



SHELL  
EDUCATION

Grade

6

# MATH GAMES

Skill-Based Practice  
for Sixth Grade



Ted H. Hull  
Ruth Harbin Miles  
Don S. Balka

# Table of Contents



## Introduction

Importance of Games . . . . .	5
Mathematical Learning . . . . .	5
Games vs. Worksheets . . . . .	6

<b>How to Use This Book</b> . . . . .	8
---------------------------------------	---

<b>Correlation to the Standards</b> . . . . .	11
---	----

<b>About the Authors</b> . . . . .	15
------------------------------------	----

## Math Games

### Domain: Ratios and Proportional Relationships

Climb the Mountain . . . . .	16
Roller Coaster Proportions . . . . .	20
Rocking Ratios . . . . .	26

### Domain: The Number System

Between . . . . .	34
Dunking Decimals . . . . .	38
Mystery Multiples . . . . .	42
GCF for the Win . . . . .	47
Quotient Corral . . . . .	55
Zero to Hero . . . . .	58
Rational Order . . . . .	60

# Table of Contents *(cont.)*

## **Domain: Expressions and Equations**

Express Yourself with Expressions .....	67
Most Valuable 7 .....	75
Distribution Concentration .....	82
Equation Bingo .....	88
True or False: Inequalities .....	101

## **Domain: Geometry**

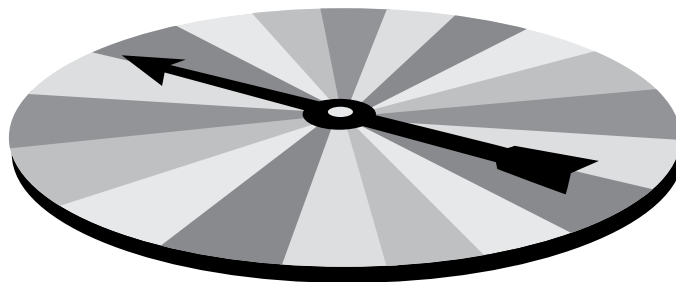
High Velocity Volume .....	106
Triangles .....	111

## **Domain: Statistics and Probability**

Mean Wins .....	114
Dive Into Distributions .....	118
Statistics Strikeout .....	122

## **Appendices**

<b>Appendix A: References Cited</b> .....	130
<b>Appendix B: Answer Key</b> .....	131
<b>Appendix C: Contents of the Digital Resource CD</b> .....	135





# Importance of Games

Students learn from play. Play begins when we are infants and continues through adulthood. Games are motivational and educational (Hull, Harbin Miles, and Balka 2013; Burns 2009). They can assist and encourage students to operate as learning communities by requiring students to work together by following rules and being respectful. Games also foster students' thinking and reasoning since students formulate winning strategies. They provide much more sustained practices than do worksheets, and students are more motivated to be accurate. Worksheets may provide 20 to 30 opportunities for students to practice a skill, while games far exceed such prescribed practice opportunities. Lastly, games provide immediate feedback to students concerning their abilities.

Games must be part of the overall instructional approach that teachers use because successful learning requires active student engagement (Hull, Harbin Miles, and Balka 2013; National Research Council 2004), and games provide students with the motivation and interest to become highly engaged. Instructional routines need balance between concept development and skill development. They must also balance teacher-led and teacher-facilitated lessons. Students need time to work independently and collaboratively in order to assimilate information, and games can help support this.



When games are used appropriately, students also learn mathematical concepts.

## Mathematical Learning

Students must learn mathematics with understanding (NCTM 2000). Understanding means that students know the relationship between mathematical concepts and mathematical skills—mathematical procedures and algorithms work because of the underlying mathematical concepts. In addition, skill proficiency allows students to explore more rigorous mathematical concepts. From this relationship, it is clear that a balance between skill development and conceptual development must exist. There cannot be an emphasis of one over the other.

The National Council of Teachers of Mathematics (2000) and the National Research Council (2001) reinforce this idea. Both organizations state that learning mathematics requires both conceptual understanding and procedural fluency. This means that students need to practice procedures as well as develop their understanding of mathematical concepts in order to achieve success. The games presented in this book reinforce skill-based practice and support students' development of proficiency. These games can also be used as a springboard for discourse about mathematical concepts. The counterpart to this resource is *Math Games: Getting to the Core of Conceptual Understanding*, which builds students' conceptual understanding of mathematics through games.

# Importance of Games *(cont.)*

The *Common Core State Standards for Mathematics* (2010) advocate a balanced mathematics curriculum by focusing standards both on mathematical concepts and skills. This is also stressed in the Standards for Mathematical Practice, which discuss the process of “doing” mathematics and the habits of mind students need to possess in order to be successful.

The Standards for Mathematical Practice also focus on the activities that foster thinking and reasoning in which students need to be involved while learning mathematics. Games are an easy way to initiate students in the development of many of the practices. Each game clearly identifies a Common Core domain, a standard, and a skill, and allows students to practice them in a fun and meaningful way.

## Games vs. Worksheets

In all likelihood, many mathematics lessons are skill related and are taught and practiced through worksheets. Worksheets heavily dominate elementary mathematics instruction. They are not without value, but they often command too much time in instruction. While students need to practice skills and procedures, the way to practice these skills should be broadened.

Worksheets generally don't promote thinking and reasoning. They become so mechanical that students cease thinking. They are lulled into a feeling that completing is the goal. This sense of “just completing” is not what the Common Core Standards for Mathematical Practice mean when they encourage students to “persevere in solving problems.”



Students need to be actively engaged in learning.

Students need to be actively engaged in learning. While worksheets do serve a limited purpose in skill practice, they also contain many potential difficulties. Problems that can occur include the following:

- **Worksheets are often completed in isolation**, meaning that students who are performing a skill incorrectly most likely practice the skill incorrectly for the entire worksheet. The misunderstanding may not be immediately discovered, and in fact, will most likely not be discovered for several days!
- **Worksheets are often boring to students**. Learning a skill correctly is not the students' goal. Their goal becomes to finish the worksheet. As a result, careless errors are often made, and again, these errors may not be immediately discovered or corrected.

## Importance of Games *(cont.)*

- **Worksheets are often viewed as a form of subtle punishment.** While perhaps not obvious, the perceived punishment is there. Students who have mastered the skill and can complete the worksheet correctly are frequently “rewarded” for their efforts with another worksheet while they wait for their classmates to finish. At the same time, students who have not mastered the skill and do not finish the worksheet on time are “rewarded” with the requirement to take the worksheet home to complete, or they finish during another portion of the day, often recess or lunch.
- **Worksheets provide little motivation to learn a skill correctly.** There is no immediate correction for mistakes, and often, students do not really care if a mistake is made. When a game is involved, students want and need to get correct answers.

The *Common Core State Standards for Mathematics*, including the Standards for Mathematical Practice, demand this approach change. These are the reasons teachers and teacher leaders must consciously support the idea of using games to support skill development in mathematics.



# How to Use This Book *(cont.)*

Students are able to work collaboratively during game play, thus promoting student discourse and deeper learning. The games can also be used to reduce the amount of time students spend completing worksheets.

Each game in this book is based upon a common format. This format is designed to assist teachers in understanding how the game activities are played and which standards and mathematical skills students will be practicing.

## Domain

The domain that students will practice is noted at the beginning of each lesson. Each of the five domains addressed in this series has its own icon.

## Standards

One or more *Common Core State Standards* will state the specific skills that students will practice during game play.

## Number of Players

The number of players varies for each game. Some may include whole-group game play, while others may call for different-size groups.

## Materials

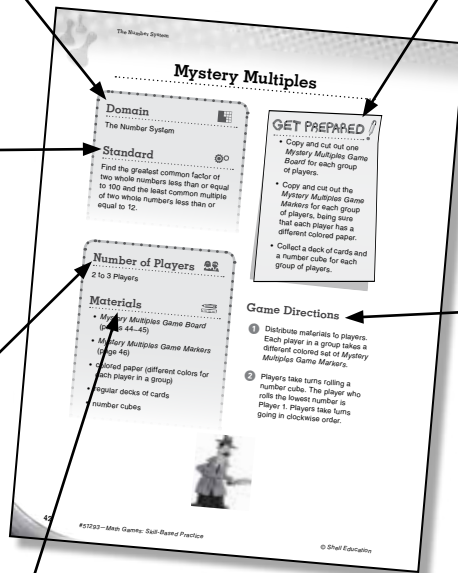
A materials list is provided for each game to notify the teacher what to have available in order to play the games.

## Get Prepared!

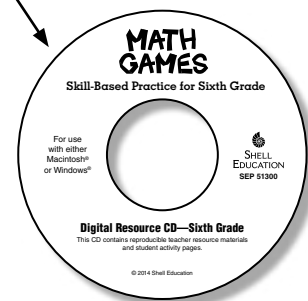
Everything a teacher needs to be prepared for game play is noted in the Get Prepared! section. This includes how many copies are needed as well as other tasks that need to be completed with the materials.

## Game Directions

The directions allow for step-by-step guidance on how to easily implement each game.



All game resources can be found on the **Digital Resource CD**. (For a complete list of the files, see pages 135–136.)

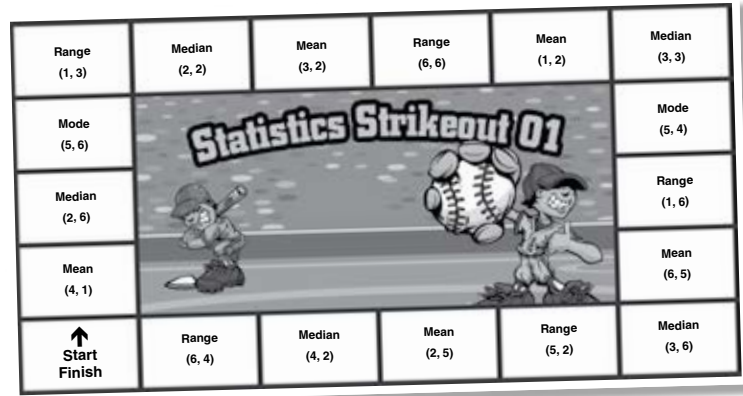


# How to Use This Book *(cont.)*

Many games include materials such as game boards, activity cards, and score cards. You may wish to laminate materials for durability.

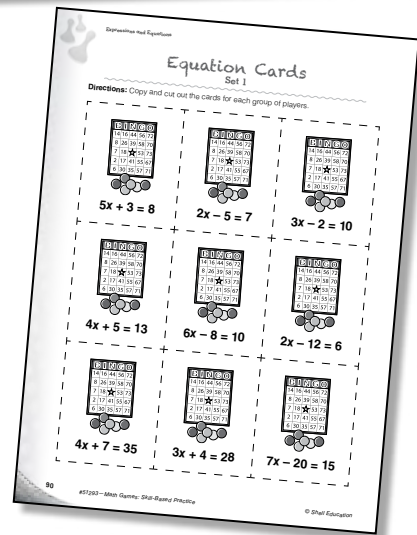
## Game Boards

Some game boards spread across multiple book pages in order to make them larger for game play. When this is the case, cut out each part of the game board and tape them together. Once you cut them apart and tape them together, you may wish to glue them to a large sheet of construction paper and laminate them for durability.



## Activity Cards

Some games include activity cards. Once you cut them apart, you may wish to laminate them for durability.





# Rocking Ratios

## Domain

**A:B**

Ratios and Proportional Relationships

## Standard



Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

## Number of Players



2 Players

## Materials



- *Rocking Ratios 1–100 Sheet* (page 28)
- *Rocking Ratios Cards* (pages 29–32)
- *Rocking Ratios Recording Sheet* (page 33)
- *Rocking Ratios Cards Answer Key* (page 132)

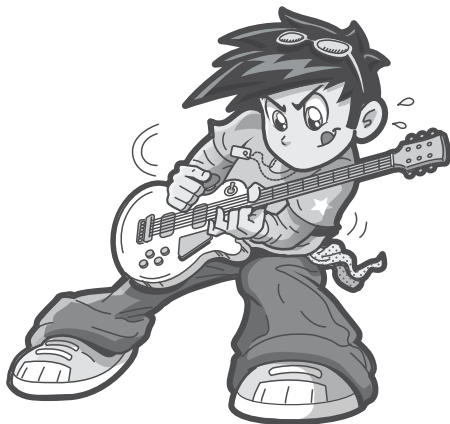
## GET PREPARED!



- Copy and cut out a set of *Rocking Ratios Cards* for each pair of players.
- Copy one *Rocking Ratios 1–100 Sheet* and one *Rocking Ratios Recording Sheet* for each pair of players.
- Prior to the game, review the ratio cards and remove cards containing content students have not yet been taught.

## Game Directions

- 1 Distribute materials to players.
- 2 Players place the cards facedown. Players take turns turning over the *Rocking Ratios Cards*.



## Rocking Ratios *(cont.)*

---

- 3 Players work together to find the ratio indicated on the card by determining from the *Rocking Ratios 1–100 Sheet* the quantity of numbers in each specified set and record answers on the *Rocking Ratios Recording Sheet*. For example, there are 25 prime numbers and 74 composite numbers on the *Rocking Ratios 1–100 Sheet*. Therefore, the ratio of prime numbers to composite numbers is  $25/74$ . Recall that 1 is not prime or composite.
- 4 Depending on what has been taught, players can simplify the ratios.
- 5 The winner is the pair of players that first correctly finds all the ratios.
- 6 Have pairs of players report the ratios found for each card. Answers can be checked using the *Rocking Ratios Cards Answer Key*.

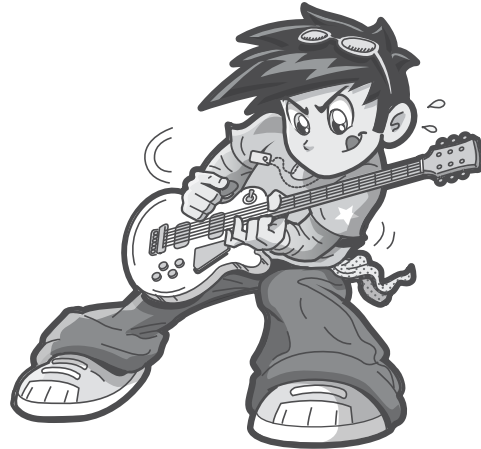


# Rocking Ratios

## 1–100 Sheet

**Directions:** Use this sheet to find the quantity of numbers in each specified set.

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

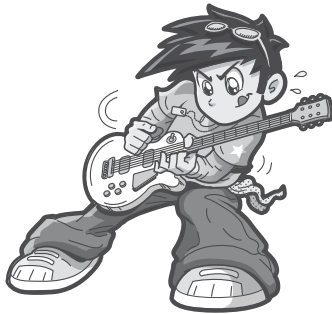


# Rocking Ratios

## Cards

**Directions:** Copy and cut out cards for each pair of students.

**Ratio of Even Numbers  
to Odd Numbers**



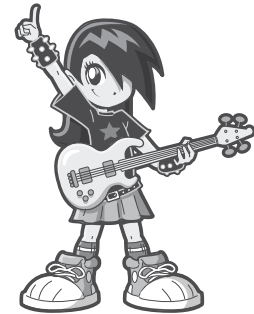
1

**Ratio of Prime  
Numbers to Composite  
Numbers**



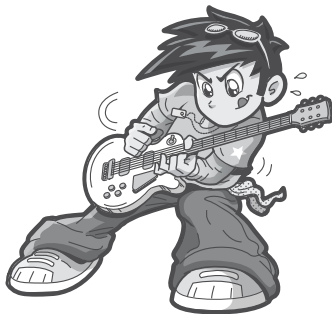
2

**Ratio of Prime  
Numbers to Numbers  
on the Chart**



3

**Ratio of Numbers  
Containing a 4 to  
Numbers Containing  
a 0**



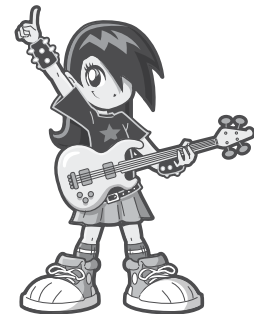
4

**Ratio of Numbers  
Ending in 0 to  
Numbers Containing  
a 5**



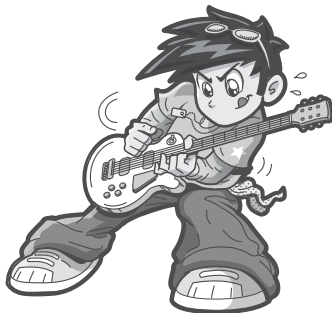
5

**Ratio of Even  
Numbers to Multiples  
of 3**



6

**Ratio of Multiples of 4  
to Multiples of 7**



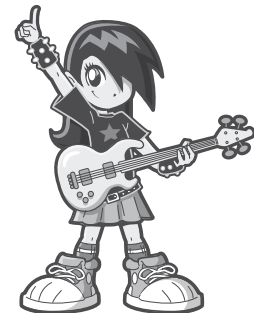
7

**Ratio of Multiples of 6  
to Multiples of 9**



8

**Ratio of Triangular  
Numbers to Square  
Numbers**



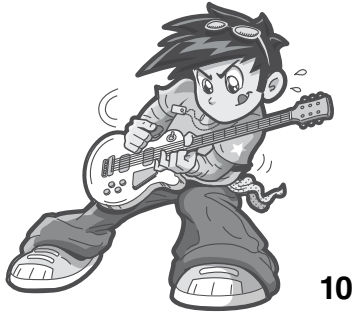
9



# Rocking Ratios

Cards (cont.)

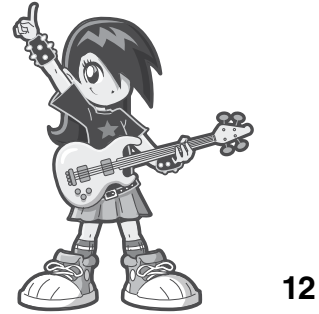
**Ratio of Multiples of 10  
to Multiples of 5**



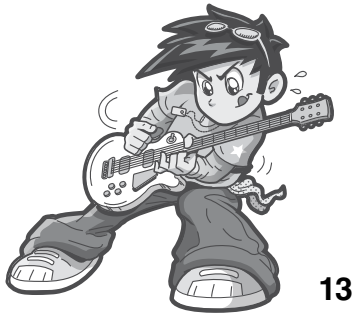
**Ratio of Square  
Numbers to Even  
Numbers**



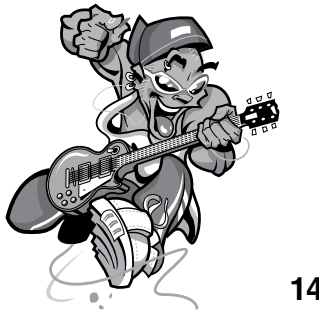
**Ratio of Prime  
Numbers to Odd  
Numbers**



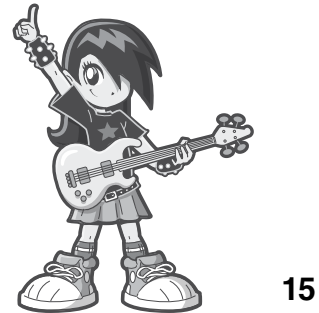
**Ratio of Numbers  
Greater Than 60 to  
Numbers Less Than 21**



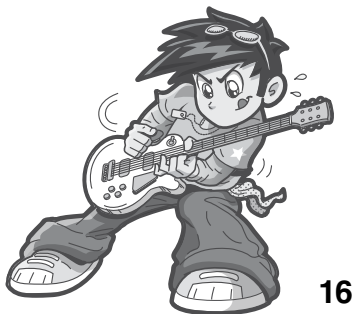
**Ratio of Numbers Less  
Than 40 to Numbers  
Greater Than 49**



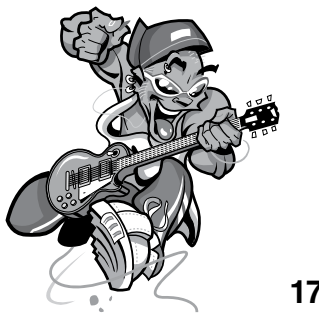
**Ratio of Numbers  
Greater Than 70 to  
Numbers Greater Than  
60**



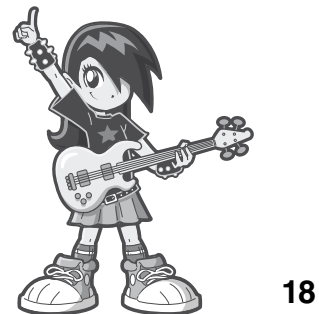
**Ratio of Multiples of 2  
to Multiples of 4**



**Ratio of Multiples of 7  
to Multiples of 8**



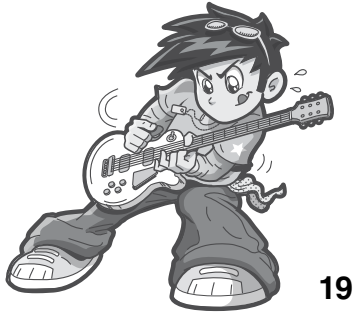
**Ratio of Numbers  
Containing a 6 to  
Numbers Ending with 2**



# Rocking Ratios

## Cards (cont.)

**Ratio of Numbers  
Containing a 9 to  
Numbers Ending with 3**



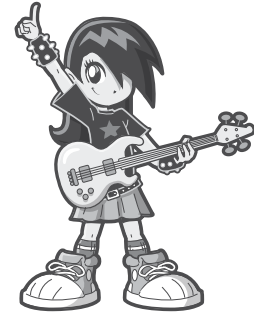
19

**Ratio of Square  
Numbers to Odd  
Numbers**



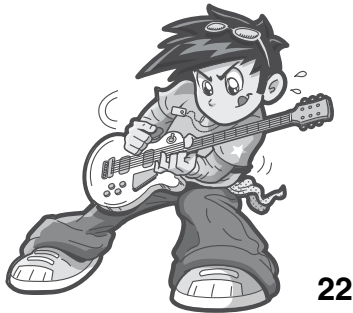
20

**Ratio of Triangular  
Numbers to Odd  
Numbers**



21

**Ratio of Numbers  
Whose Digits Sum Is  
3 to Numbers Whose  
Digits Sum Is 8**



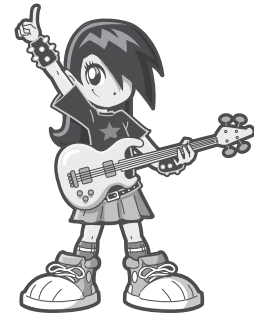
22

**Ratio of Numbers  
Whose Digits Sum Is  
12 to Numbers Whose  
Digits Sum Is 14**



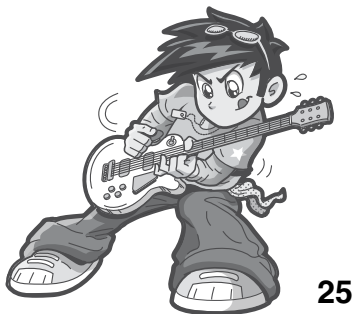
23

**Ratio of Numbers  
Whose Digits Sum Is  
5 to Numbers Whose  
Digits Sum Is 9**



24

**Ratio of Multiples of 11  
to Multiples of 13**



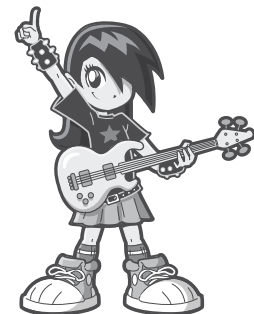
25

**Ratio of Multiples of  
25 to Multiples of 20**



26

**Ratio of Multiples of  
40 to Multiples of 30**

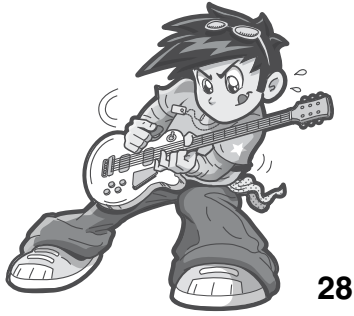


27

# Rocking Ratios

Cards (cont.)

**Ratio of Multiples  
of 4 to Numbers  
Containing 4**



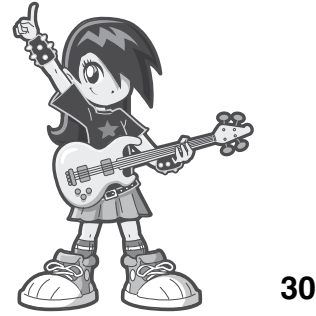
28

**Ratio of Multiples  
of 7 to Numbers  
Containing 7**



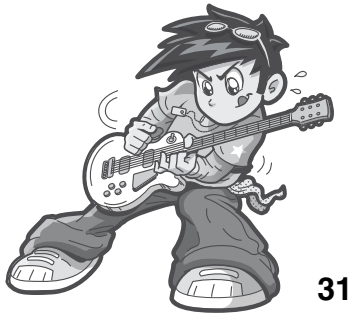
29

**Ratio of Odd Square  
Numbers to Even  
Square Numbers**



30

**Ratio of Numbers Less  
Than 25 to Numbers  
Greater Than 40**



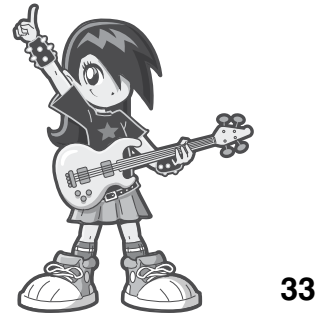
31

**Ratio of "Teen"  
Numbers to Multiples  
of 10**



32

**Ratio of Prime  
Numbers to Even  
Numbers**



33



Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Rocking Ratios Recording Sheet

**Directions:** Record your answer for each ratio card on the recording sheet.

Card Number	Answer	Card Number	Answer	Card Number	Answer
1		12		23	
2		13		24	
3		14		25	
4		15		26	
5		16		27	
6		17		28	
7		18		29	
8		19		30	
9		20		31	
10		21		32	
11		22		33	

