

## Preseason Guide – Teacher’s Companion

Hello, teachers! My name is Coach Powers, and I’m the cartoon spokesman for ThinkFun, the company that makes MathDice. In this Teacher’s Guide, I want to talk a little bit about the MathDice program in general and how you can use it to help build your students’ computational math skills.



Now, you may not be accustomed to having a dialogue with a pencil drawing, but I’m hoping your kids will get a kick out of working with me, so I’m going to stay in character with you as well. Thanks for suspending your disbelief.

This Teacher’s Guide is a companion piece to the MathDice Preseason Guide that I’m recommending you offer to all your students. In this guide there is a schedule for working through the Preseason Guide with your students. Plus, I’ve posted all the solutions to the preseason challenges in the appendix at the back of this guide.

But first, I want to start by personally thanking you for agreeing to try this program in your classroom. Over the course of the school year, you’ll probably be in contact with Todd Etter or Bill Ritchie from ThinkFun. They’re not as smart as cartoons, but they’re still pretty cool. Along with me, they’re looking forward to listening to your experiences with MathDice in your classrooms and helping share the success stories across Arlington.

## The MathDice Program in General

MathDice is a simple, fun game that gets kids excited about mental math. Just in itself, that's pretty good. But, I believe very strongly that kids will get even more out of MathDice if we introduce a companion program to the dice-rolling game where we can expose them to particularly interesting and challenging number combinations and give them a variety of different ways to play with the MathDice system.

And so, I've worked with ThinkFun to develop a set of "paper and pencil" games that use the basic concepts of MathDice. Like MathDice, the games are simple to learn, they're clever and they're fun. So here they are.

- **Ski Patrol** - In this game, students pretend they're skiing through a series of gates going down a ski slope. Players must use three scoring numbers to create math equations where the results fall between the numbers on the gates.
- **Soccer Shootout** - In this game, players are given three scoring numbers, and they have to come up with as many target numbers as they can that fall between a range defined by the soccer goal.
- **Tenpin Bowling** - Players use two sets of scoring numbers (shown on two bowling balls), and have to use these scoring numbers to find equations that equal each of the numbers shown on ten bowling pins.
- **Mini Golf** - In this game, players use their scoring numbers to come as close as possible to posted target numbers, but it is not certain whether they can hit the target exactly or not. (Note: Mini Golf is a part of the main season but does not appear in the preseason guide.)

We've developed a whole variety of challenges for each of these games, ranging from beginner to expert. I'm convinced that if your students mix in these pencil-and-paper games with playing the MathDice dice game, that they will learn more math and become stronger players more quickly, and that they will also enjoy playing all forms of the MathDice game program more. Once you try it, you'll see for yourself!

## A Look at the Preseason Guide

In terms of math exercises, the Preseason Guide consists of

- Two basic math exercises
- Introduction to three of the four MathDice games described above
- Three advanced math exercises that require exponents (optional, at back of book)

Another purpose of the guide is to invite students to join me for the MathDice Main Season. The Main Season involves students playing MathDice and playing pencil-and-paper games in order to earn reward points which they track on their personal progress chart. The obvious purpose is to get kids excited about playing the MathDice game and doing MathDice exercises over the course of the whole year. Yeah!

For now, though, we're working with the MathDice Preseason Guide. You should have a copy of this guide to hand out to each of your students. Some of you will prefer handing out the entire booklet to your students. Others may find it easier to retain one master version and simply run off copies of several of the pages at a time.

What I'd like to do on these next few pages is to outline a timetable with my best recommendations for how to assign the Preseason Guide to your students.

OK? You with me? Great! Then let's go!

## Preseason Lesson Plans

OK now, do you have your MathDice Preseason Guide in front of you? Let's go through it now and organize it in terms of lesson plans. (Note: the lesson plans don't include sessions of playing MathDice. If you have time, we strongly encourage having your kids continue to play the game, in or out of class.)

I'm assuming that you have all already had your students play MathDice in your classrooms, for one or more sessions.\*

### Assignment 1:

- Hand out the MathDice Preseason Guides (or copies of specific pages) to each of your students. Ask them to write their names in the upper right corner of their copy of the guide and to be careful to not lose it.
- Assign Pages 2-4 and 12-14 for students to read. This will refresh them on MathDice "how to play" rules.
- Have your students do the Agility Drill exercise at the bottom of Page 4.

### Classroom Discussion 1:

- When the assignment is due, reserve 10-15 minutes of class time to clarify game rules and to go over the Agility Drill problem set from Page 4. (Answers to this problem set and the other challenges are posted in the back of this teacher's guide.)

### Assignment 2:

- Have your students read Page 5 and do the Soccer Shootout challenge at the bottom of this page.

### Classroom Discussion 2:

- When the assignment is due, reserve 10-15 minutes of class time to discuss the Soccer Shootout game, and to go over students' answers.

### Assignment 3:

- Have your students read Pages 6-7.
- Have students do the Agility Drill on Page 6.
- Have students do the Ski Patrol challenge on Page 7.

### Classroom Discussion 3:

- Reserve 15-20 minutes of class time going over student answers to the Agility Drill and the skiing game.

#### Assignment 4:

- Have your students read Pages 8-9.
- Have students do the Tenpin Bowling game on Page 9.
- Have your students read the wrap up on Page 10.

#### Classroom Discussion 4:

- Reserve 10-15 minutes of class time to discuss the bowling game and to go over student answers.

#### Assignment 5 (Optional):

- For students who have some understanding of exponents, have them do the Power Drills on Page 13.

#### Classroom Discussion 5 (Optional):

- Reserve 15-20 minutes to go over student answers to the Page 11 Power Drill.

These are fun math games and exercises by themselves. But what's really great is that when your students get through this program, they'll be trained and ready to go with a whole series of challenges I'm getting ready for you, based on the MathDice games introduced in the Preseason Guide. I promise you, if your kids play MathDice through the year, and play these paper-and-pencil games as well, that they will graduate the year as true Mathletes!

\* If you haven't had your students play MathDice yet, that's fine. In that case, start the program by handing out the MathDice Preseason Guide; have your students read pages 2-3 and 12-14 to learn the basic MathDice rules. When the assignment is due, spend class time having your students play MathDice in your classroom. Then pick up on the program as described above.

## **Pencil and Paper Games Guide**

This section explains the games in the guide more fully and also suggests a way to play them in the classroom as an individual or group activity. All of the suggested classroom exercises can be performed as an entire class or in smaller groups.

### **Soccer Shootout**

This game is the easiest of the four and should be taught first. Since there's a range of target numbers and not just one, it will reward students who may have a tough time reaching the target number when first learning MathDice.

It's important to remember that you only score goals with different target numbers. Reaching the same target number with two different equations doesn't count. Also, the student must find target numbers between the two defenders and not equal to their jersey numbers.

Each challenge has a perfect score of six goals, but in the Main Season the number of goals may differ from one goal to the next within the challenge. For example, the first goal may only have one answer, the second goal three answers, and the third goal two answers.

#### **Optional classroom play exercise**

Roll the scoring dice and pick two defender numbers. Challenge the group or individual to find as many target numbers as possible within the range. This works well in a group setting and can involve the whole class.

### **Ski Patrol**

Another simple game. The concept is similar to Soccer Shootout, but in this case, the goal is to find one number within a series of ranges, or gates. In the Main Season, the numbers on the gates will always increase, but that doesn't mean the difficulty of the problems will increase as the student makes it down the slope.

This exercise shows the student the flexibility of numbers and how to best combine them to reach ever-increasing target numbers. The student will soon learn that certain combinations of numbers will always generate higher targets than others. As in Soccer Shootout, the answer cannot equal the number on one of the gates. The answer must fall within the two numbers. Also, in some of the easier problems, there might be more than one answer that works. Only one answer is needed.

### **Optional classroom play exercise**

Write on the blackboard a series of gates, or ranges, such as 1-5, 6-10, 11-15, and so on. Have a student roll the scoring dice. As a group, have the class try to come up with answers that fall within each range. See if they can make it all the way through the course.

### **Tenpin Bowling**

This game is slightly more involved than the first two. The goal is to knock down all ten pins by using two scoring balls. To knock down a pin, the student must pick a ball and then use the scoring numbers on that ball only. He/she may not mix the numbers on the two balls. However, one ball will not work for all the pins. The trick is to find out which balls can knock over which pins.

Some of the pins can be knocked down by either ball. As a bonus, challenge your students to find these pins.

### **Optional classroom play exercise**

Tenpin Bowling is a great solitaire game that can be played with a pencil and paper. Write down the numbers from 1 to 10. Roll the scoring dice and see how many pins you can knock down by making MathDice expressions. The goal is to knock down every pin. If the student cannot do this, he/she rerolls the dice and tries to knock down the rest of the pins.

# MathDice Preseason Guide Answer Key

## Page 4 - Agility Drill #1

Scoring Numbers	Target #	Solution 1	Solution 2
1 2 4	7	$(1+2)+4=7$	$(2\times 4)-1=7$
1 3 4	8	$(1+3)+4=8$	$(3-1)\times 4=8$
1 2 5	8	$(1+2)+5=8$	$(5-1)\times 2=8$
2 2 6	10	$(2+2)+6=10$	$(2\times 6)-2=10$
2 4 5	3	$(5-4)+2=3$	$(2\times 4)-5=3$

## Page 5 - Soccer Shootout

Scoring Numbers	Defender #'s	Winning Math Expressions
1 2 5	11, 16	$(1+5)\times 2=12$ $(1+2)\times 5=15$
2 3 6	16, 21	$(3+6)\times 2=18$ $(3\times 6)+2=20$
2 4 5	11, 14	$(5-2)\times 4=12$ $(2\times 4)+5=13$

## Page 6 - Agility Drill #2

Scoring Numbers	Target #	Solution 1	Solution 2
2 3 4	14	$(3\times 4)+2=14$	$(3+4)\times 2=14$
3 3 6	15	$(3\times 3)+6=15$	$(3\times 6)-3=15$
3 4 5	17	$(3\times 4)+5=17$	$(4\times 5)-3=17$
4 5 6	26	$(4\times 5)+6=26$	$(5\times 6)-4=26$
3 5 6	33	$(5\times 6)+3=33$	$(5+6)\times 3=33$

## Page 7 - Ski Patrol

Scoring Numbers	Gates	Gate Expression
2 3 5	3, 5	$(5-3)+2=4$
	4, 6	$(3-2)\times 5=5$
	6, 9	$(2\times 5)-3=7$
	10, 12	$(2\times 3)+5=11$
	11, 14	$(2\times 5)+3=13$

## Page 9 – Tenpin Bowling

(Note: Five pins can be knocked down with either ball)

Bowling Pin Target	Ball 1,3,5	Ball 2,3,4
2	$(5-3)\times 1=2$	$(2\times 3)-4=2$
4		$(3-2)\times 4=4$
6		$(3\times 4)/2=6$
8	$(5+3)\times 1=8$	
10	$(3-1)\times 5=10$	$(2\times 3)+4=10$
12	$(5-1)\times 3=12$	
14	$(5\times 3)-1=14$	$(3+4)\times 2=14$
16	$(3\times 5)+1=16$	
18	$(1+5)\times 3=18$	$(2+4)\times 3=18$
20	$(1+3)\times 5=20$	$(2+3)\times 4=20$

## Page 11 - Power Drills

Two different solutions, one uses powers

Scoring Numbers	Target #	Solution 1	Solution 2
2 4 5	11	$(2+4)+5=11$	$(4^2)-5=11$
2 3 6	15	$(2\times 6)+3=15$	$(3^2)+6=15$
2 5 5	20	$(5+5)\times 2=20$	$(5^2)-5=20$
3 3 6	21	$(3\times 6)+3=21$	$(3^3)-6=21$
2 4 5	28	$(2+5)\times 4=28$	$(2^5)-4=28$

Two different solutions, both use powers

Scoring Numbers	Target #	Solution 1	Solution 2
2 3 4	13	$(3^2)+4=13$	$(4^2)-3=13$
2 4 5	21	$(5^2)-4=21$	$(2^4)+5=21$
2 5 6	31	$(5^2)+6=31$	$(6^2)-5=31$
2 3 4	32	$(2^3)\times 4=32$	$(4^3)/2=32$
2 3 6	81	$(3+6)^2=81$	$3^{(6-2)}=81$

Three different solutions

Scoring Numbers	Target #	Solution 1	Solution 2	Solution 3
2 3 5	4	$(2+5)-3=4$	$(3+5)/2=4$	$(3^2)-5=4$
2 5 5	5	$(2\times 5)-5=5$	$(5+5)/2=5$	$(5^2)/5=5$
2 3 6	9	$(2\times 6)-3=9$	$(6/2)\times 3=9$	$(6-3)^2=9$
2 3 5	13	$(2\times 5)+3=13$	$(3\times 5)-2=13$	$(2^3)+5=13$
2 4 6	16	$(6-2)\times 4=16$	$(2\times 6)+4=16$	$(2^6)/4=16$