⓪ WARM-UP ACVITITY

BIG IDEAS: Identifying Patterns, Making Connections, Algorithms

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Step #1: Using the last two digits of your phone number, create a two digit number.

Step #2: If the number is even, then divide it by 2 and record the result.
If the number is odd, then multiply it by 3 and add 1 and record the result.

Step #3: With the new number you just wrote down, repeat step #2.

Example: 58 → 58 ÷ 2 = 29

29 → (3 × 29) + 1 = 88

88 → 88 ÷ 2 = 44

44 → 44 ÷ 2 = 22

22 → 22 ÷ 2 = 11

11 → (3 × 11) + 1 = 34

⋮   ⋮

1. **How long could you continue this procedure?**

2. **What do you think would happen if you continued doing this?**

Extension Ideas/Further Exploration
- Would starting with a negative number affect the result?
- Given a start value, can you predict how long it will take to enter the cycle?
- Are there other algorithms that generate different cycles?

QUICK START ≫ ANIMAL SURVIVAL

BIG IDEAS: Visual Representations, Equivalence, Appearance vs. Structure

source of this activity: http://www.colorado.edu/education/DMP

The zoo keeper of a major zoo wants to redo the zoo in such a way that the animals live together in their natural habitat. Unfortunately, it is not possible to put all the animals together in one location because some are predators of others. The X marks in the chart at right show a predator-prey relationship, so those pair of animals cannot be safely placed in the same location.

Create a graph that represents the relationships indicated in the chart.

	A	B	C	D	E	F	G	H
A		X			X			
B	X			X			X	
C								X
D		X				X		
E	X							
F				X				
G		X						
H			X					

Some Connections/Ideas for Extensions

- What is the minimum number of locations required to safely house all of the animals?
- If the graph represented a computer network, what are the most crucial edges?
- If you needed to deliver items to 6 different classrooms, what would be the most efficient route?

❷ ACTIVITY: SPROUTS
BIG IDEAS: Quantifiable Differences, Data Collection & Analysis, Pattern Recognition

The Game of Sprouts was invented in 1967 by Princeton mathematician John H. Conway and by Michael S. Paterson, when both were at the University of Cambridge in the UK.

With a partner, play a couple of Sprouts game that begins with 3, 4, or 5 vertices.

Determine the maximum number of moves possible in a Sprouts game that begins with 42 vertices.
**(without actually playing a game with that many vertices)**

Some Connections/Ideas for Extensions
- What would happen to the game if you changed some of the rules?
- How could you figure out if there is a winning strategy?
- How are Sprouts games connected to 3-dimenional nets and Euler?

❸ QUICK START ≫ CALCULATOR DECEPTION

BIG IDEAS: Partitions, Divisibility Rules, Precision of Technology

Below is a screen capture from a division calculation done using a TI-84 calculator.
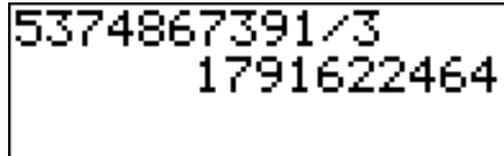
```
5374867391/3
         1791622464
```

Discuss at least two different ways that you can show that the calculator is providing false information.

Some Connections/Ideas for Extensions

- What is "casting out nines" and why was it important before computing devices?
- Is there a divisibility rule for multiples of 7?
- What are some algorithms for determining if a number is prime or composite?

❹ ACTIVITY: UNLUCKY 13
BIG IDEAS: Organizing Patterns, Modular Arithmetic, Containing the Infinite, Proof

What is the maximum number of times Friday the 13th that can occur within a single January to December calendar year? Show/Explain your method.

Is it possible to not have a Friday the 13th within a single January to December calendar year? Show/Explain your method.

Some Connections/Ideas for Extensions
- How can you tell if a book ISBN number is valid or not?
- What is Goldbach's Conjecture and how is it related to partitions?
- How do you deal with negative numbers in a modular system?

You are planning your holiday visit with family in who live in 5 different cities.
Below is a matrix of the names and distances between these 5 cities.

```
                        |    1     2     3     4     5
------------------------+------------------------------
1 Tampa FL              |         10    27     6    15
2 Seffner FL            |   10          30    15     6
3 Clearwater FL         |   27    30          22    30
4 Lutz FL               |    6    15    22          19
5 Brandon FL            |   15     6    30    19
```

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1. **If you plan to stay with your family in Lutz, in what order should you visit each of the other cities in order to minimize your travelling distance?**

2. **If you wanted to achieve the absolute minimum traveling distance for visiting each city, where should your plan to stay?**

❻ **CHALLENGE ACVITITY**
BIG IDEAS: Identifying Patterns, Making Connections, Algorithms

The letters in the phrase "What is Discrete Math" have been scrambled and placed in groups of three.

Scramble #1:	H T A	T E M	E R C	D I S	S I T	W H A
Scramble #2:	W E T	H R E	A CM	T S A	I I T	S D H
Scramble #3:	S T E	DMA	I T T	H AW	R E I	S CH
Scramble #4:	A HW	T M E	I A T	S T E	D H R	I S C

One of the scrambles was generated by randomly selecting the message letters from a hat while the other three scrambles were generated using an algorithm based on a basic geometrical concept.

1. **Identify which is the random selection scramble and explain how/why you arrived at your decision.**

2. **What geometrical concept was central to the scrambling algorithm?**

Some Connections/Ideas for Extensions
- How would using other shapes affect the scrambling algorithm?
- How many total possible ways are there for scrambling the letters in the phrase?
- What are some modifications could you make to the scrambling algorithm?