
♦ **representing** a pattern, formed by using a rule of the form, Number of Tiles = (Position Number) × (multiplier) + (constant) as a graph;   ♦ **making connections** among the zero position in the pictorial representation, the vertical intercept in the graphical representation, and the constant in the pattern rule representation;   ♦ **reasoning** to determine a concrete representation for position zero;   ♦ **selecting tools** to determine a term in a linear relationship given its term number (e.g., extrapolating a line).

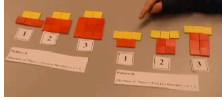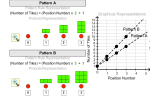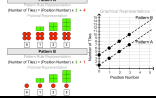| Activity Number/Type	Activity Title	Math content
2.1 Minds On	Rocket Rules	Students will: • investigate linear growing patterns that have both a constant part and a multiplier • show that a pattern rule works numerically for a given pictorial representation of a rule • investigate how a pictorial representation of a pattern rule will change when the multiplier is changed and/or the constant is changed • use the terms 'growing part' and 'constant part' to describe parts of a pattern rule
2.2 Action	Position 0 and Beyond 1) Pattern Rule Representation (Number of Tiles) = (Position Number) x 4 + 2 2) Pictorial Representation 3) Graphical Representation	Students will: • build position 0 of a pattern rule given positions 1, 2, and 3 • reflect on how the pattern rule can be used to determine the number of tiles in position 0 • graph a linear growing pattern starting at position zero, given the pictorial representation • define the term 'vertical intercept' and connect the vertical intercept to parts of the pictorial and pattern rule representations • use the graph of a pattern rule to determine the number of tiles in a given position • reason that graphs can be used to estimate terms given large position numbers, but that a pattern rule will can given an exact answer
2.3 Consolidate	Check Your Understanding	Students will: • determine the constant part of a pattern rule given a pictorial representation or a graphical representation • match a pattern rule and the number of tiles in position 0 of that same pattern • practice determining the vertical intercept of a graph given the pattern rule • select a pictorial representation of a pattern rule that has either the same constant or the same multiplier as a given rule. • select graphs that do not represent linear growing patterns • match graphs to a given pattern rule

2.4 Consolidate	Practice Graphing	Students will: • create graphical representations of linear growing patterns, given a pictorial representation • use the graphical representation to determine the number of tiles needed to build position 10 in the pattern rule
2.5 Show What You Know		
2.5.1 Performance Assessment	Practice Graphing	Students will: • create graphical representations of linear growing patterns, given a pictorial representation • use the graphical representation to determine the number of tiles needed to build position 10 in the pattern rule
2.5.2 Assessment Game	Who's With Whom? (printable)	Students will: • play a game where they roll pattern cubes to match 3 representations of a linear growing pattern
2.5.3 Assessment Game	Zero 'n' Five (printable)	Students will: • match the graphical representation of a pattern with the number of tiles in positions 0 and 5
2.5.4 Assessment Game	Memory Match Game	Students will: • practice matching different representations of linear growing patterns
2.5.5 Written Assessment	R.A.F.T. (offline)	Students will: • create a poem to show the connections between a pictorial representation and a graphical representation

CLIP 3: Comparing Families of Linear Growing Patterns

Critical Learning:
♦ **reasoning** how similarities and differences in pictorial patterns, the pattern rules, or the graphical representations of a linear growing pattern family (with either the same constant or the same multiplier) connect to parameters in a different representation of the same linear growing pattern family.

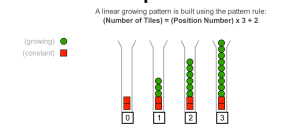| Activity Number/Type	Activity Title	Math content
3.1 Minds On	Comparing Pattern Rules	Students will: • reflect on 2 linear growing patterns created by interchanging the values used for the multiplier and constant • reflect on different ways to create a pictorial representation of a given pattern rule
3.2 Action	Same Constant – Different Multiplier	Students will: • investigate similarities and differences in linear growing patterns that have the same constant • reflect on reasons for changes in the graphical and pictorial representations when the multiplier is increased or decreased in a pattern rule
3.3 Action	Different Constant – Same Multiplier	Students will: • investigate similarities and differences in linear growing patterns that have the same multiplier • reflect on reasons for changes in the graphical and pictorial representations when the constant is increased or decreased in a pattern rule
3.4 Consolidate	Check Your Understanding	Students will: • make connections between the various representations of linear growing patterns, focussing on the similarities and differences between the patterns that have either the same multiplier or constant
3.5 Show What You Know		
3.5.1 Assessment Game	Hex-Ominoes "Domino" Game (offline)	Students will: • match linear growing patterns that share a feature (constant, multiplier, etc)
3.5.2 Assessment Demonstration	Exploring Different Representations	Students will: • predict either a pattern rule representation, pictorial representation or graphical representation of a linear growing pattern, given one of those representations • explain the role of the constant and multiplier of a pattern rule using different representations of pattern rules
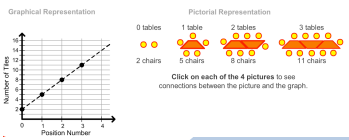
3.5.3 Assessment Organizer	Rainbow Patterns (offline or using IWB)	Students will: • use graphical representations of pattern rules that share either a constant or a multiplier to communicate similarities and differences in the pattern rules.
3.5.4 Assessment Think Aloud	Check Your Understanding Think Aloud	Students will: • communicate their thinking while completing activity 3.4
3.5.5 Assessment Organizer	Frayer Model (offline or using Smart Ideas)	Students will: • create a Frayer model to summarize their understanding of concepts and vocabulary associated with linear growing patterns

CLIP 4: Building Patterns and Telling Stories from Graphs

Critical Learning:
♦ **representing** the graph of a linear growing pattern in a variety of ways concretely and as a pattern rule in words and symbols;
♦ **connecting** concrete or pictorial or graphical representations of linear growing patterns to real-life contexts.

Activity Number/Type	Activity Title	Math content
4.1 Minds On	Whoops! Damage Repair	Students will: • review the meaning of the terms 'constant', 'multiplier' and 'linear growing pattern' • reflect on how a graph can be used to determine the number of tiles needed for different positions of a linear growing pattern
4.2 Action	Building Patterns from Graphs A linear growing pattern is built using the pattern rule: (Number of Tiles) = (Position Number) x 3 + 2 (growing) (constant)	Students will: • build a pictorial representation of a pattern rule given the graphical representation • explore ways of determining the pattern rule of a linear growing pattern from a graphical representation • investigate similarities and differences in all 3 representations as the y-intercept or the multiplier is changed in a linear growing pattern • explore different pictorial representations of a pattern rule given in graphical form
4.3 Action	Telling Stories Telling Stories Graphical Representation Pictorial Representation 0 tables 1 table 2 tables 3 tables 2 chairs 5 chairs 8 chairs 11 chairs Click on each of the 4 pictures to see connections between the picture and the graph.	Students will: • determine the pattern rule for a linear growing pattern given a graphical representation • rename a pattern rule after renaming the axis of a graph to represent a real life situation • investigate the meaning of the vertical intercept in the context of the real life situation • build a pattern from a graph to represent the given context • investigate how pictorial, graphical and pattern rule representations can be used to solve problems and answer questions • select a story to match a given graph • explore connections between a graph and a story as the numbers in the story increase or decrease
4.4 Consolidate	Check Your Understanding	Students will: • practice determining the pattern rule for a linear growing pattern from a graph • practice building a pictorial representation of a linear growing pattern from a graph • connect different pictorial representations that have the same pattern rule • practice matching patterns that have parallel trend lines • practice matching a graphical representation of a linear growing pattern to a story
4.5 Show What You Know		

4.5.1 Performance Assessment	Exploring Different Representations	Students will: • practice predicting the story, pattern rule, graphical representation or pictorial representation of a pattern given at least one of these representations
4.5.2 Assessment Demonstration	Real Life Contexts (offline)	Students will: • create their own graph of a linear growing pattern and then write the pattern rule and a context for the graph they created
4.5.3 Assessment Think Aloud	Check Your Understanding Think Aloud	Students will: • communicate their thinking while completing activity 4.4
4.5.4 Assessment presentation	Choice Board Tasks (offline)	Students will: • choose how they would like to demonstrate their understanding of linear growing patterns from a set of options given on a choice board.