LessonTitle: Patterns and Rules **Pre 6.2**

Utah State Core Standard and Indicators Algebra Content Standard 2 Process Standards 1-5

Summary

In this lesson, students analyze number patterns found in sequences of coordinate pairs. They describe the pattern and create a rule. They are asked to differentiate between a constant pattern of growth (linear) and an exponential pattern. In the assessment activity, students generate numeric patterns from geometric drawings, then describe the growth pattern and write a rule.

Enduring Understanding	Essential Questions
Mathematical patterns are found everywhere in the real world. We can communicate about these patterns using mathematical conventions.	How do mathematical patterns relate to the real world? How do you communicate about and use patterns to solve problems?

Skill Focus	Vocabulary Focus
• Finding patterns • Finding the sequence rule • Determining a formula for a pattern	

Assessment

Materials

Launch ideas: See the warm-up below if your students need to learn to solve for y.

"[one member of the group] in particular loved the Families of Equations worksheet. He said it was the most successful assignment he's done all year."

Explore

Summarize

Apply

Directions:
This activity should definitely be done in student cooperative groups!

Do one or two problems to model the process of finding a sequence rule, predicting the 10^{th} number and generating an equation from the sequence rule. Then circulate among the groups and coach them in the problem solving process (without giving away the process or solution).

The third page involves a different kind of pattern. $y = x^2$. The last (challenge) problem is $y = 2^x$.

Through discussion the class should come up with some version of the following three families of growth patterns. You may choose to only examine the first two.

1. Repeated addition of the same number. (Ask students what you can do instead of adding repeatedly.)You may wish to call it ***Repeated Addition*** or you could refer to it as a ***Constant Growth Rate*** or as an ***Arithmetic Sequence***
2. Repeated multiplication of the same number. ($y = x^2$ or $y = x^2$)You may wish to call it ***Repeated Multiplication*** or a ***Geometric Sequence***.
3. Repeated doubling. ***($y = 2^x$)*** (This is also repeated multiplication a geometric sequence—a special one) You may wish to call it ***Repeated Doubling*** or you could refer to it as a ***Binary Sequence***.

The assessment included below should also be done in groups.

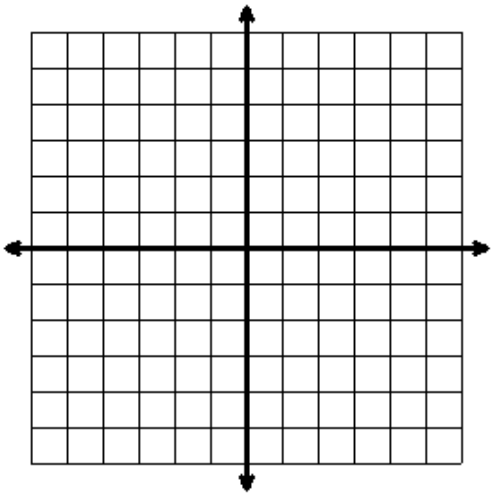
The extra for experts should only be given to the exceptional student.

Pre 6.2a Warm-up

Complete the table. Graph the coordinate points.

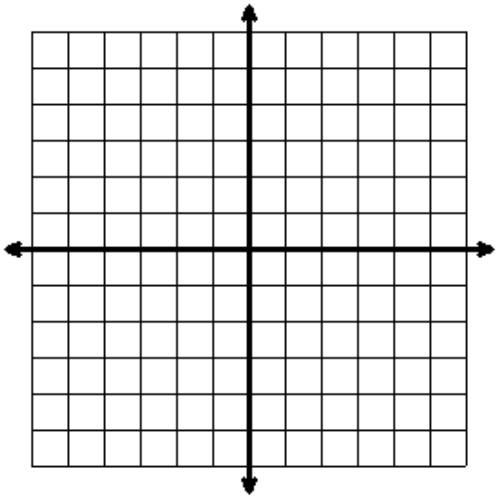
1. $y = x + 3$

x	x + 3	y	(x,y)
-2			
-1			
0			
1			
2			
____			



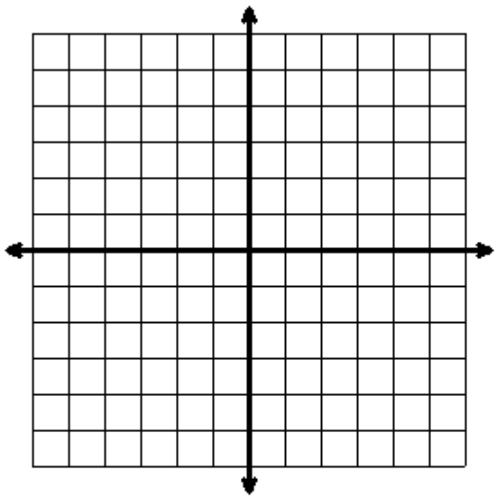
2. $y = 2x - 1$

x	x + 3	y	(x,y)
1			
2			
3			
4			
5			
____			



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

x	x + 3	y	(x,y)
0			
2			
4			
6			
____			



Pre 6.2a Patterns and Rules

Finding equations from sequence patterns

1) Find another coordinate pair that fits the pattern.
2) Describe the patterns.
3) Write the pattern in a y = _____ rule.
4) Predict the 10^{th} number.

1) x	y
1	2
2	4
3	6
10	___

Describe the pattern

y = _____

2) x	y
2	6
3	9
4	12
10	___

Describe the pattern

y = _____

3) x	y
2	6
4	10
6	14
10	___

Describe the pattern

y = _____

4) x	y
3	11
4	14
5	17
10	___

Describe the pattern

y = _____

5) x	y
5	8
6	10
7	12
10	___

Describe the pattern

y = _____

6) x	y
3	5
5	9
9	17
10	___

Describe the pattern

y = _____

7) x	y
7	12
9	14
11	16
10	___

Describe the pattern

y = _____

8) x	y
5	13
20	43
100	203
10	___

Describe the pattern

y = _____

9) x	y
4	1
8	2
12	3
10	___

Describe the pattern

y = _____

10) x	y
6	3
10	5
14	7
10	___

Describe the pattern

y = _____

11) x	y
2	4
3	9
4	16
10	___

Describe the pattern

y = _____

12) x	y
1	1
2	4
3	9
10	___

Describe the pattern

y = _____

What could you say about all of the patterns you have observed so far?

What would the graphs of these patterns look like?

There are three different kinds of patterns on this page. When you face a different pattern, be prepared to shift your thinking. **The last two problems are an extra challenge.**

13) x	y
4	14
5	17
6	20
10	___

Describe the pattern

y = _____

14) x	y
1	4
2	7
3	10
10	___

Describe the pattern

y = _____

15) x	y
1	2
2	8
3	9
10	___

Describe the pattern

y = _____

16) x	y
2	8
3	27
4	64
10	___

Describe the pattern

y = _____

17) x	y
2	5
3	10
4	17
10	___

Describe the pattern

y = _____

18) x	y
1	2
2	4
3	8
10	___

Describe the pattern

y = _____

Describe the different kinds of patterns you found on this page.

How would the graphs of these patterns be different?

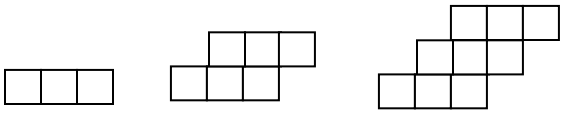
Pre 6.2b Pattern and Function Families Assessment

Name_____

Observe the pattern and fill in the stages and totals.
Then write the sequence rule, figure out the formula and the 10^{th} stage total.

1) Count the squares in the stair-steps.
Sequence Rule: 10^{th} number

_____ _____



stage 1 stage 2 stage 3

stage (x)	total squares (y)

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

2) Count the edges of squares above.
. (where 2 square meet is 1 edge)
Sequence Rule: 10^{th} number

_____ _____

stage (x)	total edges (y)

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

3) Count the triangles.
Sequence Rule: 10^{th} number

_____ _____

stage 1 stage 2 stage 3

stage (x)	total triangles (y)

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

4) Count the edges of the triangles.

stage (x)	total (y)

Sequence Rule: 10^{th} number

_____ _____

stage 1 stage 2 stage 3

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

5) Paper Tearing: Begin with 1 piece of paper at stage 1. For stage 2, tear it in 2 pieces. For each succeeding stage tear each piece of paper into two. Keep track of the total pieces of paper.

Sequence Rule: 10^{th} number

_____ _____

Stage (x)	total pieces (y)
1	1
2	2

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

6) Gossip: One student tells three other students a secret. These three students each tell three more students. Keep track of the total people who know the secret.

Sequence Rule: 10^{th} number

_____ _____

1 4 ____ ____ ____

stage (x)	total (y)
1	1
2	4

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

Extra for experts:

Fibonacci rabbits (Babies come in pairs, It takes 2 months before new pairs can have babies. But after that, rabbits can have a pair of babies every month.)

Sequence Rule: 10^{th} month number stage (x) | total rabbits (y)

_____ _____

1 mo,1 pr 2 mo,1 pr 3 mo, _____ _____ _____ _____

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

Handshakes: Students enter the room one at a time. As each student enters it is a new stage. Each student shakes hands with every other student in the room once (no repeats). How many handshakes?

Sequence Rule: _____number (no. of students in the class)

_____ _____ (total handshakes)

1 student, 0 handshakes 2 st, 1 hs 3 st, 2 hs _____ _____ _____

Describe the pattern_____ equation: y =_____

Describe what the graph would look like _____

stage (x) total shakes (y)