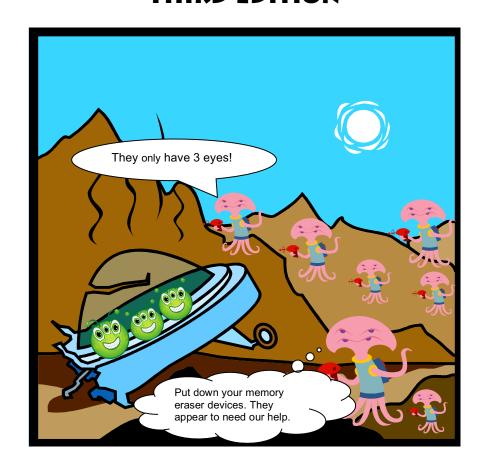
IF ALIENS TAUGHT ALGEBRA

MULTIPLICATION AND DIVISION WOULD BE OUT OF THIS WORLD! GRADE 3 THIRD EDITION



STUDENT MATHEMATICIAN NOTEBOOK

STUDENT MATHEMATICIAN _____

University of Connecticut

JUNE 2019

THE NATIONAL RESEARCH CENTER ON THE GIFTED AND TALENTED (2008-2013) 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: 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
Siamak Vahidi
Rachel R. McAnallen
Stacy Hayden
University of Connecticut
Storrs, Connecticut

JUNE 2018

THINKING LIKE MATHEMATICIANS: CHALLENGING ALL GRADE 3 STUDENTS THIRD EDITION

Shelbi Cole
Lisa DaVia Rubenstein
Tutita M. Casa
Cindy M. Gilson
Micah N. Bruce-Davis
E. Jean Gubbins
Alexis Melendez
Hannah F. Brown
Siamak Vahidi
Rachel R. McAnallen
Stacy Hayden
University of Connecticut
Storrs, Connecticut

JUNE 2019

THE NATIONAL RESEARCH CENTER ON THE GIFTED AND TALENTED (2008-2013)

The National Research Center on the Gifted and Talented (NRC/GT) is funded under the Jacob K. Javits Gifted and Talented Students Education Act, Institute of Education Sciences, United States Department of Education.

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 https://nrgct.uconn.edu

The work reported herein was supported under the National Research Development Centers Program, PR/Award Number 305A060044, as administered by the Institute of Education Sciences, United States Department of Education. The findings and opinions expressed in this report do not reflect the position or policies of the Institute of Education Sciences of the United States Department of Education.

Thinking Like Mathematicians: Challenging All Grade 3 Students

Thinking Like Mathematicians: Challenging All Grade 3 Students is funded under the Jacob K. Javits Gifted and Talented Students Education Act, Office of Elementary and Secondary Education, United States Department of Education.

University of Connecticut
Dr. E. Jean Gubbins, Principal Investigator
Dr. Aarti Bellara, Co-principal Investigator
Dr. Tutita Casa, Co-principal Investigator
Dr. Bianca Montrosse-Moorhead, Co-principal Investigator

Visit us on the web at https://thinkinglikemathematicians.uconn.edu

The work reported herein was supported under the Jacob K. Javits Gifted and Talented Students Education Act, Award Number S2068170023, as administered by the Office of Elementary and Secondary Education, United States Department of Education. The findings and opinions expressed in this report do not reflect the position or policies of the Office of Elementary and Secondary Education of the United States Department of Education.

TABLE OF CONTENTS

Lesson 1: Decomposition—Preparing for Blast off Spaceship Seats Spaceship Seats Challenge Packing Party for Earth Super Challenges Triangles for Super Challenge 3 Breaking it Down Practice Breaking it Down Practice 2 The Magical Number 10	1 5 9 15 17 19 21
Lesson 2: Rounding—The ALIEN-R2200, A Wonderful Invention Understanding the ALIEN-R2200—Fibonacci Understanding the ALIEN-R2200—Diophantus Understanding the ALIEN-R2200—Kovalevsky Super Challenges Understanding Rounding (Extra Practice)	25 25 29 31 33 35
Lesson 3: Mental Math—Planet Nine Aliens Go on a Shopping Spree! A Planet Nine Alien Shopping Spree!—Directions Number Cube—Diophantus Number Cube—Kovalevsky Tommy's Toy Store A Planet Nine Alien Shopping Spree!—Diophantus A Planet Nine Alien Shopping Spree!—Kovalevsky Toy Store Wish List—Homework	39 39 41 43 45 47 51
Lesson 4: Flexible Numbers—Equal Sides Introduction to Equal Sides Equal Sides—Fibonacci Equal Sides—Diophantus Equal Sides—Kovalevsky Equal Sides—Homework	57 57 59 65 71
Lesson 5: 100s Charts—Where Did I Leave My Treasure? Introduction to 100s Charts Where Did I Leave my Treasure? Treasure Hunt Directions for All Groups Treasure Hunt—Diophantus (Hider) Treasure Hunt—Diophantus (Finder) Treasure Hunt Questions—Diophantus Treasure Hunt—Extra Diophantus (Hider) Treasure Hunt—Extra Diophantus (Finder) Treasure Hunt—Koyalevsky (Hider)	79 79 81 85 87 89 91 93 95

TABLE OF CONTENTS (continued)

Treasure Hunt—Kovalevsky (Finder) Treasure Hunt Questions—Kovalevsky Treasure Hunt—Extra Kovalevsky (Hider) Treasure Hunt—Extra Kovalevsky (Finder) Extra 100s Chart Super Challenges Patterns Mysteries—Homework	99 101 105 107 109 111 113
Lesson 6: 100s Charts—Searching for Patterns Multiples of Three 100s Chart Pattern Language Searching for Patterns—Fibonacci Searching for Patterns—Diophantus Searching for Patterns—Kovalevsky Extra 100s Chart 500s Chart Super Challenges Searching for Patterns—Homework	115 117 119 123 129 133 135 137
Lesson 7: Multiplication Madness—Getting to Know Planet Nine Aliens Getting to Know Planet Nine Aliens Getting to Know Planet Nine Aliens—Homework	143 143 151
Lesson 8: Multiplication Madness—Seeing Stars Planet Nine Alien Manipulatives 2-Eyed Planet Nine Alien Multiplication Tables 4-Eyed Planet Nine Alien Multiplication Tables Multi-Eyed Planet Nine Alien Multiplication Tables Eye Love Multiplication! (OPTIONAL) Multiplication Chart Picture This! Picture This! Your Turn! Planet Nine Alien Manipulatives for Picture This! Multiplication Problems—Homework	153 153 155 157 159 163 165 167 169 171
Lesson 9: Arrays—Arranging Planet Nine Aliens Acting Planet Nine Aliens—Arrangement A Acting Planet Nine Aliens—Arrangement B Chair Manipulatives Marching Band Planet Nine Aliens—Fibonacci Marching Band Planet Nine Aliens—Diophantus Marching Band Planet Nine Aliens—Kovalevsky Collectibles—Fibonacci Collectibles—Diophantus Collectibles—Kovalevsky	177 177 179 181 183 185 187 189 193

TABLE OF CONTENTS (continued)

Division Exploring Factors of 12 Finding Factors	201 201 207
Lesson 11: Orbiting Oberon on the Oneida Rocket Ship—Pre-boarding Task for Ms. Oort's Class (OPTIONAL) Number Sentences for 36 Assessment: Creative Mathematicians	211 211 213
Lesson 12: Perplexing Visualizations—Unlocking the Code Helping Nacci Unlock Her Bag—Fibonacci Helping Nacci Unlock Her Bag—Diophantus Helping Nacci Unlock Her Bag—Kovalevsky Confounding Combinations—Fibonacci Confounding Combinations—Diophantus Confounding Combinations—Kovalevsky Locking Into Creative Combinations—Homework	215 217 217 219 221 225 229 233
Lesson 13: Repeating Patterns—Teaching Planet Nine Aliens Mathematical Terms Teaching Planet Nine Aliens Mathematical Terms Improving Planet Nine Aliens' Vocabulary—Fibonacci Improving Planet Nine Aliens' Vocabulary—Diophantus Teaching Students Planet Nine Alien Words	235 235 237 241 245
Lesson 14: Growing Patterns—Coasting at the Amusement Park! Coasting at the Amusement Park! Table Coasting at the Amusement Park!—Fibonacci Coasting at the Amusement Park!—Diophantus/Kovalevsky Rollercoaster Cars Cutouts Super Challenges Coasting at the Amusement Park!—Homework	247 247 249 251 255 257 259
Lesson 15: Growing Patterns—Cookies That Are out of This World! Toxo's Out of This World Ideas!—Increasing and Decreasing Patterns Toxo's Out of This World Cookie Recipe!—Fibonacci Toxo's Out of This World Cookie Recipe!—Diophantus Toxo's Out of This World Cookie Recipe!—Kovalevsky Toxo's Out of This World Ideas!—Homework Super Challenges	261 261 265 269 273 277 281

TABLE OF CONTENTS (continued)

Lesson 16: An Intergalactic Top Secret Mission—Find the Planet Nine	
Alien Spaceship Crew!	285
An Intergalactic Mission Play	285
Find Captain Chavir's Crew! Top Secret Clues!—Fibonacci	287
"Captain Chavir! We Have Found Your Crew!"—Fibonacci	289
Find Captain Chavir's Crew! Top Secret Clues!—Diophantus	291
"Captain Chavir! We Have Found Your Crew!"—Diophantus	293
Find Captain Chavir's Crew! Top Secret Clues!—Kovalevsky	295
"Captain Chavir! We Have Found Your Crew!"—Kovalevsky	297
The Planet Nine Alien Amusement Park	299
Planet Nine Alien Pictures (OPTIONAL)	301
If Aliens Taught Algebra Mathematicians' Glossary	303

Famous Mathematicians

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

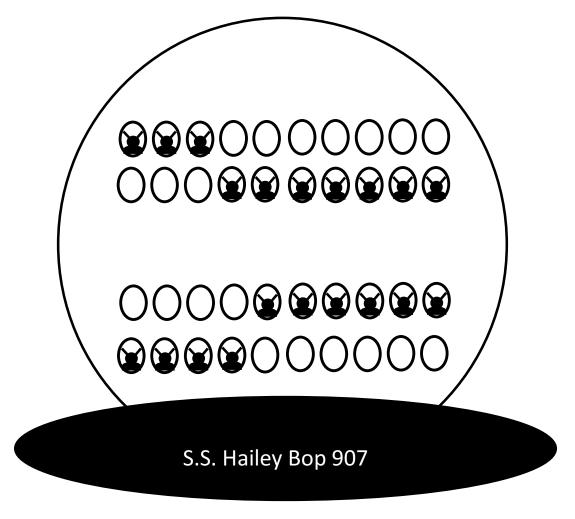
Spaceship Seats

The Planet Nine aliens are getting ready for their long trip.

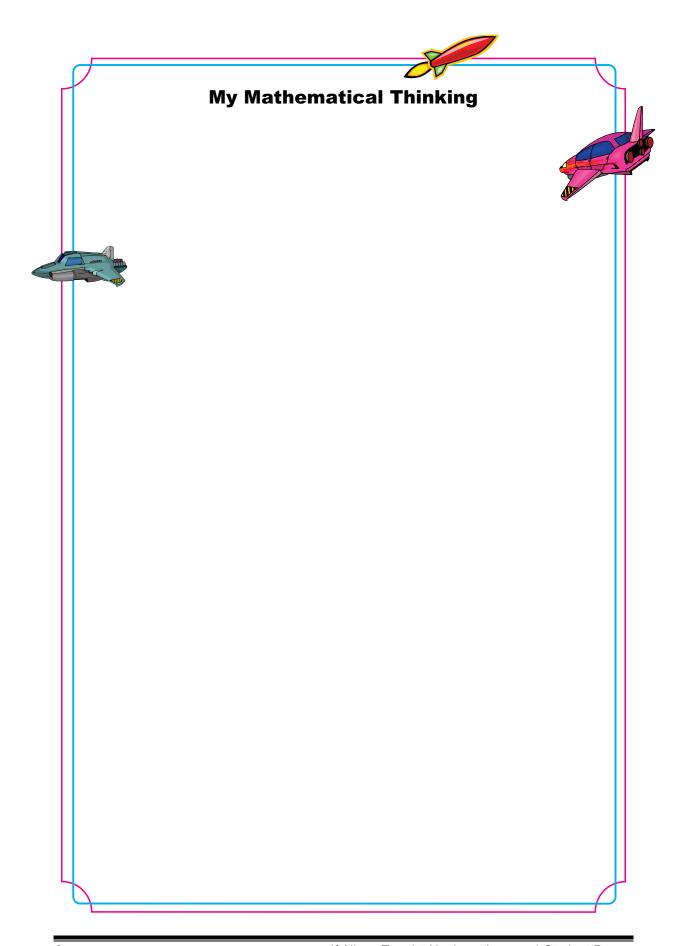
They are boarding and packing their ship.

They need your help to know . . .

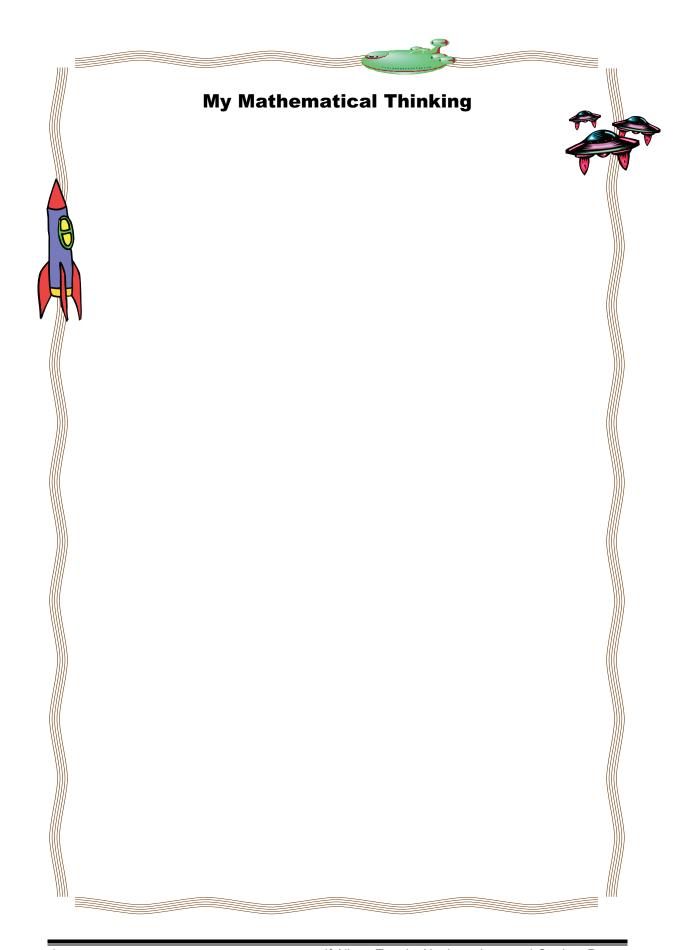
How many Planet Nine aliens are ready to go?



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?



Planet Nine Alien Helper Da	ate
-----------------------------	-----

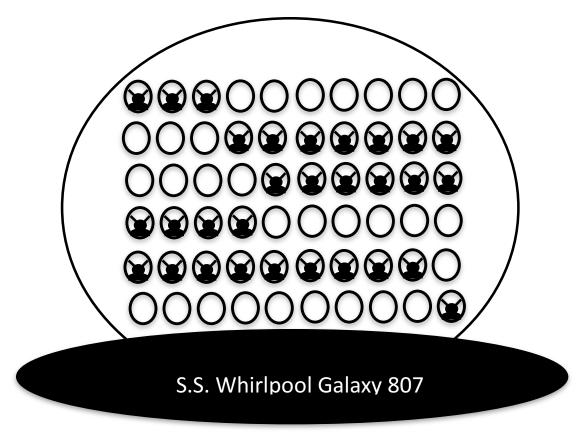
Spaceship Seats Challenge

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?

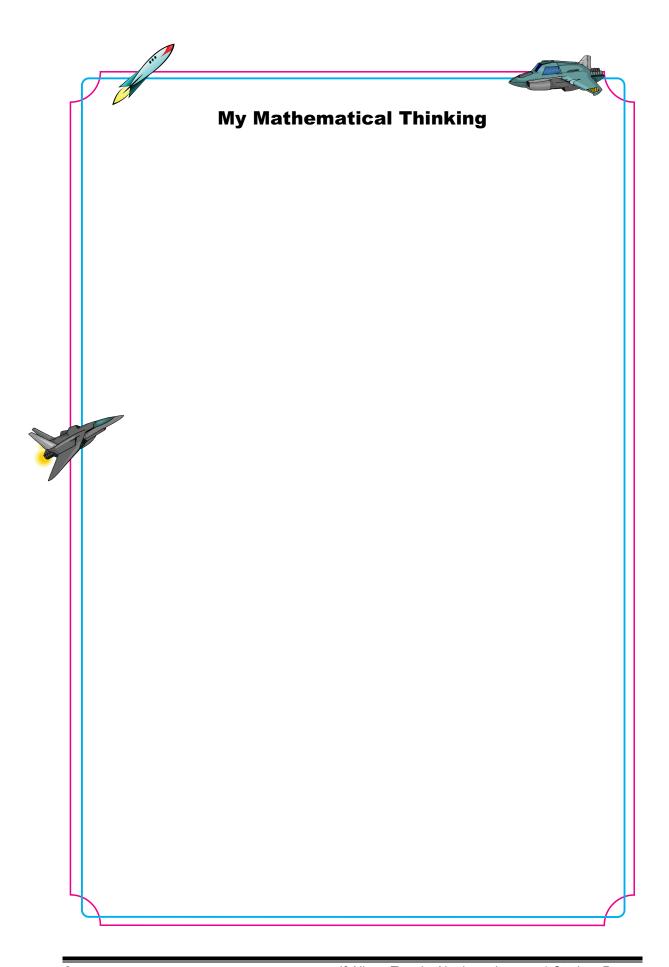


My Mathematical Thinking





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?



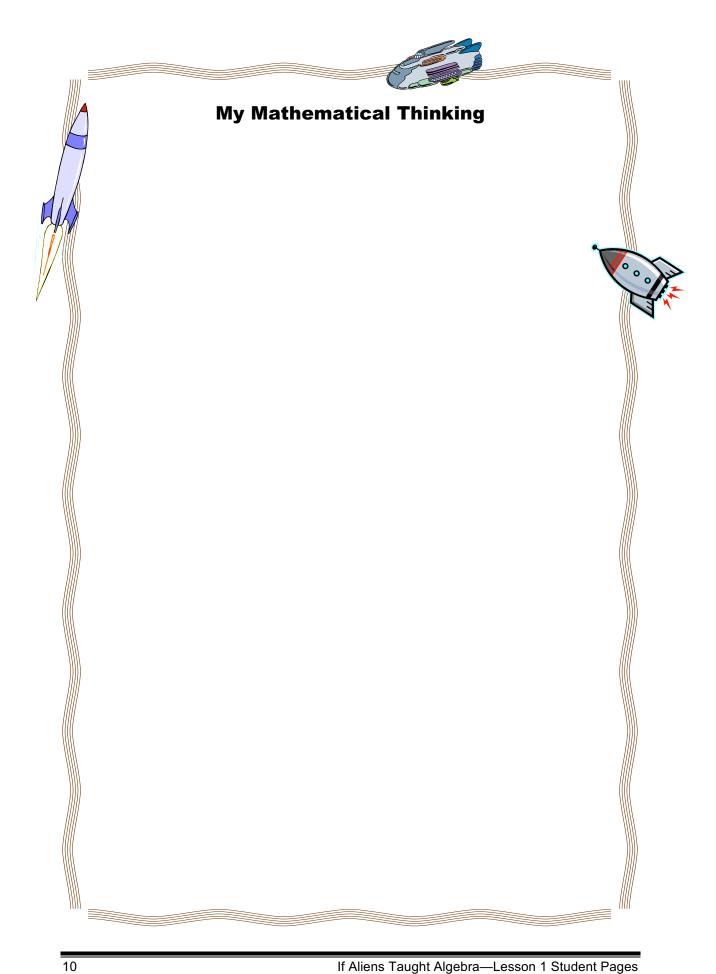
Suitcase Stuffer Date

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.

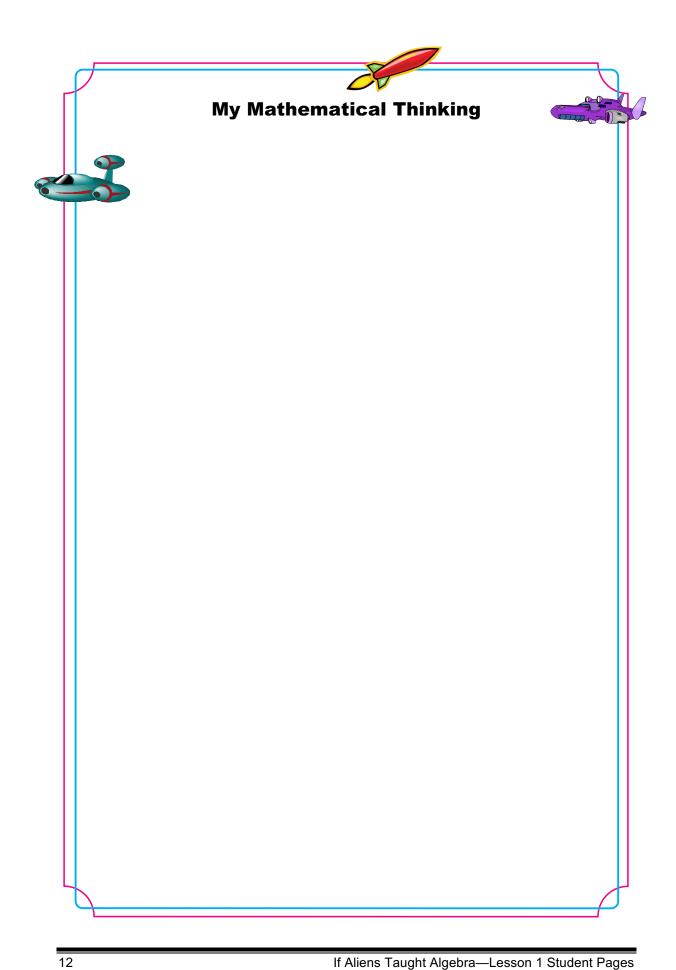
Wombles	+	Snufplets	= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10



Packing Party for Earth (Continued)

Wombles	+	Snufplets	= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10
	+		= 10

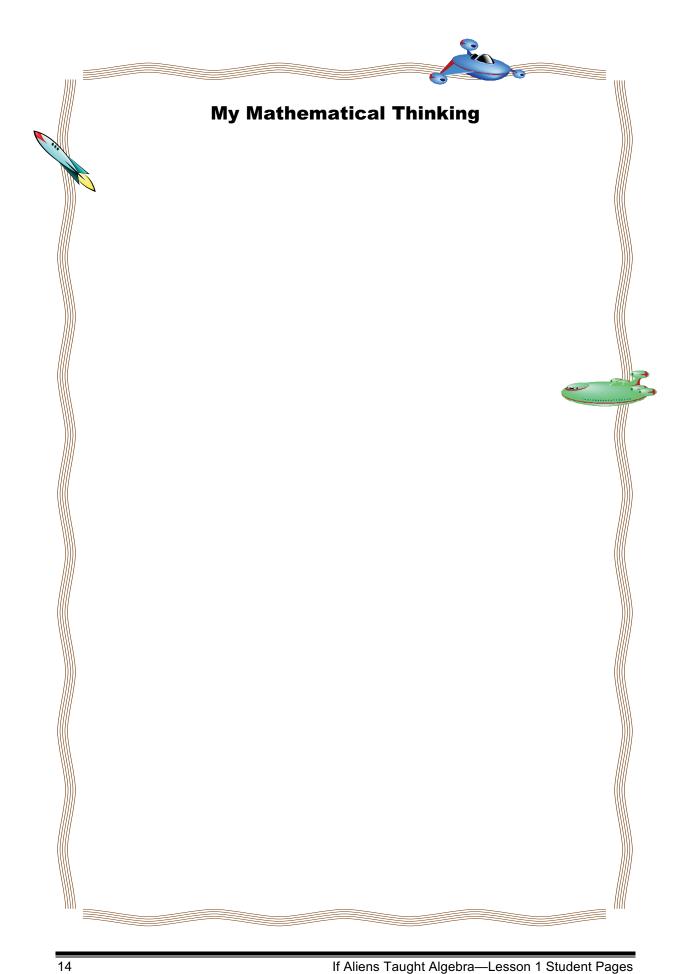
1. How do you know if you have all the possible combinations?



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 Nine Alien		+		= 10
	Wombles		Snufplets	
Jupit	2	+		= 10
Olive		+	5	= 10
BeeBop	8	+		= 10
Zulu		+	9	= 10
D2L4	6	+		= 10

- 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 2



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

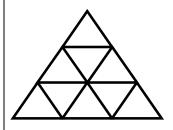
+	5	ш	
+	5	II	
+	5	=	
+	5	=	
+	5	=	

Super Challenge 3



(This challenge is from http://nrich.maths.org/192, used with permission.)

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.)

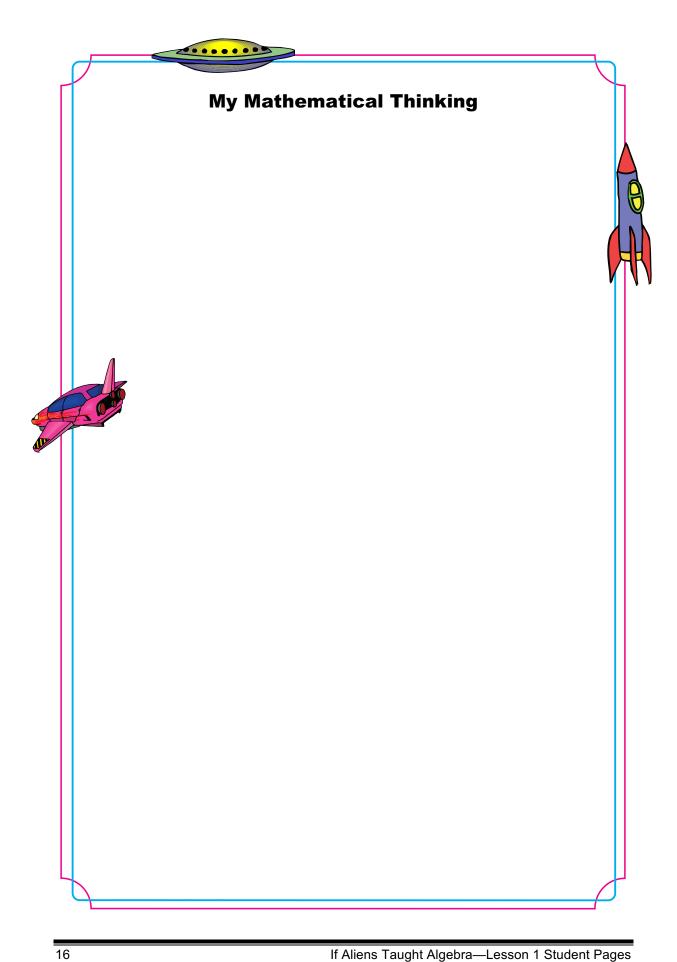




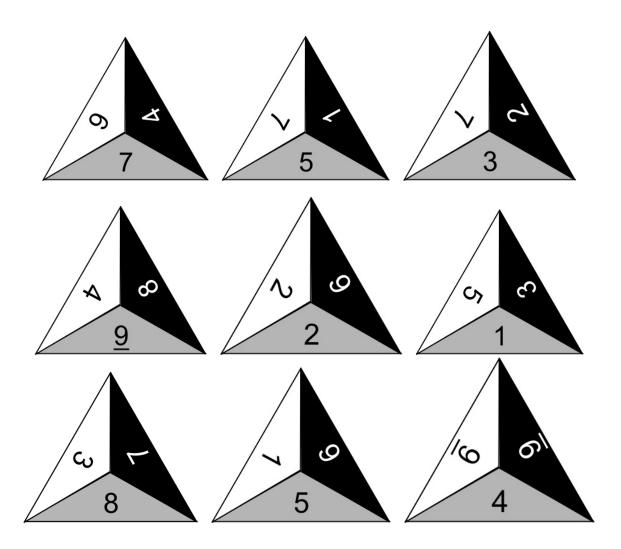
Super Challenge 4

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



Number Master	!	Date	

Breaking it Down Practice

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

Sample:

Start with: 8

Need <u>2</u> 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 ____ to equal 10.

Add on remainder:

Total:

2.8 + 6 =

Start with:

Need to equal 10.

Add on remainder:

Total:

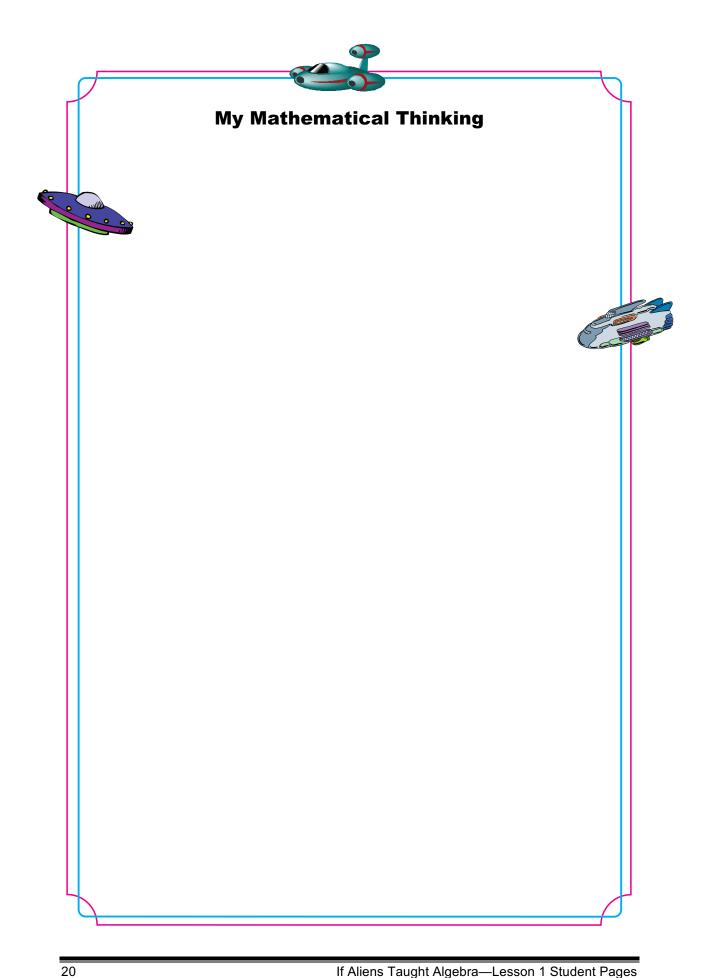
3.5 + 6 =

Start with:

Need ____ to equal 10.

Add on remainder:

Total:



Number Master	!	Date	

Breaking it Down Practice 2

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

Sample:

Start with: 8

Need $\underline{2}$ to equal 10.

Add on remainder: +3

Total: 13

1.9 + 9 =

Start with:

Need ____ to equal 10.

Add on remainder:

Total:

2. 18 + 6 =

Start with:

Need ____ to equal 20.

Add on remainder:

Total:

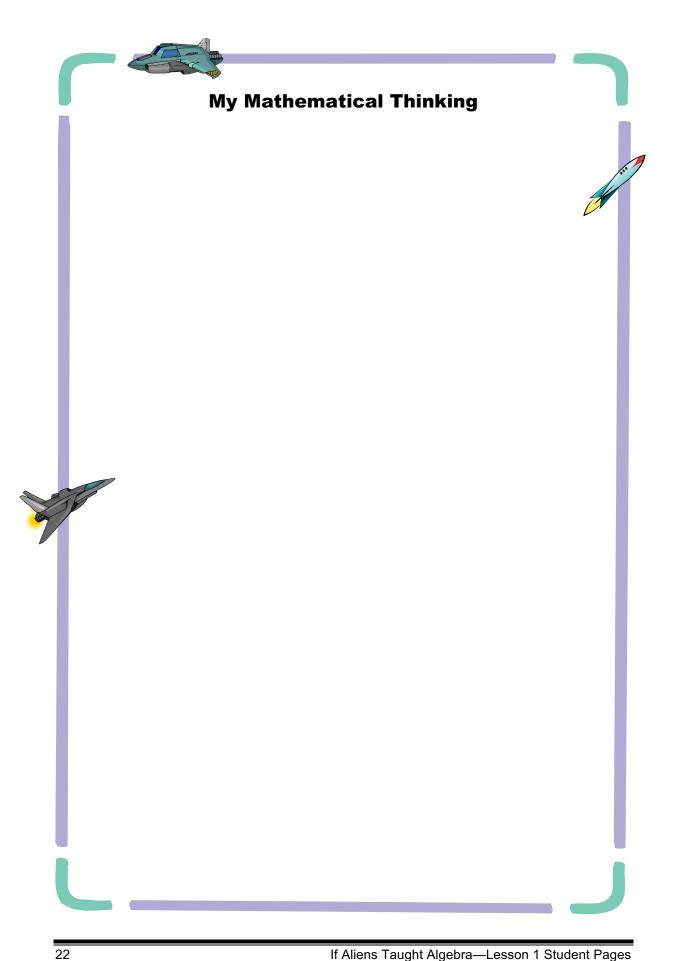
3. 15 + 9 =

Start with:

Need ____ to equal 20.

Add on remainder:

Total:

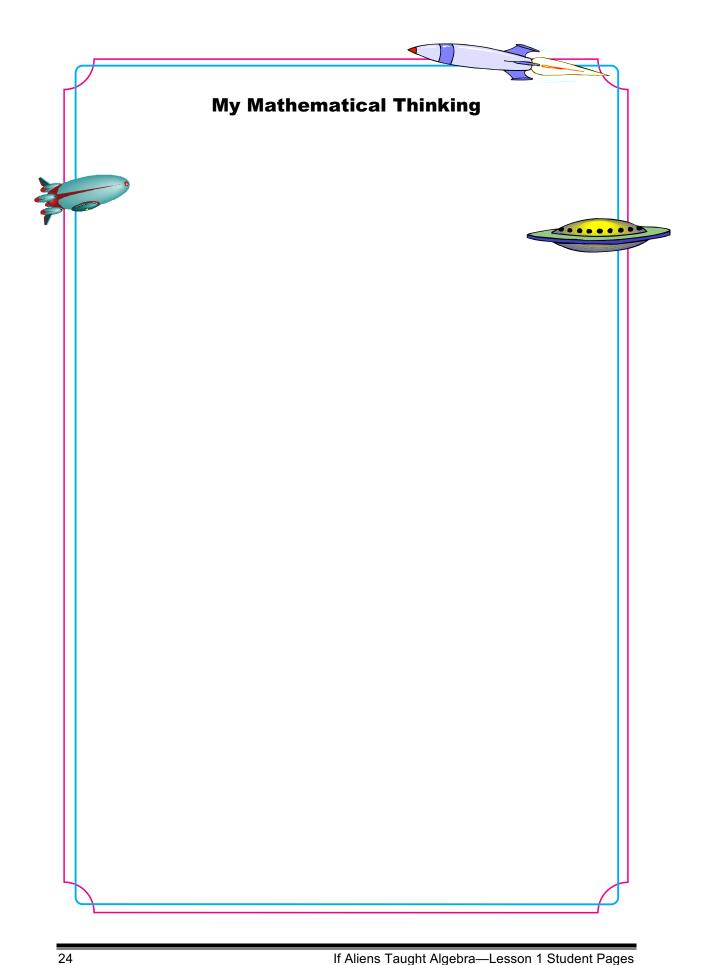


The Magical Number

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



Lesson 2 Student Pages

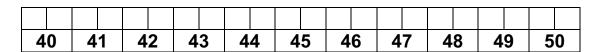
Invention Expert	Date	

Understanding the ALIEN-R2200—Fibonacci

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

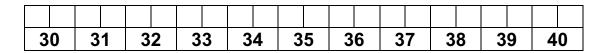
IN	OUT
48	50
32	30
19	20
67	70
64	60
23	20
35	40

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.

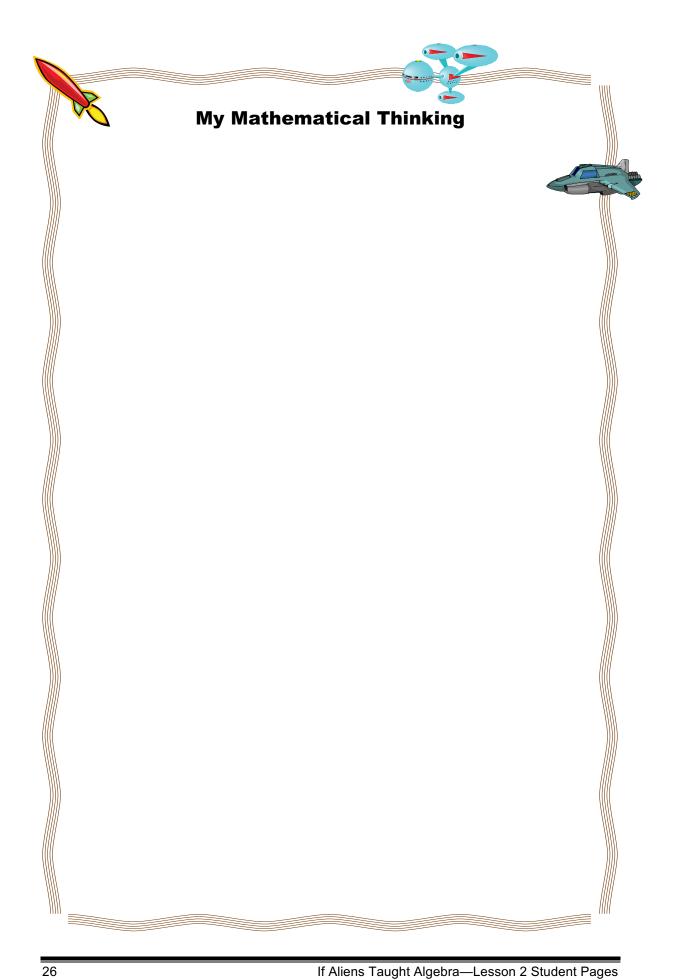


What could be happening?

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.



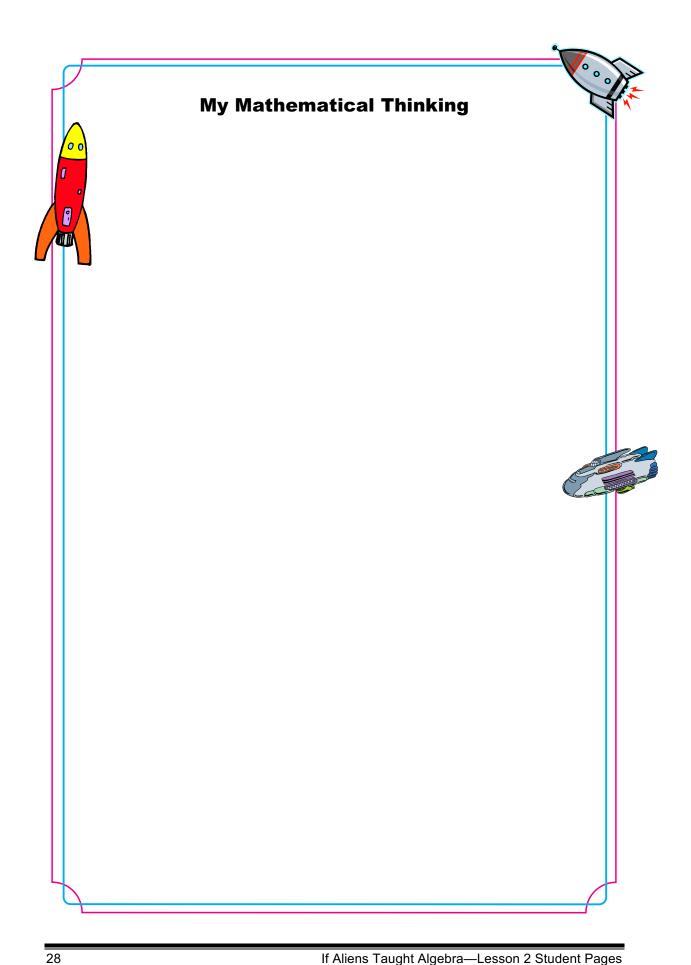
What could be happening?



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.

10	11	12	13	14	15	16	17	18	19	20

What could be happening?



Understanding the ALIEN-R2200— Diophantus

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

IN	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.

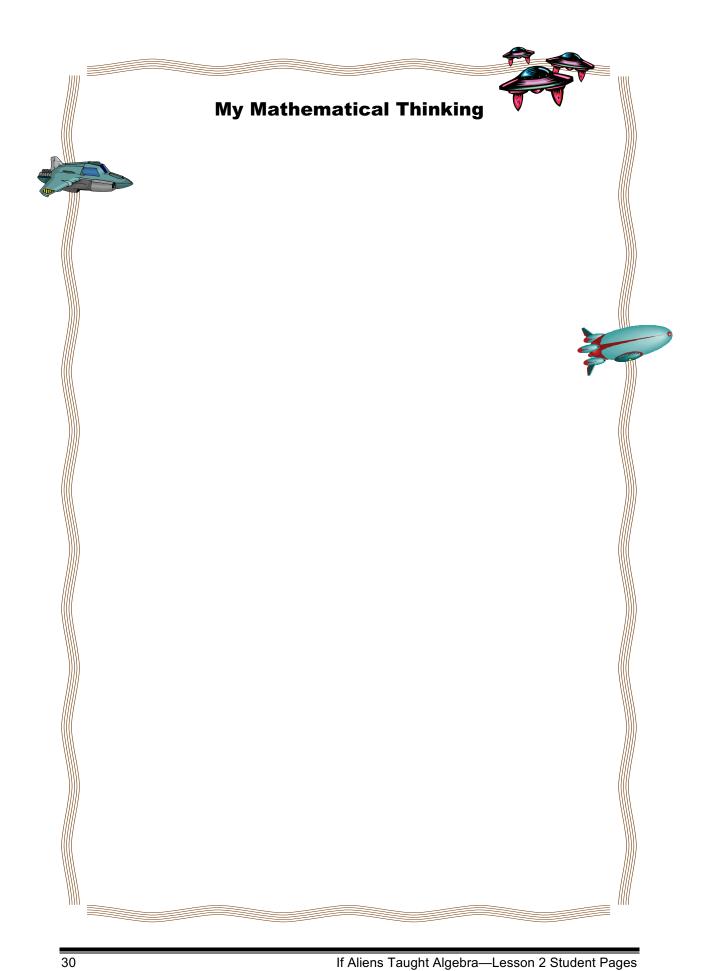
What could be happening?

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.

;	30	31	3	2	3	3	3	4	3	5	3	6	3	7	3	8	3	9	4	0

What could be happening?

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



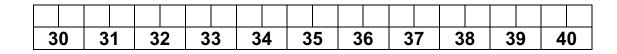
Invention Expert	Date	

Understanding the ALIEN-R2200— Kovalevsky

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?



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



My Mathematical Thinking





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.

Super Challenge 2



Think about a time when it would be better to round down than to round up. Draw a picture of this below with a caption.

\Rightarrow

Super Challenge 3

A **palindrome** is a number that can be read forwards and backwards using the same order of digits. This is a palindrome:

5775

Can you think of three palindromes that would be rounded down to the nearest 10?



Super Challenge 4

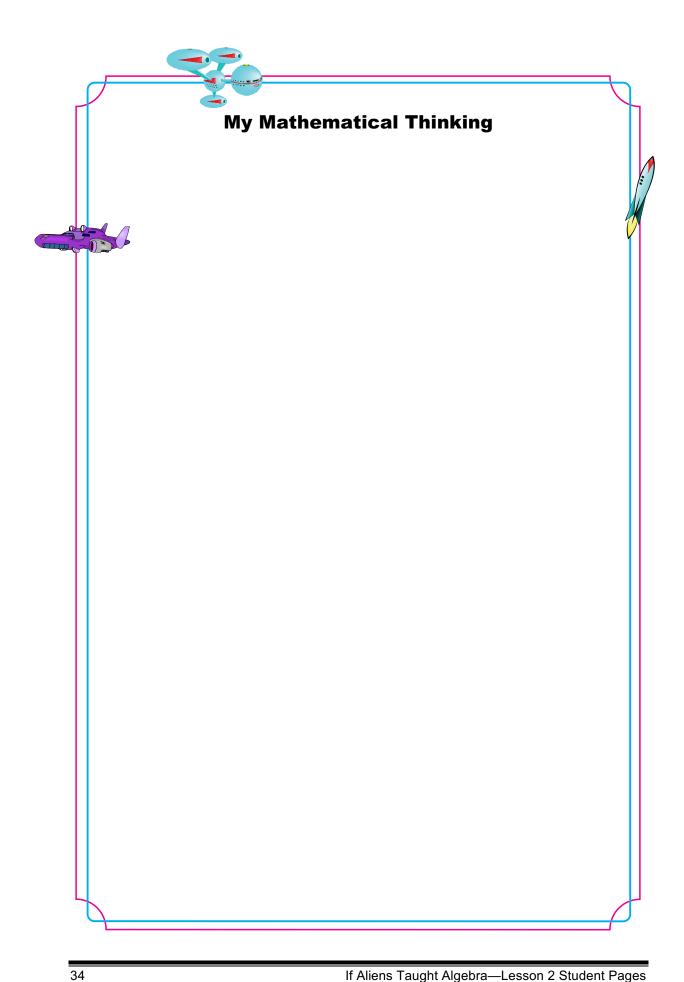
One- and two-digit numbers aren't the only numbers that can be rounded. How would you round the following numbers to the nearest 10?

315

2,247

\$63.42

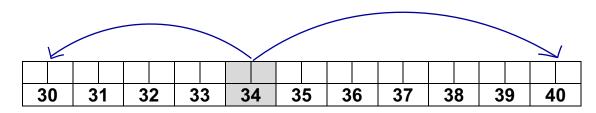
Explain your thinking.



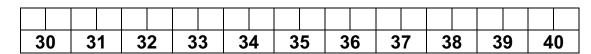
Understanding Rounding (Extra Practice)

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.

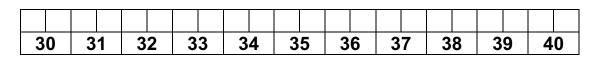
1. 34 rounds to 30



2. 31 rounds to



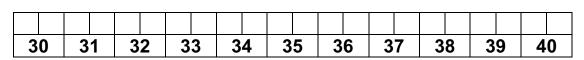
3. 39 rounds to

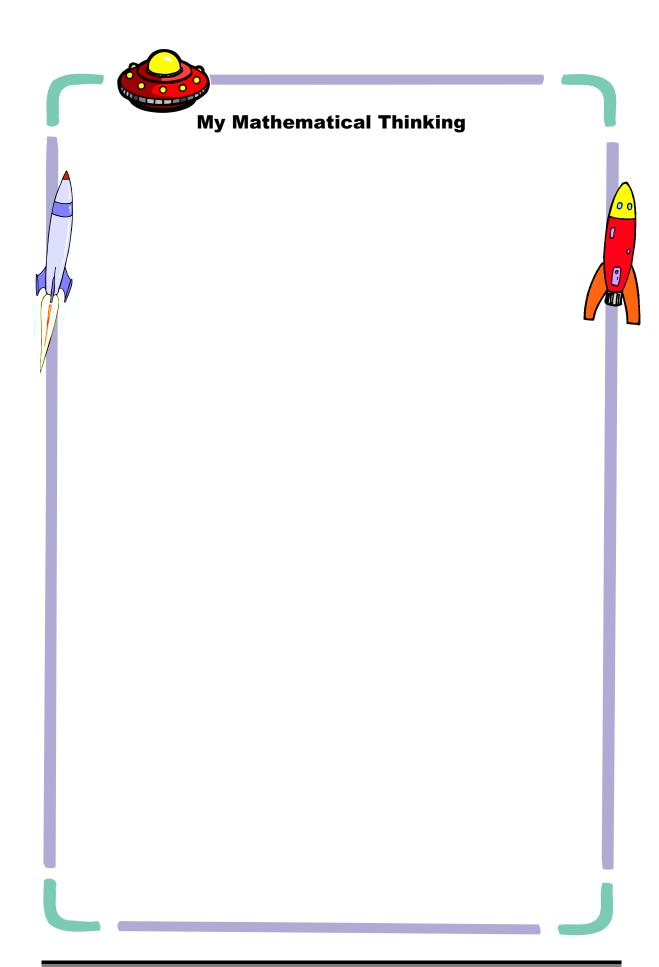


4. 37 rounds to ____

7	80	3	1	3	2	3	3	3	1	3	5	3	6	3	7	3	8	3	q	4	0
																					l

5. 35 rounds to



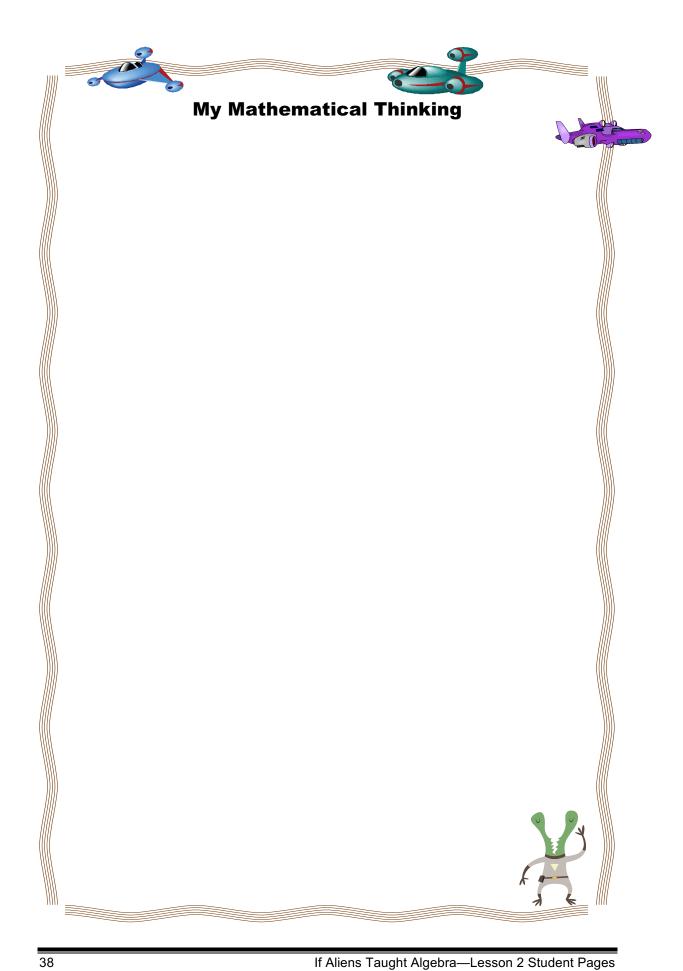


On Your Own

Round each number to the nearest 10.

27 ___ 11 ___ 15 ___ 33 ___ 79 ___

48 ___ 62 ___ 54 ___ 20 ___ 6 ___



Lesson 3 Student Pages

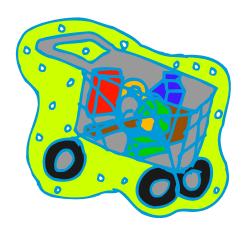
Shop	per	Date	

A Planet Nine Alien Shopping Spree!— Directions

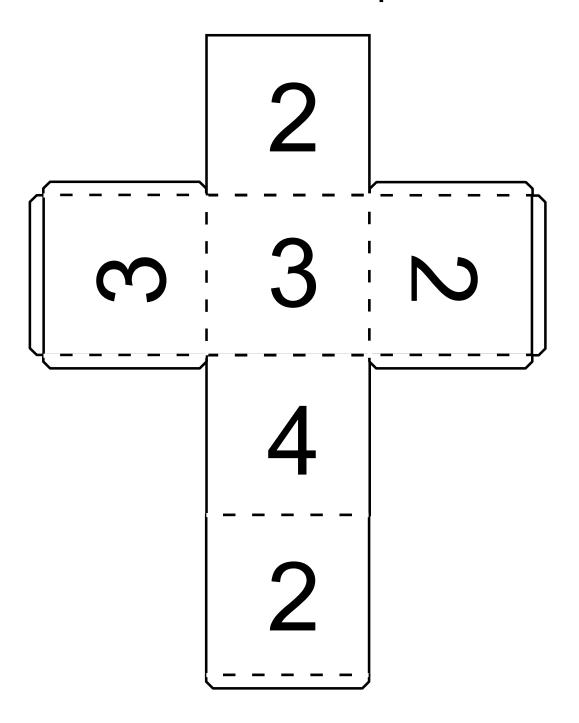
Soland the mathematician would like to go on a shopping spree at *Tommy's Toy Store!* The toy store is located at the Amusement Park, so this is a special kind of toy store. Each customer gets to roll a die to see how many toys he/she can buy at one time. Soland would like to spend less than \$100 for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



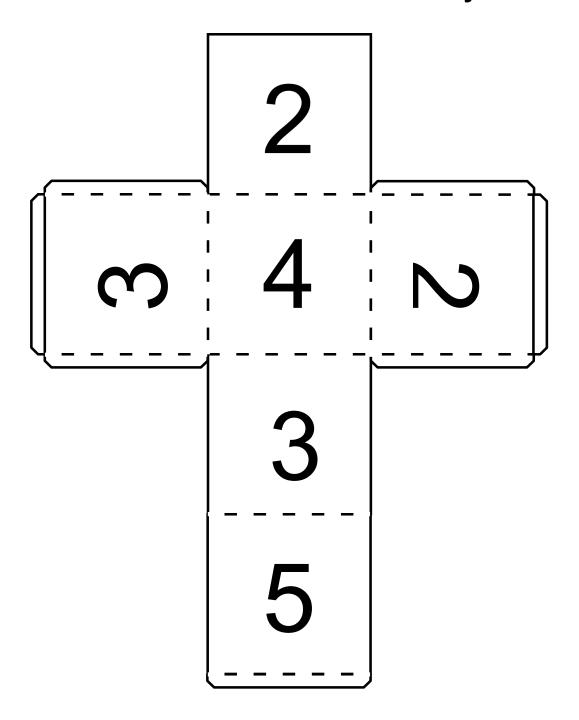
- 1. Roll the die to see how many toys Soland can buy.
- 2. Help Soland decide which items she should buy that total **less** than \$100.
- 3. Estimate the cost of the items so Soland does not go over \$100 for each roll.
- 4. Next, use mental math to figure out the exact total for the items.
- 5. Show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



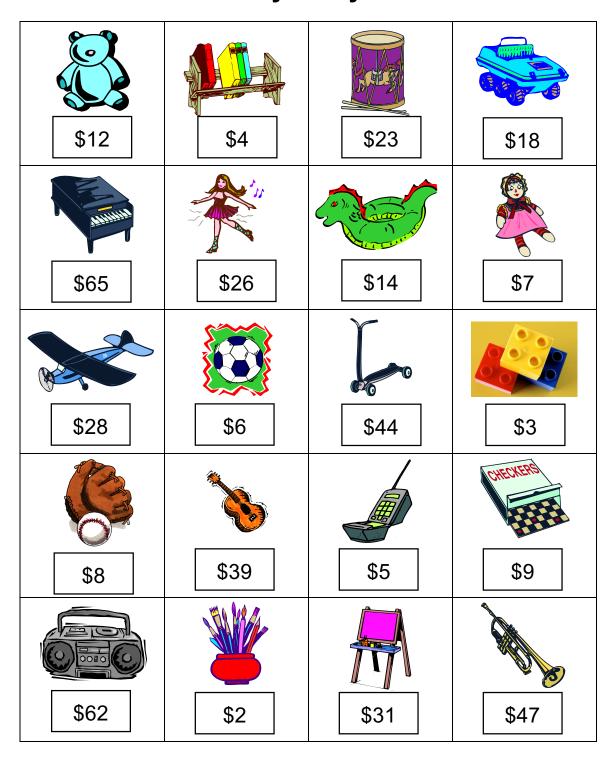
Number Cube—Diophantus



Number Cube—Kovalevsky



Tommy's Toy Store

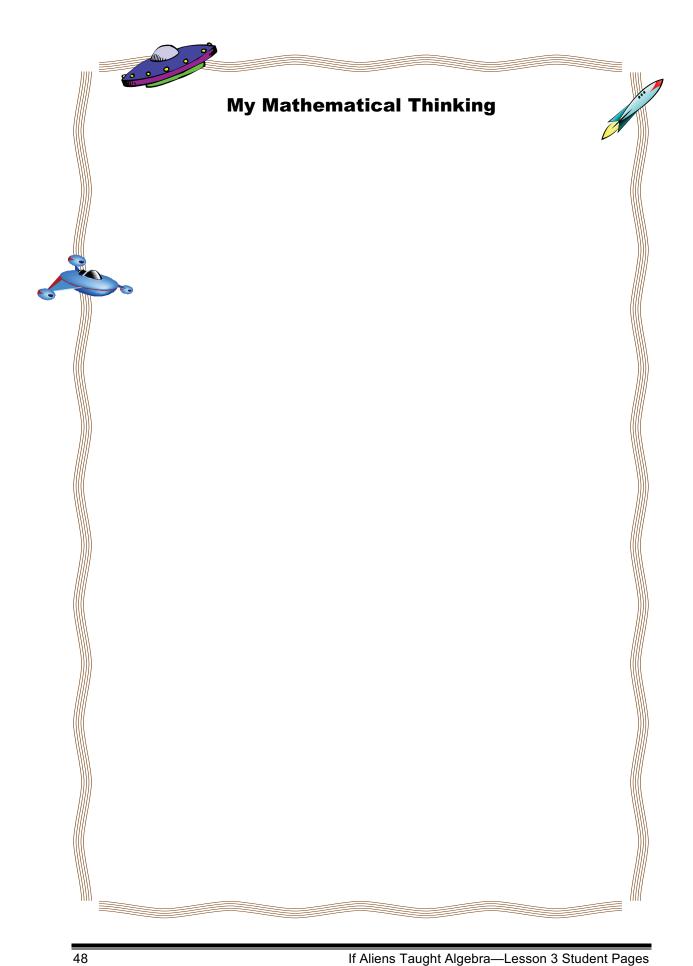


Shopper	Date	

A Planet Nine Alien Shopping Spree!— Diophantus

	tems Placed in the Shopping Cart	Cost of the Items	
			69
_			

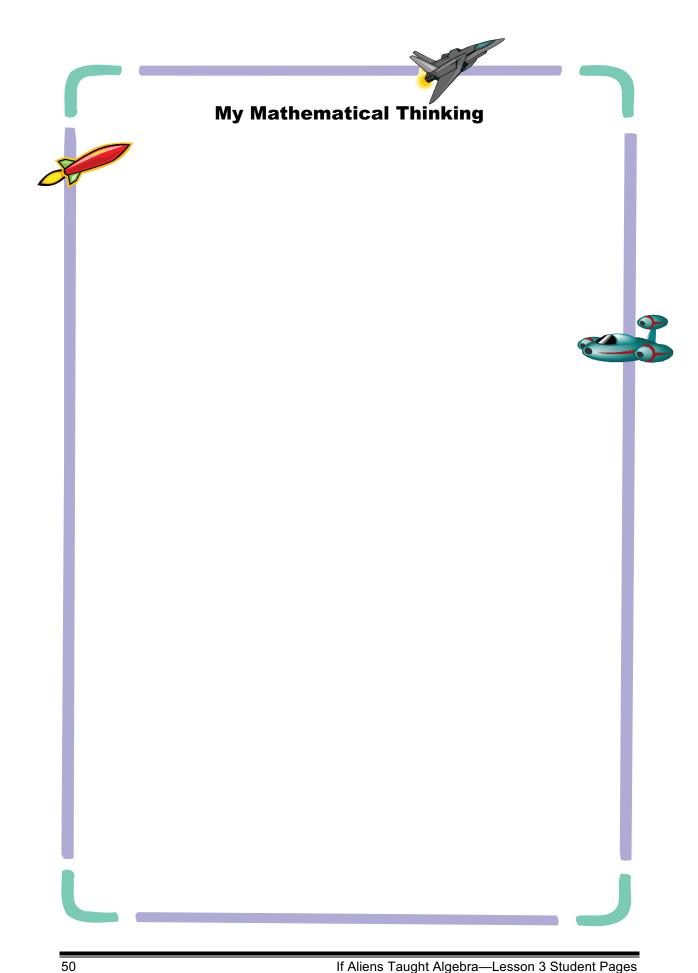
- 1. How did you estimate the total cost of all the items? Show your thinking here:
- 2. What is the exact cost of all the items? Show your thinking here:
- 3. Think of one other way to mentally add the numbers to find the exact cost. Keep in mind the different ways to equal 10.
- 4. How close was your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



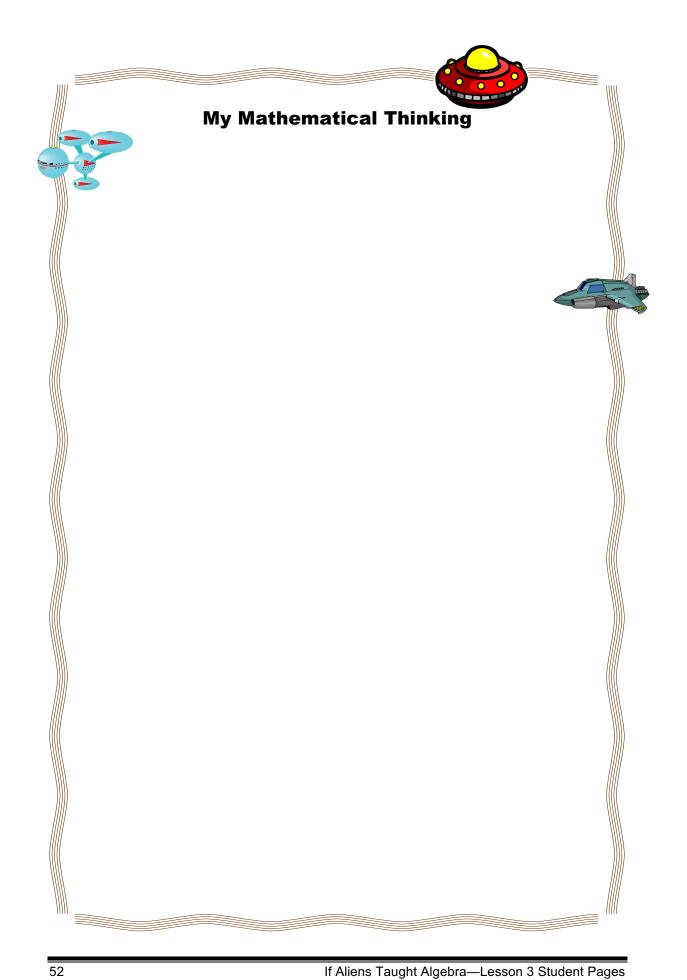
Shopper	Date	

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!

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





Shopper	Date	

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.

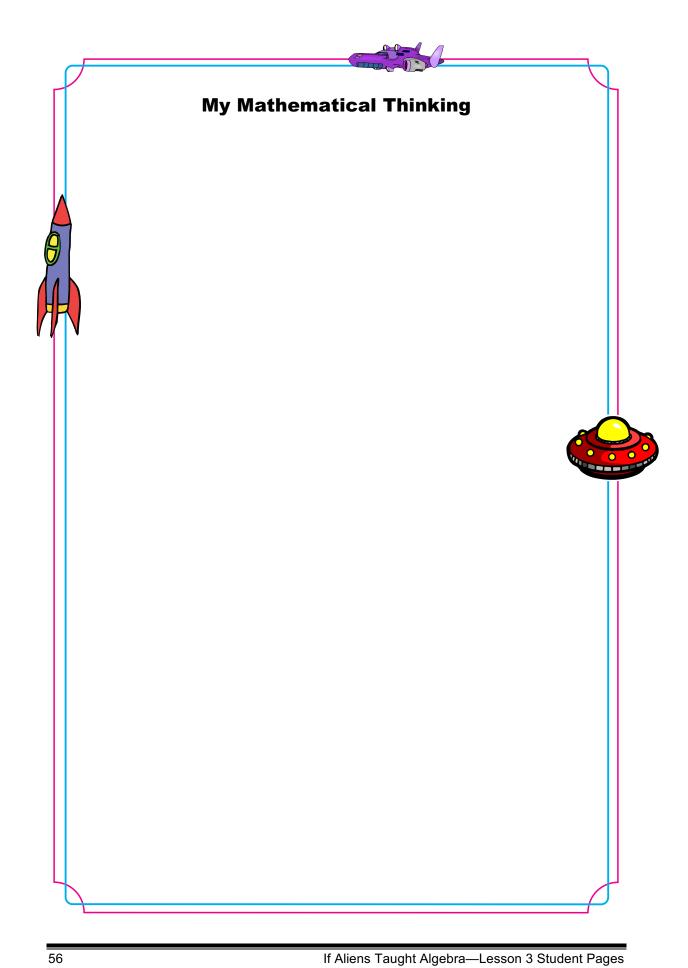
Wish List	Cost of the Items



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:

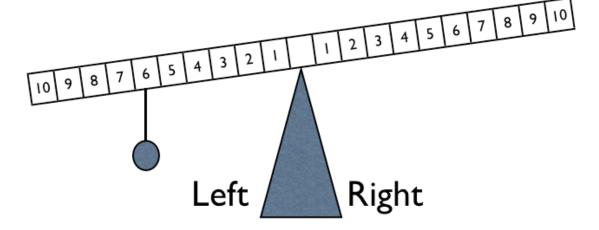
3. How close was your estimate in #1 to the exact cost you found in #2?



Lesson 4 Student Pages

Name Date

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?

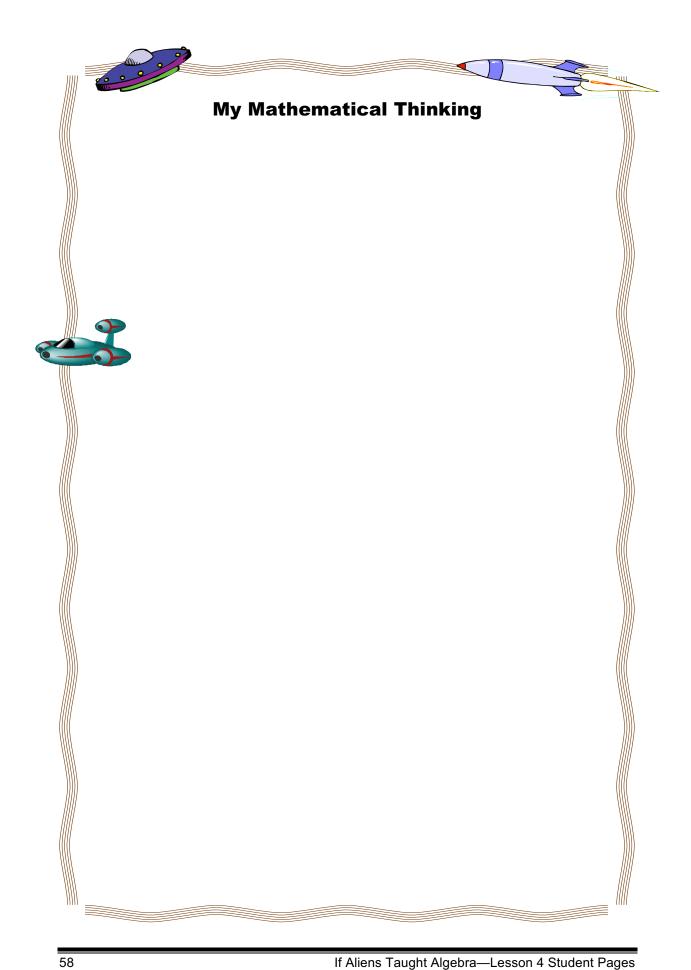
Location:

Number Sentence:

3. Where else could you place the two weights on the right side?

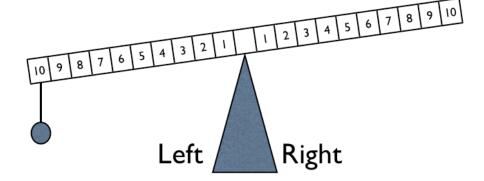
Location:

Number Sentence:



Name	Date	

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:

2. What if you had to use 2 weights on the right side?

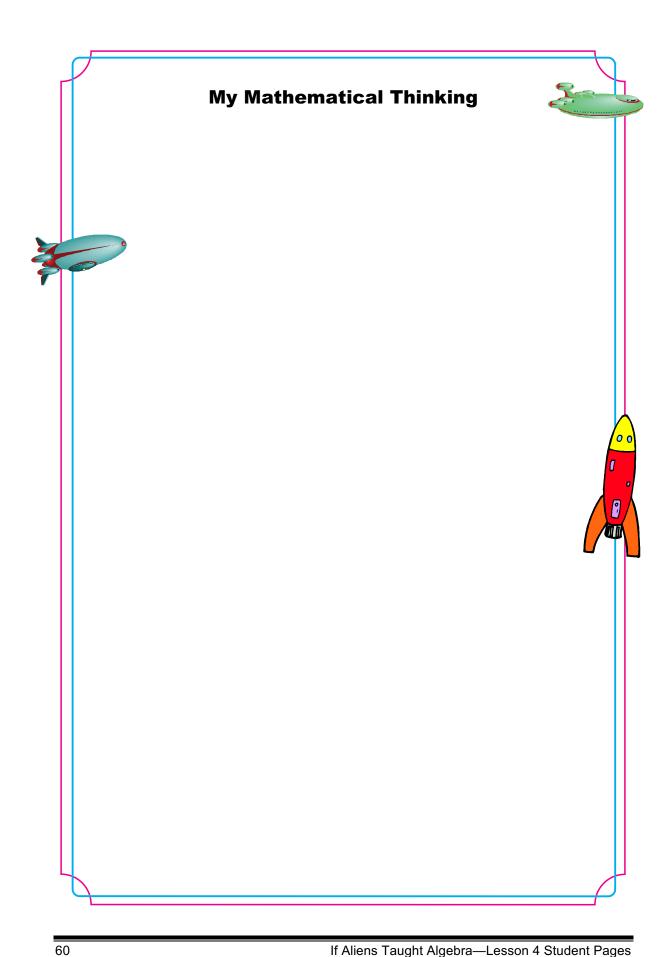
Locations:

Number Sentence:

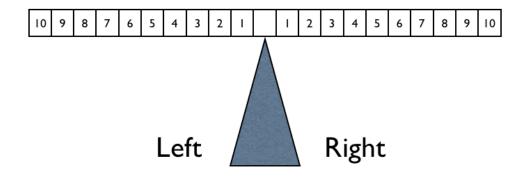
3. What if you had to use 3 weights on the right side?

Locations:

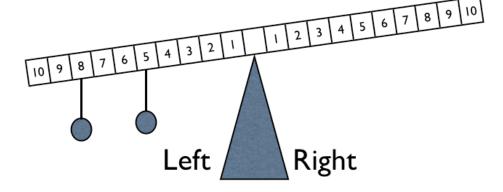
Number Sentence:



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



Number Sentence:



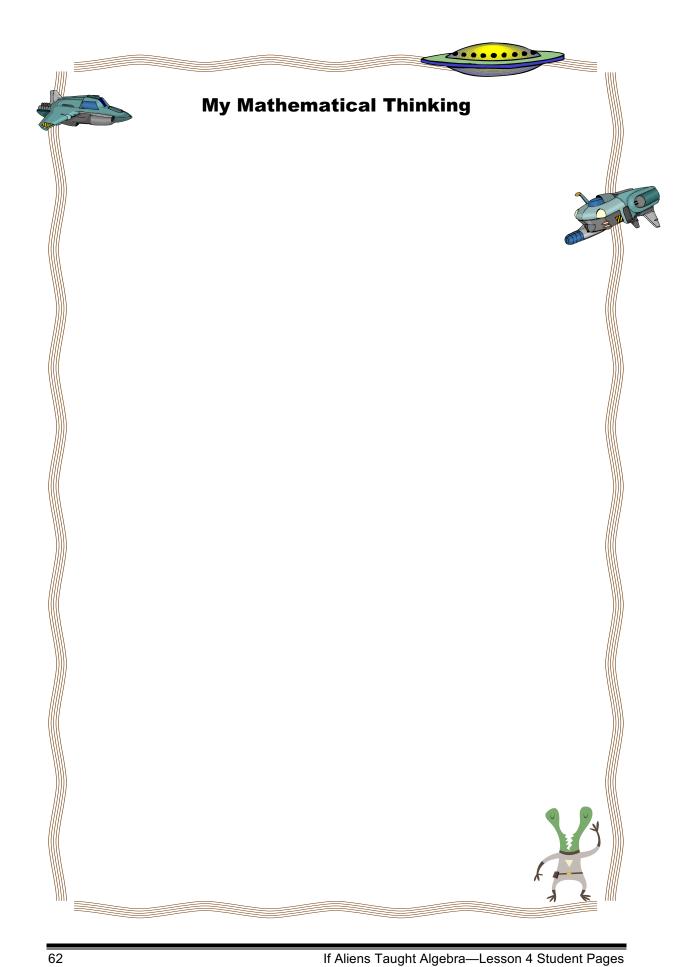
- 5. What do the weights on the left side add up to?
- 6. What is one way you could use 2 weights on the right side to balance the scale?

Locations:

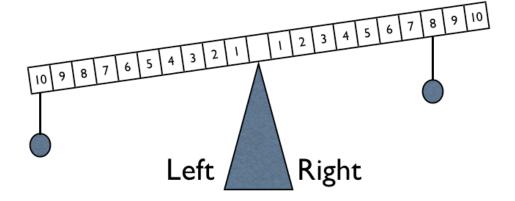
Number Sentence:

7. What if you had to use 3 weights on the right side? Where would you place them?

Locations:



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:

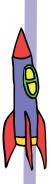
Number Sentence:

Explanation:

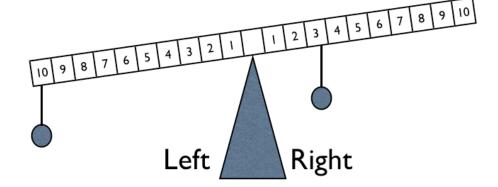


My Mathematical Thinking





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:

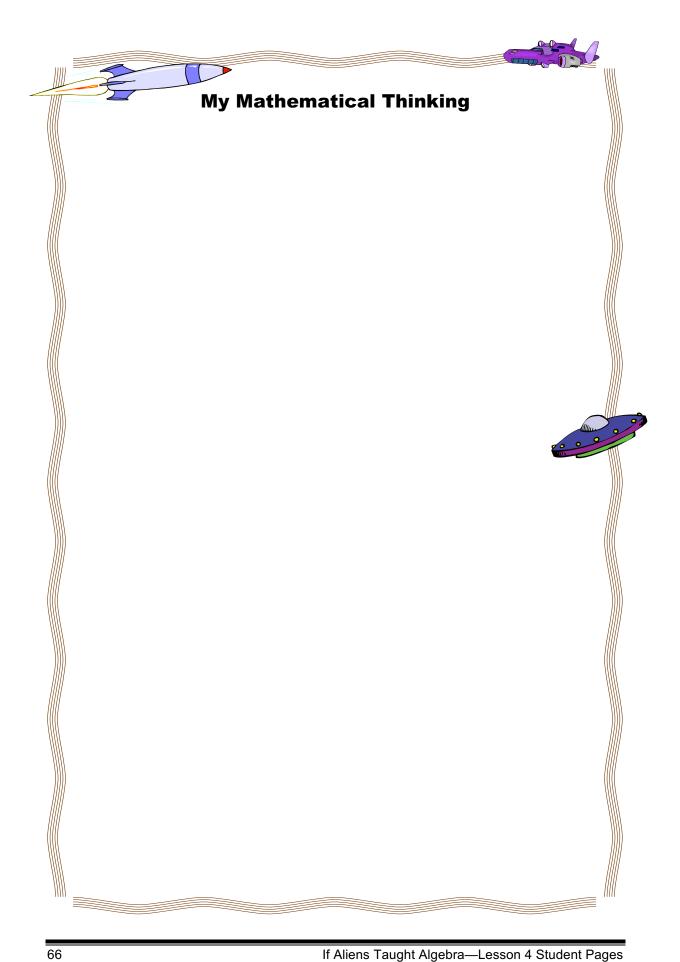
2. What if you had to use 2 weights on the right side?

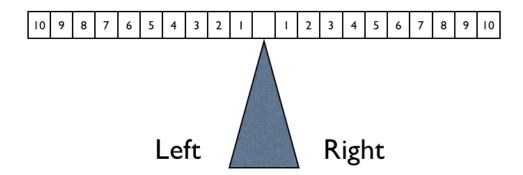
Locations:

Number Sentence:

3. What if you had to use 3 weights on the right side?

Locations:

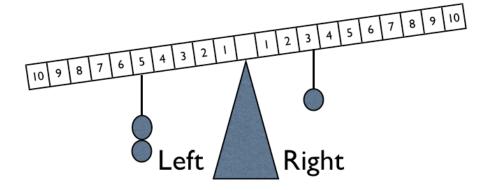




4. Create your own problem using 4 weights on four different numbers to make this scale balance. Write your number sentence below.

Number Sentence:

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 5s or a total of 10. Where could you place 2 weights on the right side to make the scale balance?

Locations:

Number Sentence:

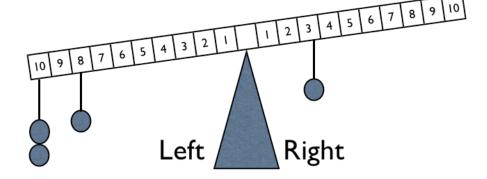
6. What is another way you could place the 2 weights?

Locations:



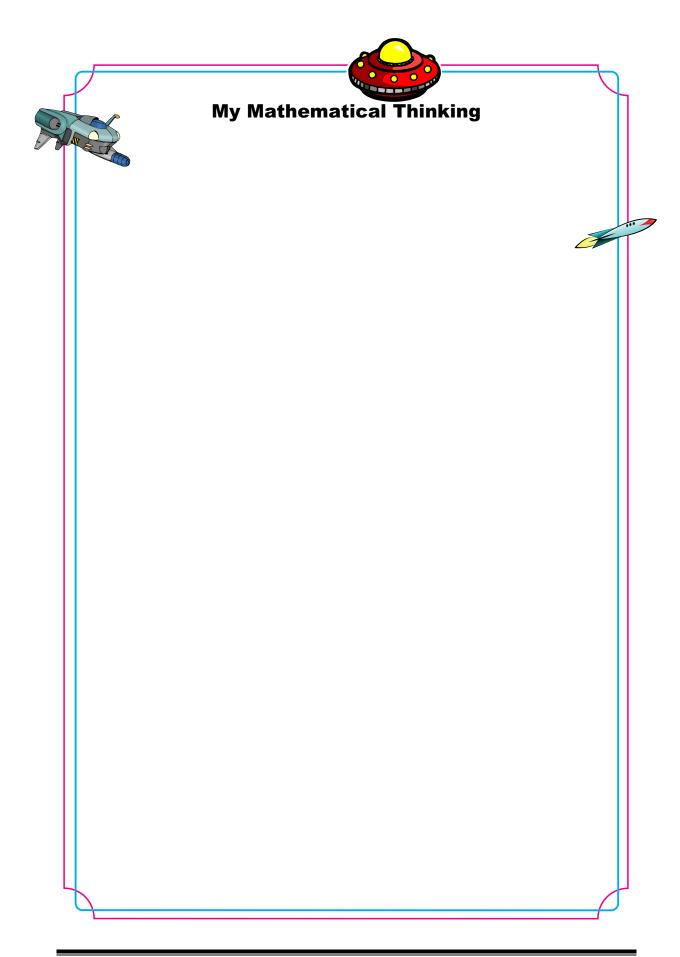




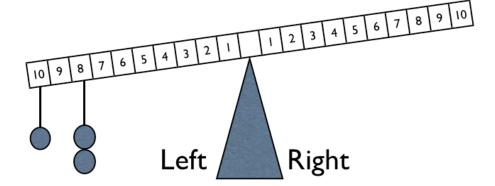


7. What if you could use as many weights as you wanted? Explain your thinking.

Locations:	
Number Sentence:	
Explanation:	



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? _____

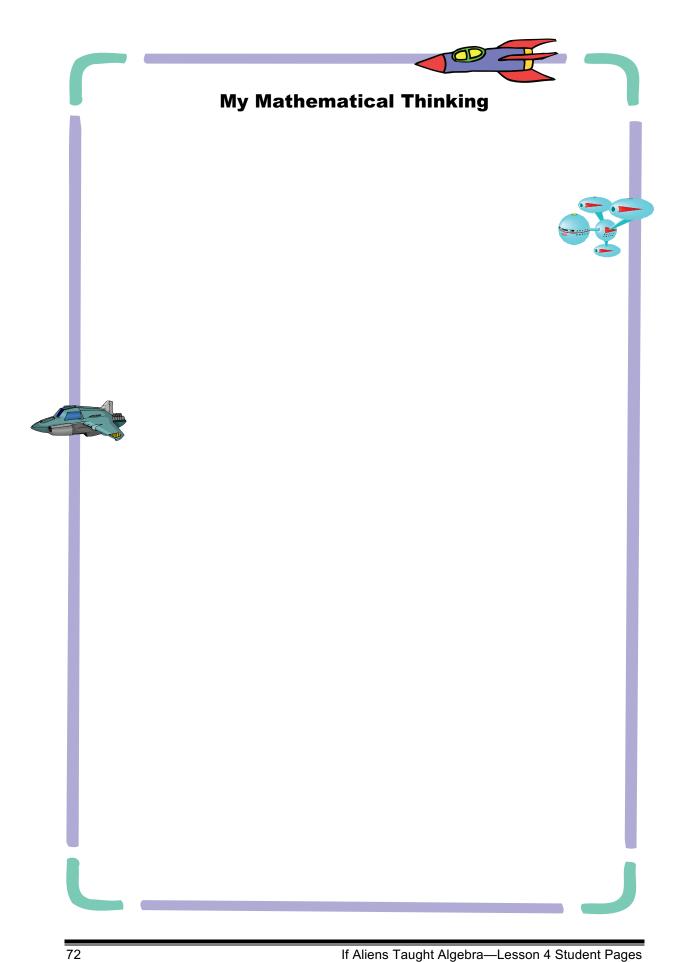
2. Where could you place 4 weights on the right side to make the scale balance?

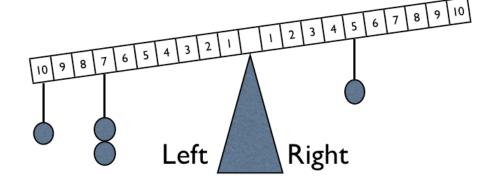
Locations:

Number Sentence:

3. What if you had to use six weights?

Locations:



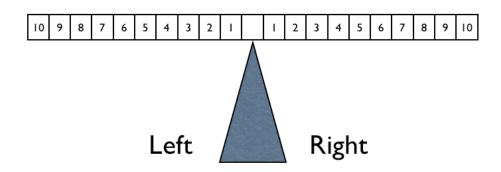


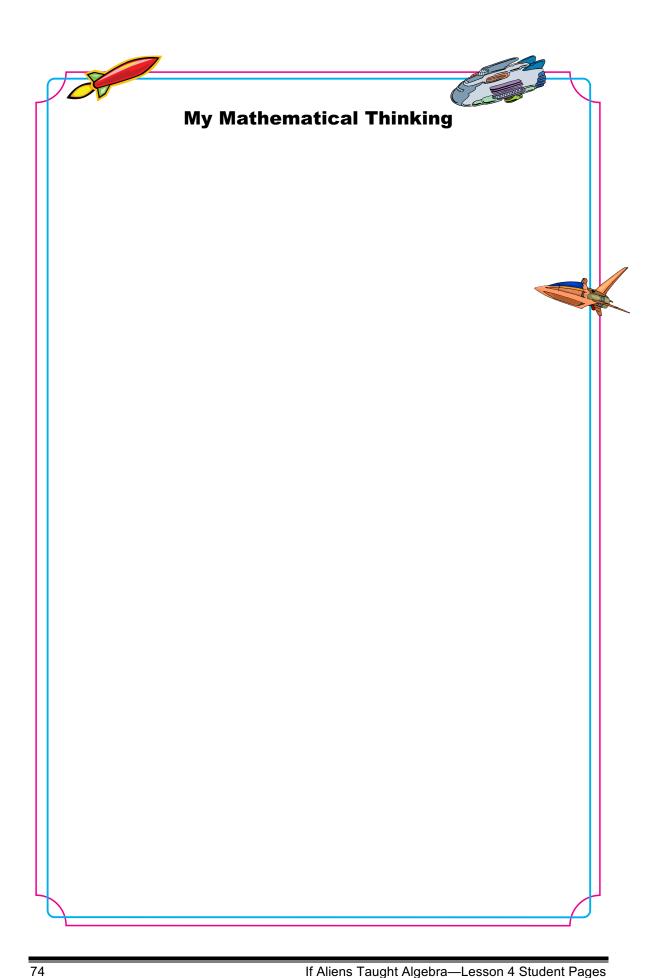
- 4. How much weight does the left side have now? _____
- 5. Where would you place 4 weights on the right side to make the scale balance?

Locations:

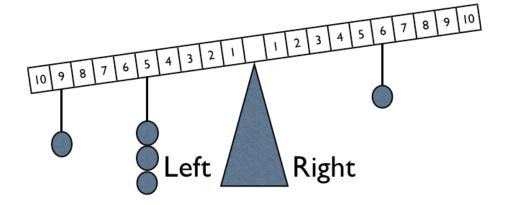
Number Sentence:

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





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 b	alance	the	scale
----	-------------	-------------	---------	--------	------------	------	--------	-----	-------

Locations: ______

Number Sentence: ______

8. What is another way you could place 5 weights on the right side to balance the scale?

Locations:

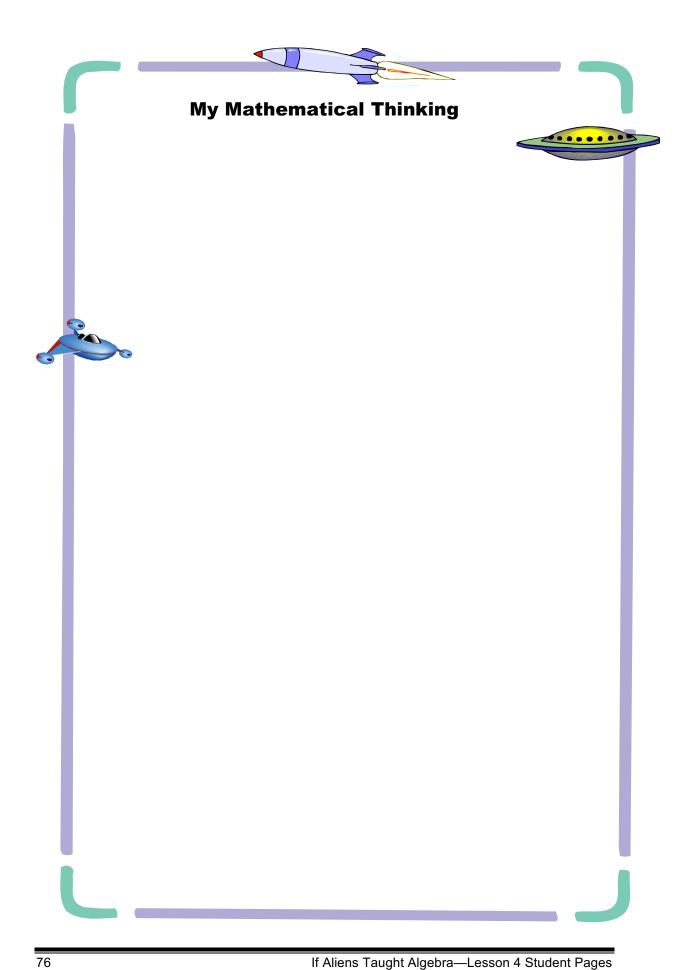
Number Sentence:

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

Locations:

Number Sentence:

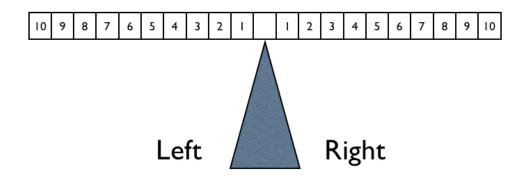
Explanation:



Name	Date	

Equal Sides—Homework

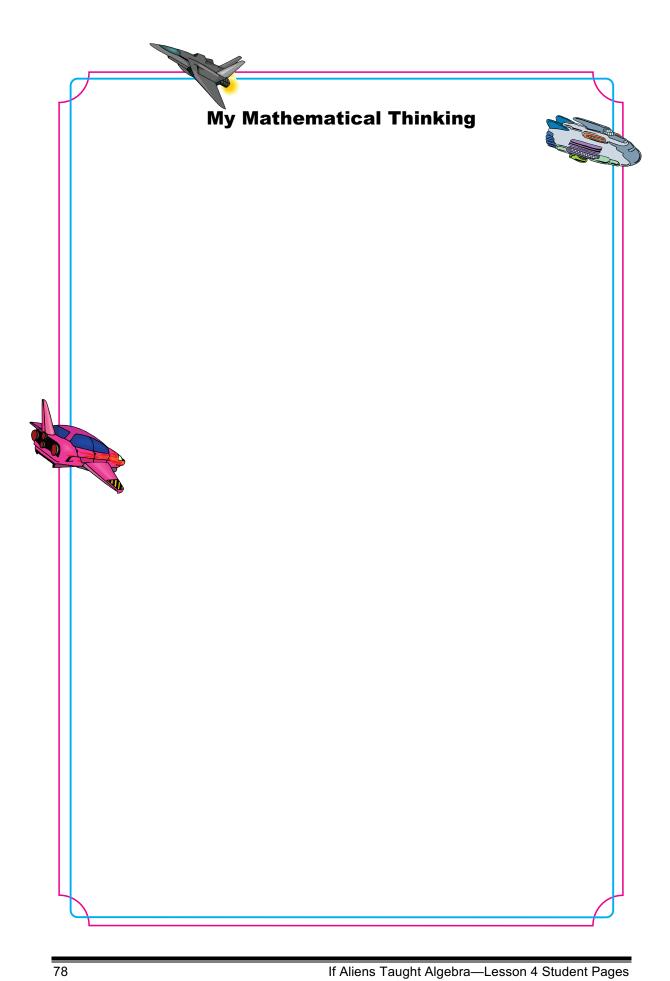
Directions: Create your own problem using 8 weights on each side to make this scale balance. Write your number sentence below.



Number sentence:

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	Date
------	------

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

Treasure Finder	Date	
Trascura Findar	Data	
i i casare i iliaci	Date	

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	*	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



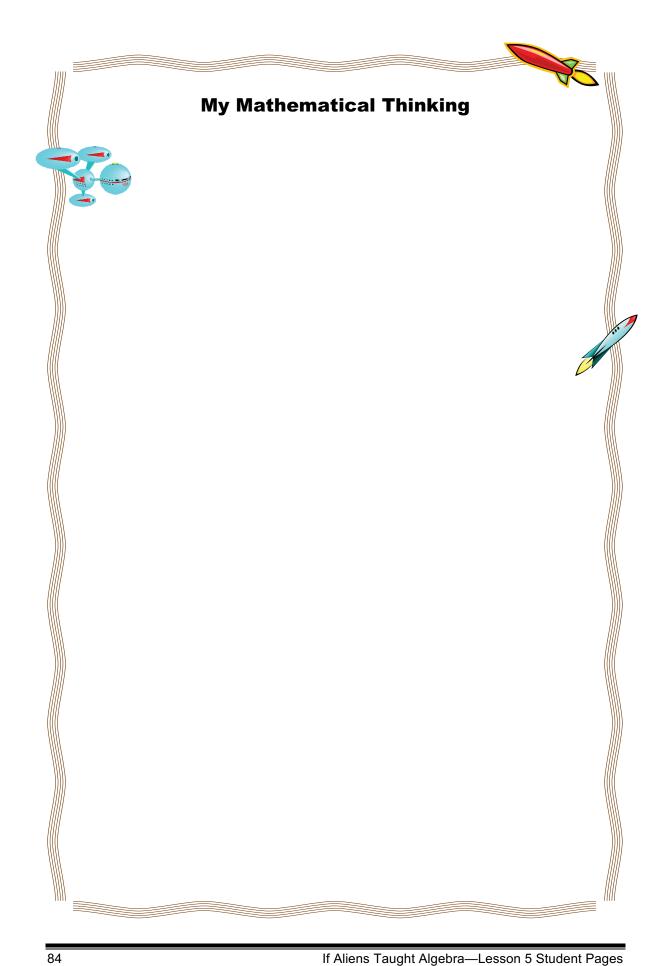
Start

Here

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!



Treasure Hunt Directions for All Groups



Treasure Hider

If you are the treasure hider, you need to place an "X" on your 100s chart where the treasure is hidden. Do not show your partner! Make sure your partner can not see where you hid the treasure. After your partner tells you where he/she is starting, you need to give directions to the treasure.



Treasure Finder

If you are the treasure finder. circle the number where you started. You can pick any number. Tell the hider where you are starting. Listen carefully to your partner's directions. When he/she is finished giving directions, tell him/her where vou believe the treasure is hidden.

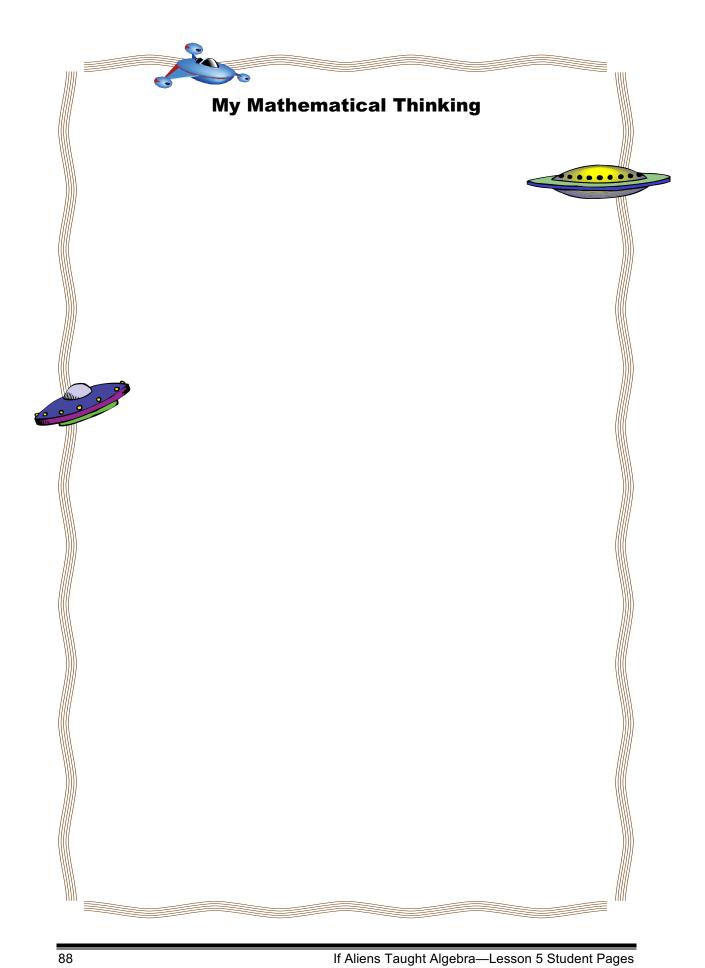
Each person in the group should have at least one chance to hide the treasure and one chance to find the treasure. After everyone has a chance to do this, answer the questions. If you have more time, you can use the extra charts to play again. Good luck!



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

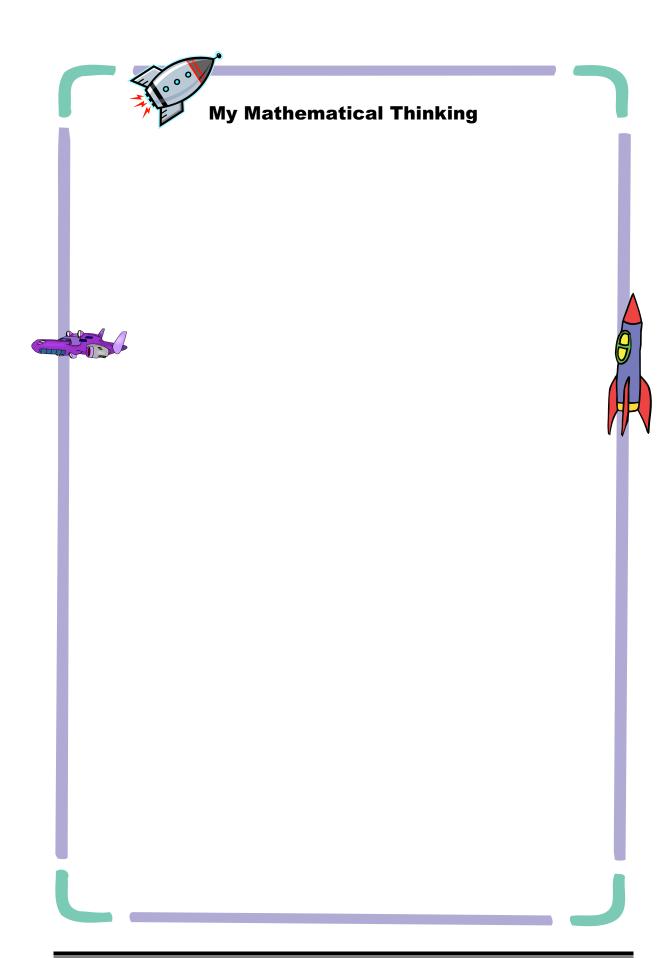
I hid the treasure at	My partner is starting at
	Here are my directions to the treasure:



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

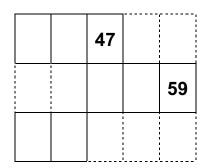
I am starting at	After fol	After following my partner's				
directions, I believe the treasure	e is at	Were you				
right?						



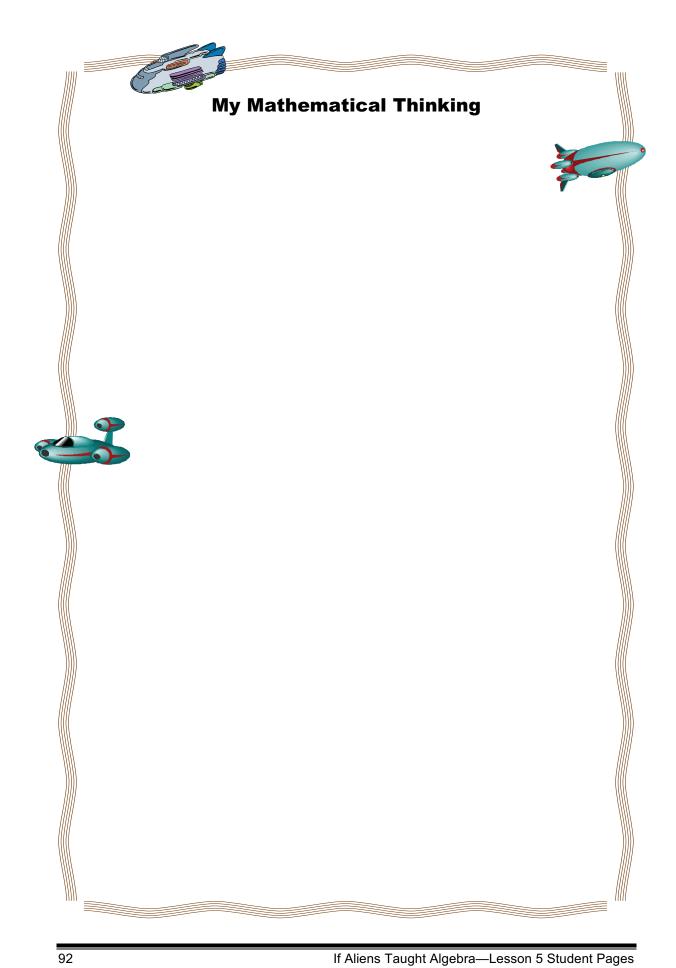
Treasure Hunt Questions—Diophantus

- 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 10s, 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.



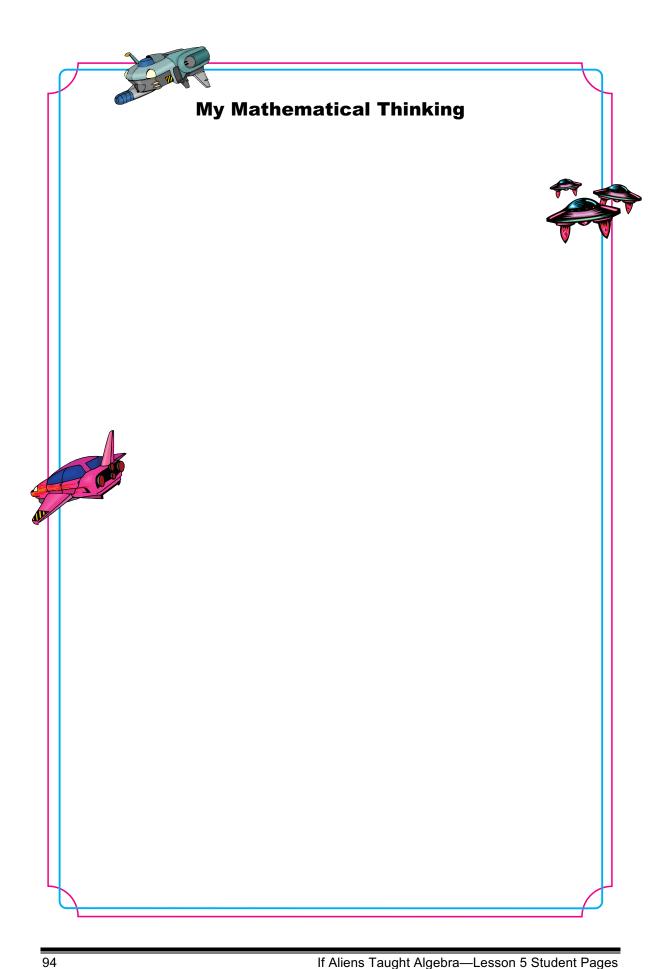
Describe how you filled in the missing numbers.



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

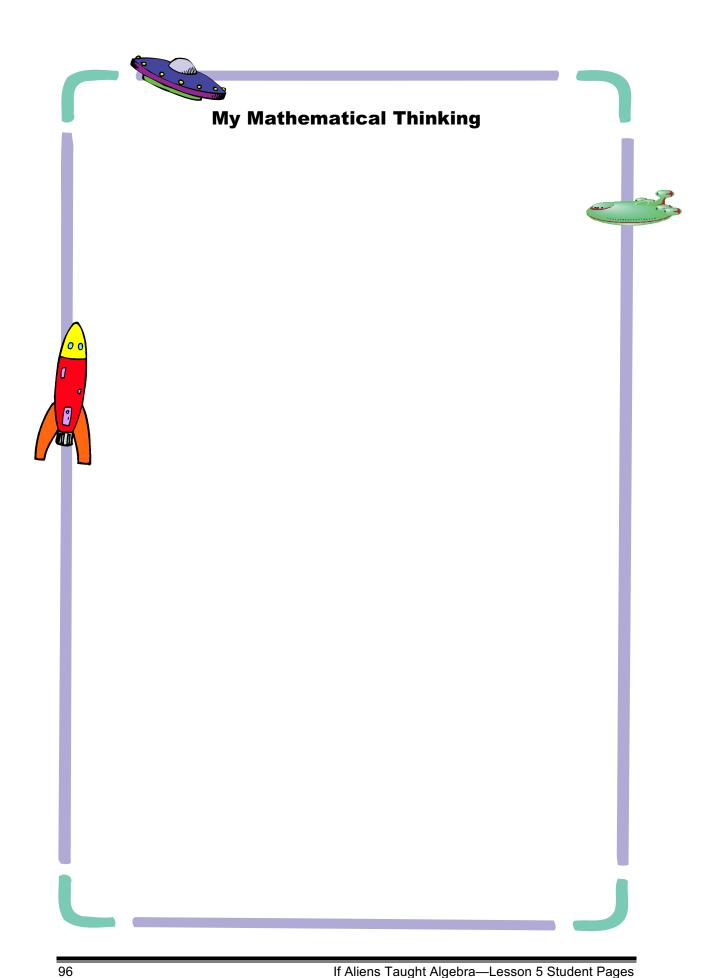
I hid the treasure at	My partner is starting at				
	Here are my directions to the treasure:				



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	After following my partner's				
directions, I believe the treasure	is at	Were you			
right?					

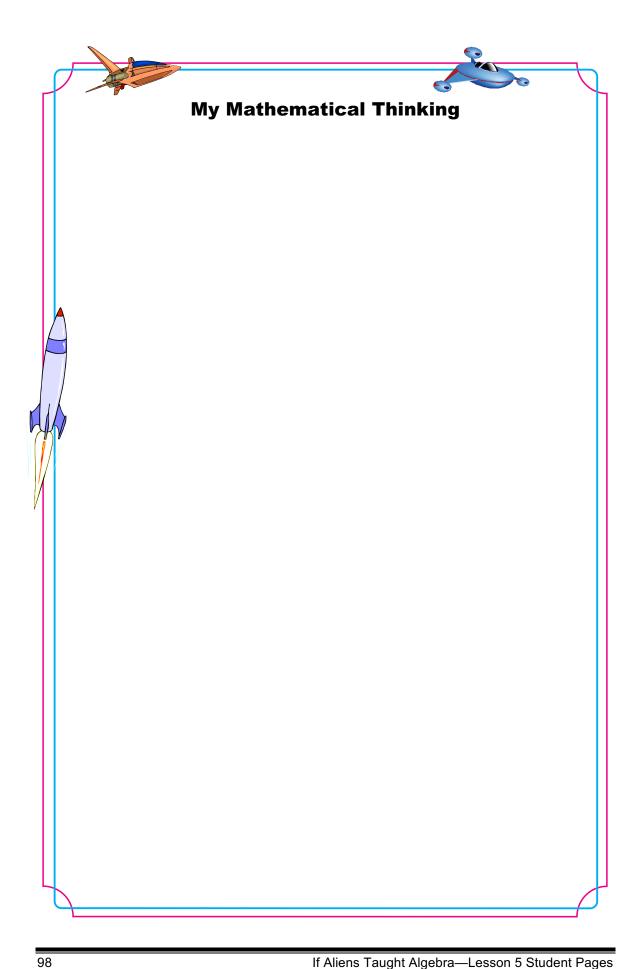


Treasure Hider Date	
---------------------	--

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		59	60
61	62	62 63 64		65
66	67	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 _____. My partner is starting at _____. Here are my directions to the treasure:

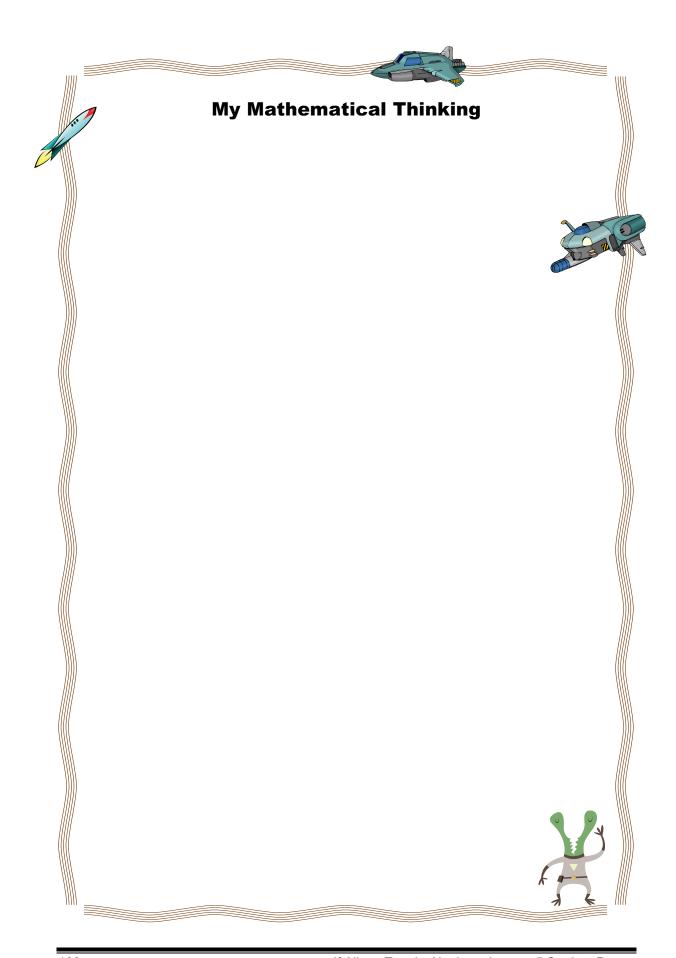


Treasure Finder	Date
-----------------	------

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	. After following my partner's
directions, I believe the treasure is	at Were you
right?	



Treasure Finder	Date
Treasure Hunt Questions—	-Kovalevsky
How is this 100s chart different from the one beginning of the lesson? Describe some of	•
2. What was the most challenging part about t	this task?
3. How would you improve your directions?	
4. Tutah just emailed you the following direction	ons: Start at 97,

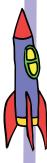
subtract four 5s, then subtract 2, add one 5, add 2, subtract four 5s, and add 2. Where is her treasure buried? Could you give

simpler instructions? If so, how?



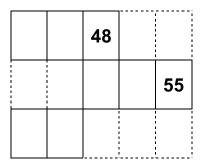
My Mathematical Thinking



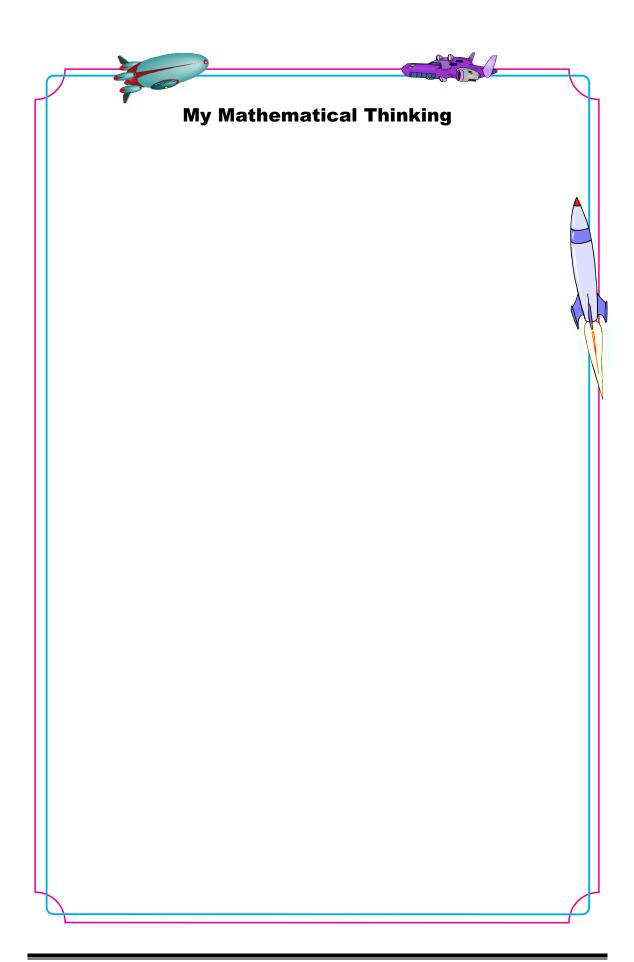


5. A new 100s chart just arrived that does not look like either of the charts you have been using. When you go down one column, the numbers increase by 7. When you go diagonally down and to the right, the numbers increase by 8. When you travel diagonally down and to the left, the numbers increase by 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.



Treasure Hider Date	
---------------------	--

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 _____. My partner is starting at _____. Here are my directions to the treasure:



My Mathematical Thinking



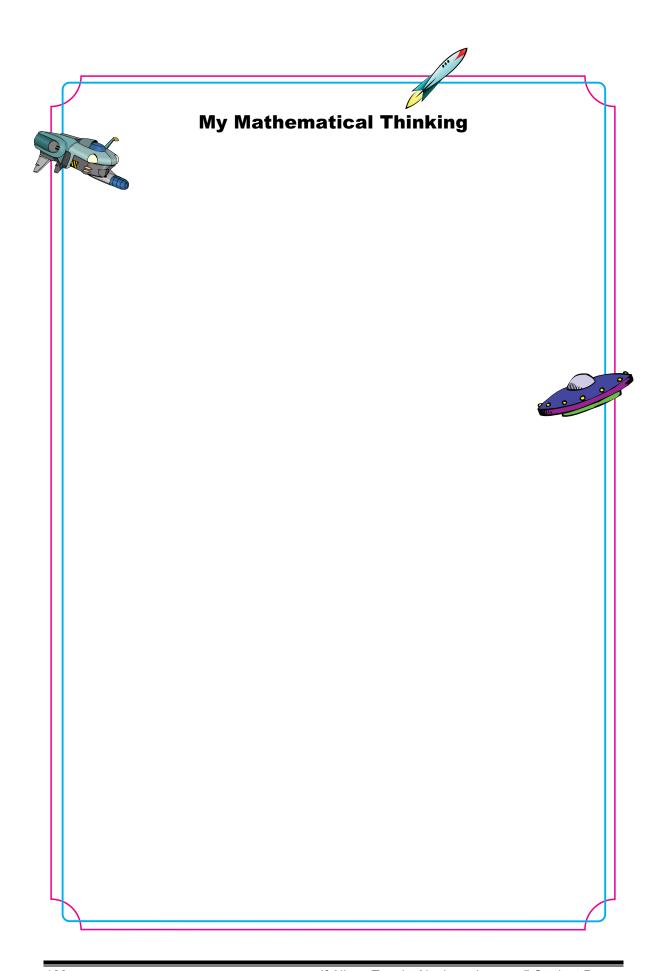


Treasure Finder	Date
-----------------	------

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	62 63 64		65
66	67	68	68 69	
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	. After following my par	rtner's
directions, I believe the treasure is	at	Were you
right?		



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 Super Challenge 2 Complete the 100s chart. (Hint: Complete the 100s chart. (Hint: This chart has 5 numbers in This chart has 5 numbers in each row.) each row.) 81 33 95 **Super Challenge 3 Super Challenge 4** Complete the 100s chart. (Hint: Complete the 100s chart. (Hint: This chart has 10 numbers in this chart has 7 numbers in each row.) each row.) 16 38 28



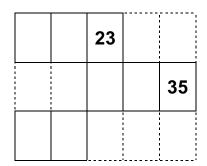




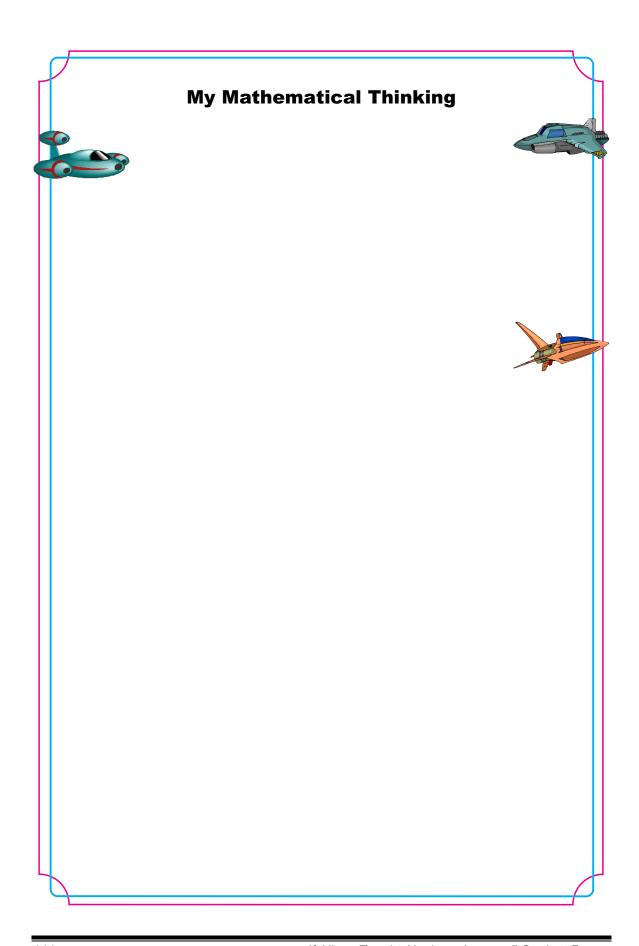
Mathematician	 Date	

Pattern Mysteries—Homework

- 1. Tutah just texted you the following directions: Start at 29, add three 10s, then subtract 4, add 11, add two 10s, 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	Date	

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 _____ Date ____

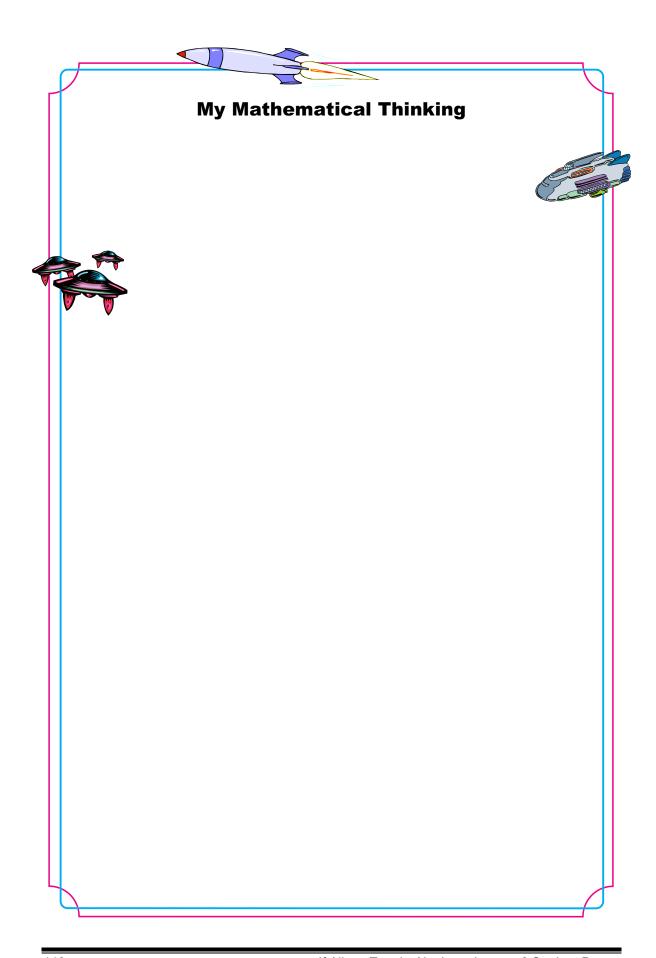
100s Chart Pattern Language

		I	Diagon 7	al				Column vertical		
	1	2	3	4	5	6	7	∞	9	10
	11	12	13	14	15	16	17	18	19	20
Row (horizontal)	21	22	23	24	25	26	27	28	29	30



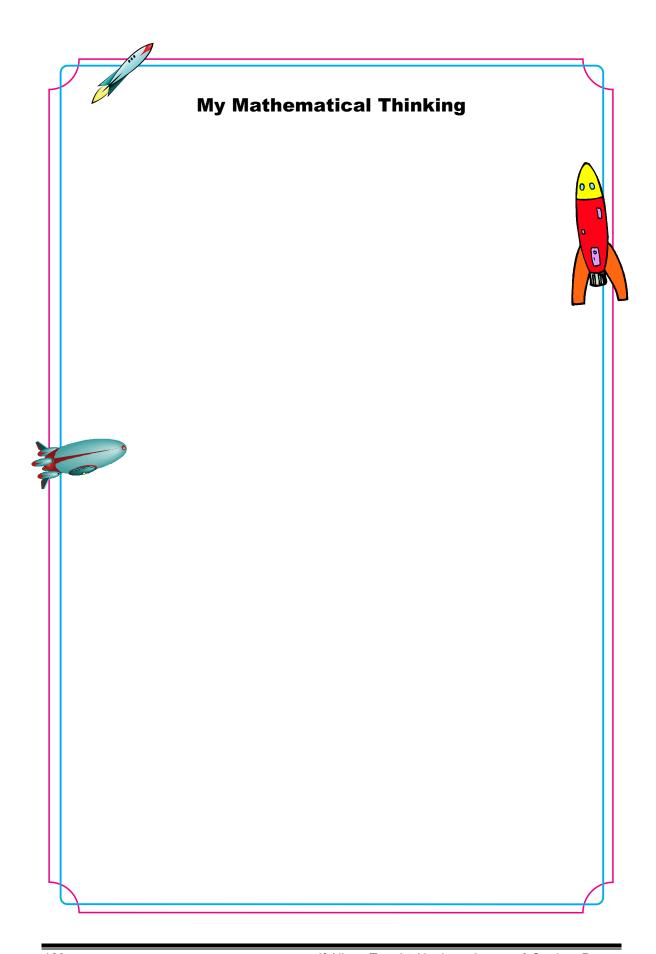
Greetings Earthlings!

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



Pattern Seeker	Date
Searching for Patterns—	Fibonacci
1. Focus on the numbers that are circled. What	at do you notice?
2. What are these numbers multiples of? (Rer pretend to start on 0 and count to the first n you find the multiples of the numbers.)	
3. Look at the numbers that have triangles in to you notice?	the corners. What do
4. What are these numbers multiples of?	
5. What is the 5th multiple of 3?	

6. Look at both the triangles and circles. When do they overlap?

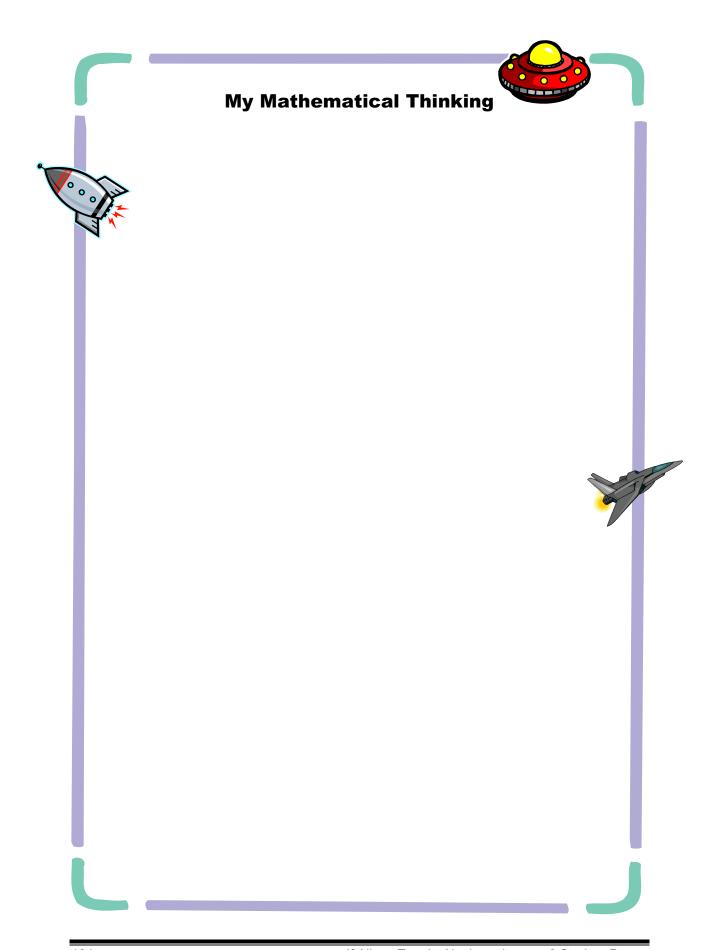


Searching for Patterns—Fibonacci (Continued)

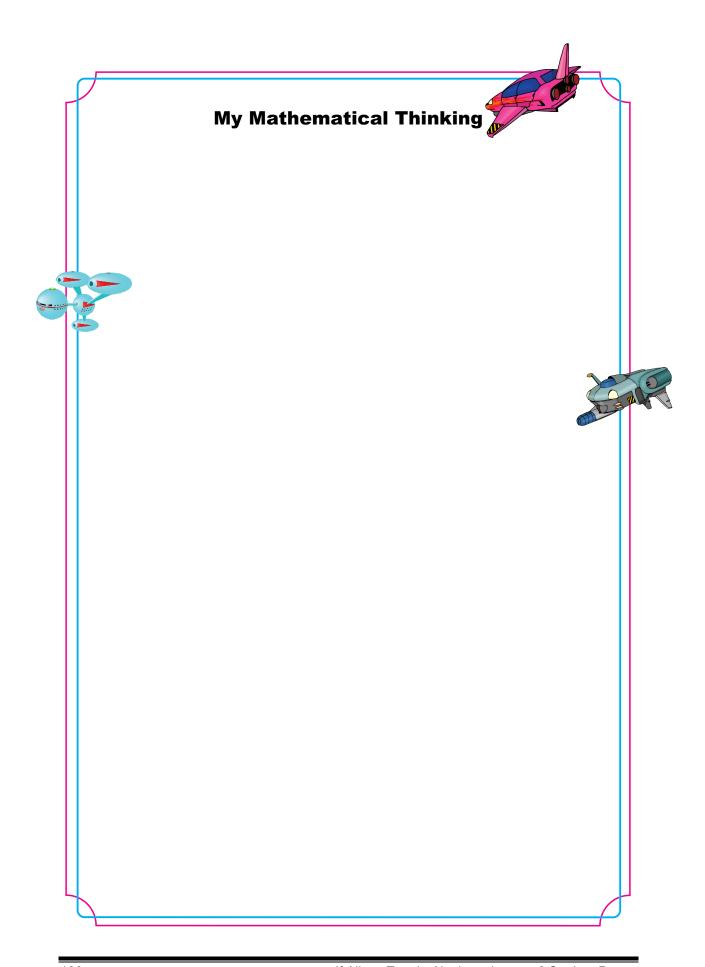
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	5 2	53	5 4	55	56	57	5 8	59	60
61	6 2	63	64	65	66	67	6 8	69	70
71	72	73	74	75	7 6	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Pa	ttern Seeker	Date
	Searching for Patterns—[Diophantus
1.	Focus on the numbers that have triangles in What do you notice?	n the lower left corner
2.	What are these numbers multiples of? (Rer pretend to start on 0 and count to the first n 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 are	ound them. What do

you notice?



6.	What are these numbers multiples of?
7.	What is the 4th multiple of 9?
8.	Look at all of the shapes. When do they overlap? What do you notice?



Pattern Seeker Date	
---------------------	--

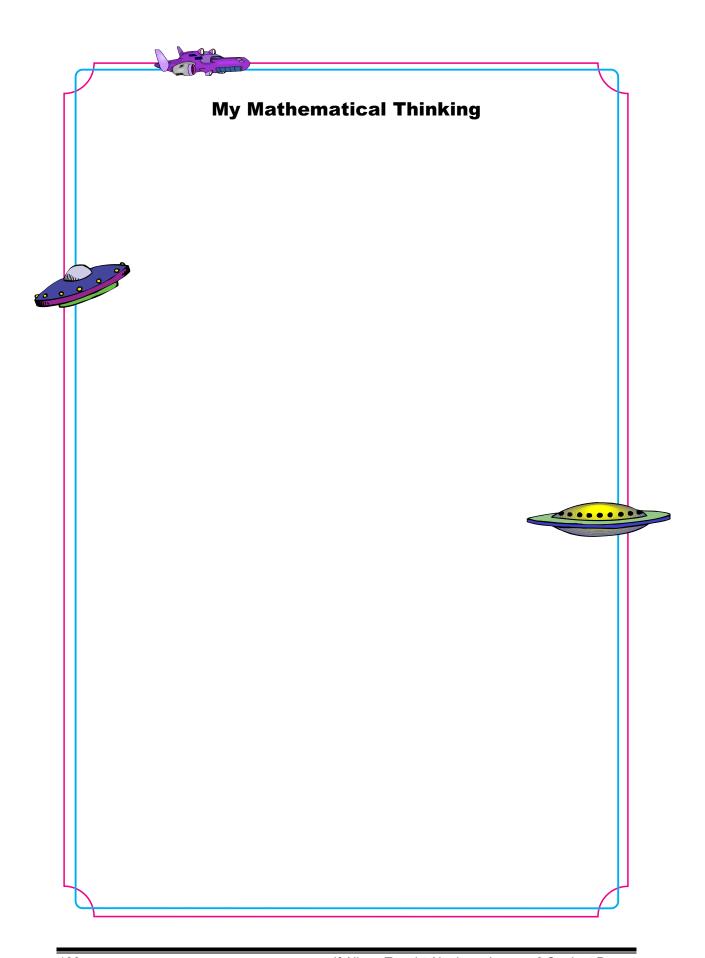
Searching for Patterns—Diophantus (Continued)

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	5 6	57	58	59	60
61	62	63	64	65	66	67	68	69	7 0
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

Pat	ttern Seeker	Date
	Searching for Patterns—Ł	
1.	Focus on the numbers that have clouds are you notice?	ound them. What do
2.	What are these numbers multiples of? (Rer pretend to start on 0 and count to the first n you find the multiples of the numbers.)	•
3.	Look at the numbers that have a triangle in What do you notice?	the top left corner.
4.	What are these numbers multiples of?	
5.	Look at all of the shapes. When do they ovenotice?	erlap? What do you

6. If you were to color in the multiples of 3, which shape would be

colored in most often? Least often?



Pattern Seeker Date	
---------------------	--

Searching for Patterns—Kovalevsky (Continued)

1	2	3	4	5	6	7	(B)	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	(F)	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

Pattern Seeker	Date	

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

Pattern Seeker	Date	

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 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 3

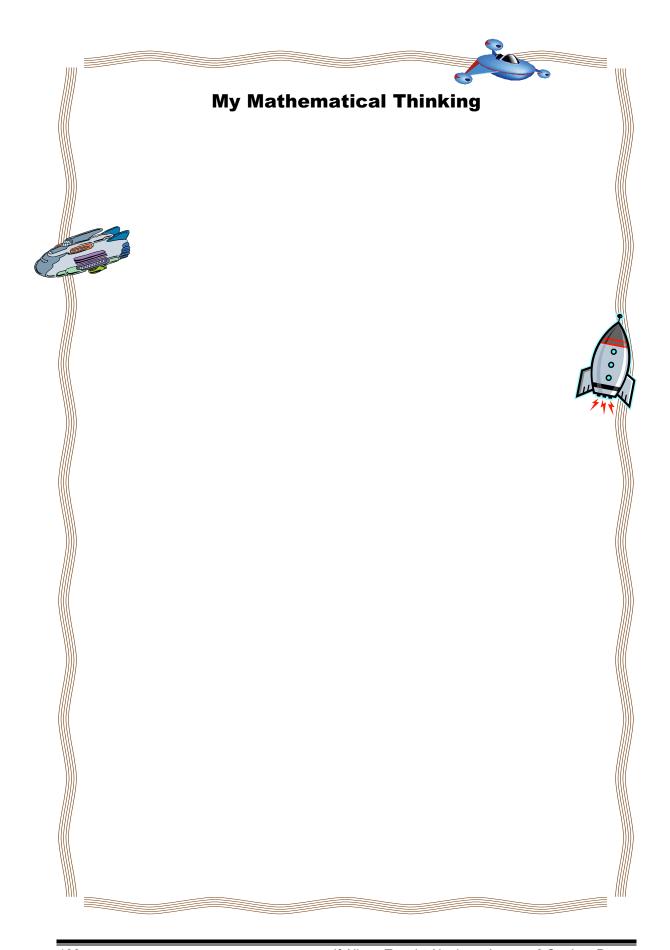
Create a 100s chart pattern using a mathematical concept. For example, all the multiples of 3 or all the even numbers could be colored. You could even share it with a partner. Ask him/her if he/she can figure out your pattern.

Super Challenge 4

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

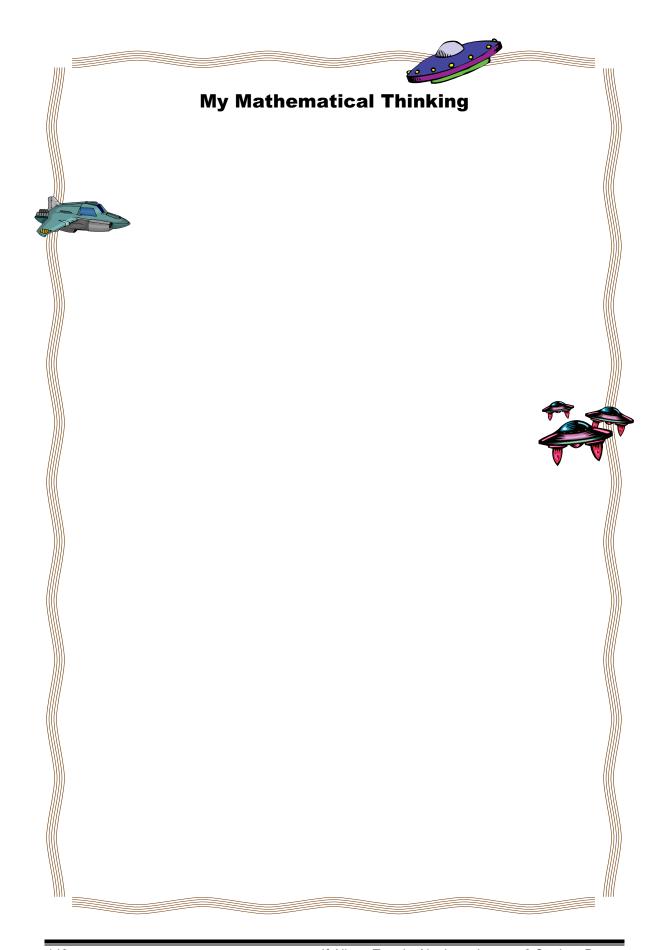
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

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



Pattern Seek	er	Date
Se	arching for Patterns—	Homework
1. What mu	ultiples are designated with the circ	le? The triangle?
2. What is t	the 6th multiple of 9?	
3. Choose	a number between 1 and 20. Color	in all the multiples of
	ber. You should not choose a mult	
4. Describe	e the patterns you see.	

5. Which multiples share the most numbers?



Searching for Patterns—Homework (Continued)

1	2	3	4	5	60	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	<u>50</u>
51	5 2	53	54	55	56	57	5 8	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

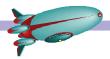
Lesson 7 Student Pages

Human .	Date	12
W,	Getting to Know Planet Nine Aliens	M

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 Planet Nine Aliens	Number of Heads	Number of Eyes	Number of Toes	Number of Fingers
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Name one strategy you used to find your answers.



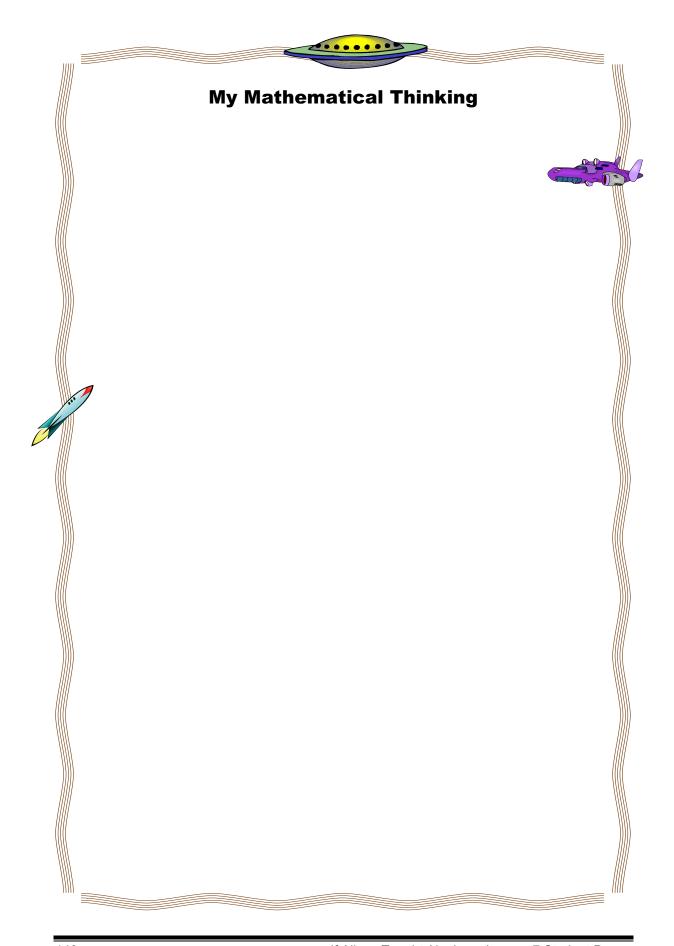
My Mathematical Thinking





Questions

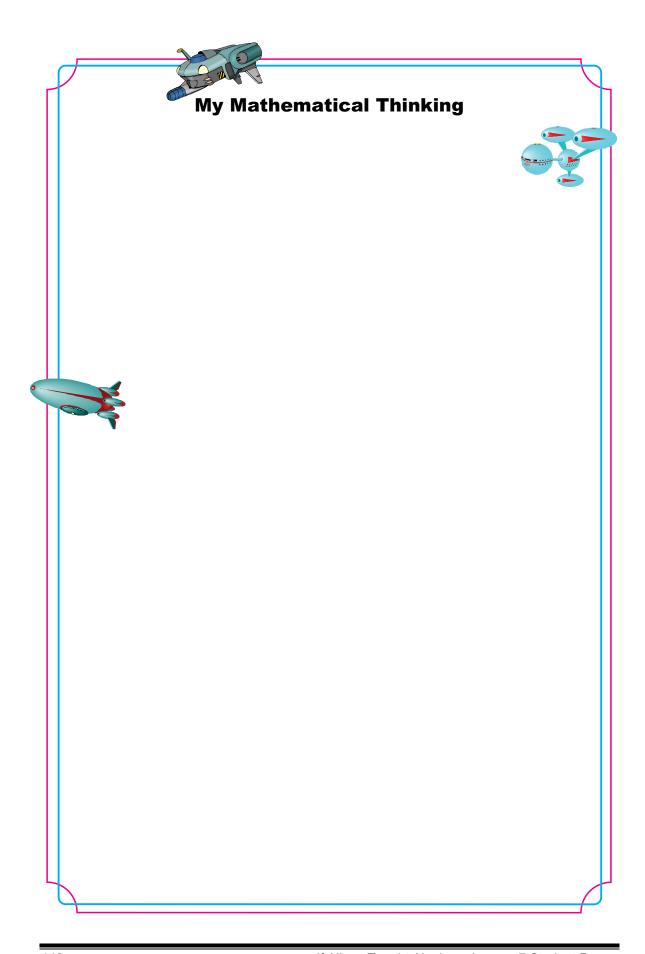
a. How many humans are in a group with 60 toes?
b. How many Planet Nine aliens are in a group with 60 toes?
c. If another group of Planet Nine aliens has 12 toes each, how many would be in a group with 60 toes? Show your work below
Create your own Planet Nine alien species. Work with a partner to create 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:

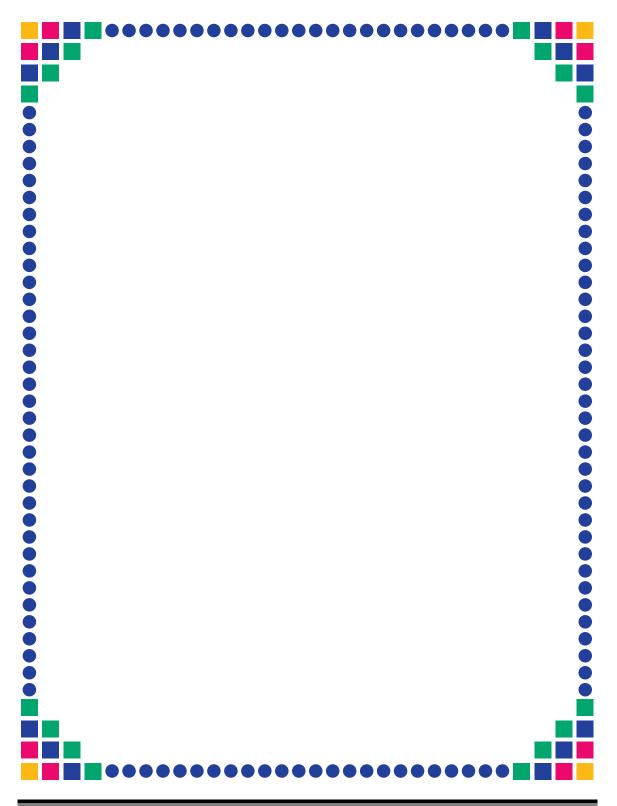
Number of Planet Nine Aliens	Number of	Number of	Number of
0			
1			
2			
3			
4			
5			
6			
7			
8			

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!

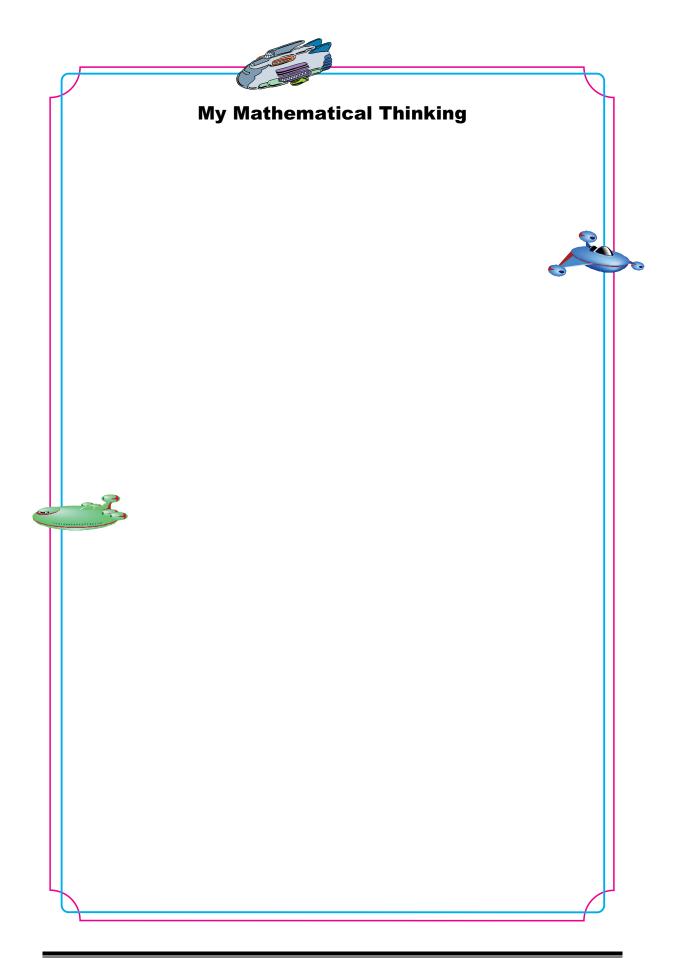






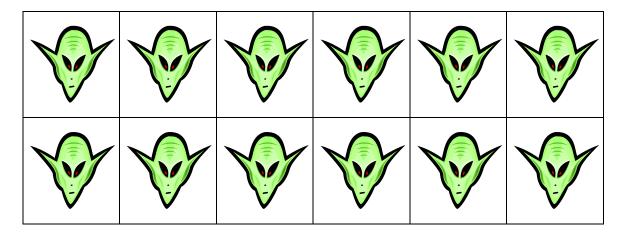
Getting to Know Planet Nine Aliens— Homework

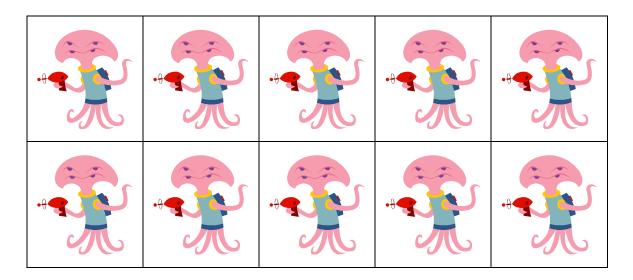
Pick any starting number and count up by 2s until you fill in all the lines.					
Count up by 10	— — — 0s starting fro	m 13 until you	fill in all the lin	 nes.	
_13					
Fill in the miss	ing boxes in th	ne table.			
Number of Planet Nine Aliens	Number of Heads	Number of Eyes	Number of Toes	Number of 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 6s starting from 0 until you fill in all the lines.					
0					
Count up by 12	Count up by 12s starting from 0 until you fill in all the lines.				
0					



Lesson 8 Student Pages

Planet Nine Alien Manipulatives





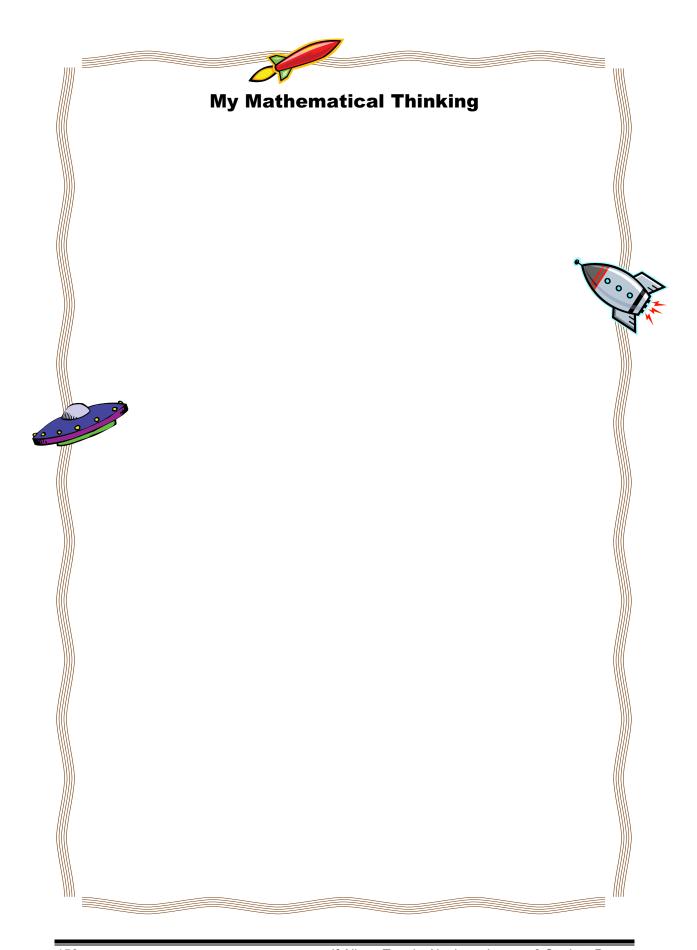
Human	Date	

Alien Multiplication Tables

2-Eyed Planet Nine Alien Multiplication Table

Table A

Number of Planet Nine Aliens	Multiplication Problem Used to Find Total	Commutative Property (Hint: Flip It!)	Total Number of Eyes
0	0 x 2	2 x 0	0
1	1 x 2	2 x 1	2
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			



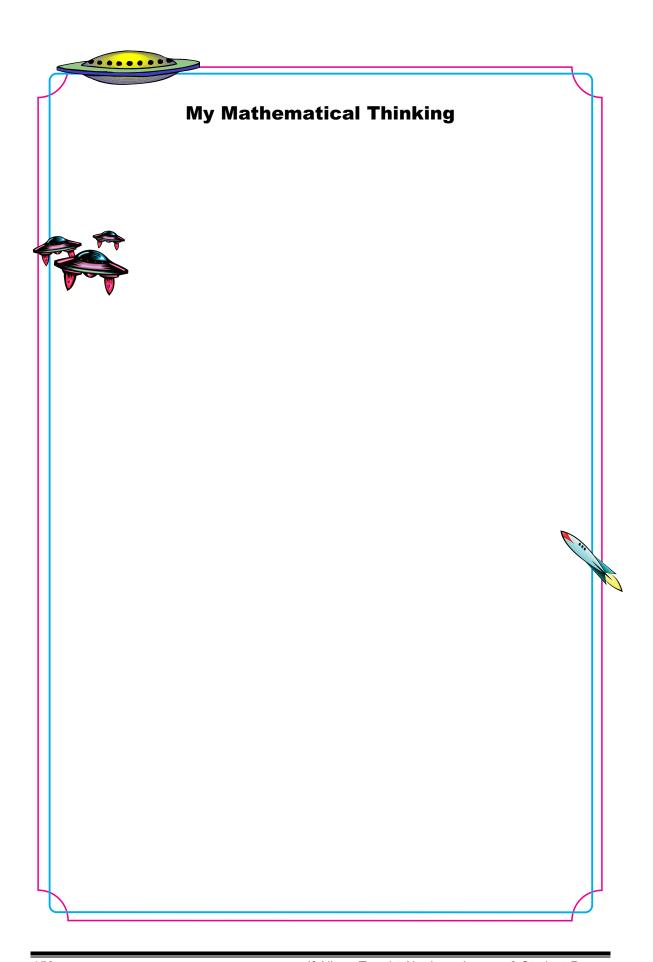
Human	Date	

4-Eyed Planet Nine Alien Multiplication Table



Table B

Number of Planet Nine Aliens	Multiplication Problem Used to Find Total	Commutative Property (Hint: Flip It!)	Total Number of Eyes
0	0 x 4	4 x 0	0
1	1 x 4	4 x 1	4
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			



Human	Date
-------	------

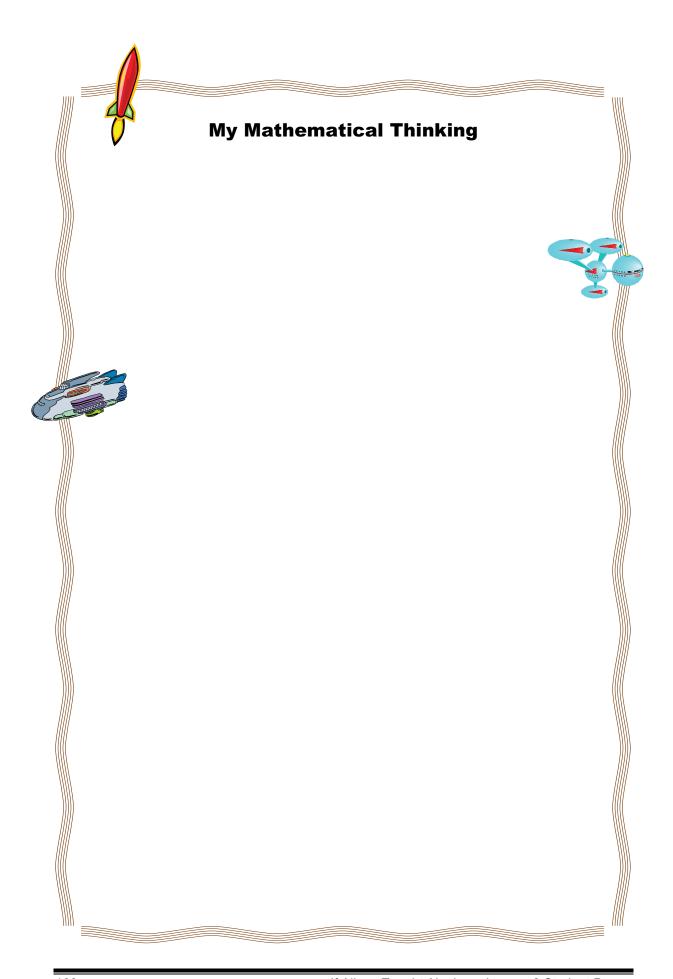


Multi-Eyed Planet Nine Alien Multiplication Table

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 Planet Nine Aliens	Number of Eyes	Multiplication Problem Used to Find Total	Commutative Property (Hint: Flip It!)	Total Number of Eyes
2	3	2 x 3	3 x 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 Date

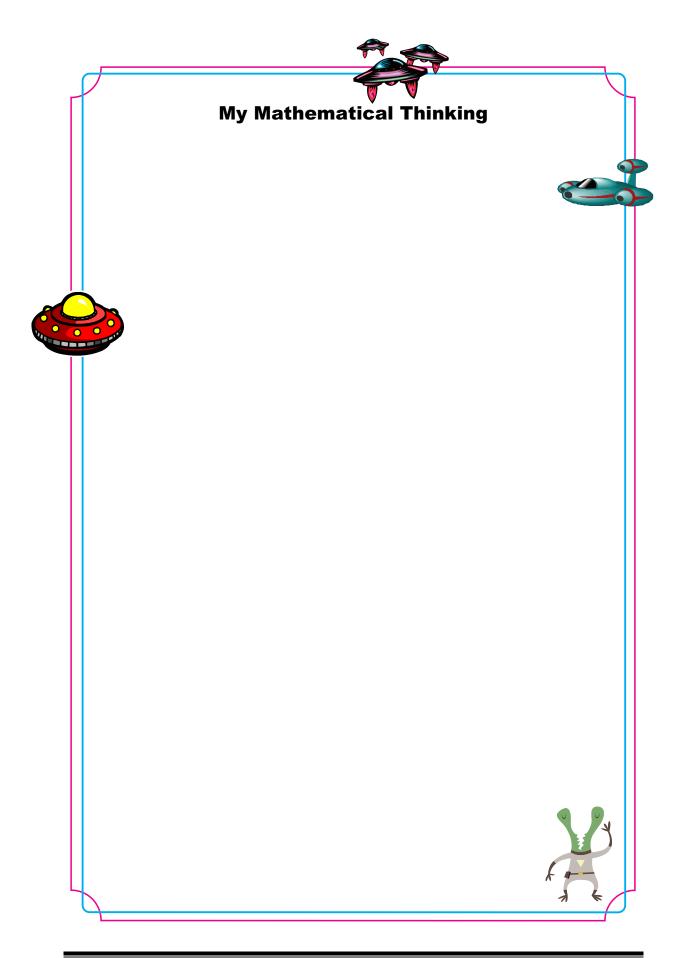
Alien Multiplication Tables (Continued)







- 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.



Human	Date	



Eye Love Multiplication! (OPTIONAL)



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 Planet Nine Aliens	Number of Eyes	Multiplication Problem Used to Find Total	Commutative Property (Hint : Flip It!)	Total Number of Eyes
2	3	2 x 3	3 x 2	6



My Mathematical Thinking



Multiplication Chart

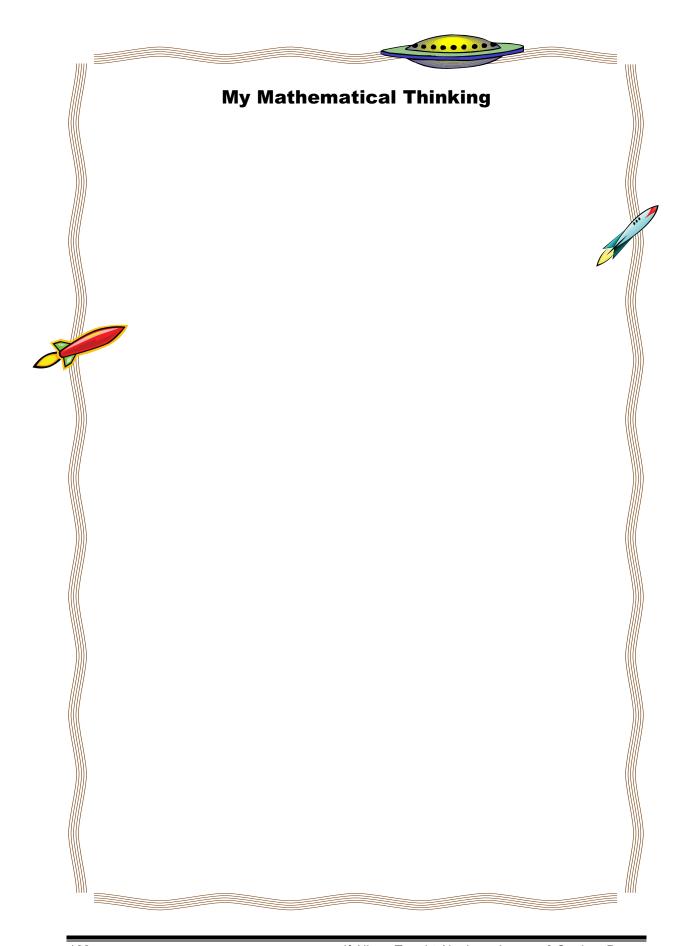
X	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49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

Picture This!

HUMAN	DATE	

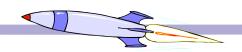
Directions: Glue the number of Planet Nine aliens needed to make 24 eyes for each group. Next, represent the total number of eyes using a multiplication and addition problem. Then, write a word problem.

2-Eyed Plane	t Nine Aliens	4-Eyed Planet Nine Aliens		
(Glue Planet N	ine aliens here)	(Glue Planet Nine aliens here)		
Multiplication Problem:	Repeated Addition:	Multiplication Problem:	Repeated Addition:	
Multiplication Word Proble	em:	Multiplication Word Problem:		



Picture This! Your Turn!

HUMAN		DATE					
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	n Picture)				
Multiplication Problem:	Repeated Addition:	Multiplication Problem:	Repeated Addition:				
Multiplication Word Proble	m·	Multiplication Word Prob	lom:				
Widitiplication word Froblei	11.		iciii.				

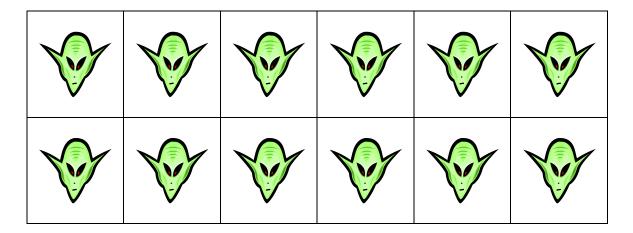


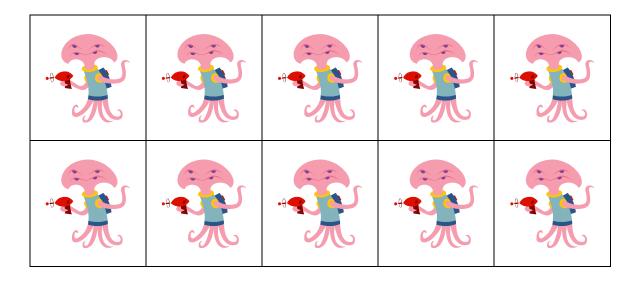
My Mathematical Thinking





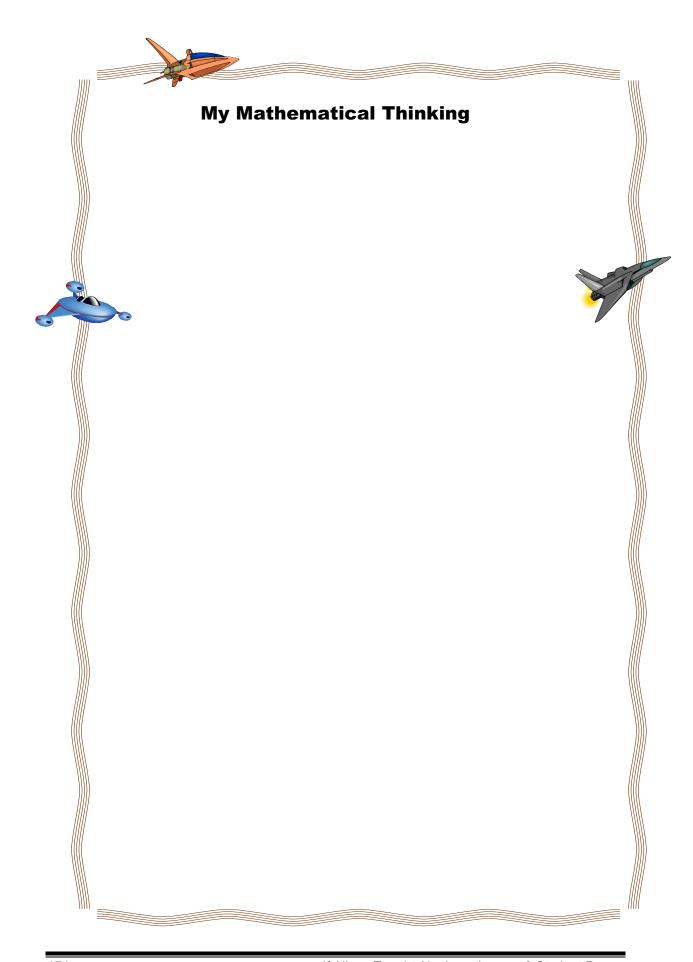
Planet Nine Alien Manipulatives for Picture This!



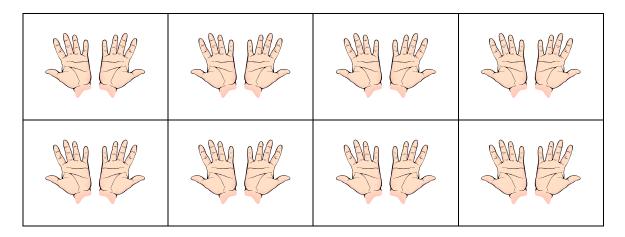


Multiplication Problems—Homework
Directions: You will need to cut out the pictures of hands and six-packs of soda cans on page 175 to complete your homework. Read each problem and solve it by pasting the appropriate number of pictures and writing a multiplication number sentence.
1. There are 4 humans 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:

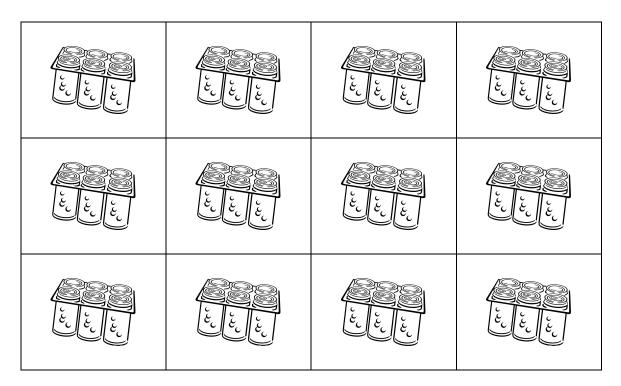
Name _____ Date ____



HANDS



SIX-PACKS OF SODA



Lesson 9 Student Pages

Allay light	"Array"nger	Date
-------------	-------------	------

Acting Planet Nine Aliens

Arrangement A

Stage					
Walkway	Chairs go here	Walkway			
,	3	,			
Walkway					

"Array"nger	Date	

Acting Planet Nine Aliens

Arrangement B

	Stage	
	Chairs go here	
Walkway		Walk-way
	Walkway and Door	

Chair Manipulatives

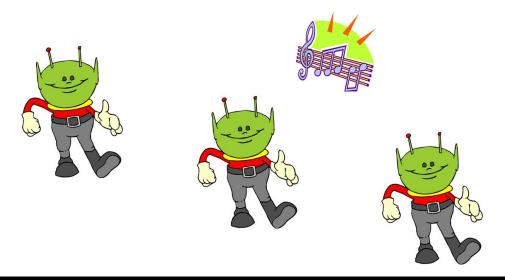
R	P	F	F	F	F	
P	P	P	P	P	P	
P	F	P	P	P	P	
P	P	F		P		
P		F				
P	P	F		P		
P	F	F		F	F	
P	P	F	F	F	F	F

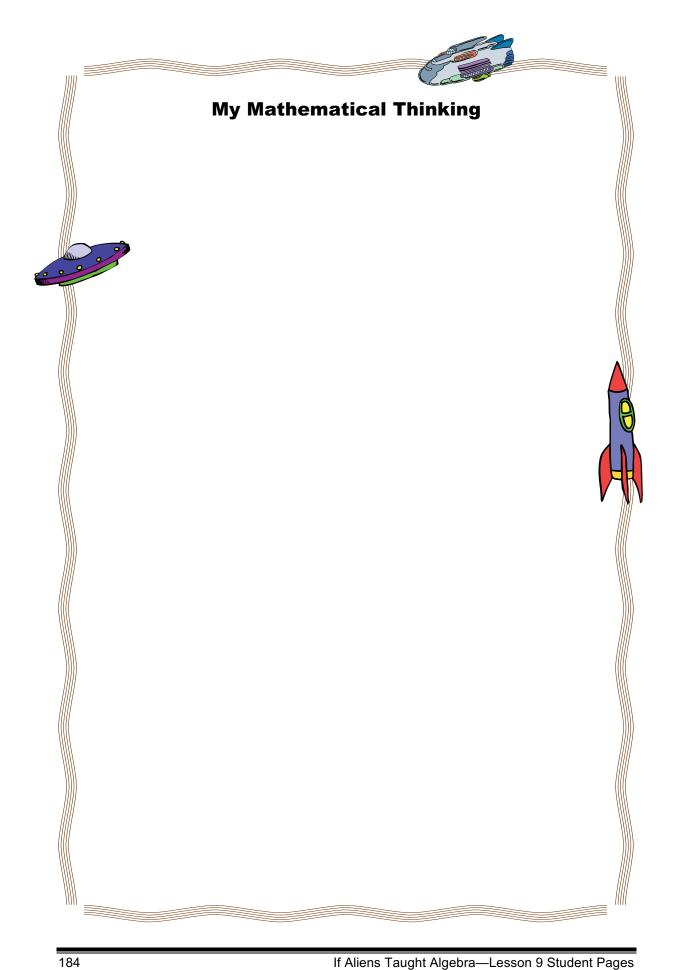
'Array"nger Date

Marching Band Planet Nine Aliens— Fibonacci

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?



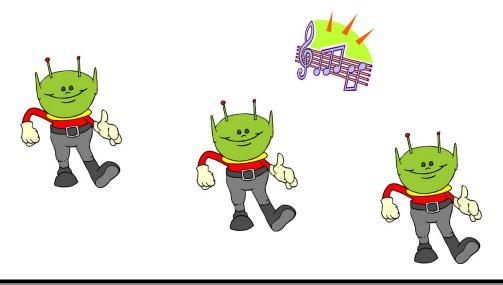


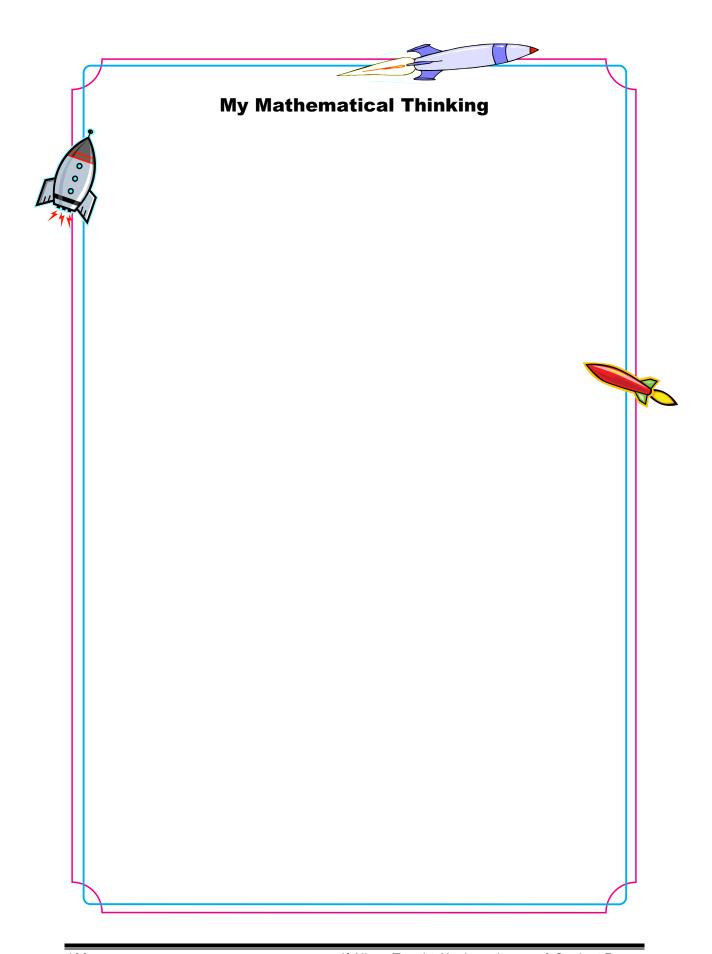
'Array"nger Date

Marching Band Planet Nine Aliens— Diophantus

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?





	"Array"nger Date
--	------------------

Marching Band Planet Nine Aliens— Kovalevsky

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?

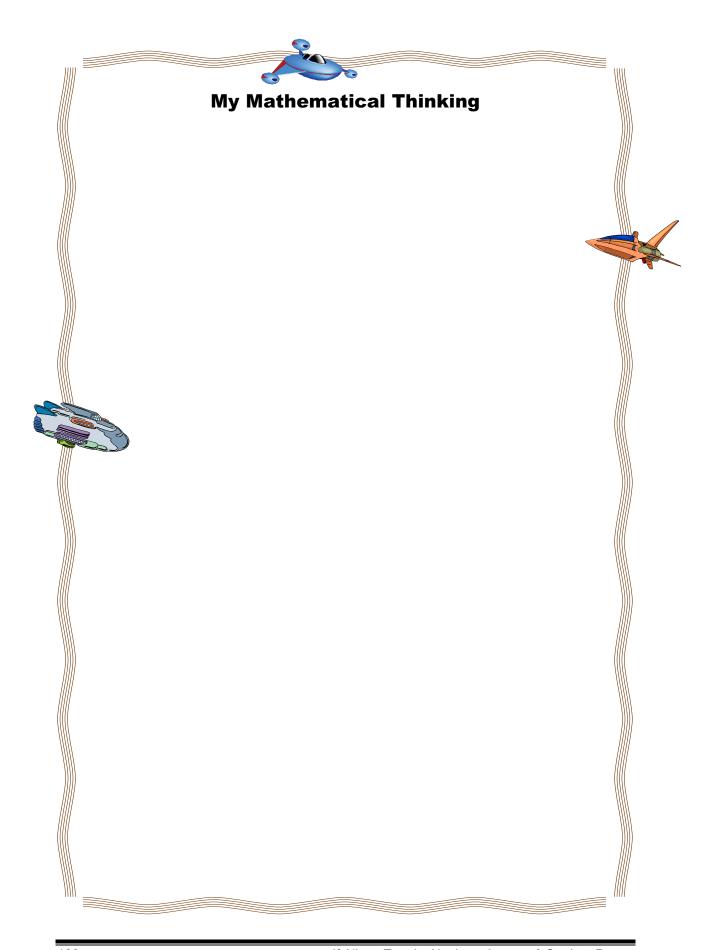
What if the city decided to build 2 bandstands for the 36 Planet Nine aliens—one for each side of the road. How many Planet Nine aliens could perform (remember each row needs to have an equal number of Planet Nine aliens)?







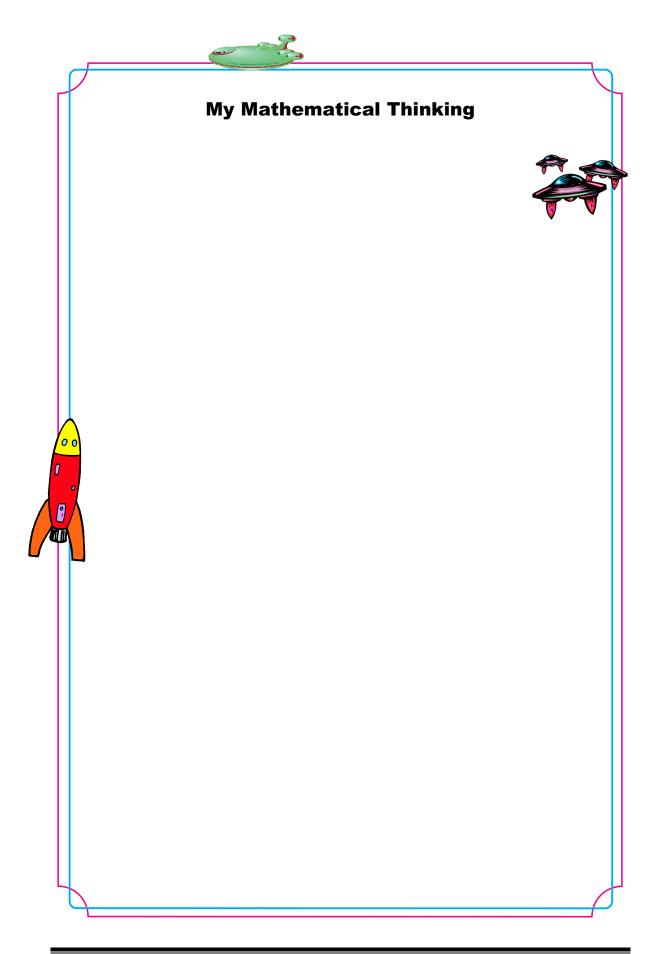




"Array"nger		Date
Col	lectibles—Fibo	nacci
with a space for each if she wants the box to	puppet. How many wa o fit exactly 16 puppets	s decided to build a box ys can she build her box ? Fill in the chart below would be for each type of
Rows	Columns	Total Spaces for Puppets
How many ways can	she build her box?	

Does it matter which way she places the box

on the wall? Why or why not?



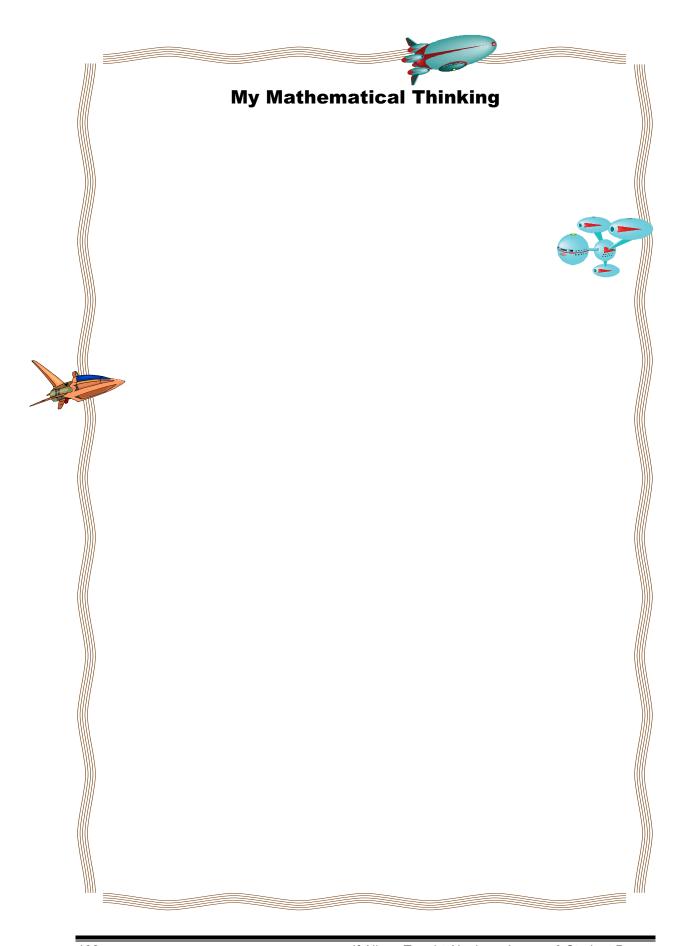
Sloosa's friend Spudnie offers to build her 2 more boxes to hold an extra 16 puppets each. Choose one way that Sloosa could have had Spudnie build her the boxes. Draw a picture below of what the 3 boxes next to each other will look like.

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

How many puppets can Sloosa fit on her wall now?

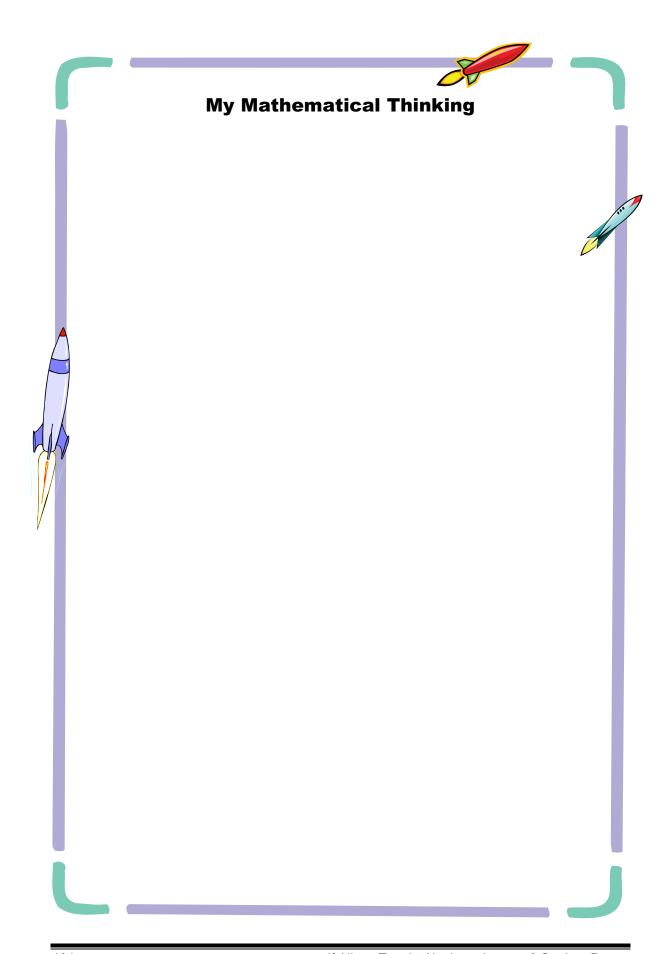
Write an algorithm or number sentence that explains how to find the total number of puppets.





"Array"nger		Date	
Collectibles—Diophantus			
with a space for eac if she wants the box	h puppet. How many w to fit exactly 24 puppet	as decided to build a box ays can she build her box s? Fill in the chart below would be for each type of	
Rows	Columns	Total Spaces for Puppets	
How many ways car	n she build her box?		

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



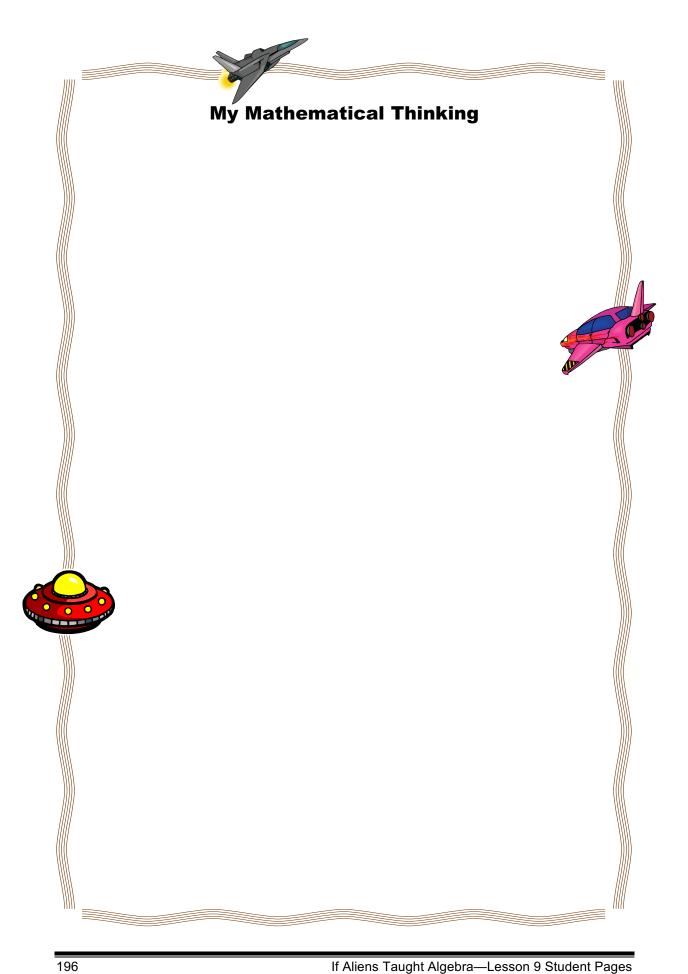
Sloosa's friend Spudnie offers to build her 2 more boxes to hold an extra 16 puppets each. Choose one way that Sloosa could have Spudnie build her the boxes. Draw a picture below of what the 3 boxes next to each other will look like.

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

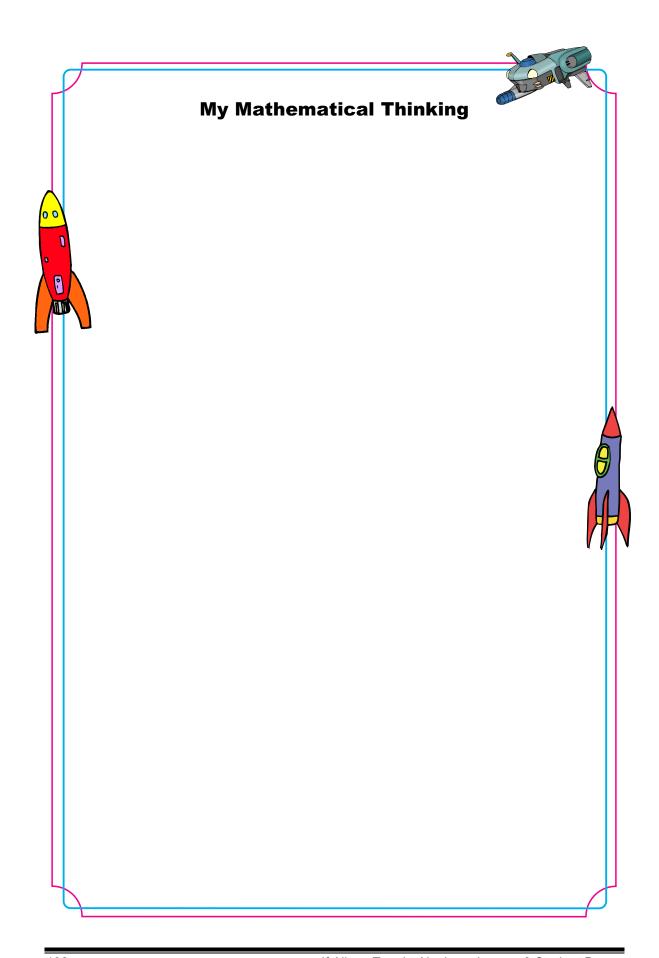
How many puppets can Sloosa fit on her wall now?

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





"Array"nger	ray"nger Date		
Collectibles—Kovalevsky			
with a space for each if she wants the box to	puppet. How many wan fit exactly 36 puppets	is decided to build a box ays can she build her box s? Fill in the chart below would be for each type of	
Rows	Columns	Total Spaces for Puppets	
		Таррото	
Llaw many ways can	aha huild har hav?		
How many ways can			
Does it matter which why or why not?	way she places the box	c on the wall?	



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

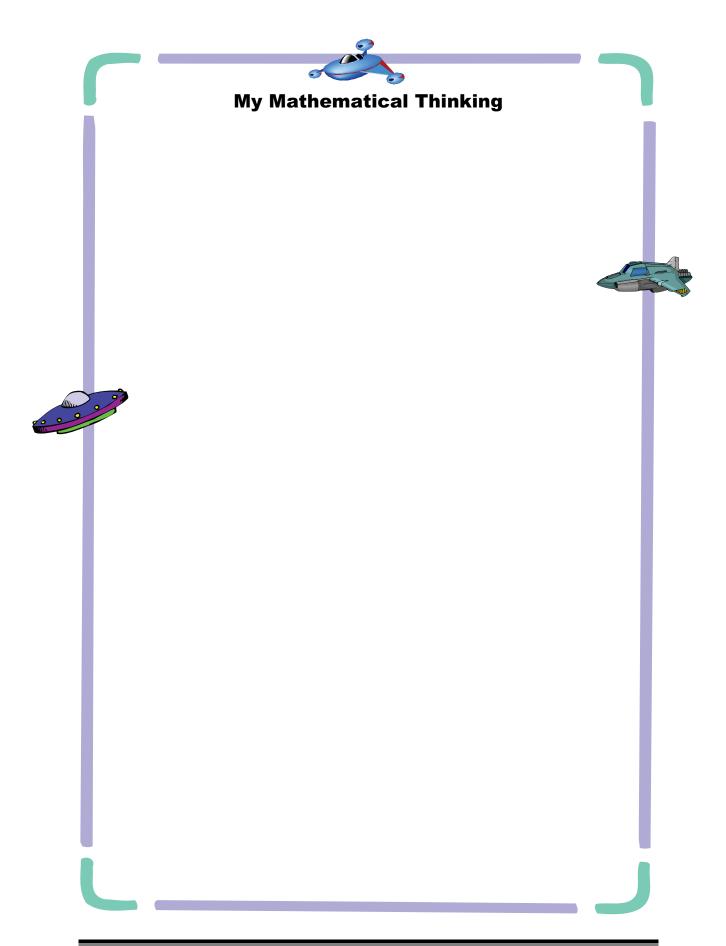
Sloosa's friend Spudnie offers to build her 2 more boxes. Choose one way that Sloosa could have Spudnie build her the boxes. Draw a picture below of what the boxes next to each other will look like.

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

How many puppets can Sloosa fit on her wall now?

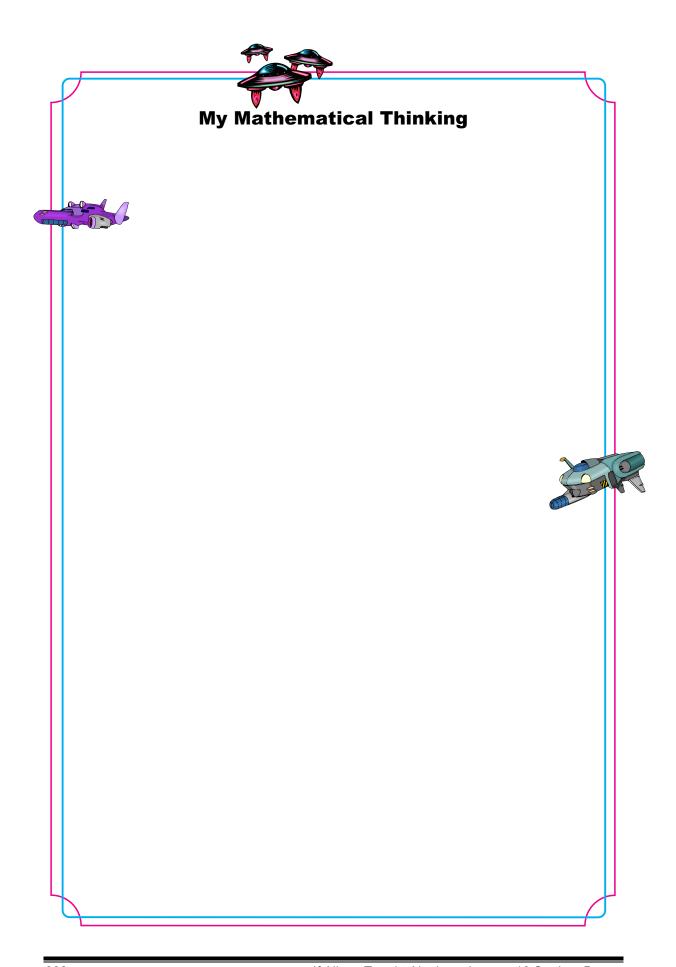
Write an algorithm or number sentence that explains how to find the total number of puppets.





Lesson 10 Student Pages

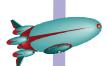
Name	Da	ite
	Exploring Factors of	12
Th	ne number I am factoring is:	12
1. Multiplication	Representation	
Piles x	Shapes in Each Pile =	Total Shapes
Division Represe	entation	
2. Multiplication	Representation	
Piles x	Shapes in Each Pile =	Total Shapes
Division Represe	entation	



	The number I am factoring is:	12	_
3. Multiplicatio	n Representation		
Piles x	Shapes in Each Pile =		_ Total Shapes
Division Repre	sentation		
4. Naultiplication	n Representation		
•	Shapes in Each Pile =		Total Shapes
Division Repre			- '

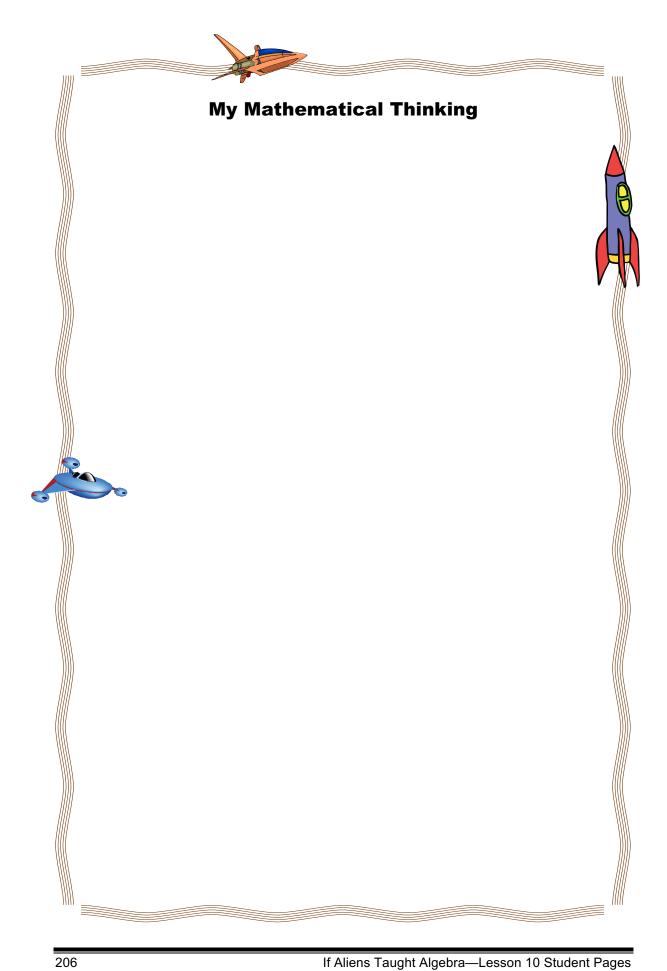


My Mathematical Thinking

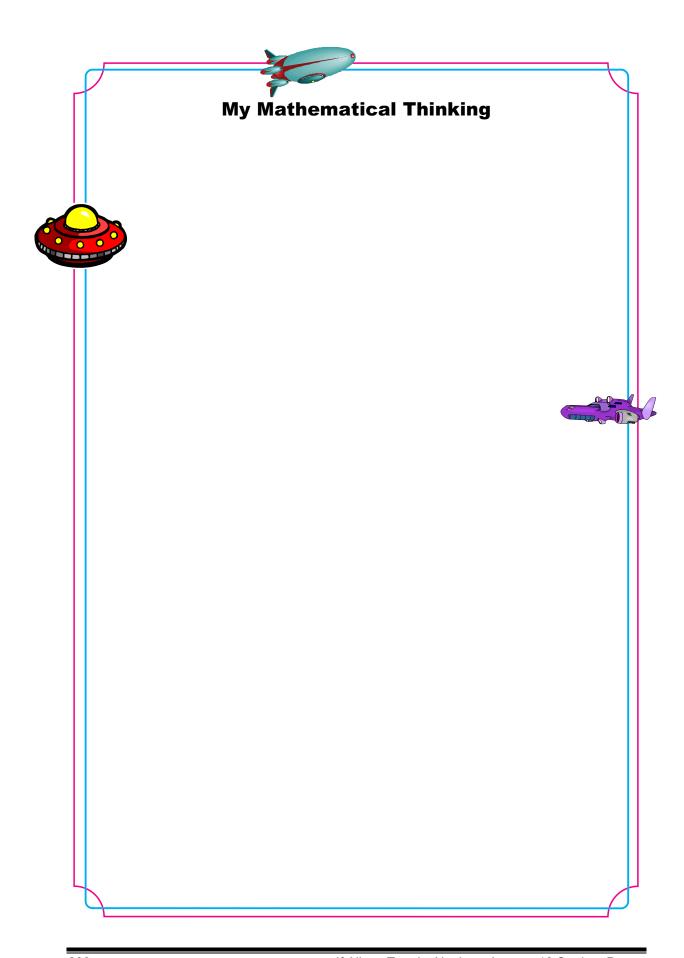




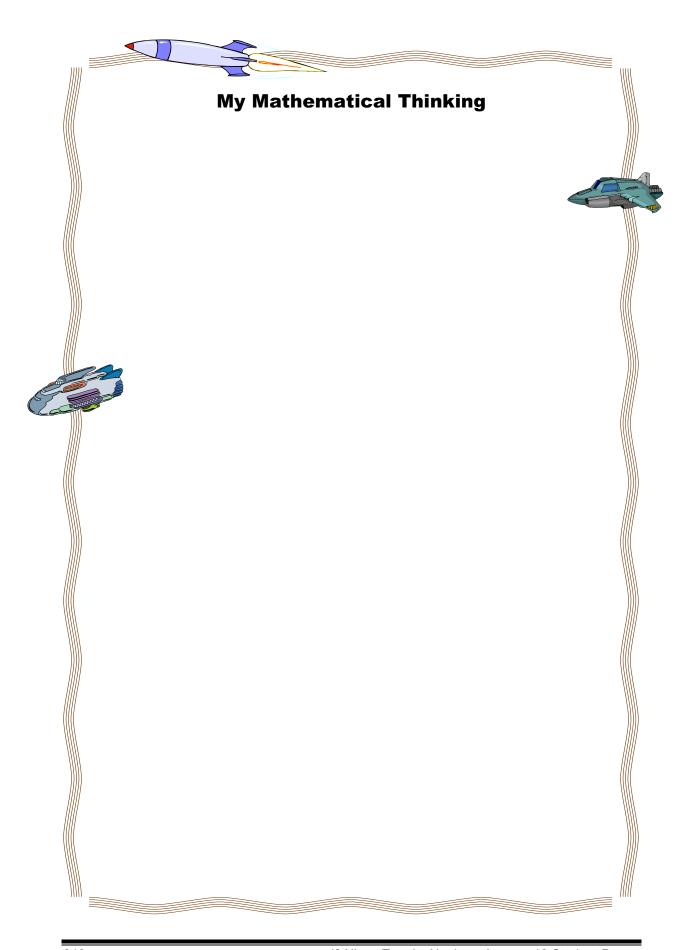
	The number I am factoring is:	12	_
5. Multiplicat	tion Representation		
Piles x	Shapes in Each Pile =		_ Total Shapes
Division Rep	resentation		
6. Multiplicat	tion Representation		
Piles x	Shapes in Each Pile =		_ Total Shapes
Division Rep	resentation		
The factors o	of 12 are:	<u>.</u>	



Name	_ Date
Finding Facto	rs
The number I am factoring is: _	
Multiplication Representation	
Piles x Shapes in Each Pile =	Total Shapes
Division Representation	
Multiplication Representation	
Piles x Shapes in Each Pile =	Total Shapes
Division Representation	



The number I am factoring is:	_
Multiplication Representation	
Piles x Shapes in Each Pile =	Total Shapes
Division Representation	
Multiplication Representation	
Piles x Shapes in Each Pile =	Total Shapes
Division Representation	



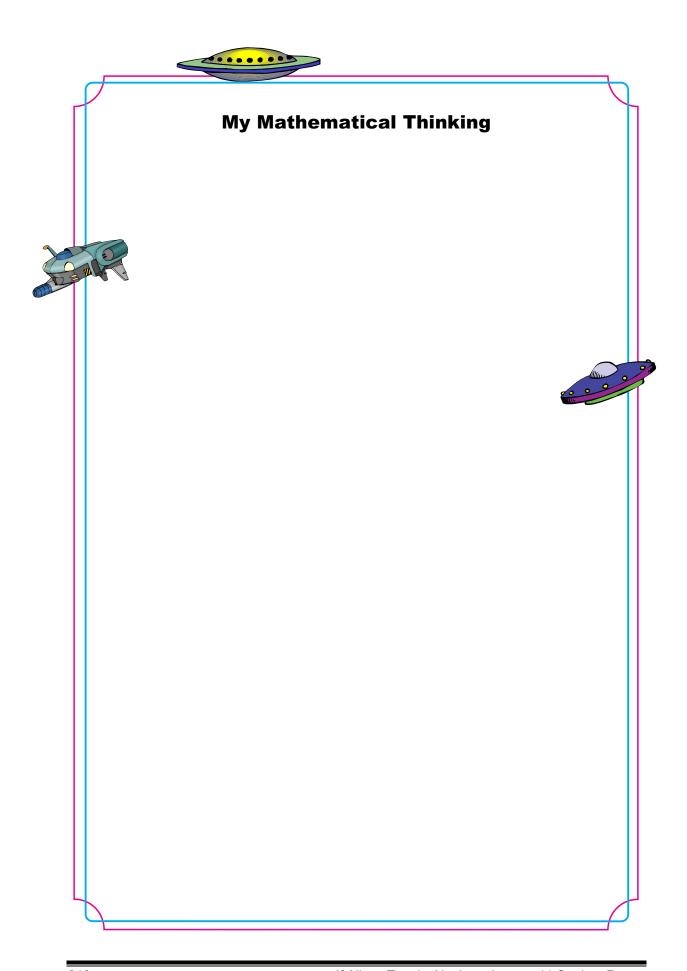
Lesson 11 Student Pages

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.



 =	_ =		=
 =	_ =	<u></u> :	=
 =	_ =	·	=
=	_ =	:	=
	_		
 =	_ =		=
 =	_ =		=
=	=		=
	-		
=	=	36	=



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

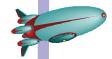
Name _____ Date ____

pictures.



My Mathematical Thinking





Lesson 12 Student Pages

Name Date

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.

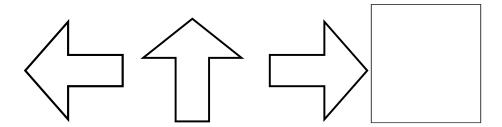
Nacci,

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.

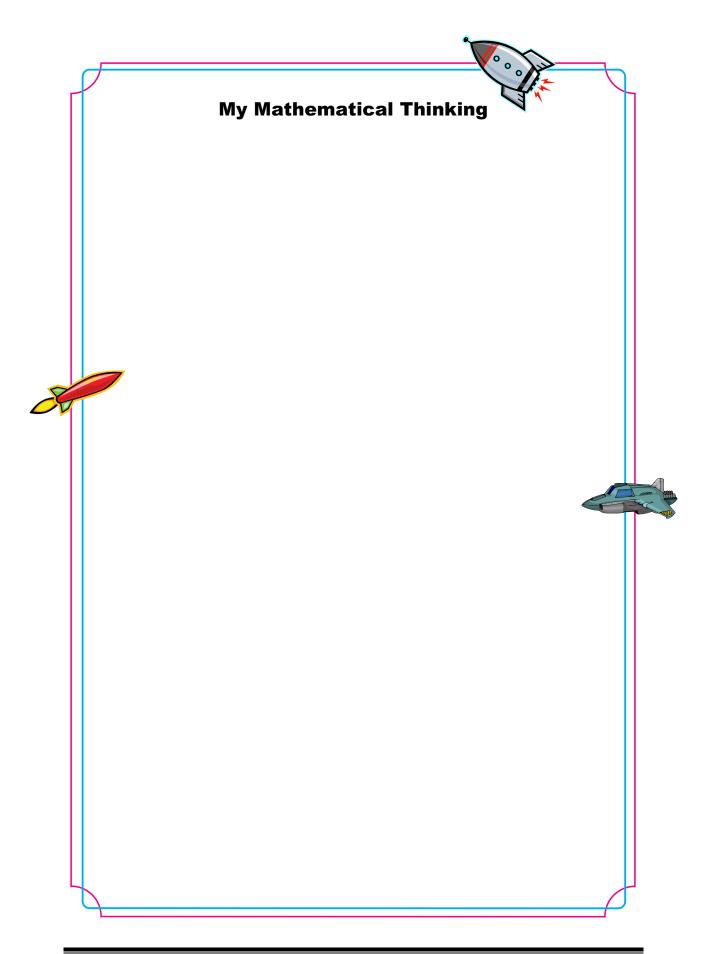
Love, Mom



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.



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.

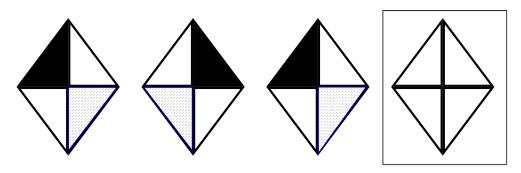
Nacci,

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.

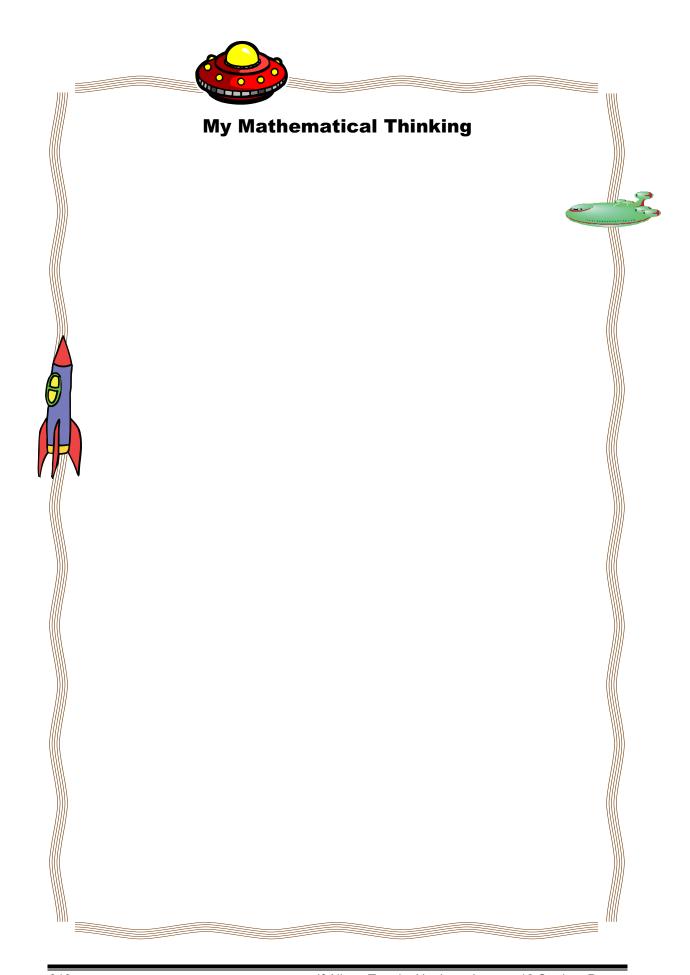
Love, Mom



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



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



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.

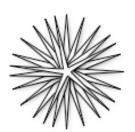
Nacci,

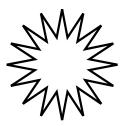
I know you can be forgetful. The first parts of the lock are set. You just need to find a logical choice for the rest of the combination.

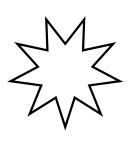
Love, Mom

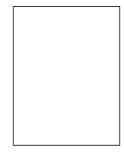


What should the last symbol in the lock combination look like?









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

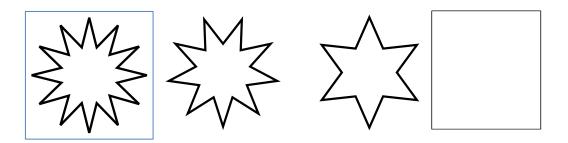


My Mathematical Thinking



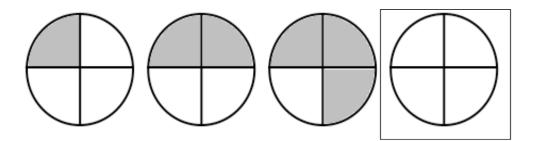
Confounding Combinations—Fibonacci

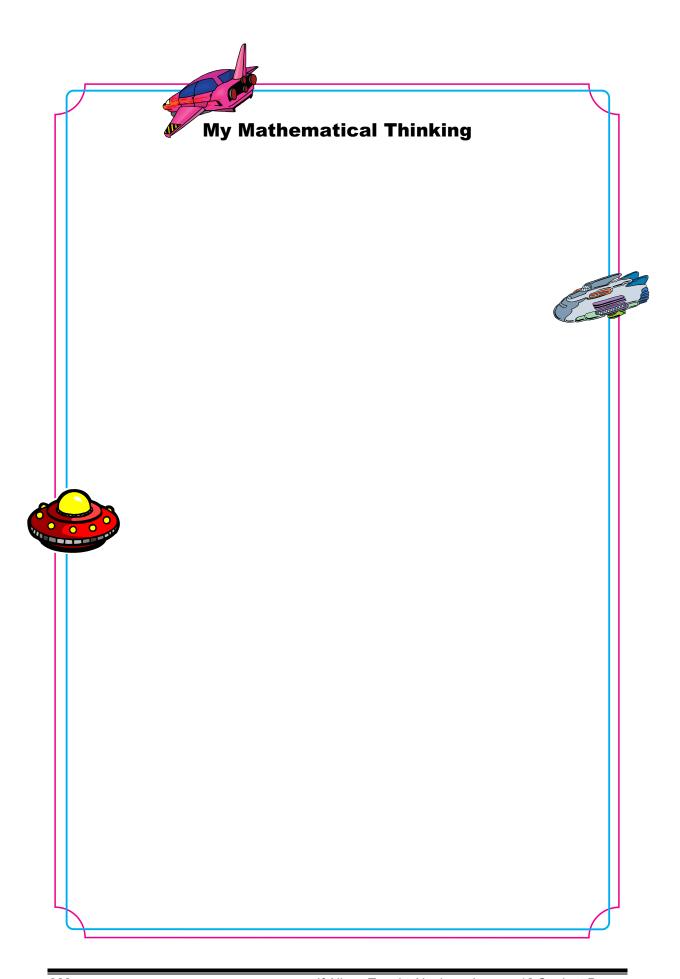
1. Unfortunately for Nacci that was not the only suitcase with a lock. Help her figure out the combinations for her other suitcases.

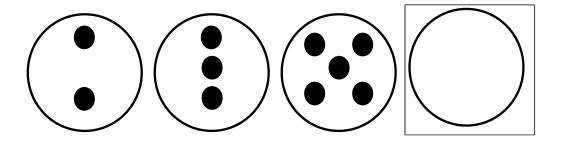


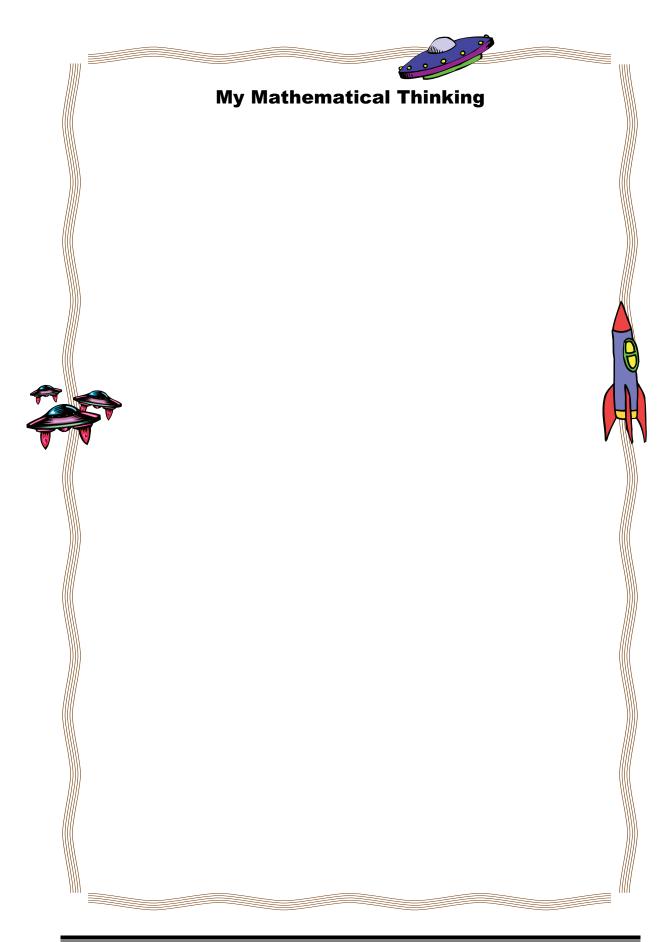
Explain how you cracked the code that Nacci's mom gave her.

2. Practice opening more suitcases by filling in the last part of the lock. Explain how the pattern is growing or repeating.



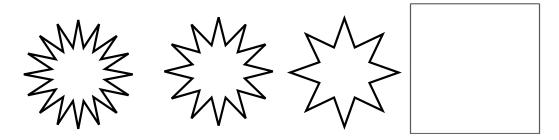






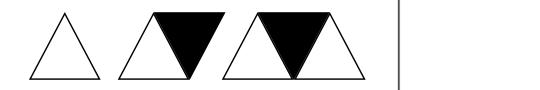
Confounding Combinations—Diophantus

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.

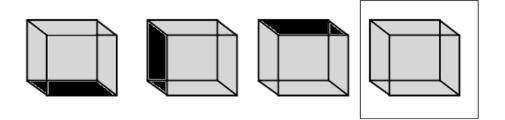


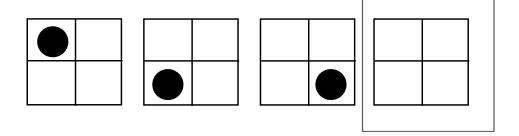


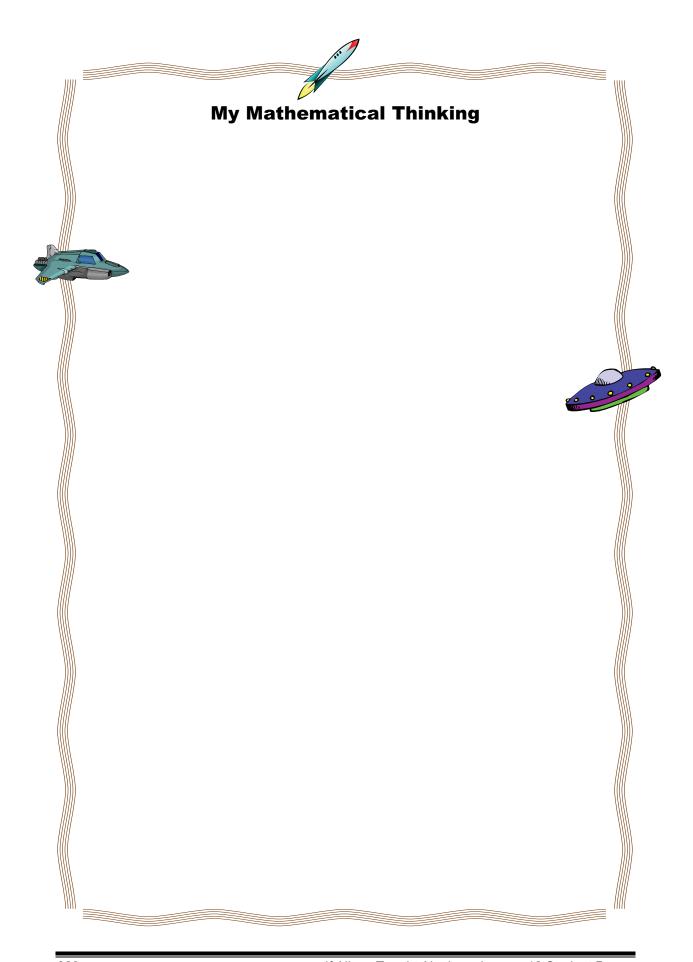
My Mathematical Thinking





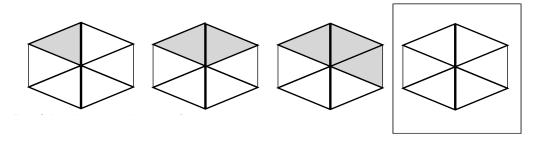






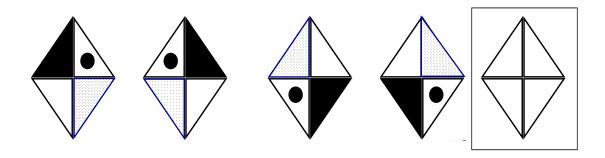
Confounding Combinations—Kovalevsky

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

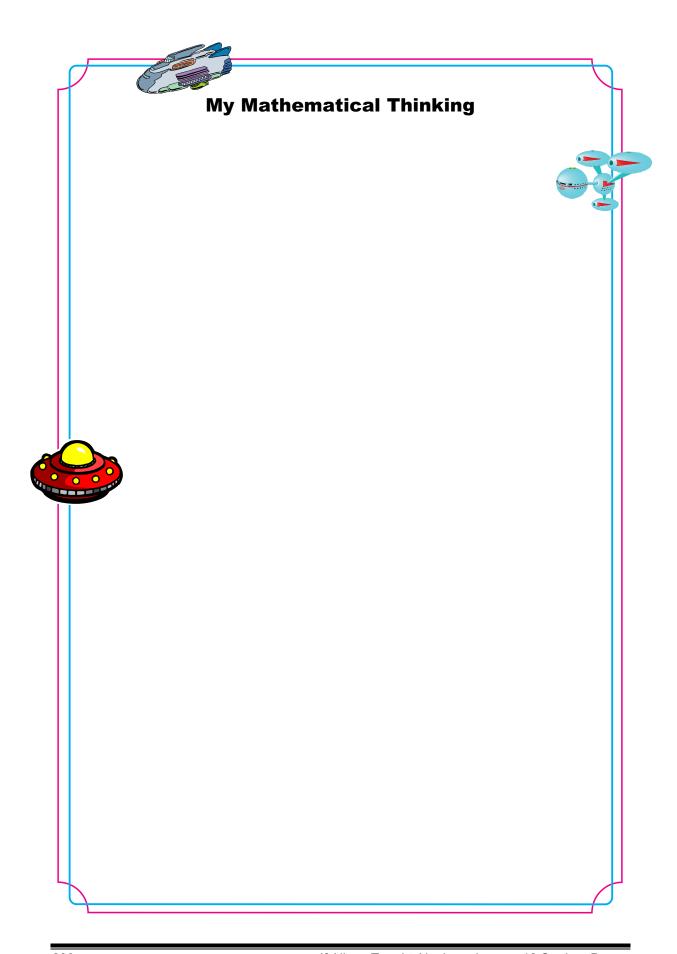


Explain how you cracked the code that Nacci's mom gave her.

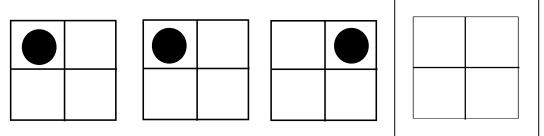
2. Practice opening more suitcases by filling in the last part of the lock. Explain how the pattern is growing or repeating.

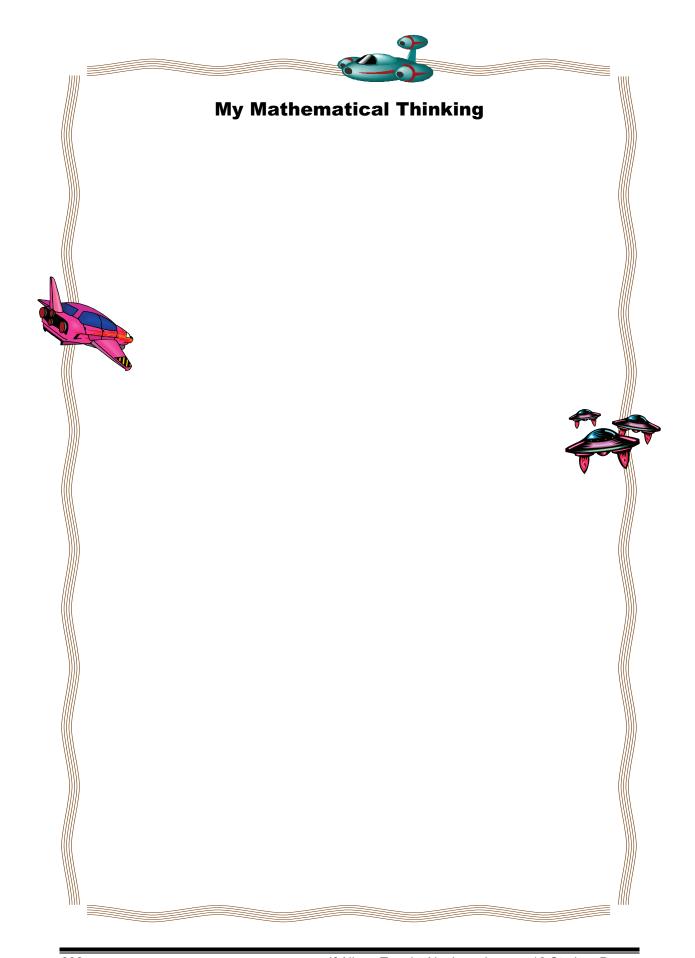


3. Predict which quadrant (or triangle) the dot will be on the 20th move.



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



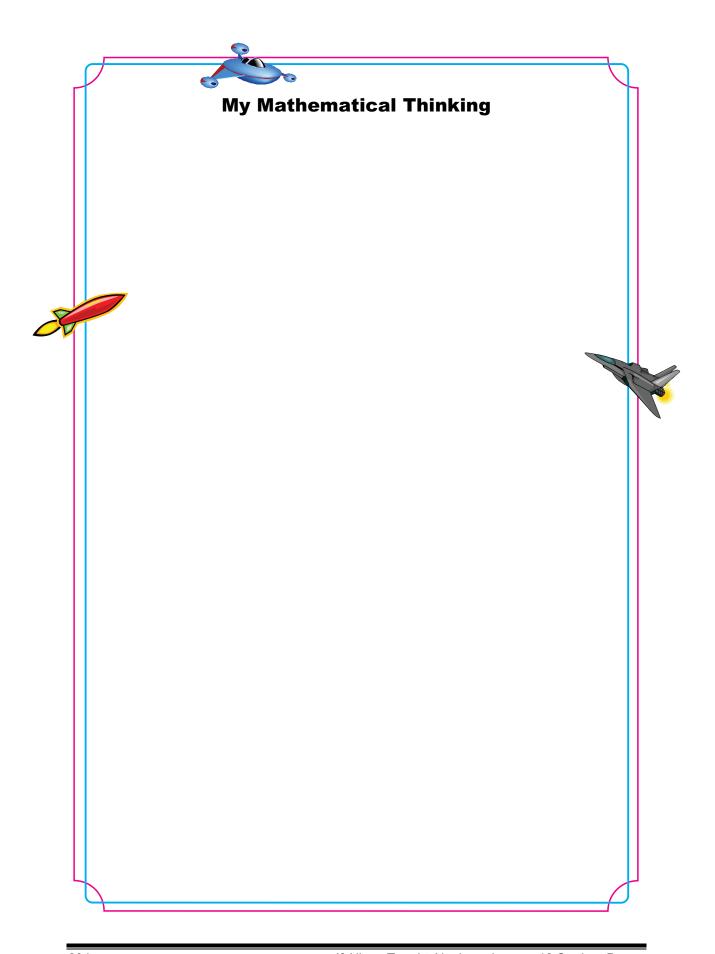


Name	 Date	



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	Date on Earth	
-------	---------------	--

Teaching Planet Nine Aliens Mathematical Terms

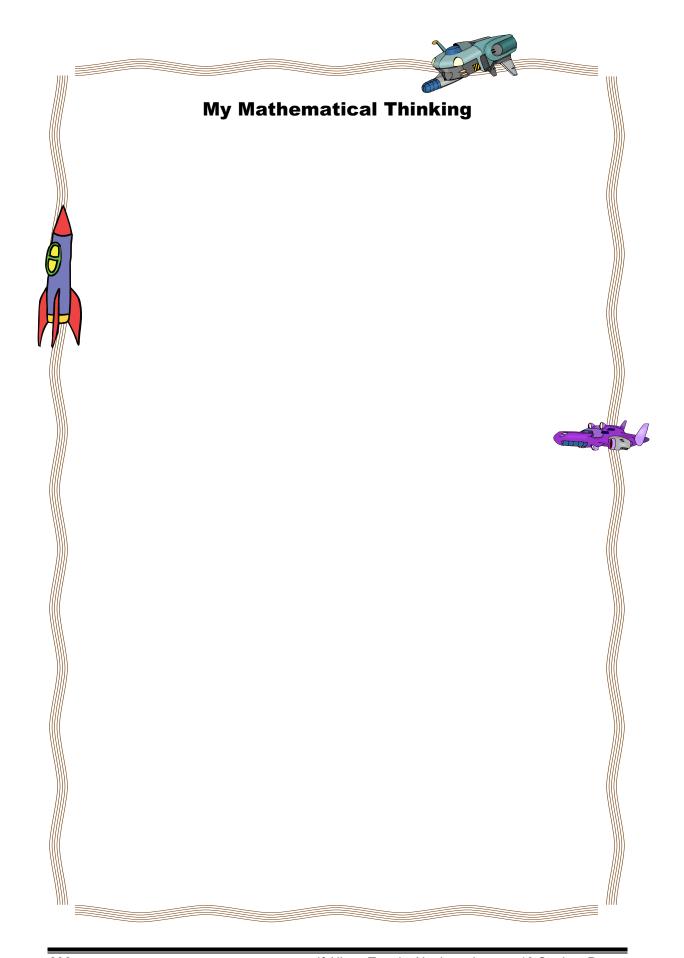
A new species of Planet Nine aliens has arrived on Earth! It is very difficult to communicate with them because they don't speak English. Choose 3 words that you think the Planet Nine aliens should learn first. Write the 3 words on the lines below.



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

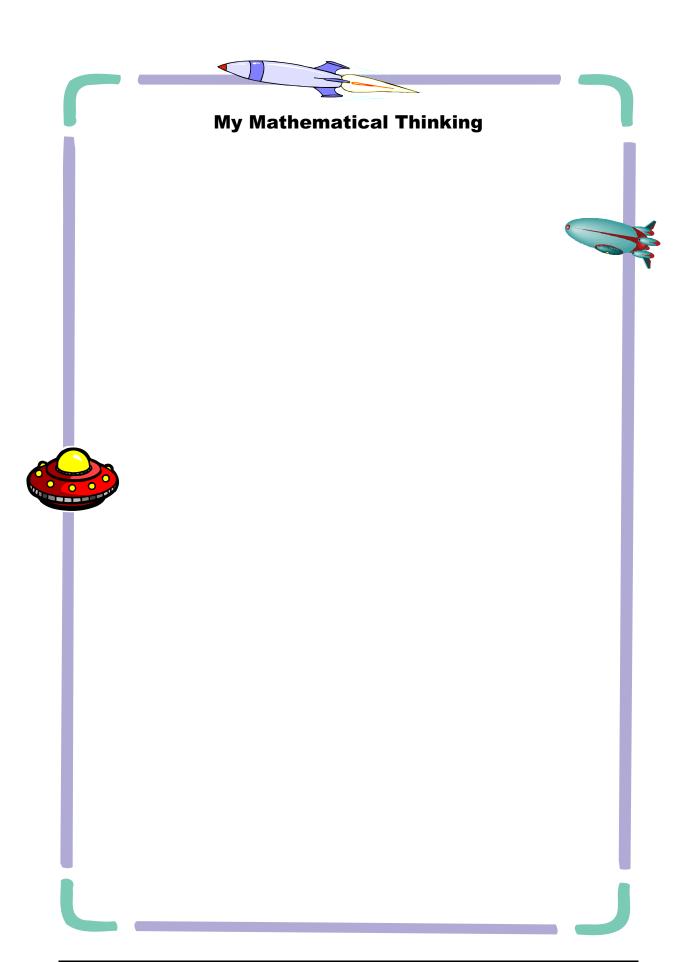
1. What will be the 7th word that the Planet Nine aliens say? Explain your thinking.

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

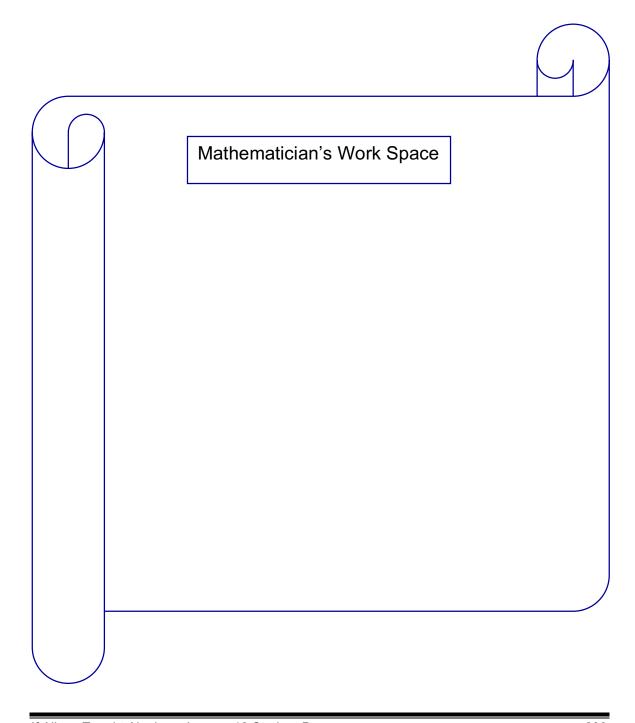


Human	Date on Earth
•	e Aliens' Vocabulary— onacci
The Planet Nine aliens have mass you taught them. They are eager the next 5 words you will teach th on the lines below.	to learn more! Write 🛮 🌂 🤭 🍆
The Planet Nine aliens learn the Sover again in order.	words by repeating them over and
What will be the 20th word that Explain your thinking.	the Planet Nine aliens say?
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.



Human	Date on Earth
Improving Plane	et Nine Aliens' Vocabulary— Diophantus
you taught them. They are	ve mastered the first 3 words e eager to learn more! Write each the Planet Nine aliens
The Planet Nine aliens lea	arn the 6 words by repeating them over and
What will be the 20th we Explain your thinking.	ord that the Planet Nine aliens say?

2. What will be the 99th word the Planet Nine aliens say? Explain

your thinking.

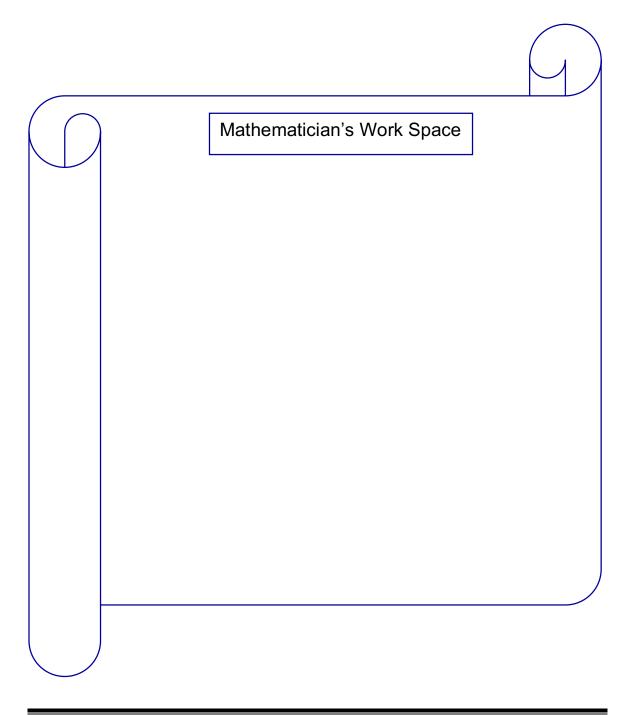


My Mathematical Thinking

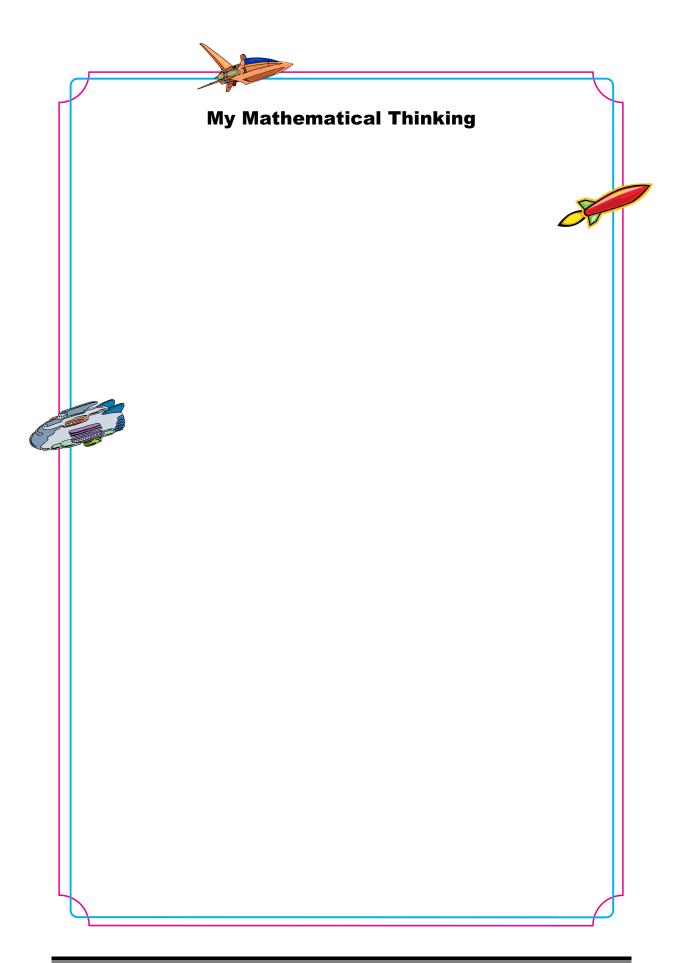




3. Can you think of a different way to figure out what the 99th word would be? Explain this method.



Human		Date	on Earth
Teachin	g Students P	lanet Ni	ne Alien Words
	line aliens have thei ike for you to learn h	•	•
jobuku	freligo	yuyu	bleebee
20th word 2. If you repe	you will say? Expla	in your thinki	ain in order, what is the
•	nink of a different wa	,	ut what the 54th word



Lesson 14 Student Pages

Rollercoaster Engineer	Date	

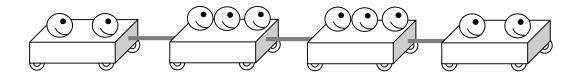
Coasting at the Amusement Park! Table

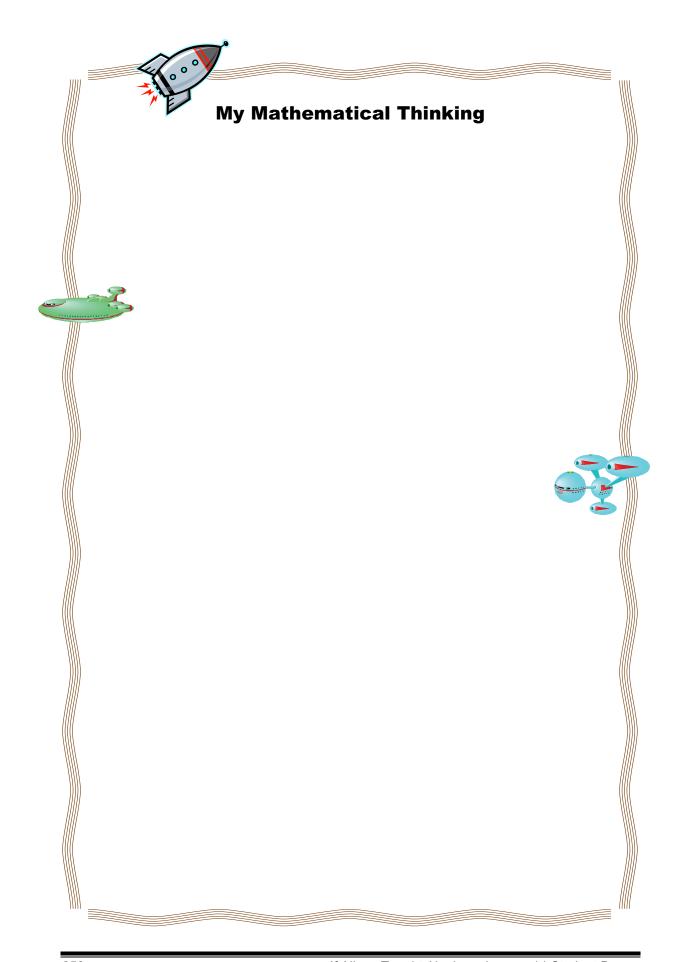
Number of cars	Number of beings
3	
4	
5	
6	

Rollercoaster Engineer	Date	
------------------------	------	--

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.





Rollercoaster Engineer	Date	

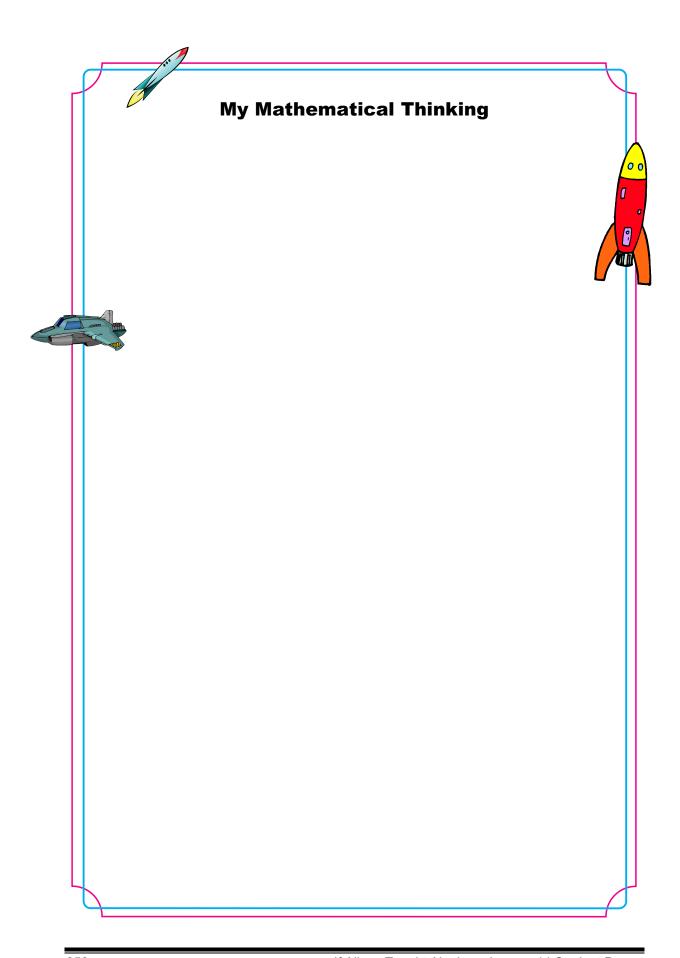
Coasting at the Amusement Park!— Diophantus/Kovalevsky

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.

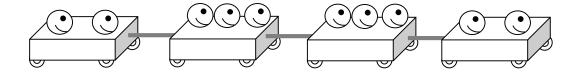


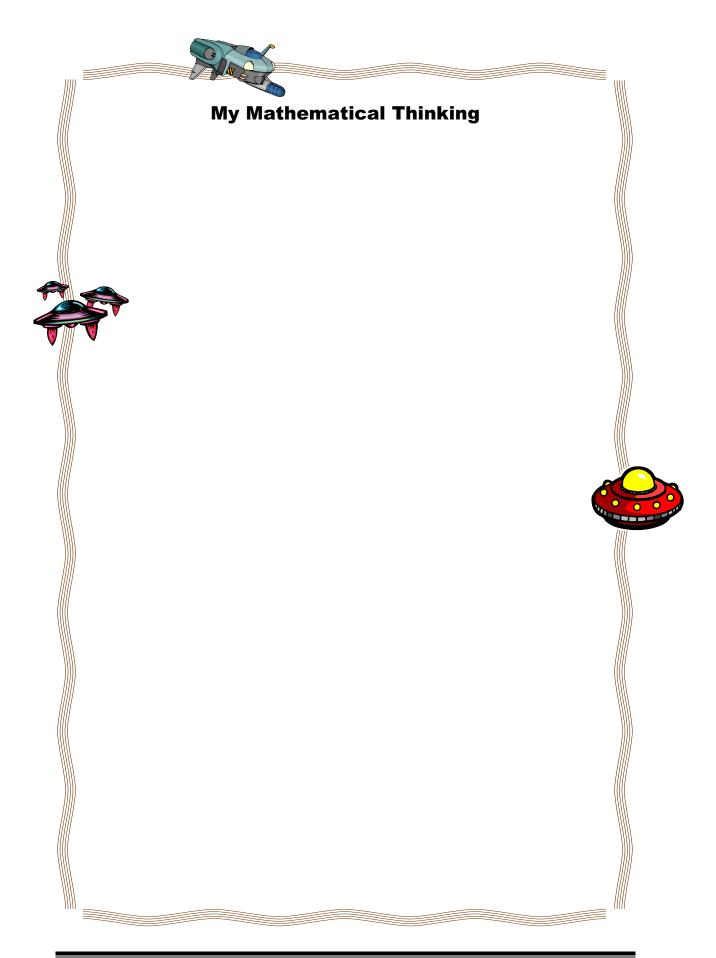
2. Explain how you found the answer.

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?

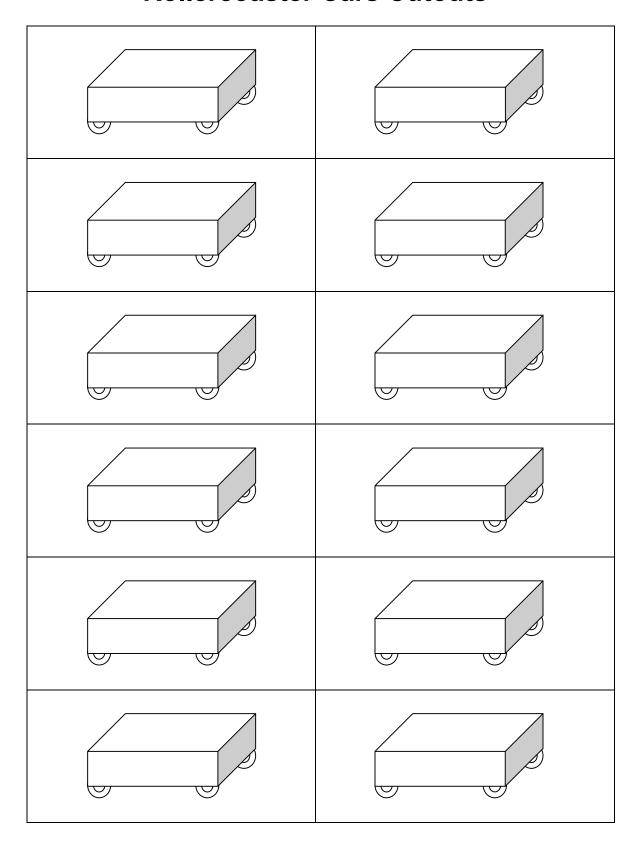


4. Explain how you found the answer.





Rollercoaster Cars Cutouts



Super Challenges

Super Challenge 1

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?

Create your own word problem about the rollercoaster cars.

Trade problems with a partner and solve.

Super Challenge 2

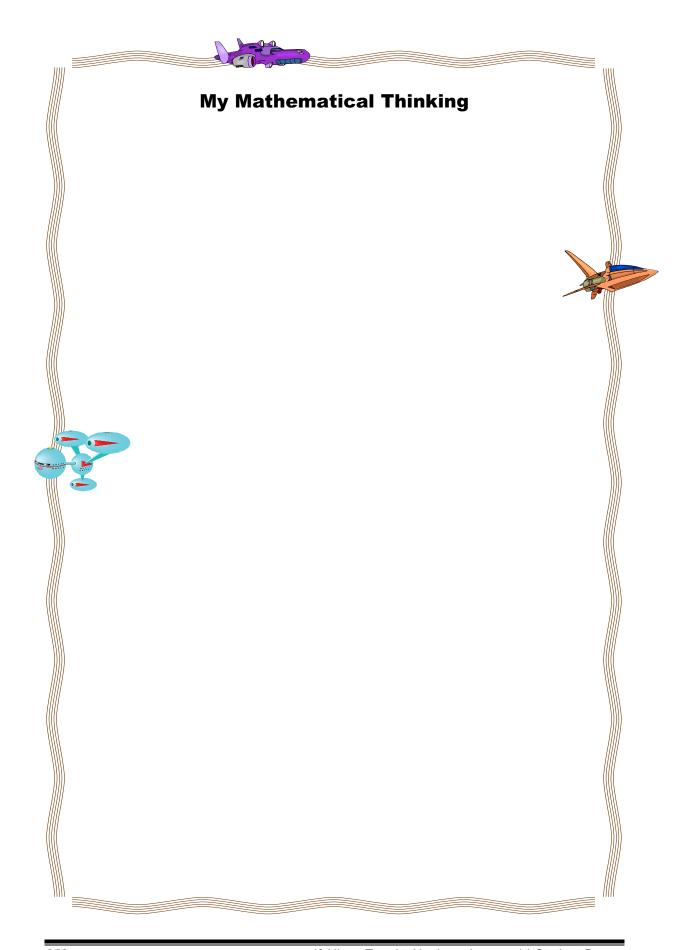
If one human sat in each of the rollercoaster cars, how many Planet Nine aliens could fill up the rest of the seats if there are 10 cars altogether?

Super Challenge 3

Toxo and 27 of his friends want to ride the Rocket Rollercoaster at the Amusement Park. How many rollercoaster cars are needed so that Toxo and all of his friends can ride at the same time?

Super Challenge 4

Imagine that 3 "beings" could fit in the first and last rollercoaster cars and that 4 "beings" could fit in the middle cars! How many "beings" could fit in 10 cars now?



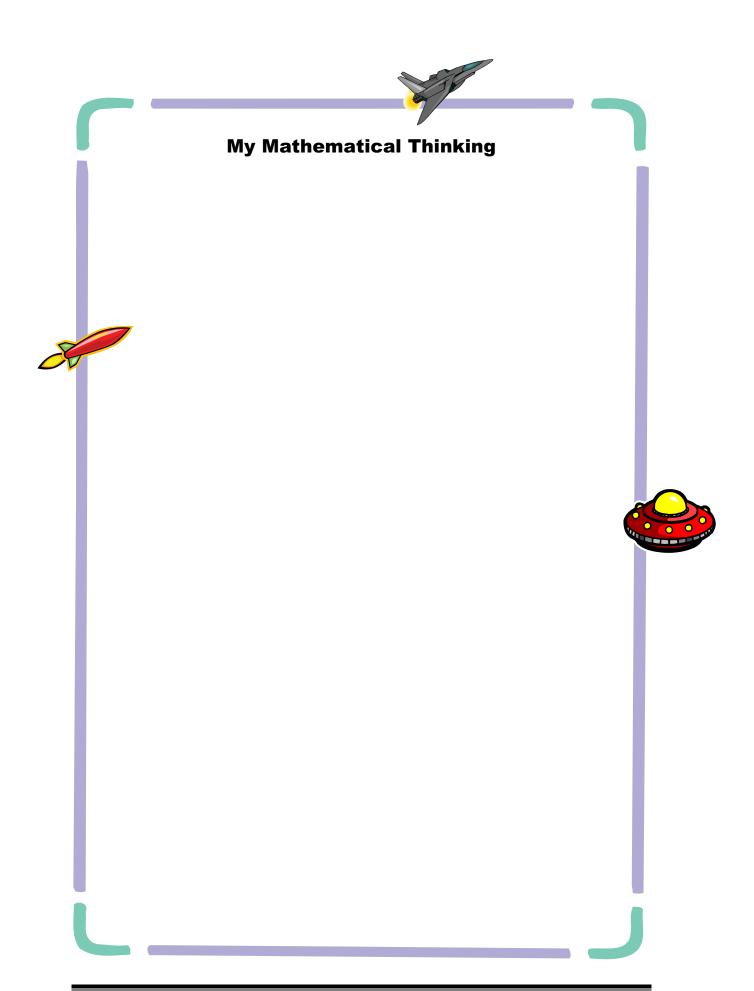
Rollercoaster Engineer	Date	

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.



Lesson 15 Student Pages



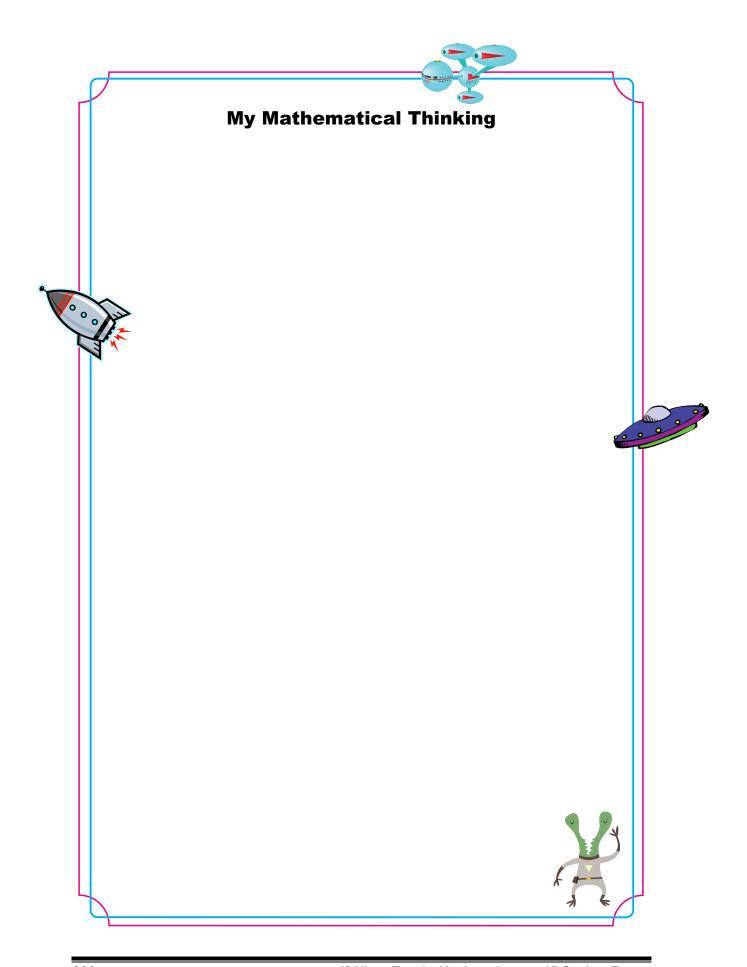
Toxo's Out of This World Ideas!— Increasing and Decreasing Patterns

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?

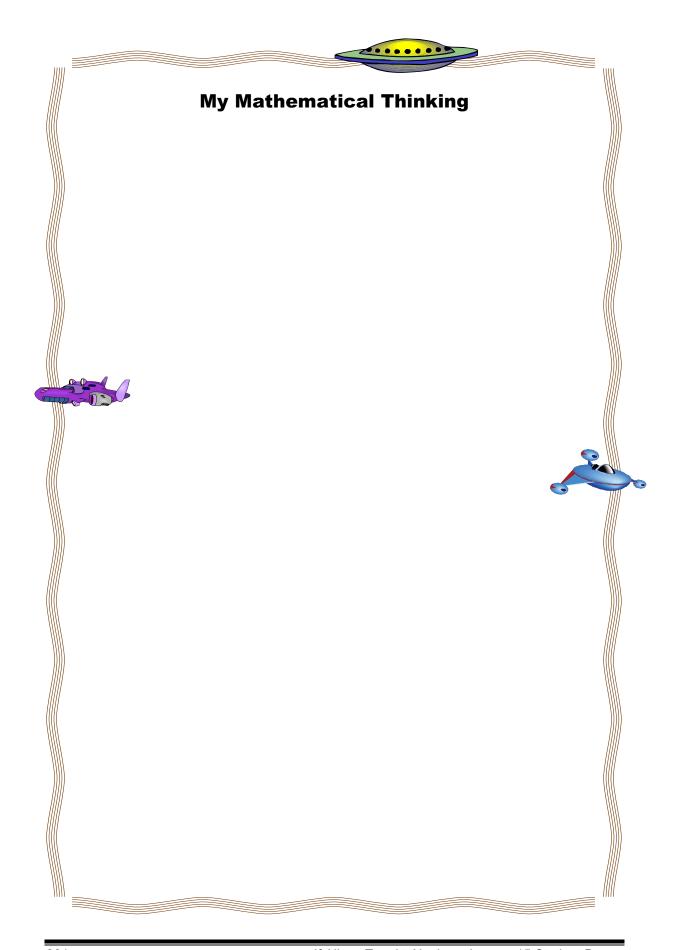


Toxo decided to frost and decorate the cookies he made. After an hour of frosting and decorating cookies he had 260 cookies left. After 2 hours he had 220 cookies left to frost and decorate. Fill in the table to figure out how many cookies Toxo had left to frost and decorate after 7 hours.

Hour	1	2	3	4	5	6	7
Number of cookies left	260	220	180				

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





Mathematical Baker Date	
-------------------------	--



Toxo's Out of This World Cookie Recipe!—Fibonacci

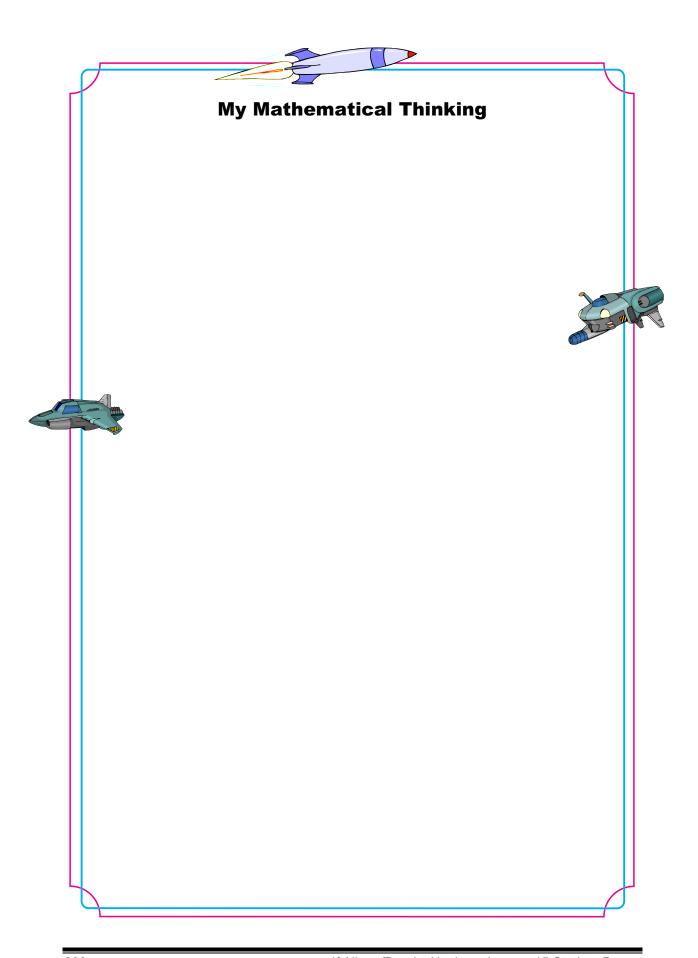


Toxo would like to make 10 batches of cookies! Toxo needs your help to figure out how much flour he must buy at the store.

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 10th 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



Mathematical Baker Date	
-------------------------	--



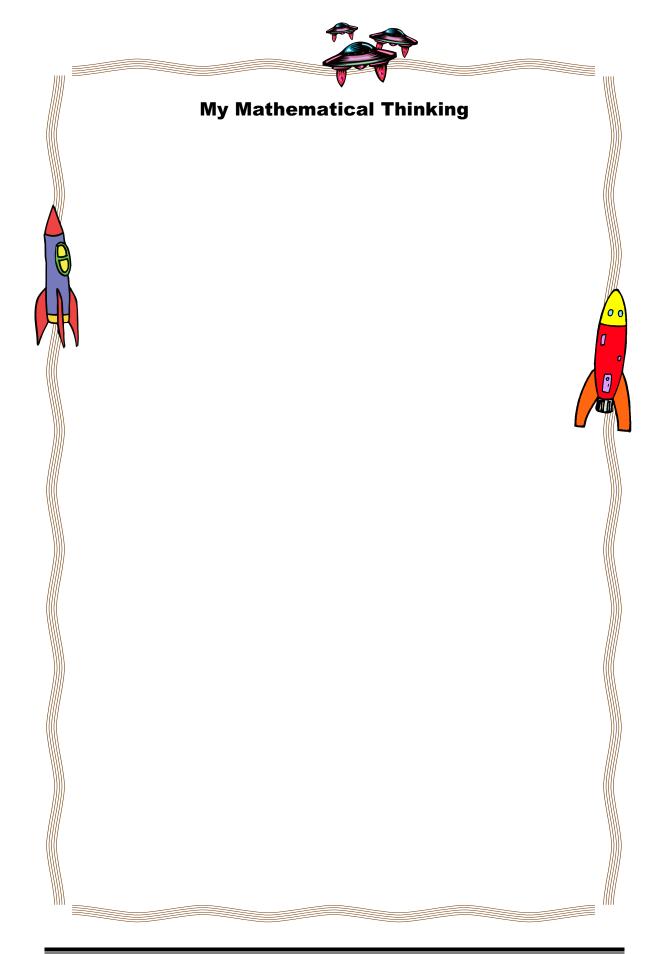
Toxo's Out of This World Cookie Recipe!—Diophantus



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 batches	1	2	3	4	5	6	7			12
Cups of Zorg 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





Mathematical Baker	Date	



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.

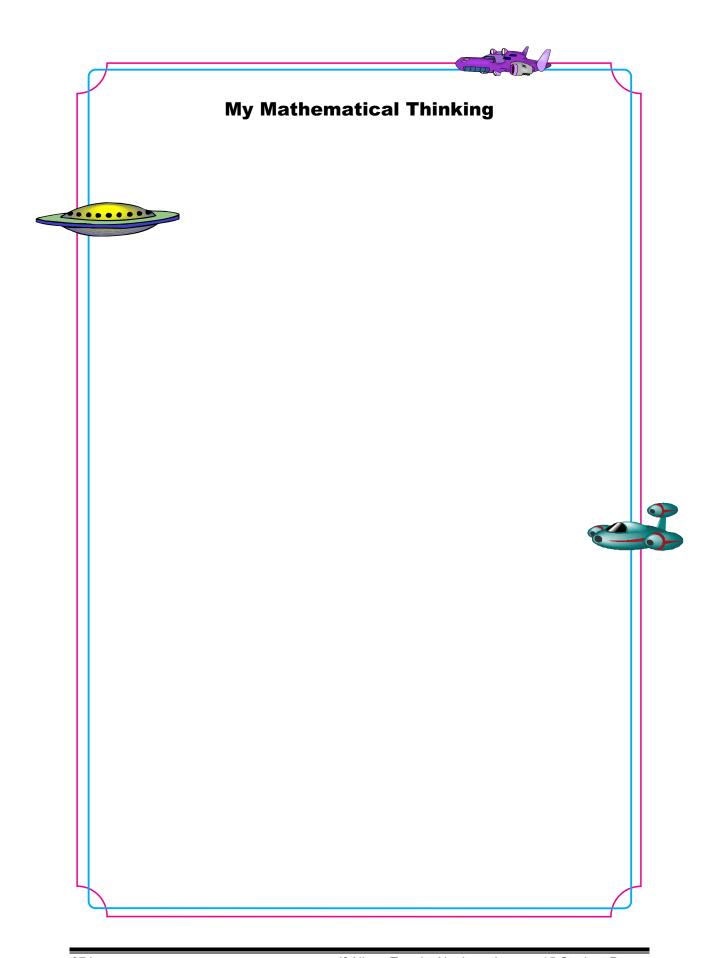
Number of batches	1	2	3	4	5	6	7	 	 	12
Cups of Zorg flour	7									

- 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	 	22
Tablespoons of Zookie butter	8					

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



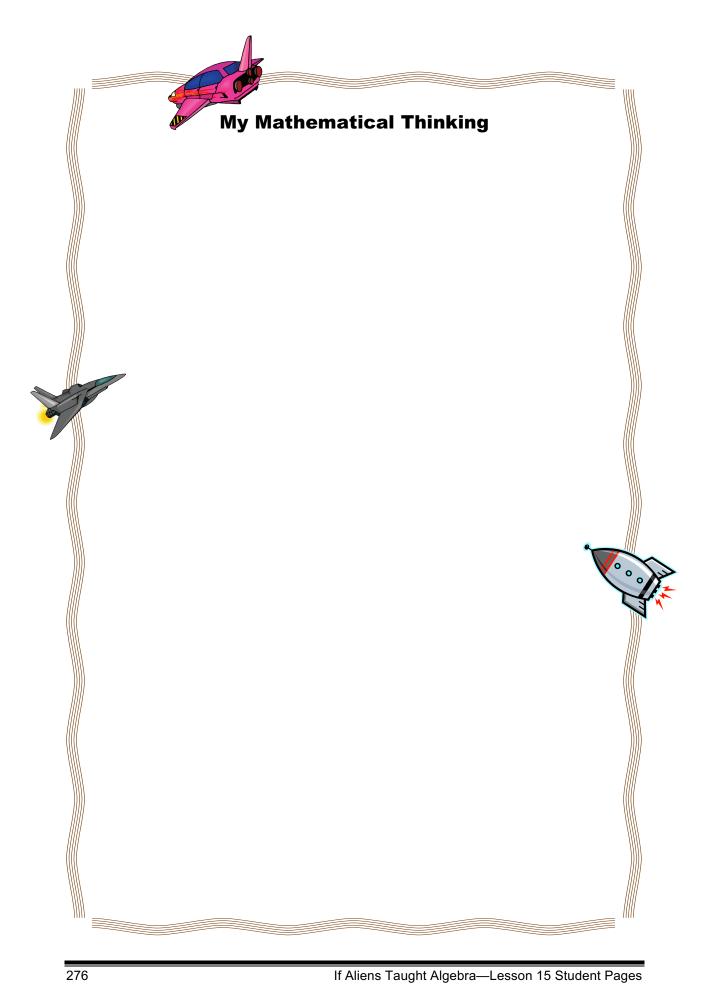
Explain how you solved this growing pattern problem.

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.





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 number	1	2	3	4	5	6		
Number of 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.



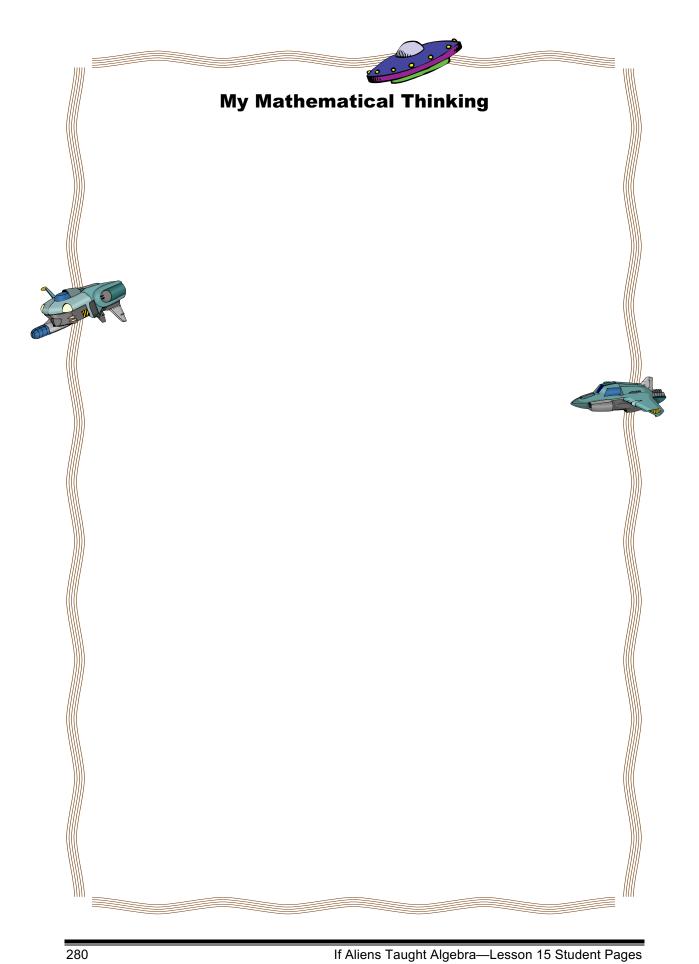
My Mathematical Thinking



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 bowls left to 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:

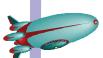
Questions for your friend about your story problem:

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



My Mathematical Thinking





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	 	20
Teaspoons of Planet Nine alien vanilla	7								
Small scoops of Zinky chips	8								

Super Challenge #3

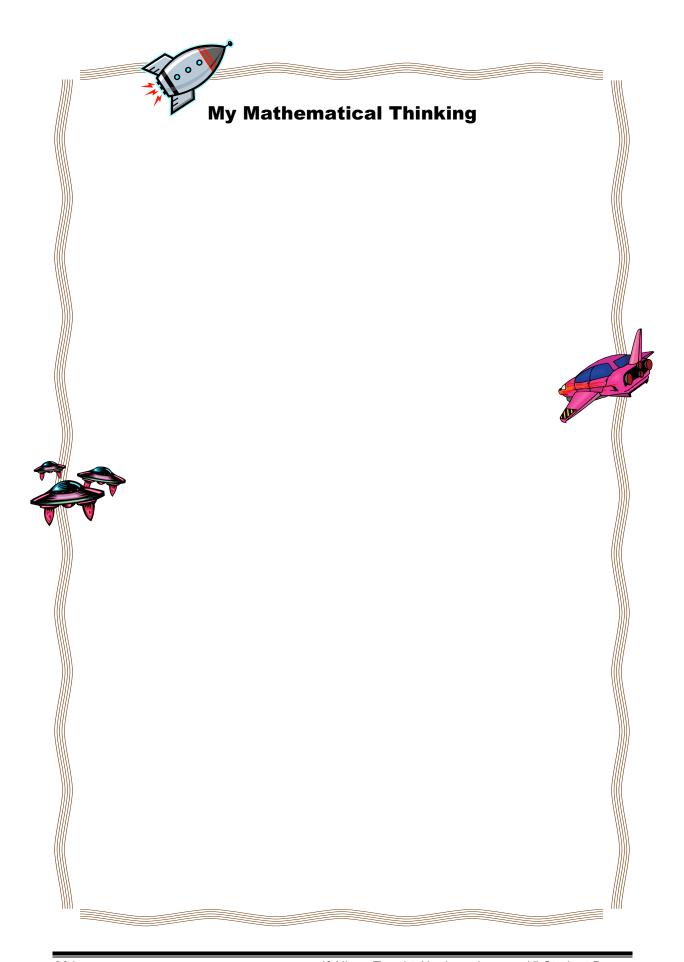
Fill in the missing numbers in the table below. Think about the patterns first.

Number of batches	1	2	3	4	5	6	7	 	10
Zoofy mini eggs		12							
Teaspoons of Planet 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

ntergalactic Officer	Date	



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.

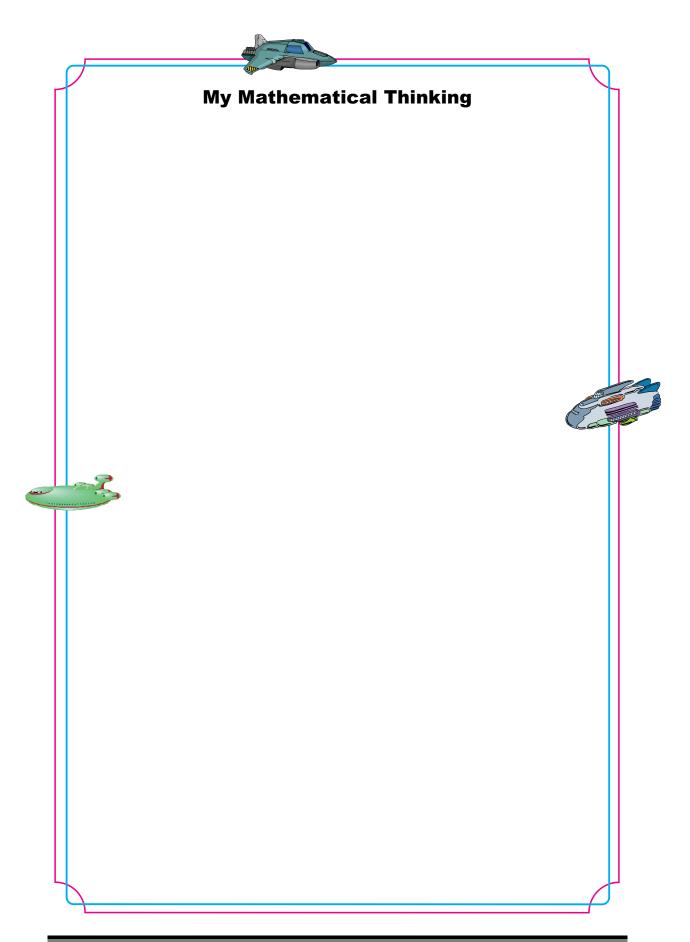
Captain Chavir: No need to worry, Mozalk! I have calculated their estimated locations at the Amusement Park. I am going to send you secret encrypted clues to help you find the crew members along with a top secret map of the park.

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!





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 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 Quarg!

- Find the 4th 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 Hilzo!

How many Planet Nine aliens can 5 ships hold?

# of ships	1	2	3
# of Planet Nine aliens	7	14	21

Find Larko!

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

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.

$$4 + 3 = \square + 5$$
 $12 - \square = 3 \times 2$ $\square + 7 = 20 - 6$ $\square \times 4 = 17 + 3$

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.)

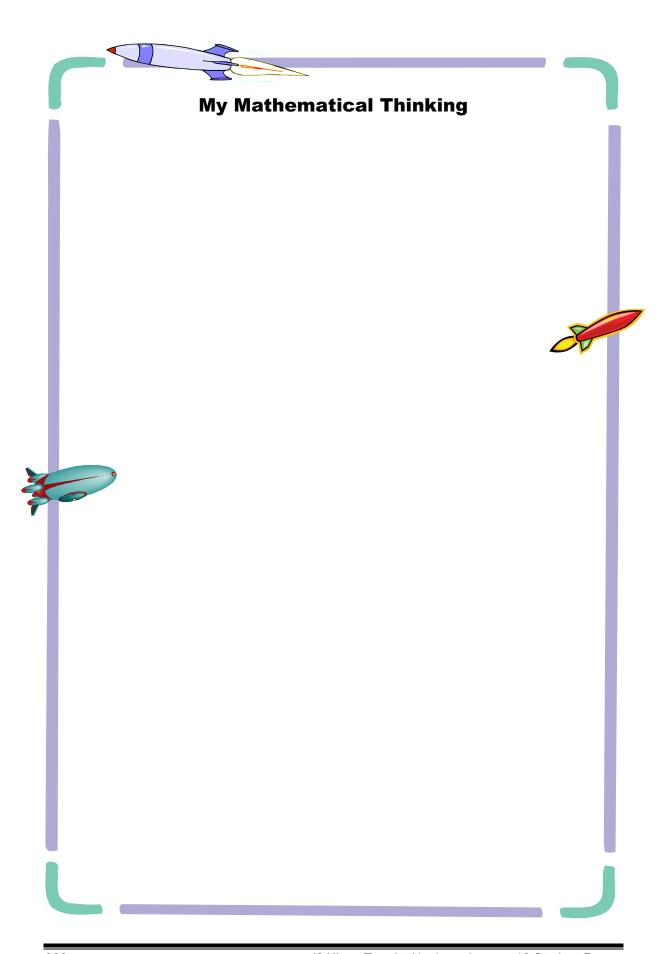
Find Bleeb!

Solve for Y in the following equations:

$$Y = 8 + 2 + 9 + 5$$

 $40 = 5 \times Y$
 $24 / Y = 12$
 $Y = 6 \times 3 + 7 + 3$

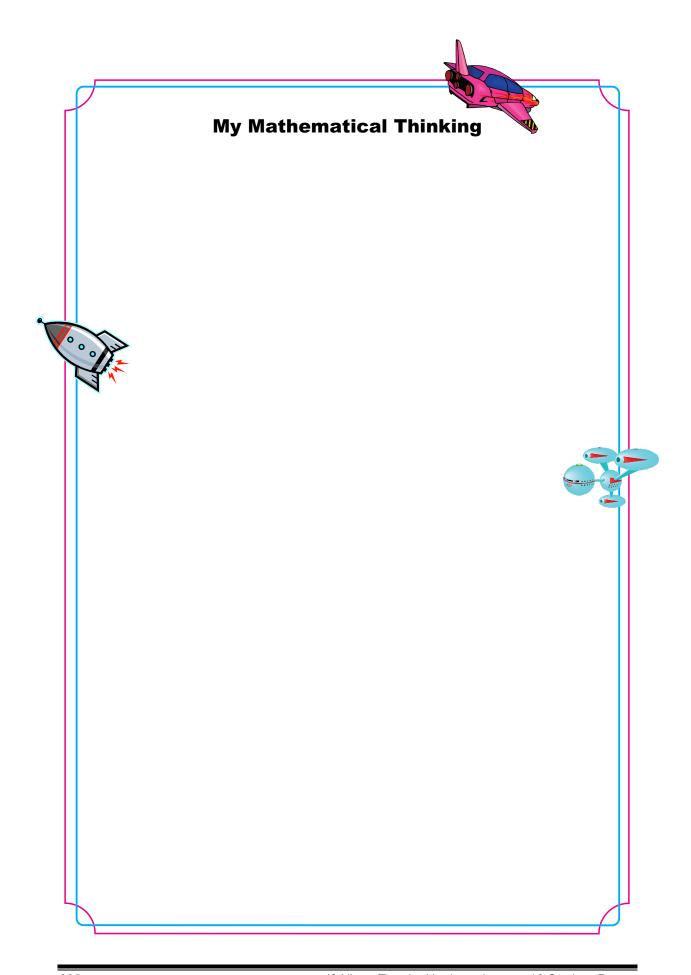
Find the sum of the four Y's. This will be the location of Bleeb.



"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	Bleeb



Find Captain Chavir's Crew! Top Secret Clues!—Diophantus

Find Zilfred!

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 2 hands and 2 feet. Also, each Planet Nine alien has 4 fingers on each hand or 4 toes on each foot. (Hint: Use mental math or draw a picture or a table.)

Find Soland!

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

Five trucks were on their way. Each bringing 7 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 Nacci!

- Find the 5th factor of the number 20 after all the factors have been placed in numerical order from least to greatest.
- 2. Now find the 5th multiple of 9.
- 3. To discover where Nacci is, find the difference between the two answers for the questions above.

Find BeBop!

How many Planet Nine aliens can 5 ships hold?

# of ships	1	2	3
# of Planet Nine aliens	8	16	24

Find G4R4!

Using only 2 whole number addends, how many ways are possible to make the sum of 15?

Find Lindy!

Find the missing numbers. Then find the sum of all the numbers in the boxes to discover the number to locate this Planet Nine alien.

$$14 + 3 = \square + 5$$
 $24 - \square = 3 \times 2$ $\square + 7 = 30 - 6$ $\square \times 4 = 17 + 3$

Find Heebie!

The Rocket Rollercoaster has a total of 8 cars. Seven people can fit in the inside cars, but only 4 people can fit on the first and last cars. How many people can fit altogether in the 8 rollercoaster cars? (Hint: Use mental math, make a table, draw a table, or use manipulatives.)

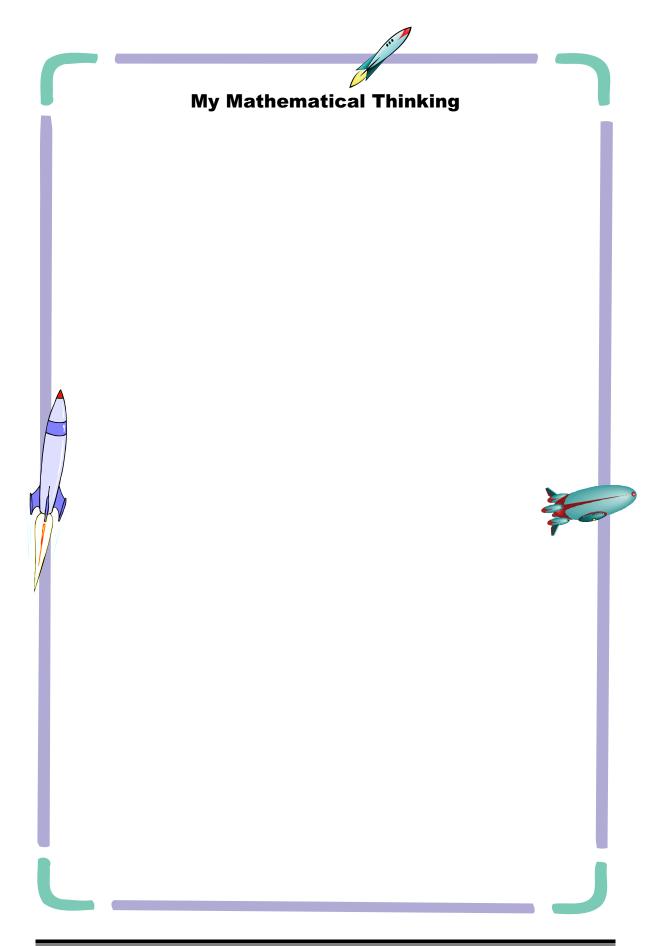
Find Im!

Solve for Y in the following equations:

$$Y = 8 + 7 + 7 + 5$$

 $15 = 3 \times Y$
 $36 / Y = 12$
 $Y = (7 \times 7) + 7 + 5$

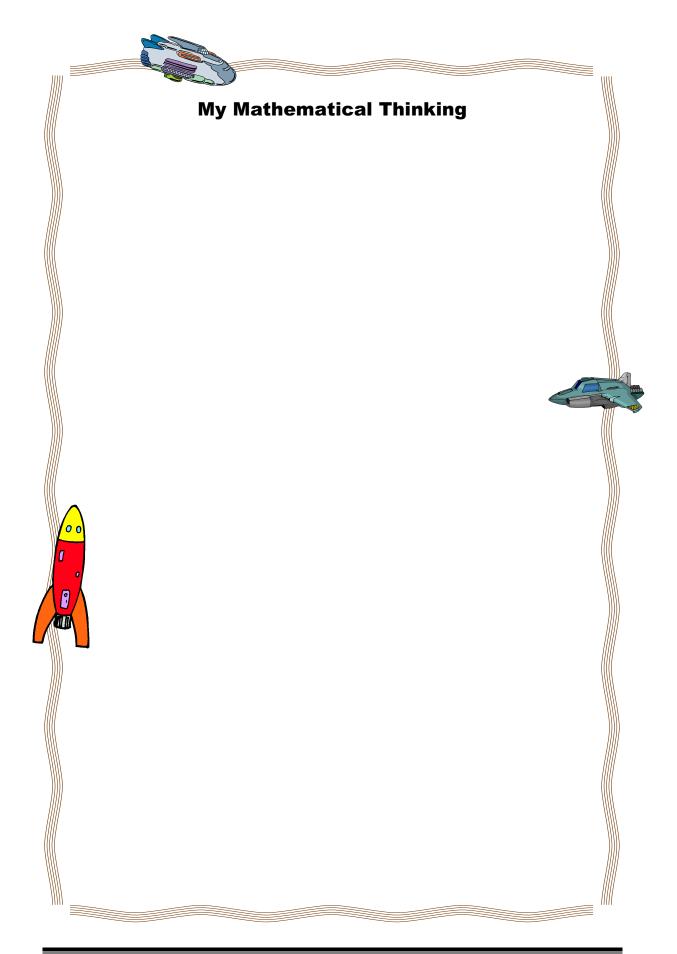
Find the sum of the four Y's. This will be the location of Im.



"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 Lindy!
Find Heebie!	Find Im!



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 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 Vloop!

- 1. Find the 7th factor of the number 36 after all the factors have been placed in numerical order from least to greatest.
- 2. Now find the 5th 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 Rukudig!

How many Planet Nine aliens can 6 ships hold?

# of ships	1	2	3
# of Planet Nine aliens	7	14	21

Find Zurp!

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

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.

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

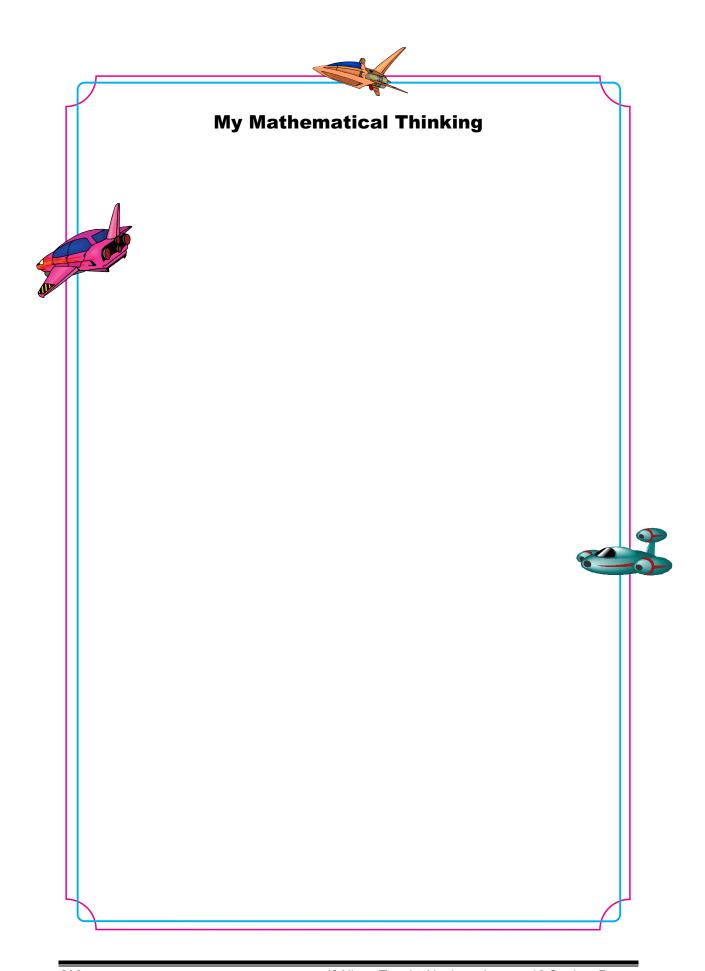
Find Hrtzzky-zzz

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 Paktaklak

Solve for Y in the following equations:

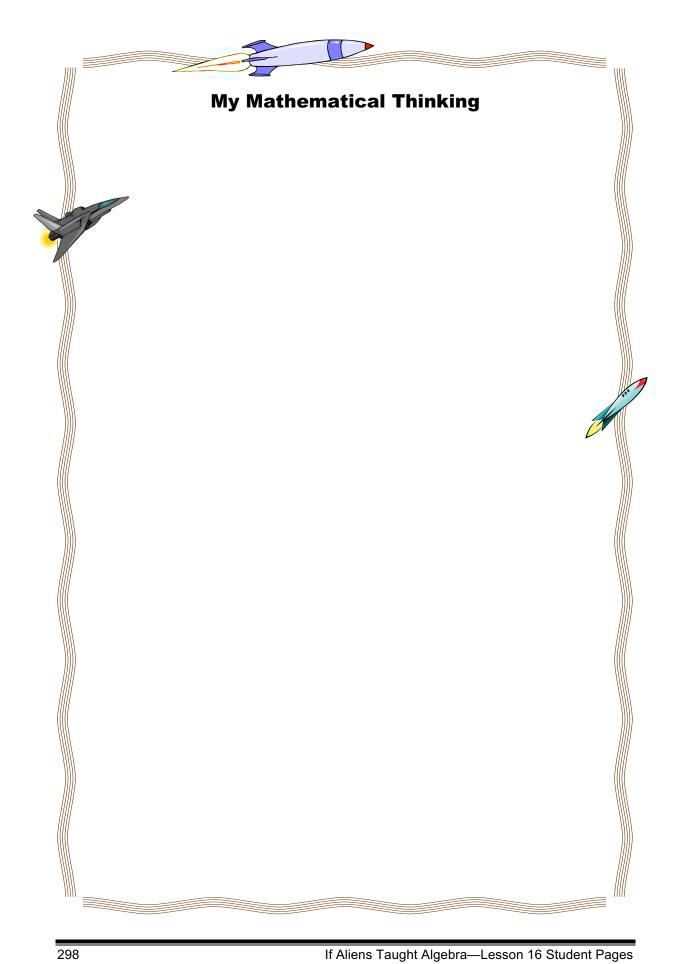
Find the sum of the four Y's. This will be the location of Paktaklak.



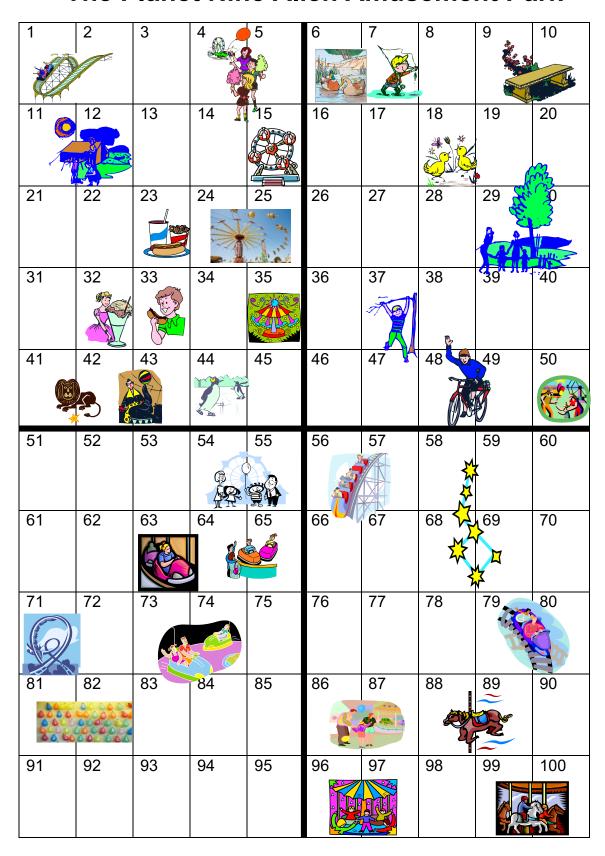
"Captain Chavir, We Have Found Your Crew!"—Kovalevsky

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

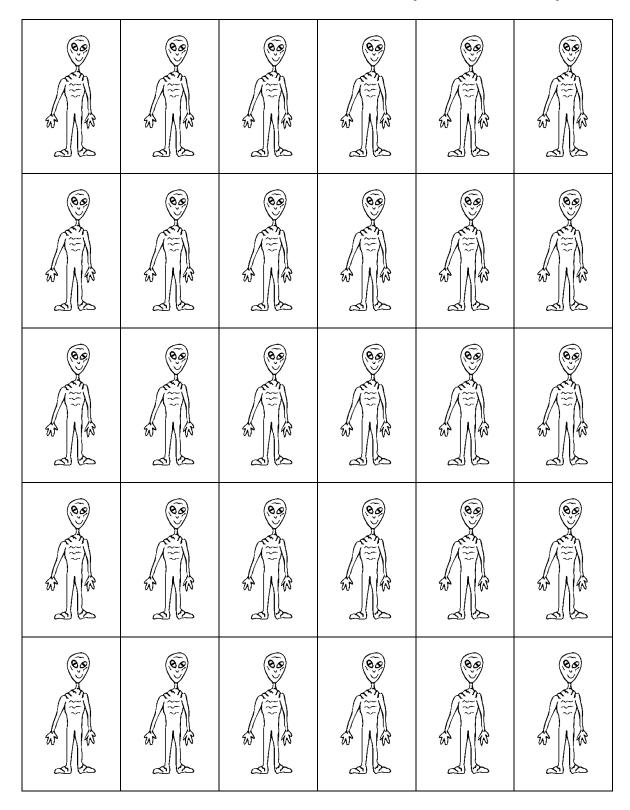
Find Zroply!	Find Lilorlilan!
Find Vloop!	Find Rukudig!
Find Zurp!	Find Q'Lok!
Find Hrtzzky-zzz!	Find Paktaklak!



The Planet Nine Alien Amusement Park



Planet Nine Alien Pictures (OPTIONAL)



IF ALIENS TAUGHT ALGEBRA MATHEMATICIANS' GLOSSARY

Addend: A number that is being added to another number. Example: In 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.

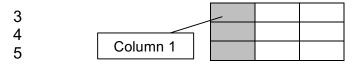
Associative Property of Addition: The grouping of addends in a number sentence does not change the sum.

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.

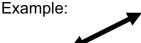


Commutative Property of Addition: The order that addends are added does not change the sum.

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.



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, . . ." 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, . . .

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.

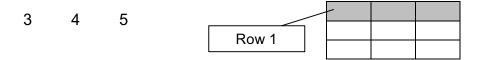
Property: A math rule.

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.



Sets: Another term for a group.

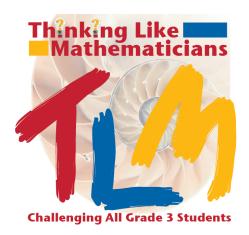
Terms: Numbers in a pattern or sequence.

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 4a = 12.

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





Thinking Like Mathematicians: Challenging All Grade 3 Students

Research Team

University of Connecticut

Dr. E. Jean Gubbins, Principal Investigator University of Connecticut 2131 Hillside Road Unit 3007 Storrs, CT 06269-3007 860-486-4676

Dr. Aarti Bellara, Co-principal InvestigatorDr. Tutita Casa, Co-principal InvestigatorDr. Bianca Montrosse-Moorhead, Co-principal Investigator

Production Team

Siamak Vahidi Hannah F. Brown Alexis Melendez Stacy Hayden