



# MATH DICE<sup>®</sup>

## TEACHER GUIDE

### Power Training Presentation Module

Welcome and thanks for agreeing to run this Math Dice Power Training presentation module. This program runs the same way as your Math Dice Introduction presentation; a one session powerpoint lesson, where ThinkFun presents the concepts and the challenge sets, you manage the discussion.

It turns out that when exponents are presented as a set of game rules that one needs to learn if one wants to win, players will pick them right up. Have fun bringing this lesson to your students, you won't believe the results you will get... they will fully understand how powers work within a half hour and they will be clamoring to practice what they have learned.

#### What You Need to Bring To The Party:

- You are a teacher or math coach with a group of kids who have been participating in a Math Dice Classroom Program and are ready for a lesson about how powers work in Math Dice
- You can present the Math Dice Powers Deck ppt to your students in a group discussion setting
- A plan for what to do after the presentation, we recommend have Math Dice games ready to go in an informal Mixer Tournament.

#### Ahead of Time Preparation:

- Download the "Math Dice Powers Deck" ppt Powerpoint document and set up projector
- Download and print this Teacher's Guide so you have access to your own copies of the Challenge Set solutions
- Review the Powerpoint lesson ahead of time so you will know how to pace the discussion and have confidence in the ideas. This is a fun program, everyone will love it!
- Download the Exponent Tables PDF file and print a copy for each player

For the most part the slides will speak for themselves, you just need to guide the discussion. This presentation is designed to last for about a half hour.



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### Math Dice Power Training Deck

### Teacher Tips & Answer Key

### How Do Powers Work (Slides 1-7)

Here we ask a simple question about Powers and demonstrate the answer in graphic detail. Pay attention to how well your students get this distinction, make sure to spend enough time so that everyone gets the idea. Everything will become clear once they start solving challenges using these techniques, this section is where you start them off right.

### Power Numbers (Slides 8-10)

With Math Dice exponents we like to train backwards: start with the Target Number and ask the question, "What combinations of Scoring Numbers will reach that Target Number directly?"

If your Target Number is 32, for example... you want to immediately look to see if you have a 2 and a 5 or if you can assemble to a 2 and 5 so you can add an exponent  $2^5=32$ .

We demonstrate how this works by presenting 5 Challenges which feature 5 prominent Power Numbers, players will start to understand why this learning strategy makes sense based on how they solve the challenges.

Power Numbers are numbers that can be reached directly by two Scoring Numbers combined with an exponent: 1, 2, 4, 8, 9, 16, 25, 27, 32, 36, 49, 81, 100, 121, 125, 128, 144. We have included a Power Training Table for each of your students that they can use to check themselves and gain confidence.

| Scoring Dice | Power Number Target | Your Equation                             |
|--------------|---------------------|---|
| <b>1 2 3</b> | <b>9</b>            | <b><math>3^2 \times 1 = 9</math></b>      |
| <b>1 2 5</b> | <b>25</b>           | <b><math>5^2 \times 1 = 25</math></b>     |
| <b>1 2 4</b> | <b>32</b>           | <b><math>2^{(4 + 1)} = 32</math></b>      |
| <b>2 3 4</b> | <b>49</b>           | <b><math>(3 + 4)^2 = 49</math></b>        |
| <b>1 3 4</b> | <b>81</b>           | <b><math>3^{(4)} \times 1 = 81</math></b> |



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### Special Powers (Slides 11-13)

The numbers 1 and 0 are especially important with exponents and with this challenge set we will call attention to this and demonstrate two principles of exponents that everyone should know.

- 1 to the power of anything is 1
- Anything to the power of 0 is 1

Each of the four challenges in the Challenge Set can only be solved by one or both of these ways, there is no other solution. They are clever, discovering them is really fun!

| Scoring Dice | Power Number Target | Find all the ways   |
|--------------|---------------------|---|
| <b>3 5 6</b> | <b>1</b>            | <b><math>(6 - 5)^3</math></b>   |
| <b>3 4 5</b> | <b>1</b>            | <b><math>(4 - 3)^5</math> or <math>(5 - 4)^3</math></b>                             |
| <b>3 5 5</b> | <b>1</b>            | <b><math>(5 / 5)^3</math> or <math>3^{(5 - 5)}</math></b>                           |
| <b>4 5 5</b> | <b>1</b>            | <b><math>(5 / 5)^4</math> or <math>(5 - 4)^5</math> or <math>4^{(5 - 5)}</math></b> |

### Two Ways to Solve (Slides 14-15)

These are full strength Math Dice challenges, each challenge can be solved two ways each of which use powers. If your students can solve these challenges then they know their powers... congratulations!

| Scoring Dice | Target Number | Expression 1                          | Expression 2                       |
|--------------|---------------|---------------------------------------|------------------------------------|
| <b>2 3 4</b> | <b>13</b>     | <b><math>3^2 + 4 = 13</math></b>      | <b><math>2^4 - 3 = 13</math></b>   |
| <b>2 5 6</b> | <b>31</b>     | <b><math>5^2 + 6 = 31</math></b>      | <b><math>6^2 - 5 = 31</math></b>   |
| <b>2 3 4</b> | <b>32</b>     | <b><math>2^3 \times 4 = 32</math></b> | <b><math>4^3 / 2 = 32</math></b>   |
| <b>2 3 6</b> | <b>81</b>     | <b><math>3^{(6 - 2)} = 81</math></b>  | <b><math>(3 + 6)^2 = 81</math></b> |