## If Aliens TAUGHT ALGEBRA MULTIPLICATION AND DIVISION WOULD BE OUT OF THIS WORLD! <br> GRADE 3 <br> THIRD EDITION



## STUDENT MATHEMATICIAN NOTEBOOK

$\qquad$
UNIVERSITY OF CONNECTICUT
JUNE 2019

# The National Research (enter On the GIFTED AND TALENTED (2008-2013) <br> FIRST EDITION 

Shelbi Cole
Lisa DaVia Rubenstein
Cindy M. Gilson
Micah N. Bruce-Davis
E. Jean Gubbins

Rachel R. McAnallen
Siamak Vahidi
University of Connecticut
Storrs, Connecticut

## JUNE 2013

## Thinking Like MATHEMATICIANS: <br> CHALLENGING ALL GRADE 3 StUDENTS SECOND EDITION

Shelbi Cole
Lisa DaVia Rubenstein
Tutita M. Casa
Cindy M. Gilson
Micah N. Bruce-Davis
E. Jean Gubbins

Alexis Melendez
Hannah F. Brown
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# THE NATIONAL RESEARCH CENTER ON THE GIFTED AND TALENTED (2008-2013) 

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University of Connecticut Dr. Joseph S. Renzulli, Director
Dr. E. Jean Gubbins, Associate Director
Dr. D. Betsy McCoach
Dr. Sally M. Reis
Dr. M. Katherine Gavin

University of Virginia

Dr. Carolyn M. Callahan, Associate Director

Dr. Tonya R. Moon
Dr. Amy Azano
Dr. Sarah Oh

Visit us on the web at
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## Thinking Like Mathematicians: Challenging All Grade 3 Students

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University of Connecticut<br>Dr. E. Jean Gubbins, Principal Investigator<br>Dr. Aarti Bellara, Co-principal Investigator<br>Dr. Tutita Casa, Co-principal Investigator<br>Dr. Bianca Montrosse-Moorhead, Co-principal Investigator<br>Visit us on the web at<br>https://thinkinglikemathematicians.uconn.edu

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## Famous Mathematicians

Leonardo Fibonacci (pronounced fee-bow-NAWH-chee) c. 1170c. 1250

Leonardo Fibonacci was born in Pisa, Italy, the same place as Galileo Galilei. His father was a merchant who sold goods to North Africa. Leonardo watched the merchants carefully and learned much about money and numbers from them. Leonardo traveled with his father to North Africa. This is where Leonardo learned a new system of numbers that was much easier than the system of numbers he had learned in Europe. He wrote a book about these numbers and introduced them to Europe. Leonardo loved animals. He also studied the patterns on the outside of pineapples. Because of his love of studying patterns, Leonardo discovered a series of numbers that is now called the Fibonacci Sequence. He also studied spiders and dogs and wrote mathematics problems about them. Leonardo wrote 6 books in all and came up with many theories, or ideas, about numbers. Leonardo became so famous that he became friends with the Emperor, and a statue was built of him that still exists to this day. Today there is a magazine about mathematics named after Fibonacci.

Diophantus of Alexandria (pronounced dy-oh-FAN-tuhs)
Diophantus of Alexandria was born in Greece over 1,800 years ago. He lived in Alexandria, Egypt, one of the mathematics centers of the ancient world. Here he studied numbers and came up with many theories about equations. He even invented symbols to represent numbers. He is known as the Father of Algebra. Diophantus wrote 13 books about these theories and inspired many great future mathematicians. One of his books survived over 1,500 years and taught many Europeans about algebra. It is considered the greatest Greek mathematics book in history. A Greek mathematician wrote a book about Diophantus that contained number games and strategy puzzles. One of these riddles is famous and is still difficult to solve, even to this day. Diophantus was married and had a son. Diophantus lived to be 84 years old when most men in his day only lived to be 40 years old.

Sonya Kovalevsky (pronounced koh-vuh-LEHV-skee) 1850-1891 Sonya Kovalevsky was born in Moscow, Russia. She is considered one of the brightest female mathematicians since Hypatia. She always loved math. Her father did not believe girls should study math, and he made her leave school at 13 years old. Sonya studied secretly. She borrowed a math book from a neighbor. Sonya showed her neighbor what she learned easily. The neighbor convinced Sonya's father to let her return to school. Sonya learned geometry and calculus in a few months. She was so good at math that she was one of the first women to earn the highest degree from the local university. Sonya is a true example of an expert mathematician.

## Lesson 1 Student Pages

Planet Nine Alien Helper $\qquad$ Date $\qquad$

## Spaceship Seats

The Planet Nine aliens are getting ready for their long trip. They are boarding and packing their ship.
They need your help to know . . .
How many Planet Nine aliens are ready to go?


1. How many Planet Nine aliens are on board? How do you know?

2. What is another way you could figure out how many Planet Nine aliens are on board?
3. How many more Planet Nine aliens could board?


4
$\qquad$
$\qquad$

## Spaceship Seats Challenge

The Planet Nine aliens are getting ready for their long trip.
They are boarding and packing their ship.
They need your help to know . . .
How many Planet Nine aliens are ready to go?


1. How many Planet Nine aliens are on board? How do you know?

2. What is another way you could figure out how many Planet Nine aliens are on board?
3. How many more Planet Nine aliens could board?

$\qquad$

## Packing Party for Earth



The Planet Nine aliens are packing for their trip to Earth. The young Planet Nine aliens have 2 types of toys: Wombles and Snufplets. Their parents are only allowing them to bring a total of 10 toys. What are all the possible combinations they could pack? You may need to use the next page.

| Wombles | $\pm$ | Snufplets | $=10$ |
| :---: | :---: | :---: | :---: |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | $\pm$ |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | $\pm$ |  | $=10$ |


$\qquad$
$\qquad$

## Packing Party for Earth (Continued)

| Wombles | + | Snufplets | $=10$ |
| :---: | :---: | :---: | :---: |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |
|  | + |  | $=10$ |

1. How do you know if you have all the possible combinations?


Several of the young Planet Nine aliens decided on their toy combination. You can see their packing list below. Fill in the missing numbers so that each Planet Nine alien is taking 10 toys.

## OFFICIAL PACKING LIST

| Planet <br> Nine <br> Alien | $\square$ | + |  | $=10$ |
| :---: | :---: | :---: | :---: | :---: |
| Jombles |  |  |  |  |
| Snufplets |  |  |  |  |

2. How many Wombles in all are being packed? Hint: Could you group the Wombles to make 10s? You can use this strategy for any addition problems because it is easier to add 10s.
3. How many Snufplets in all are being packed?
4. If you have some extra time, draw a picture of a Womble and a Snufplet. What would these Planet Nine alien toys be like?


## Super Challenges

## Super Challenge 1

Think about the possible combinations of toys if the Planet Nine aliens had a third toy, the Lululo.

Wombles + Lululos + Snufplets $=10$
How many different combinations are possible? You can't have the same number of Wombles, Lululos, and Snufplets. (e.g., $5+4+1=10$ )

How do you know you have every possible combination?

Does adding a third toy increase or decrease the number of combinations?

## Super Challenge 3



Cut out the 9 triangles on page 17 and try to create a triangle that looks like the one below. The touching sides must add up to 10. (Hint: Grey sides will match with grey sides, white with white, and black with black.)


## Super Challenge 2

What numbers would make these number sentences true? (Hint: There are many possible answers!)


## Super Challenge 4

Add all of the numbers in the boxes together. Think about making 10s to make your addition easier. (Hint:
Cross off numbers when you use them.)

| 1 | 4 | 2 | 9 | 12 |
| :--- | :--- | :--- | :--- | :--- |
| 3 | 6 | 5 | 6 | 7 |
| 5 | 4 | 6 | 2 | 8 |
| 2 | 3 | 8 | 7 | 6 |
| 3 | 5 | 7 | 10 | 5 |



## Triangles for Super Challenge 3


$\qquad$ Date $\qquad$

## Breaking it Down Practice

Directions: Use what you learned today about the pieces of 10 to add these numbers.

Sample:
$8+5=$
Start with: 8
Need_2 to equal 10. *Think: $2+8$ equals 10.
Add on remainder: +3*Think: $5-2=3$, so $3+10=13$
Total: 13

1. $7+9=$

Start with:
Need $\qquad$ to equal 10.

Add on remainder:
Total:
2. $8+6=$

Start with:
Need $\qquad$ to equal 10.

Add on remainder:
Total:
3. $5+6=$

Start with:
Need $\qquad$ to equal 10.

Add on remainder:

Total:

$\qquad$ Date $\qquad$

## Breaking it Down Practice 2

Directions: Use what you learned today about the pieces of 10 to add these numbers.

Sample:
$8+5=$
Start with: 8
Need _2 to equal 10.
Add on remainder: +3
Total: 13

1. $9+9=$

Start with:
Need $\qquad$ to equal 10.

Add on remainder:
Total:
2. $18+6=$

Start with:
Need $\qquad$ to equal 20.

Add on remainder:
Total:
3. $15+9=$

Start with:
Need $\qquad$ to equal 20.

Add on remainder:

Total:

## My Mathematical Thinking


$\qquad$ Date $\qquad$

## The Magical Number 110

The answer is 10 . What is the question?

Think of 10 different ways to equal 10. Try to think of a unique way that no one else in your class will think of!

Examples: $1+2+4+3=10$ or $42-32=10$

## My Mathematical Thinking



## Lesson 2 Student Pages

Invention Expert $\qquad$ Date $\qquad$

## Understanding the ALIEN-R2200—Fibonacci

Directions: Your task is to figure out how the ALIEN-R2200 operates.

| IN | OUT |
| :---: | :---: |
| 48 | 50 |
| 32 | 30 |
| 19 | 20 |
| 67 | 70 |
| 64 | 60 |
| 23 | 20 |
| 35 | 40 |

1. Let's take the first set of numbers. When 48 went in, it came out 50 . Color 48 green and 50 red on the number line and draw an arrow from 48 to 50.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |  |  |  |  |

What could be happening?
2. Now let's take the second set. The number 32 was put through the machine and came out 30 . Color 32 green and 30 red on the number line and draw an arrow from 32 to 30 .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

What could be happening?

3. Now let's take the third set. The number 19 was put through the machine and came out 20 . Color 19 green and 20 red on the number line and draw an arrow from 19 to 20.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

What could be happening?

$\qquad$ Date $\qquad$

## Understanding the ALIEN-R2200— Diophantus

Directions: Your task is to figure out how the ALIEN-R2200 operates.

| $\mathbf{I N}$ | OUT |
| :---: | :---: |
| 48 | 50 |
| 32 | 30 |
| 49 | 50 |
| 67 | 70 |
| 64 | 60 |
| 73 | 70 |

1. Let's take the first set of numbers. When 48 went in, it came out 50 . Color 48 green and 50 red on the number line and draw an arrow from 48 to 50.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

What could be happening?
2. Now let's take the second set. The number 32 was put through the machine and came out 30 . Color 32 green and 30 red on the number line and draw an arrow from 32 to 30 .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

What could be happening?
3. What do you think would happen if you put the number 35 into the ALIEN-R2200?

$\qquad$ Date $\qquad$

## Understanding the ALIEN-R2200Kovalevsky

Directions: Your task is to figure out how the ALIEN-R2200 operates.

| IN | OUT |
| :---: | :---: |
| 48 | 50 |
| 32 | 30 |
| 19 | 20 |
| 67 | 70 |
| 64 | 60 |
| 23 | 20 |
| 35 | 40 |

1. What patterns do you notice about how certain numbers come out of the ALIEN-R2200?
2. What happens when a number with a 5 in the ones place is put into the ALIEN-R2200?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |  |  |  |  |

3. What is the effect of using $5 s$ in that way? What is a possible way to fix the problem when 5 s are always rounded up?


## Super Challenges

| Super Challenge 1 |
| :--- | :--- |
| BeBop said that rounding up seems to |
| be more popular than rounding down. |
| Do you think that is true? Give a few |
| examples of when you would want to |
| round up. | \(\left.\begin{array}{l}Think about a time when it would be <br>

better to round down than to round up. <br>
Draw a picture of this below with a <br>
caption.\end{array}\right\}\)

$\qquad$ Date $\qquad$

# Understanding Rounding 

 (Extra Practice)Color each given number on the number line. Draw an arrow from the given number to the 30 and the 40 . Decide which path is the shortest. This helps you decide how to round the given number. The first one has been done for you.

1. 34 rounds to $\qquad$

2. 31 rounds to $\qquad$

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

3. 39 rounds to $\qquad$

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

4. 37 rounds to $\qquad$

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |  |  |  |  |  |

5. 35 rounds to $\qquad$

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |



## On Your Own

Round each number to the nearest 10.
27
11 $\qquad$ 15
33
79 $\qquad$
48 $\qquad$ 62 $\qquad$ 54 20
6 $\qquad$


## Lesson 3 Student Pages

Shopper $\qquad$ Date $\qquad$

## A Planet Nine Alien Shopping Spree!Directions

Soland the mathematician would like to go on a shopping spree at Tommy's Toy Store! The toy store is located at the Amusement Park, so this is a special kind of toy store. Each customer gets to roll a die to see how many toys he/she can buy at one time. Soland would like to spend less than $\$ 100$ for each roll. Soland
 needs help from you and your partner.

1. Roll the die to see how many toys Soland can buy.
2. Help Soland decide which items she should buy that total less than $\$ 100$.
3. Estimate the cost of the items so Soland does not go over \$100 for each roll.
4. Next, use mental math to figure out the exact total for the items.
5. Show your work on the next page.


Number Cube-Diophantus


Number Cube-Kovalevsky


## Tommy's Toy Store

|  |  |  | $\$ 18$ |
| :---: | :---: | :---: | :---: |
| $\$ 65$ |  | \$14 |  |
| $\$ 28$ |  | $\begin{aligned} & 100 \\ & \$ 44 \\ & \hline \end{aligned}$ | $\$ 3$ |
|  |  |  | $\$ 9$ |
|  |  |  |  |

$\qquad$ Date $\qquad$

## A Planet Nine Alien Shopping Spree!Diophantus

| Items Placed in the Shopping Cart | Cost of the Items |
| :--- | :--- |
|  |  |
|  |  |
|  |  |

1. How did you estimate the total cost of all the items? Show your thinking here:
2. What is the exact cost of all the items? Show your thinking here:
3. Think of one other way to mentally add the numbers to find the exact cost. Keep in mind the different ways to equal 10.
4. How close was your estimate in \#1 to the exact cost you found in \#2?


Soland has another $\$ 100$ to spend in Tommy's Toy Store. The shopping spree continues! This time try to purchase different items. Roll again!

| Items Placed in the Shopping Cart | Cost of the Items |
| :--- | :--- |
|  |  |
|  |  |
|  |  |
|  |  |


5. How did you estimate the total cost of all the items? Show your thinking here:
6. What is the exact cost of all the items? Use decomposition. Show your thinking here:
7. Think of one other way to mentally add the numbers to find the exact cost. Keep in mind the different ways to equal 10.
8. How close was your estimate in \#5 to the exact cost you found in \#6?

## My Mathematical Thinking

$\qquad$ Date $\qquad$

## A Planet Nine Alien Shopping Spree!Kovalevsky

| Items Placed in the Shopping Cart | Cost of the Items |
| :--- | :--- |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



1. How did you estimate the total cost of all the items? Show your thinking here:
2. What is the exact cost of all the items? Show your thinking here:
3. Think of one other way to mentally add the numbers to find the exact cost. Keep in mind the different ways to equal 10.
4. How close was your estimate in \#1 to the exact cost you found in \#2?



Soland now has $\$ 150$ to spend in Tommy's Toy Store. The shopping spree continues! This time try to purchase different items. Roll again!

5. How did you estimate the total cost of all the items? Show your thinking here:
6. What is the exact cost of all the items? Use decomposition. Show your thinking here:
7. Think of one other way to mentally add the numbers to find the exact cost. Keep in mind the different ways to equal 10.
8. How close was your estimate in \#5 to the exact cost you found in \#6?

$\qquad$
$\qquad$

## Toy Store Wish List—Homework

Directions: Select any 5 different items from Tommy's Toy Store to put onto Soland's wish list and answer the questions below.

| Wish List | Cost of the Items |
| :--- | :--- |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



1. Estimate the total cost of all the items. How did you estimate the total cost of all the items? Show your thinking here:
2. What is the exact cost of all the items? Show your thinking here:
3. How close was your estimate in \#1 to the exact cost you found in \#2?


## Lesson 4 Student Pages

Name $\qquad$ Date $\qquad$

## Introduction to Equal Sides



1. What can you do to balance this scale? Remember: The weight on the left may not be moved or taken off the scale.
2. What if you were given 2 weights that needed to be placed on the right side? Where would you place them to make the scale balance?

Location: $\qquad$
Number Sentence: $\qquad$
3. Where else could you place the two weights on the right side?

Location: $\qquad$
Number Sentence: $\qquad$

$\qquad$
$\qquad$

## Equal Sides-Fibonacci



1. Your task is to make the balance level. Where would you need to place your weight if you only had 1 weight?

Location: $\qquad$
2. What if you had to use 2 weights on the right side?

Locations: $\qquad$
Number Sentence: $\qquad$
3. What if you had to use 3 weights on the right side?

Locations: $\qquad$
Number Sentence: $\qquad$

4. Create your own problem using 4 weights on four different numbers to make this scale balance. Write your number sentence below.


Number Sentence: $\qquad$

5. What do the weights on the left side add up to?
6. What is one way you could use 2 weights on the right side to balance the scale?

Locations: $\qquad$
Number Sentence: $\qquad$
7. What if you had to use 3 weights on the right side? Where would you place them?

Locations: $\qquad$
Number Sentence: $\qquad$


If you have time before the end of the lesson, think about this problem.

8. What if you could use as many weights as you wanted? How many would you use and where would you place them? Explain where you would place them to make the scale balance.

Location: $\qquad$
Number Sentence: $\qquad$
Explanation:

## My Mathematical Thinking


$\qquad$
$\qquad$

## Equal Sides-Diophantus



1. Your task is to make the balance level. Where would you need to place a weight if you only had 1 weight?

Location: $\qquad$
2. What if you had to use 2 weights on the right side?

Locations: $\qquad$
Number Sentence: $\qquad$
3. What if you had to use 3 weights on the right side?

Locations: $\qquad$
Number Sentence: $\qquad$


4. Create your own problem using 4 weights on four different numbers to make this scale balance. Write your number sentence below.

Number Sentence: $\qquad$
If you have time before the end of the lesson, think about these problems.

5. On the left side there are 2 weights under 5 , which means there are two 5 s or a total of 10 . Where could you place 2 weights on the right side to make the scale balance?

Locations: $\qquad$
Number Sentence: $\qquad$
6. What is another way you could place the 2 weights?

Locations: $\qquad$
Number Sentence: $\qquad$


7. What if you could use as many weights as you wanted? Explain your thinking.

Locations: $\qquad$
Number Sentence: $\qquad$
Explanation:

$\qquad$ Date $\qquad$

## Equal Sides—Kovalevsky



1. This scale has one weight under the 10 to make 10 pounds. Also, there are 2 weights under the 8 . That means there are two 8 -pound weights on the left side.

How much weight does the left side have? $\qquad$
2. Where could you place 4 weights on the right side to make the scale balance?

Locations: $\qquad$
Number Sentence: $\qquad$
3. What if you had to use six weights?

Locations: $\qquad$
Number Sentence: $\qquad$


4. How much weight does the left side have now? $\qquad$
5. Where would you place 4 weights on the right side to make the scale balance?

Locations: $\qquad$
Number Sentence: $\qquad$
6. Create your own problem using 4 weights on four different numbers to make this scale balance. Write your number sentence below.


Number Sentence: $\qquad$


If you have time before the end of the lesson, think about this problem.

7. Where would you place 5 weights on the right side to balance the scale?

Locations: $\qquad$
Number Sentence: $\qquad$
8. What is another way you could place 5 weights on the right side to balance the scale?

Locations: $\qquad$
Number Sentence: $\qquad$
9. What if you could use as many weights as you wanted? Explain your thinking. Locations: $\qquad$
Number Sentence: $\qquad$
Explanation:


Name $\qquad$ Date $\qquad$

## Equal Sides-Homework

Directions: Create your own problem using 8 weights on each side to make this scale balance. Write your number sentence below.


Number sentence: $\qquad$

Use the space below if you need it to work out this problem.

Challenge: Make each side total to 30.


## Lesson 5 Student Pages

Name $\qquad$ Date $\qquad$
Introduction to 100s Charts

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

$\qquad$ Date $\qquad$

## Where Did I Leave My Treasure?



Greetings Earthlings! I accidentally left my treasure map in your Student Mathematician Notebook. Could you give me directions to find my treasure? I am currently at 19.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 3 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

Record your directions here. Can you think of another way to describe how to get to the treasure that no one else will have?


Thank YOU Humans!
I am so grateful for these directions! Soon I will be running my 8 fingers through my long lost treasure!

$\qquad$
Treasure Hunt Directions for All Groups

|  | If you are the <br> treasure <br> hider, you <br> need to place <br> an "X" on your <br> 100s chart <br> where the <br> treasure is <br> hidden. Do not <br> show your <br> partner! Make <br> sure your <br> partner can not <br> see where you <br> hid the <br> treasure. After <br> your partner <br> tells you where <br> he/she is <br> starting, you <br> need to give <br> directions to <br> the treasure. | If you are the <br> treasure <br> finder, circle <br> the number <br> where you <br> started. You <br> can pick any <br> number. Tell <br> the hider where <br> you are <br> starting. Listen <br> carefully to <br> your partner's <br> directions. <br> When he/she is |
| :--- | :--- | :--- | :--- |
| finished giving |  |  |
| directions, tell |  |  |
| him/her where |  |  |
| you believe the |  |  |
| treasure is |  |  |
| hidden. |  |  |

Each person in the group should have at least one chance to hide the treasure and one chance to find the treasure. After everyone has a chance to do this, answer the questions. If you have more time, you can use the extra charts to play again. Good luck!

$\qquad$ Date $\qquad$
Treasure Hunt—Diophantus (Hider)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

I hid the treasure at $\qquad$ . My partner is starting at
$\qquad$ . Here are my directions to the treasure:


Treasure Finder $\qquad$ Date $\qquad$
Treasure Hunt-Diophantus (Finder)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

I am starting at $\qquad$ . After following my partner's directions, I believe the treasure is at $\qquad$ . Were you right? $\qquad$


## Treasure Hunt Questions-Diophantus

1. Did you find this task challenging? Why or why not?
2. How would you improve your directions?
3. Tutah just emailed you the following directions: Start at 97, subtract four 10 s, then subtract 5 , add one 10 , add 11 , subtract four 10s, and add 2. Where is her treasure buried? Could you give simpler instructions? If so, how?
4. Using your knowledge about 100s chart patterns, fill in the missing numbers in the boxes from the 100s chart.


Describe how you filled in the missing numbers.

$\qquad$ Date $\qquad$
Treasure Hunt-Extra Diophantus (Hider)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

I hid the treasure at $\qquad$ . My partner is starting at
$\qquad$ . Here are my directions to the treasure:

$\qquad$ Date $\qquad$

## Treasure Hunt-Extra Diophantus (Finder)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

I am starting at $\qquad$ . After following my partner's directions, I believe the treasure is at $\qquad$ .Were you right? $\qquad$

$\qquad$ Date $\qquad$

## Treasure Hunt—Kovalevsky (Hider)

| 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 |
| 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 |
| 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 |
| 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 |
| 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 |
| 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 |
| 96 | 97 | 98 | 99 | 100 |

I hid the treasure at $\qquad$ . My partner is starting at
$\qquad$ . Here are my directions to the treasure:


Treasure Finder $\qquad$ Date $\qquad$
Treasure Hunt-Kovalevsky (Finder)

| 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 |
| 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 |
| 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 |
| 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 |
| 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 |
| 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 |
| 96 | 97 | 98 | 99 | 100 |

I am starting at $\qquad$ . After following my partner's directions, I believe the treasure is at $\qquad$ .Were you right? $\qquad$

$\qquad$

## Treasure Hunt Questions—Kovalevsky

1. How is this 100s chart different from the one you were using in the beginning of the lesson? Describe some of the patterns you see.
2. What was the most challenging part about this task?
3. How would you improve your directions?
4. Tutah just emailed you the following directions: Start at 97, subtract four 5 s, then subtract 2 , add one 5 , add 2 , subtract four 5 s , and add 2 . Where is her treasure buried? Could you give simpler instructions? If so, how?
5. A new 100s chart just arrived that does not look like either of the charts you have been using. When you go down one column, the numbers increase by 7 . When you go diagonally down and to the right, the numbers increase by 8 . When you travel diagonally down and to the left, the numbers increase by 6 . How many numbers are in each row of this chart?
6. Using your knowledge about 100s charts that have 5 numbers in each row like you used for your treasure hunt, fill in the missing numbers in the boxes from the 100s chart.


Describe how you filled in the missing numbers.

$\qquad$ Date $\qquad$

## Treasure Hunt—Extra Kovalevsky (Hider)

| 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 |
| 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 |
| 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 |
| 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 |
| 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 |
| 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 |
| 96 | 97 | 98 | 99 | 100 |

I hid the treasure at $\qquad$ . My partner is starting at
$\qquad$ . Here are my directions to the treasure:


Treasure Finder $\qquad$ Date $\qquad$
Treasure Hunt-Extra Kovalevsky (Finder)

| 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 |
| 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 |
| 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 |
| 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 |
| 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 |
| 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 |
| 96 | 97 | 98 | 99 | 100 |
|  | 97 |  | 7 |  |

I am starting at $\qquad$ . After following my partner's directions, I believe the treasure is at $\qquad$ .Were you right? $\qquad$

## My Mathematical Thinking

$\qquad$ Date $\qquad$
Extra 100s Chart

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

## Super Challenges

| Super Challenge 1 <br> Complete the 100s chart. (Hint: This chart has 5 numbers in each row.) |  |  | Super Challenge 2 <br> Complete the 100s chart. (Hint: This chart has 5 numbers in each row.) |  |
| :---: | :---: | :---: | :---: | :---: |
| 81 |  |  |  |  |
|  |  |  | 33 |  |
|  |  | 95 |  |  |
| Sup | alle |  | Super Chall |  |
| Complete the This chart each row.) | 10 n | rt. (Hint: bers in | Complete the 100s this chart has 7 nu each row.) | t. (Hint: ers in |
| 16 |  |  |  |  |
|  |  |  |  |  |
|  | 38 |  |  | 28 |


$\qquad$

## Pattern Mysteries—Homework

1. Tutah just texted you the following directions: Start at 29, add three 10 s, then subtract 4 , add 11 , add two 10 s, and add 3 . Where is her treasure buried? Could you give simpler instructions? If so, how?
2. It is now your turn to hide the treasure! Decide where the treasure should be buried and write the instructions. Remember to give the starting number.
3. Using your knowledge about 100s charts that have 10 numbers in each row like you used for your treasure hunt, fill in the missing numbers in the boxes from the 100s chart.


Describe how you filled in the missing numbers.


## Lesson 6 Student Pages

Pattern Seeker $\qquad$ Date $\qquad$
Multiples of Three
Directions: Color in only the multiples of three.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

Name $\qquad$ Date $\qquad$

## 100s Chart Pattern Language



Greetings Earthlings!
I love 100s charts! Describe the pattern you see when you color in the multiples of 3 .

$\qquad$

## Searching for Patterns-Fibonacci

1. Focus on the numbers that are circled. What do you notice?
2. What are these numbers multiples of? (Remember you can pretend to start on 0 and count to the first number. That will help you find the multiples of the numbers.)
3. Look at the numbers that have triangles in the corners. What do you notice?
4. What are these numbers multiples of?
5. What is the 5 th multiple of 3 ?
6. Look at both the triangles and circles. When do they overlap?

## My Mathematical Thinking


$\qquad$ Date $\qquad$
Searching for Patterns—Fibonacci (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

$\qquad$ Date $\qquad$

## Searching for Patterns-Diophantus

1. Focus on the numbers that have triangles in the lower left corner. What do you notice?
2. What are these numbers multiples of? (Remember you can pretend to start on 0 and count to the first number. That will help you find the multiples of the numbers.)
3. Look at the numbers that have suns. What do you notice?
4. What are these numbers multiples of?
5. Look at the numbers that have triangles around them. What do you notice?
6. What are these numbers multiples of?
7. What is the 4 th multiple of 9 ?
8. Look at all of the shapes. When do they overlap? What do you notice?

$\qquad$ Date $\qquad$

## Searching for Patterns-Diophantus <br> (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 22 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

$\qquad$ Date $\qquad$

## Searching for Patterns—Kovalevsky

1. Focus on the numbers that have clouds around them. What do you notice?
2. What are these numbers multiples of? (Remember you can pretend to start on 0 and count to the first number. That will help you find the multiples of the numbers.)
3. Look at the numbers that have a triangle in the top left corner. What do you notice?
4. What are these numbers multiples of?
5. Look at all of the shapes. When do they overlap? What do you notice?
6. If you were to color in the multiples of 3, which shape would be colored in most often? Least often?

$\qquad$ Date $\qquad$
Searching for Patterns—Kovalevsky
(Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 3 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 163 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 243 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 323 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 403 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 483 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 563 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 643 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 723 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 803 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 883 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 963 | 97 | 98 | 99 | 100 |

$\qquad$ Date $\qquad$
Extra 100s Chart

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

$\qquad$ Date $\qquad$
500s Chart

| 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 |
| 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 | 529 | 530 |
| 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 |
| 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 |
| 551 | 552 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 |
| 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 | 569 | 570 |
| 571 | 572 | 573 | 574 | 575 | 576 | 577 | 578 | 579 | 580 |
| 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 | 589 | 590 |
| 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 |

## Super Challenges

## Super Challenge 1

Soland does not like when a number has more than one symbol or color on it. Which chart would Soland like more?

- a chart with the multiples of 2 and 3 marked?
or
- a chart with the multiples of 2 and 4 marked?

Explain your answer.

## Super Challenge 3

Create a 100s chart pattern using a mathematical concept. For example, all the multiples of 3 or all the even numbers could be colored. You could even share it with a partner. Ask him/her if he/she can figure out your pattern.

## Super Challenge 2

Ask your teacher for a copy of the 500s chart. Compare the 500s chart with the 100s chart. What would happen if you colored in the multiples of 3 on both charts? (Hint: 600 is a multiple of 3.) Would the patterns look the same? What if you colored in the multiples of 5 ? Would the patterns be the same?

## Super Challenge 4

What if instead of the rows ending in multiples of 10s, the first row ended with multiples of 5 like this?

| 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |

What do the multiples of 2 look like in this new chart? How is it different from the 100 s chart?

$\qquad$
$\qquad$

## Searching for Patterns-Homework

1. What multiples are designated with the circle? The triangle?
2. What is the 6 th multiple of 9 ?
3. Choose a number between 1 and 20. Color in all the multiples of that number. You should not choose a multiple already designated.
4. Describe the patterns you see.
5. Which multiples share the most numbers?

$\qquad$ Date $\qquad$
Searching for Patterns-Homework
(Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | $(10$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 11 | 12 | 13 | $(14$ | 15 | 16 | 17 | 18 | 19 | $(20$ |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | $(40$ |
| 41 | $(42$ | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

## Lesson 7 Student Pages




## Getting to Know Planet Nine Aliens

A spaceship full of Planet Nine aliens has just landed in your backyard. As the first Planet Nine alien steps out, you notice that it has 1 head, 2 eyes, 6 toes, and 8 fingers. Use the table to keep track of the number of heads, eyes, toes, and fingers as the Planet Nine aliens get out of their spaceship.

| Number of <br> Planet Nine <br> Aliens | Number of <br> Heads | Number of <br> Eyes | Number of <br> Toes | Number of <br> Fingers |
| :---: | :---: | :---: | :---: | :---: |
| 0 |  |  |  |  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |
| 6 |  |  |  |  |
| 7 |  |  |  |  |
| 8 |  |  |  |  |
| 9 |  |  |  |  |
| 10 |  |  |  |  |
| 11 |  |  |  |  |
| 12 |  |  |  |  |
| 2 |  |  |  |  |

Name one strategy you used to find your answers.

## My Mathematical Thinking



1. Which column was the easiest to calculate? Explain why.
2. a. How many humans are in a group with 60 toes?
b. How many Planet Nine aliens are in a group with 60 toes?
c. If another group of Planet Nine aliens has 12 toes each, how many would be in a group with 60 toes? Show your work below.
3. Create your own Planet Nine alien species. Work with a partner to create a problem like the one you just did. You must name 3 body parts that the Planet Nine aliens have and tell how many of each body part they have. You MAY NOT use the numbers 1, 2, 6, 8, or 10.

YOUR STORY:


## YOUR TABLE TITLE:

| Number <br> of Planet <br> Nine <br> Aliens |  | Number of | Number of |
| :---: | :---: | :---: | :---: |
|  | n |  |  |
|  |  |  | Number of |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |

Name one strategy you used to find your answers.


## Planet Nine Alien Visit

Draw a picture of a Planet Nine alien from the species you created. Give him or her a name!

$\qquad$

## Getting to Know Planet Nine AliensHomework

Pick any starting number and count up by 2 s until you fill in all the lines.
$\qquad$
$\qquad$
$\qquad$
$\qquad$

$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
Count up by 10s starting from 13 until you fill in all the lines. 13


Fill in the missing boxes in the table.

| Number of <br> Planet Nine <br> Aliens | Number of <br> Heads | Number of <br> Eyes | Number of <br> Toes | Number of <br> Fingers |
| :---: | :---: | :---: | :---: | :---: |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 4 | 3 | 7 | 11 |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |

How did you find the number of toes for 4 Planet Nine aliens?

Count up by 6 s starting from 0 until you fill in all the lines.
$\qquad$
Count up by 12s starting from 0 until you fill in all the lines.
0


## Lesson 8 Student Pages

## Planet Nine Alien Manipulatives


$\qquad$ Date $\qquad$


Table A

| Number of <br> Planet Nine <br> Aliens | Multiplication <br> Problem Used to <br> Find Total | Commutative <br> Property <br> (Hint: Flip It!) | Total Number <br> of Eyes |
| :---: | :---: | :---: | :---: |
| 0 | $0 \times 2$ | $2 \times 0$ | 0 |
| 1 | $1 \times 2$ | $2 \times 1$ | 2 |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| 11 |  |  |  |
| 12 |  |  |  |


$\qquad$

## 4-Eyed Planet Nine Alien Multiplication Table

Table B


| Number of Planet Nine Aliens | Multiplication Problem Used to Find Total | Commutative Property <br> (Hint: Flip It!) | Total Number of Eyes |
| :---: | :---: | :---: | :---: |
| 0 | $0 \times 4$ | $4 \times 0$ | 0 |
| 1 | $1 \times 4$ | $4 \times 1$ | 4 |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| 11 |  |  |  |
| 12 |  |  |  |


$\qquad$
$\qquad$

## Multi-Eyed Planet Nine Alien Multiplication Table

Some students at The Oberon Academy have different numbers of eyes. For example, 2 students at The Academy have 3 eyes. How many eyes do the students have altogether?

Table C

| Number of <br> Planet <br> Nine <br> Aliens | Number of <br> Eyes | Multiplication <br> Problem <br> Used to Find <br> Total | Commutative <br> Property <br> (Hint: Flip It!) | Total <br> Number of <br> Eyes |
| :---: | :---: | :---: | :---: | :---: |
| 2 | 3 | $2 \times 3$ | $3 \times 2$ | 6 |
| 5 | 4 |  |  |  |
| 3 | 6 |  |  |  |
| 8 | 5 |  |  |  |
| 4 | 4 |  |  |  |
| 6 | 7 |  |  |  |
| 3 | 9 |  |  |  |
| 11 | 4 |  |  |  |
| 10 | 6 |  |  |  |
| 7 | 5 |  |  |  |
| 9 | 8 |  |  |  |
| 12 | 4 |  |  |  |
| 6 | 6 |  |  |  |



Human $\qquad$ Date $\qquad$

(Continued)


1. Why is the first answer the same in Tables $A$ and $B$ ?
2. How many 2-eyed Planet Nine aliens are in a group with 12 eyes?
3. How many 3-eyed Planet Nine aliens are in a group with 12 eyes?
4. How many 4-eyed Planet Nine aliens are in a group with 12 eyes?
5. Why is the answer the same for the inverse of each multiplication algorithm?
6. Can you get exactly 12 eyes in a group of 5 -eyed Planet Nine aliens? Explain.

$\qquad$ Date


Some students at The Oberon Academy have different numbers of eyes. How many eyes do the students have altogether? Create problems for yourself or ask someone to create them for you!

## Table D

| Number of <br> Planet <br> Nine <br> Aliens | Number of <br> Eyes | Multiplication <br> Problem <br> Used to Find <br> Total | Commutative <br> Property <br> (Hint: Flip It!) | Total <br> Number of <br> Eyes |
| :---: | :---: | :---: | :---: | :---: |
| 2 | 3 | $2 \times 3$ | $3 \times 2$ | 6 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |



Multiplication Chart

| $\mathbf{X}$ | $\mathbf{0}$ | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ | $\mathbf{5}$ | $\mathbf{6}$ | $\mathbf{7}$ | $\mathbf{8}$ | $\mathbf{9}$ | $\mathbf{1 0}$ | $\mathbf{1 1}$ | $\mathbf{1 2}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{0}$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $\mathbf{1}$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| $\mathbf{2}$ | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| $\mathbf{3}$ | 0 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| $\mathbf{4}$ | 0 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| $\mathbf{5}$ | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| $\mathbf{6}$ | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| $\mathbf{7}$ | 0 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| $\mathbf{8}$ | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| $\mathbf{9}$ | 0 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
| $\mathbf{1 0}$ | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| $\mathbf{1 1}$ | 0 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 |
| $\mathbf{1 2}$ | 0 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

## Picture This!

HUMAN
DATE $\qquad$
Directions: Glue the number of Planet Nine aliens needed to make 24 eyes for each group. Next, represent the total number of eyes using a multiplication and addition problem. Then, write a word problem.

| 2-Eyed Planet Nine Aliens |  | 4-Eyed Plan | t Nine Aliens |
| :---: | :---: | :---: | :---: |
| (Glue Planet Nine aliens here) |  | (Glue Planet Nine aliens here) |  |
| Multiplication Problem: | Repeated Addition: | Multiplication Problem: | Repeated Addition: |
| Multiplication Word Problem: |  | Multiplication Word Problem: |  |



## Picture This! Your Turn!

HUMAN
DATE $\qquad$
Directions: Now it is your turn to create your own multiplication problem. Represent your problem in pictures, numbers, and words.

| (Draw a Picture) |  |  |  |
| :--- | :--- | :--- | :--- |
|  |  | (Draw a Picture) |  |
| Multiplication Problem: | Repeated Addition: | Multiplication Problem: | Repeated Addition: |
| Multiplication Word Problem: |  |  |  |



## Planet Nine Alien Manipulatives for Picture This!




Name $\qquad$ Date $\qquad$

## Multiplication Problems-Homework

Directions: You will need to cut out the pictures of hands and sixpacks of soda cans on page 175 to complete your homework. Read each problem and solve it by pasting the appropriate number of pictures and writing a multiplication number sentence.

1. There are 4 humans in a room. How many fingers are in the room?

Paste your pictures here:

Multiplication problem with answer:
2. Warsu's mom goes to the store and buys 8 six-packs of soda. How many cans of soda does she buy?

Paste your pictures here:

Multiplication problem with answer:


## HANDS

|  |  |  |  |
| :---: | :---: | :---: | :---: |
| $2-\frac{10}{2}$ |  | $2$ | $2$ |

## SIX-PACKS OF SODA

|  |  |  |  |
| :---: | :---: | :---: | :---: |
|  |  |  |  |
|  |  |  |  |

## Lesson 9 Student Pages

"Array"nger $\qquad$ Date $\qquad$

## Acting Planet Nine Aliens Arrangement A

| Stage |  | Walkway |
| :--- | :---: | :---: |
| Walkway | Chairs go here |  |
|  |  |  |
|  |  |  |

"Array"nger $\qquad$ Date $\qquad$

## Acting Planet Nine Aliens

 Arrangement B

Chair Manipulatives

$\qquad$

## Marching Band Planet Nine AliensFibonacci

The Planet Nine aliens really like to perform. One group of Planet Nine aliens brought instruments. They would like to perform in the "Welcome to Earth" Celebration. Unfortunately, the bandstand that the Planet Nine aliens will be performing on cannot hold all the Planet Nine aliens. If 5 Planet Nine aliens can fit on each row and there are 4 rows, how many Planet Nine aliens can perform on the bandstand? Explain your answer.

The city is considering putting up 2 more bandstands that are the same size. How many Planet Nine aliens can perform now?


$\qquad$

## Marching Band Planet Nine AliensDiophantus

The Planet Nine aliens really like to perform. One group of Planet Nine aliens brought instruments. They would like to perform in the "Welcome to Earth" Celebration. Unfortunately, the bandstand that the Planet Nine aliens will be performing on cannot hold all the Planet Nine aliens. If 7 Planet Nine aliens can fit on each row and there are 4 rows, how many Planet Nine aliens can perform on the bandstand? Explain your answer, and include the algorithm (number sentence).

The city is considering putting up 2 more bandstands that are the same size. How many Planet Nine aliens can perform now?


$\qquad$

## Marching Band Planet Nine AliensKovalevsky

The Planet Nine aliens really like to perform. One group of Planet Nine aliens brought instruments. They would like to perform in the "Welcome to Earth" Celebration. Unfortunately, the bandstand that the Planet Nine aliens will be performing on cannot hold all the Planet Nine aliens. The city has decided to build a new bandstand. If 36 Planet Nine aliens want to perform, list the different ways the city could build one bandstand (remember each row needs to have an equal number of Planet Nine aliens).

How do you know that you have listed all the ways to create the bandstand?

What if the city decided to build 2 bandstands for the 36 Planet Nine aliens-one for each side of the road. How many Planet Nine aliens could perform (remember each row needs to have an equal number of Planet Nine aliens)?


$\qquad$ Date $\qquad$

## Collectibles-Fibonacci

Sloosa has lots of puppets for plays. She has decided to build a box with a space for each puppet. How many ways can she build her box if she wants the box to fit exactly 16 puppets? Fill in the chart below to show how many rows and columns there would be for each type of box.

| Rows | Columns | Total Spaces for <br> Puppets |
| :---: | :---: | :---: |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

How many ways can she build her box?

Does it matter which way she places the box
 on the wall? Why or why not?


Sloosa's friend Spudnie offers to build her 2 more boxes to hold an extra 16 puppets each. Choose one way that Sloosa could have had Spudnie build her the boxes. Draw a picture below of what the 3 boxes next to each other will look like.

How many columns do you need? How many rows do you need?

How many puppets can Sloosa fit on her wall now?

Write an algorithm or number sentence that explains how to find the total number of puppets.


$\qquad$ Date $\qquad$

## Collectibles—Diophantus

Sloosa has lots of puppets for plays. She has decided to build a box with a space for each puppet. How many ways can she build her box if she wants the box to fit exactly 24 puppets? Fill in the chart below to show how many rows and columns there would be for each type of box.

| Rows | Columns | Total Spaces for <br> Puppets |
| :---: | :---: | :---: |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

How many ways can she build her box?


Does it matter which way she places the box on the wall? Why or why not?


Sloosa's friend Spudnie offers to build her 2 more boxes to hold an extra 16 puppets each. Choose one way that Sloosa could have Spudnie build her the boxes. Draw a picture below of what the 3 boxes next to each other will look like.

How many columns do you need? How many rows do you need?

How many puppets can Sloosa fit on her wall now?

Write an algorithm or number sentence that explains how to find the total number of puppets.


$\qquad$ Date $\qquad$

## Collectibles—Kovalevsky

Sloosa has lots of puppets for plays. She has decided to build a box with a space for each puppet. How many ways can she build her box if she wants the box to fit exactly 36 puppets? Fill in the chart below to show how many rows and columns there would be for each type of box.

| Rows | Columns | Total Spaces for <br> Puppets |
| :---: | :---: | :---: |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

How many ways can she build her box?


Does it matter which way she places the box on the wall? Why or why not?


Is there a reason why it might matter which way she attaches the box to the wall?

Sloosa's friend Spudnie offers to build her 2 more boxes. Choose one way that Sloosa could have Spudnie build her the boxes. Draw a picture below of what the boxes next to each other will look like.

How many columns do you need? How many rows do you need?

How many puppets can Sloosa fit on her wall now?

Write an algorithm or number sentence that explains how to find the total number of puppets.


## Lesson 10 Student Pages

Name $\qquad$ Date $\qquad$

## Exploring Factors of 12

The number I am factoring is: 12

1. Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

Division Representation
$\square$
2. Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

Division Representation
$\square$


The number I am factoring is:
3. Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

Division Representation

4. Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

## Division Representation

$\square$


The number I am factoring is:
5. Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

## Division Representation


6. Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

## Division Representation

$\square$

The factors of 12 are: $\qquad$ .


Name $\qquad$ Date $\qquad$

## Finding Factors

The number I am factoring is: $\qquad$
Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

Division Representation
$\square$

Multiplication Representation
$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

Division Representation
$\square$


The number I am factoring is: $\qquad$

## Multiplication Representation

$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

Division Representation


## Multiplication Representation

$\qquad$ Piles x $\qquad$ Shapes in Each Pile = $\qquad$ Total Shapes

Division Representation
$\square$


## Lesson 11 Student Pages

Name $\qquad$ Date $\qquad$

## Number Sentences for 36

Fill in each blank below with a number sentence that is equal to 36 . Try to use number sentences that include addition, subtraction, multiplication, and division.

$\qquad$ $=$ $\qquad$ $=$ $\qquad$ $=$
$\qquad$ $=$ $\qquad$ $=$ $\qquad$ =
$\qquad$ = $\qquad$
$\qquad$ =
$\qquad$
$\qquad$ $=$ $\qquad$ $=$
$\qquad$
$\qquad$ $=$ $\qquad$ =
$\qquad$ $=$ $\qquad$ $=$ $\qquad$ =
$\qquad$ $=$ $\qquad$ $=$ $\qquad$ $=$
$\qquad$ = $\qquad$ $=$ $\qquad$ =

## My Mathematical Thinking

Name $\qquad$

## Assessment: Creative Mathematicians

Directions: In each box, write your own multiplication problem. Show that you know what the commutative property means by rewriting the multiplication problem. Then pick 2 multiplication problems to create a picture that can be used to solve the problem.

|  |  |
| :--- | :--- |
|  |  |
|  |  |
|  |  |
|  |  |

Challenge: Create a story problem that goes along with your pictures.


## Lesson 12 Student Pages

Name $\qquad$ Date $\qquad$

## Helping Nacci Unlock Her Bag-Fibonacci

Nacci's mom sent her to Earth with a locked suitcase. Her mom was worried that she wouldn't remember the code so she set the first few parts of the lock for her.

Nacci,

I know you can be forgetful. The first
 parts of the lock are set. You just need to find a logical choice for the rest of the combination.

Love,
Mom

What should the last symbol in the lock combination look like? Draw it in the box.


Explain how you cracked the code that Nacci's mom gave her.

$\qquad$

## Helping Nacci Unlock Her Bag—Diophantus

Nacci's mom sent her to Earth with a locked suitcase. Her mom was worried that she wouldn't remember the code so she set the first few parts of the lock for her.

Nacci,
I know you can be forgetful. The
 first parts of the lock are set. You just need to find a logical choice for the rest of the combination.

Love,
Mom

What should the last symbol in the lock combination look like?


Explain how you cracked the code that Nacci's mom gave her.

$\qquad$

## Helping Nacci Unlock Her Bag—Kovalevsky

Nacci's mom sent her to Earth with a locked suitcase. Her mom was worried that she wouldn't remember the code so she set the first few parts of the lock for her.

Nacci,
I know you can be forgetful. The
 first parts of the lock are set. You just need to find a logical choice for the rest of the combination.

Love,
Mom

What should the last symbol in the lock combination look like?


$\square$
Explain how you cracked the code that Nacci's mom gave her.

$\qquad$
$\qquad$

## Confounding Combinations-Fibonacci

1. Unfortunately for Nacci that was not the only suitcase with a lock. Help her figure out the combinations for her other suitcases.


Explain how you cracked the code that Nacci's mom gave her.
2. Practice opening more suitcases by filling in the last part of the lock. Explain how the pattern is growing or repeating.





Name $\qquad$ Date $\qquad$

## Confounding Combinations-Diophantus

1. Unfortunately for Nacci that was not the only suitcase with a lock. Help her figure out the combinations for her other suitcases. Draw it in the box.


Explain how you cracked the code that Nacci's mom gave her.
2. Practice opening more suitcases by filling in the last part of the lock. Explain how the pattern is growing or repeating.

$\square$



$\qquad$ Date $\qquad$

## Confounding Combinations-Kovalevsky

1. Unfortunately for Nacci that was not the only suitcase with a lock. Help her figure out the combinations for her other suitcases.


Explain how you cracked the code that Nacci's mom gave her.
2. Practice opening more suitcases by filling in the last part of the lock. Explain how the pattern is growing or repeating.

3. Predict which quadrant (or triangle) the dot will be on the 20th move.

4. Fill in the last part of the lock. How many different ways can you explain the pattern?



Name $\qquad$ Date $\qquad$


## Locking Into Creative Combinations-Homework

Directions: Imagine that you are a locksmith for a Planet Nine alien luggage company! Put on your creative thinking cap and design your own repeating pattern combination using 5 symbols. Draw the symbols for your combination in the boxes below:


Explain why your combination is a repeating pattern.

Create another combination for the luggage. This time design your own growing pattern using 5 symbols. Draw the symbols for your combination in the boxes below:


Explain why your combination is a growing pattern.


## Lesson 13 Student Pages

Human $\qquad$ Date on Earth $\qquad$

## Teaching Planet Nine Aliens Mathematical Terms

A new species of Planet Nine aliens has arrived on Earth! It is very difficult to communicate with them because they don't speak English. Choose 3 words that you think the Planet Nine aliens should learn first. Write the 3 words on the lines below.


The Planet Nine aliens decide that they will learn the 3 words by repeating them over and over again in order.

1. What will be the 7th word that the Planet Nine aliens say? Explain your thinking.
2. What will be the 30th word the Planet Nine aliens say? Explain your thinking.

$\qquad$
$\qquad$

# Improving Planet Nine Aliens' VocabularyFibonacci 

The Planet Nine aliens have mastered the first 3 words you taught them. They are eager to learn more! Write the next 5 words you will teach the Planet Nine aliens on the lines below.

$\qquad$
$\qquad$

The Planet Nine aliens learn the 5 words by repeating them over and over again in order.

1. What will be the 20th word that the Planet Nine aliens say? Explain your thinking.
2. What will be the 99th word the Planet Nine aliens say? Explain your thinking.

3. Can you think of a different way to figure out what the 99th word would be? Explain this method.

$\qquad$

## Improving Planet Nine Aliens' VocabularyDiophantus

The Planet Nine aliens have mastered the first 3 words you taught them. They are eager to learn more! Write the next 6 words you will teach the Planet Nine aliens on the lines below.

$\qquad$
$\qquad$
$\qquad$

The Planet Nine aliens learn the 6 words by repeating them over and over again in order.

1. What will be the 20th word that the Planet Nine aliens say? Explain your thinking.
2. What will be the 99th word the Planet Nine aliens say? Explain your thinking.

3. Can you think of a different way to figure out what the 99th word would be? Explain this method.

$\qquad$

## Teaching Students Planet Nine Alien Words

The Planet Nine aliens have their own language called Alienese. They would like for you to learn how to say the 4 Alienese words listed below.
jobuku freligo yuyu bleebee

1. If you repeat the 4 words over and over again in order, what is the 20th word you will say? Explain your thinking.
2. If you repeat the 4 words over and over again in order, what is the 54th word you will say? Explain your thinking.
3. Can you think of a different way to figure out what the 54th word would be? Explain this method.

## My Mathematical Thinking



## Lesson 14 Student Pages

Rollercoaster Engineer $\qquad$ Date $\qquad$
Coasting at the Amusement Park! Table

| Number of cars | Number of beings |
| :---: | :---: |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
|  |  |
|  |  |
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$\qquad$ Date $\qquad$

# Coasting at the Amusement Park!- 

Fibonacci

1. Toxo and his friends are going to ride the Rocket Rollercoaster at the Amusement Park. There are a total of 7
 cars on the ride. How many of Toxo's friends can go for a ride?
2. Six of Toxo's friends arrived late at the rollercoaster, but all 10 cars were full! How many more middle cars would be needed so the 6 friends can ride the rollercoaster?
3. Imagine that there were 20 cars on the Rocket Rollercoaster! Now how many beings could ride altogether? Remember that the first and last car can only seat 2 beings.
4. Explain how you found the answer.


$\qquad$ Date $\qquad$

# Coasting at the Amusement Park!Diophantus/Kovalevsky 

1. Imagine that there were 19 cars on the Rocket Rollercoaster! Now how many beings could ride altogether? Remember that the first and last car can only seat 2 beings.
2. Explain how you found the answer.
3. Toxo and his friends are going to ride the Rocket Rollercoaster at the Amusement Park. There are a total of 10 cars on the ride. Two of Toxo's friends get into each car. How many of Toxo's human friends can fill up the rest of the seats?

4. Explain how you found the answer.



Rollercoaster Cars Cutouts

|  |  |
| :---: | :---: |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

## Super Challenges

| Super Challenge 1 | Super Challenge 2 |
| :--- | :--- |
| Imagine that the first and last |  |
| rollercoaster cars have only 2 |  |
| wheels and the middle cars have |  |
| 4 wheels. How many wheels |  |
| would there be altogether on 10 |  |
| rollercoaster cars? | If one human sat in each of the <br> rollercoaster cars, how many <br> Planet Nine aliens could fill up <br> the rest of the seats if there are <br> 10 cars altogether? |
| Create your own word problem <br> about the rollercoaster cars. <br> Trade problems with a partner <br> and solve. |  |
| Super Challenge 3 |  |
| Toxo and 27 of his friends want <br> to ride the Rocket Rollercoaster <br> at the Amusement Park. How <br> many rollercoaster cars are <br> needed so that Toxo and all of <br> his friends can ride at the same <br> time? | Imagine that 3 "beings" could fit <br> in the first and last rollercoaster <br> cars and that 4 "beings" could fit <br> in the middle cars! How many |
| "beings" could fit in 10 cars now? |  |$\quad$| Super Challenge 4 |
| :--- |


$\qquad$ Date $\qquad$

## Coasting at the Amusement Park!Homework

1. Toxo's cousins from Pluto went for a ride on the Rocket Rollercoaster. There were 11 cars on the tracks of the rollercoaster. How many "beings" could go for a ride on the Rocket Rollercoaster? Explain your thinking.
2. How many "beings" can fit into 13 cars on a rollercoaster?
3. How many cars are needed to fit 13 "beings?"
4. If 3 Planet Nine aliens are already sitting in a car on the rollercoaster that has 5 cars, how many more Planet Nine aliens or humans can join them for a ride?
5. How many rollercoaster cars are needed to fit 15 Planet Nine alien and human friends? Explain your thinking.

## My Mathematical Thinking



## Lesson 15 Student Pages

Mathematical Baker $\qquad$ Date $\qquad$

## Toxo's Out of This World Ideas!Increasing and Decreasing Patterns

| Term $(t)$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number $(n)$ | 50 | 54 | 58 |  |  |  |  |

1. What is the rule for this pattern?
2. What is the 7th term?

| Term $(t)$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number $(n)$ | 50 | 42 | 34 |  |  |  |  |

3. What is the rule for this pattern?
4. What is the 7th term?

## My Mathematical Thinking

Toxo decided to frost and decorate the cookies he made. After an hour of frosting and decorating cookies he had 260 cookies left. After 2 hours he had 220 cookies left to frost and decorate. Fill in the table to figure out how many cookies Toxo had left to frost and decorate after 7 hours.

| Hour | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of <br> cookies left | 260 | 220 | 180 |  |  |  |  |

5. What is the rule for this pattern?
6. What is the 7 th term?

$\qquad$ Date $\qquad$

## Toxo's Out of This World Cookie Recipe!-Fibonacci



Toxo would like to make 10 batches of cookies! Toxo needs your help to figure out how much flour he must buy at the store.

Directions: Identify the rule for each pattern. Fill in the following table to find the 10th term in the growing pattern. Answer each question below.

| Number of batches | 1 | 2 | 3 | 4 | 5 | 6 | 7 |  |  | 10 |
| :--- | :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Cups of Zorg flour | 4 | 8 | 12 |  |  |  |  |  |  |  |

1. What is the 10 th term?
2. What is the rule for the growing pattern of cups of Zorg flour?
3. Is there another way that you could figure out the 10th term for the cups of Zorg flour without having to fill out the table?


Here is Toxo's table for his Zinky chips. He found a new recipe for 10 batches of cookies. But he only needs 4 batches. Look carefully at the pattern. Help Toxo finish filling in his table.

| Number of batches | 10 | 9 | 8 | 7 | 6 | 5 | 4 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Small scoops of Zinky chips | 30 | 27 | 24 |  |  |  |  |

4. How many scoops of Zinky chips will Toxo need to buy to make 4 batches of cookies?
5. Is there another way that you could figure out how many scoops of Zinky chips are needed for 4 batches without having to fill out the whole table? Explain your thinking.

## My Mathematical Thinking


$\qquad$ Date $\qquad$

## Toxo's Out of This World Cookie Recipe!-Diophantus



Toxo would like to make 12 batches of cookies! But now he is out of Zinky chips! How much Zorg flour does he need to buy at the store? Fill in the table below. Answer the questions.

| Number of <br> batches | 1 | 2 | 3 | 4 | 5 | 6 | 7 |  |  |  |  | 12 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Cups of Zorg <br> flour | 4 | 8 | 12 |  |  |  |  |  |  |  |  |  |

1. What is the rule for the growing pattern of cups of Zorg flour?
2. How many cups of Zorg flour will Toxo need to buy to make 12 batches of cookies?
3. Is there another way that you could figure out the 12th term for the cups of Zorg flour without having to fill out the table?


Here is Toxo's table for his Zinky chips. He found a new recipe for 10 batches of cookies. But he only needs 4 batches. Look carefully at the pattern. Help Toxo finish filling in his table.

| Number of batches | 10 | 9 | 8 | 7 | 6 | 5 | 4 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Small scoops of Zinky chips | 40 | 36 | 32 |  |  |  |  |

4. How many scoops of Zinky chips will Toxo need to buy to make 4 batches of cookies?
5. Is there another way that you could figure out how many scoops of Zinky chips are needed for 4 batches without having to fill out the whole table? Explain your thinking.

## My Mathematical Thinking


$\qquad$ Date $\qquad$

## Toxo's Out of This World Cookie Recipe!-Kovalevsky



Toxo would like to make 12 batches of cookies! But now he is out of all his ingredients! How much of each ingredient does he need to buy at the store?

Directions: Answer each question below.

| Number of <br> batches | 1 | 2 | 3 | 4 | 5 | 6 | 7 | $\ldots$ | $\ldots$ | $\ldots$ | $\ldots$ | 12 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Cups of Zorg <br> flour | 7 |  |  |  |  |  |  |  |  |  |  |  |

1. What is the rule for the growing pattern cups of Zorg flour?
2. How many cups of Zorg flour will Toxo need to buy to make 12 batches of cookies?

Toxo just got news that his cousins are joining him and his friends when they go to the Amusement Park! Now Toxo would like to bake 22 batches of cookies! Toxo decided to draw a table to figure out how much Zookie butter he needs to buy at the store, but he has run out of room! Help Toxo figure out a different way to find the 22nd terms in the growing patterns for each of the ingredients instead of extending the table.

| Number of batches | 1 | 2 | 3 | 4 | $\ldots$ | $\ldots$ | 22 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Tablespoons of Zookie butter | 8 |  |  |  |  |  |  |

3. How many tablespoons of Zookie butter will Toxo need?

## My Mathematical Thinking

Explain how you solved this growing pattern problem.

Here is Toxo's table for his Zinky chips. He found a new recipe for 10 batches of cookies. But he only needs 4 batches. Look carefully at the pattern. Help Toxo finish filling in his table.

| Number of batches | 10 | 9 | 8 | 7 | 6 | 5 | 4 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Small scoops of Zinky chips | 70 | 63 | 56 |  |  |  |  |

4. How many scoops of Zinky chips will Toxo need to buy to make 4 batches of cookies?
5. Is there another way that you could figure out how many scoops of Zinky chips are needed for 4 batches without having to fill out the whole table? Explain your thinking.

$\qquad$ Date $\qquad$

## Toxo's Out of This World Ideas!Homework

Toxo took a ceramics class and painted his own mixing bowls for his cookies. On the first bowl he painted 6 stripes. On the second bowl he painted 13 stripes. Figure out the growing pattern and complete the table.

| Mixing bowl <br> number | 1 | 2 | 3 | 4 | 5 | 6 |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of <br> stripes | 6 | 13 | 20 |  |  |  |  |  |  |

1. What is the rule for the growing pattern of number of stripes?
2. How many stripes are on the 12th mixing bowl?
3. Explain how you found the 12th term in question \#2.


Toxo decided to make 43 mixing bowls for all of his friends so that they could bake Planet Nine alien cookies as well! Each day during ceramics class Toxo painted a certain number of bowls. Figure out the growing pattern and fill in the table.

| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of <br> bowls left to <br> paint | 43 | 38 | 33 |  |  |  |  |  |  |

4. What is the rule for the growing pattern of bowls to paint?
5. How many bowls are left to paint after the 9th day?
6. Explain how you found the 9th term in question \#5.


## super Challenges

## Super Challenge \#1

Create your own growing pattern about Toxo and his great ideas in the kitchen! Fill in a few of the numbers in the table and write a story problem. Exchange your story problem with a friend. Have your friend solve the problem.

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |

Write your story problem here:

Questions for your friend about your story problem:

1. What is the rule for my pattern?
2. What is the 7 th term?


## Super Challenge \#2

Fill in the missing numbers in the table below. Think about the pattern first.

| Number of batches | 1 | 2 | 3 | 4 | 5 | 6 | 7 | $\ldots$ | $\ldots$ | 20 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Teaspoons of Planet <br> Nine alien vanilla | 7 |  |  |  |  |  |  |  |  |  |
| Small scoops of Zinky <br> chips | 8 |  |  |  |  |  |  |  |  |  |

## Super Challenge \#3

Fill in the missing numbers in the table below. Think about the patterns first.

| Number of batches | 1 | 2 | 3 | 4 | 5 | 6 | 7 | $\ldots$ | $\ldots$ | 10 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Zoofy mini eggs |  | 12 |  |  |  |  |  |  |  |  |
| Teaspoons of Planet <br> Nine alien vanilla |  |  | 15 |  |  |  |  |  |  |  |

## Super Challenge \#4

Fill in the missing numbers in the table below. Think about the pattern first.

| Term | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number | 197 |  | 193 |  |  |  |  |  |  |  |



## Lesson 16 Student Pages

Intergalactic Officer $\qquad$ Date $\qquad$

## An Intergalactic Mission Play

Narrator: The leader of the Planet Nine aliens that are visiting planet Earth, named Captain Chavir, just received an urgent intergalactic message commanding that he and his spaceship crew must return to a planet on the other side of the Milky Way as soon as possible for a top secret mission! Captain Chavir is waiting to beam his
 crew up to the spaceship, which is hovering in Earth's upper stratosphere.

Captain Chavir: Mozalk Navigator, come in, please! Do you read me?
Mozalk Navigator: Mozalk here! Captain, what can I do for you?
Captain Chavir: Central command has ordered us to return home for a top secret mission! You must quickly help me get the crew back to the transporter station at the Earthly Alien Base. I can't beam up the crew because they are all spread out at the Amusement Park.

Mozalk Navigator: Yes, Captain! I will find the crew, but it may take a while.

Captain Chavir: No need to worry, Mozalk! I have calculated their estimated locations at the Amusement Park. I am going to send you secret encrypted clues to help you find the crew members along with a top secret map of the park.

Mozalk Navigator: Yes, Captain! I will stand by until I receive the top secret clues. Oh, and would it be ok if a few of my trusted human friends help me out?

Captain Chavir: Great idea, but make sure that they are mathematicians!

Mozalk Navigator: Yes, Captain!

## My Mathematical Thinking

# Find Captain Chavir's Crew! Top Secret Clues!-Fibonacci 

## Find Diggy!

This Planet Nine alien can be found by finding the total number of toes and fingers of 3 of our Planet Nine alien friends. Each Planet Nine alien has 2 hands and 2 feet. Also, each Planet Nine alien has 5 fingers on each hand or 5 toes on each foot. (Hint: Use mental math or draw a picture or a table.)

## Find Quarg!

1. Find the 4 th factor of the number 12 after all the factors have been placed in numerical order from least to greatest.
2. Now find the 4th multiple of 4.
3. To discover the number of this Ferris wheel car, find the difference between the two answers for the questions above.

## Find Larko!

Using only 2 addends, how many ways are possible to make a sum of 12?

Find Frazzy!
Here is a riddle to find Frazzy's location. Use the following information about Mr. Mailer's order of hay.

Four trucks were on their way.
Each bringing 3 bales of hay.
More bales were needed for Mr. Mailer, so 2 extra bales were towed in a trailer.

How many bales of hay were delivered?

## Find Hilzo!

How many Planet Nine aliens can 5 ships hold?

| \# of ships | 1 | 2 | $3 \ldots$ |
| :--- | :--- | :--- | :--- |
| \# of Planet <br> Nine aliens | 7 | 14 | 21 |

## Find Yile!

Find the missing numbers. Then find the sum of all the numbers in the boxes to discover the number for this Ferris wheel car.

$$
4+3=\square+5
$$

$$
12-\square=3 \times 2
$$

$$
7+7=20-6
$$

$$
x 4=17+3
$$

## Find Snork!

The Rocket Rollercoaster has a total of 6 cars. Four people can fit in the inside cars, but only 2 people can fit on the first and last cars. How many people can fit altogether in the 6 rollercoaster cars? (Hint: Use mental math, make a table, draw a table, or use manipulatives.)

## Find Bleeb!

Solve for Y in the following equations:
$Y=8+2+9+5$
$40=5 \times Y$
$24 / Y=12$
$\mathrm{Y}=6 \times 3+7+3$
Find the sum of the four Y's. This will be the location of Bleeb.


## "Captain Chavir, We Have Found Your Crew!"—Fibonacci

Here are their locations of your crew at the Amusement Park.

| Diggy | Frazzy |
| :--- | :--- |
|  |  |
| Quarg | Hilzo |
| Larko | Yile |
| Snork |  |



# Find Captain Chavir's Crew! Top Secret Clues!-Diophantus 

| Find Zilfred! <br> This Planet Nine alien can be found <br> by finding the total number of toes and <br> fingers of 5 of our Planet Nine alien <br> friends. Each Planet Nine alien has 2 <br> hands and 2 feet. Also, each Planet <br> Nine alien has 4 fingers on each hand <br> or 4 toes on each foot. (Hint: Use <br> mental math or draw a picture or a <br> table.) | Find Soland! <br> Here is a riddle to find Soland the <br> Planet Nine alien's location. Use the <br> following information about Mr. <br> Mailer's order of hay. |
| :--- | :--- | :--- | :--- |
| Five trucks were on their way. <br> Each bringing 7 bales of hay. |  |

# My Mathematical Thinking 

# "Captain Chavir, We Have Found Your Crew!"-Diophantus 

Here are their locations of your crew at the Amusement Park.

| Find Zilfred! | Find Soland! |
| :--- | :--- |
| Find Nacci! | Find BeBop! |
| Find G4R4! |  |



# Find Captain Chavir's Crew! Top Secret Clues!-Kovalevsky 

## Find Zroply!

This Planet Nine alien can be found by finding the total number of toes and fingers of 5 of our Planet Nine alien friends. Each Planet Nine alien has 3 hands and 2 feet. Also, each Planet Nine alien has 4 fingers on each hand or 4 toes on each foot.

## Find Vloop!

1. Find the 7 th factor of the number 36 after all the factors have been placed in numerical order from least to greatest.
2. Now find the 5 th multiple of 8 .
3. To discover the number of this Ferris wheel car, find the difference between the two answers for the questions above.

## Find Zurp!

Using only 2 addends that are whole numbers, how many ways are possible to make the sum of 30 ?

## Find Hrtzzky-zzz

The Rocket Rollercoaster has a total of 10 cars. Five people can fit in the inside cars, but only 2 people can fit on the first and last cars. How many people can fit altogether in the 10 rollercoaster cars?

Find Lilorlilan!
Here is a riddle to find Lilorlilan the Planet Nine alien's location. Use the following information about Mr. Mailer's order of hay.

Nine trucks were on their way.
Each bringing 9 bales of hay.
More bales were needed for Mr. Mailer, so 7 extra bales were towed in a trailer.

How many bales of hay were delivered? Find Rukudig!

How many Planet Nine aliens can 6 ships hold?

| \# of ships | 1 | 2 | $3 \ldots$ |
| :--- | :--- | :--- | :--- |
| \# of Planet <br> Nine aliens | 7 | 14 | 21 |

## Find Q'Lok!

Find the missing numbers. Then find the sum of all the numbers in the boxes to discover the number for this Ferris wheel car.

| $62+2=\square \times 8$ | $100-\square=5 \times 7$ |
| :--- | :--- |
| $\square+7=76-50$ | $\square \times 4=62-34$ |

## Find Paktaklak

Solve for Y in the following equations:
$\mathrm{Y}=9+1+7+5+8$
$25=5 x Y$
$48 / Y=12$
$Y=81 / 27-18$
Find the sum of the four Y's. This will be the location of Paktaklak.

## My Mathematical Thinking



# "Captain Chavir, We Have Found Your Crew!"—Kovalevsky 

Here are their locations of your crew at the Amusement Park.

| Find Zroply! | Find Lilorlilan! |
| :--- | :--- |
| Find Vloop! |  |
| Find Zurp! |  |
| Find Rukudig! |  |
|  | Find Q'Lok! |



## The Planet Nine Alien Amusement Park

| $1$ | $2$ | 3 | $4$ | $5$ | $6$ |  | 8 |  | $10$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 13 | $14$ |  | 16 | 17 |  | 19 | $20$ |
| 21 | 22 | $\begin{gathered} 23 \\ \\ \hline \end{gathered}$ | $24$ | $25$ | 26 | 27 | 28 | $29$ |  |
| 31 |  | $33$ |  |  | 36 | $37$ | $38$ |  | $7-40$ |
|  | $42$ | $43$ | $\begin{gathered} 44 \\ 20 \\ 5 \end{gathered}$ | $45$ | 46 | 47 | 48 | $\begin{aligned} & 49 \\ & 3 \\ & 4 \end{aligned}$ | $50$ |
| 51 | 52 | 53 |  | $55$ |  |  |  | $59$ | 60 |
| 61 | 62 | $\begin{aligned} & 63 \\ & \text { ar } \\ & \text { ce } \end{aligned}$ | $64$ |  |  | 67 |  | $4$ | 70 |
|  | 72 | 73 | $74$ | 75 | 76 | 77 | 78 |  |  |
|  | $82$ | 83 | 84 | 85 |  | $87$ |  |  | 90 |
| 91 | 92 | 93 | 94 | 95 | $96$ | $97$ | 98 |  |  |

## Planet Nine Alien Pictures (OPTIONAL)

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## If Aliens TAUGht Algebra MATHEMATICIANS' GLOSSARY

Addend: A number that is being added to another number. Example: $\ln 4+5=$ 9 , numbers 4 and 5 are addends.

Algebra: A topic studied as part of mathematics; the study of mathematical symbols (e.g., numbers; equal, addition, or multiplication signs) and the rules for working with these symbols.

Array: A way to organize information in rows and columns.
Associative Property of Addition: The grouping of addends in a number sentence does not change the sum.

Astronomy: The scientific study of space, stars, planets, and other celestial bodies.

Astronomers: People who study astronomy.
Benchmark: A point of reference.
Column: A vertical arrangement of items or numbers in a list or table.
3
4
5


Commutative Property of Addition: The order that addends are added does not change the sum.

Commutative Property of Multiplication: The order that factors are multiplied does not change the product.

Decomposition: Breaking down a number to make a problem mentally easier to calculate.

Diagonal: A line that is on a slant compared to the top and sides of a page.
Example:


Divisible: A whole number is divisible by another whole number if the remainder after dividing the two numbers is zero.

Division: A mathematical operation in which a number is subtracted from itself a certain number of times.

Equation: A mathematical sentence that contains an equal sign.
Estimate: An educated guess for the answer to an algorithm.
Estimating: Rounding numbers to calculate an answer such as a sum or difference.

Factors: The numbers in a multiplication problem that are multiplied together to arrive at the product.

Flip (Reflection): A term for describing the movement of a shape that is flipped to the left, right, up, or down.

Formula: A rule or function for a pattern of numbers to make a prediction about a specific term.

Function: A rule for calculating sums or differences when using input and output boxes.

Generalization: Stating a conclusion based on a small amount of information, instances, or items.

Growing Patterns: Patterns that increase or decrease in a linear manner. Patterns may "grow" in ascending order such as " $2,4,6,8, \ldots$. or they may "grow" in descending order such as "12, 9, 6, 3, ..."

Horizontal: Parallel to the horizon. Example:

Inequality Sign: A sign used to represent a number sentence that is not equal $(\neq)$.

Mathematics: The study and use of numbers, patterns, and shapes.
Mathematicians: People who study or use mathematics in their work.
Multiple: The product of a whole number and any other whole number. Example: The multiples of 3 are $0,3,6,9,12,15, \ldots$

Multiplication: A mathematical operation in which a number is added to itself a certain number of times.

Number Sentence: A mathematical sentence that contains any sign (equality or inequality); an open number sentence that contains a variable or missing number.

Perfect Squares: Products that have the same two factors. For example, 81 is a perfect square because $9 \times 9=81$.

Prime Number: A whole number greater than one with two factors: 0 and itself.
Product: The answer to a multiplication problem.
Property: A math rule.
Recompose: Putting numbers back together after decomposing them to make a problem mentally easier to calculate.

Repeating Pattern: A repeating arrangement of numbers or objects.
Rounding: Altering a number so that it is easier to use in calculations.
Row: A horizontal arrangement of items or numbers in a list or table.

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Sets: Another term for a group.
Terms: Numbers in a pattern or sequence.
Turn (Rotation): A term for describing the movement of a shape in either a clockwise or counterclockwise direction.

Variable: A symbol or letter that represents a number or amount. Example: $a$ is the variable in $4 \times a=12$ or $4 a=12$.

Vertical: At a right angle to the horizon (up and down). Example:


