The HANOVER THEATRE
for the Performing Arts

MatheMagic!®
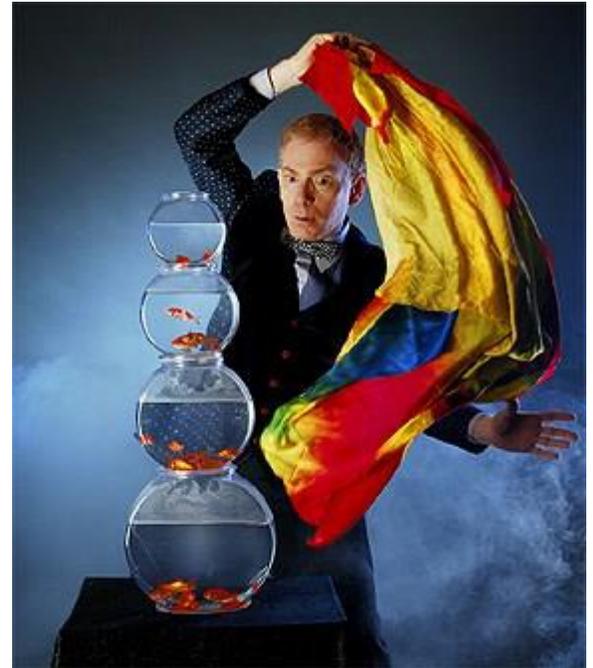### Starring Bradley Fields

Study Guide

Introduction

In this guide you will find:

- ❖ Information About the Performance
  - o The Production
  - o Things to Think About Before/During/After the Show
  - o Bradley Fields: Mathemagician
- ❖ Magic and Math Facts
- ❖ Activities to Deepen Understanding
  - o Paper Pass Through
  - o Mind Reading Math
  - o Adding 100 Numbers
  - o Mysterious Dice

Common Core Standards

The Common Core broadens the definition of a "text," viewing performance as a form of text, so your students are experiencing and interacting with a text when they attend a student matinee show. Seeing live performance provides rich opportunities to write reflections, narratives, arguments, and more. By writing responses and/or utilizing Study Guides, all performances can be linked to Common Core: **CC ELA: W 1-10**

You can use this performance and study guide to address the following Common Core Standards (additional standards listed by specific activities): **MATH: CC, OA, G, F, MD, NS.**
CC ELA: RST 3,4,7,8, SL1-4, L3-5

Theatre Etiquette to Discuss with Your Students

- Be sure to use the restroom before the show! You don't want to miss any of the action.
- Turn your cell phones off.
- Keep your feet off the back of the seats. Photography is never allowed!
- It is standard etiquette to applaud at the end of the show. Not only are you applauding for the performers, but also the hard work that everyone has put in behind the scenes!
- Above all, the theatre is truly a special place. Unlike movies or TV shows, what you see onstage is happening right before your eyes. The performers are giving their all, so it's important that you give them your all.

The Production

MatheMagic!™ is a real theatrical magic show with music, costumes, comedy, and illusions. In this fun format, kids (unknowingly) practice classroom skills, i.e., math facts and problem-solving. In the course of the show, they discover that the first "magicians" were really mathematicians! (By using math they were able to "do the impossible.") They then go on to learn about mathematical contributions from the Egyptians, Greeks, Romans, Indians, Chinese and other cultures. Students of different ages and abilities are engaged and challenged by facts and ideas they can all understand. There is audience participation throughout in which thinking skills are encouraged. The program will stimulate, fascinate, and motivate your students not only with regard to math, but also to science, history, vocabulary and ancient civilizations. MatheMagic uses theatrical magic, costumes and humor to connect with kids and bring the worlds of math and magic together in a thrilling way!

Bradley Fields: Mathemagician

Actor, director and one of the most acclaimed magicians in the world, Bradley Fields has headlined in theatres, performing arts centers, and cabarets to rave reviews, sold-out houses, and standing ovations. Bradley taught in the New York City public school system, which is where he conceived the idea for MatheMagic! He knew he could combine his magic skills to help kids learn math concepts. Bradley has appeared on Broadway, London's West End and in major venues world-wide. Fields has also collaborated with Oscar and Tony winning artists on projects for theatre, television and film. He is now touring his two acclaimed productions: *MatheMagic!* and *Out of Thin Air!*

Before you see the show:
- How do we use math in our lives everyday?
- What does magic mean to you? When we say something is magical, what are we saying really?
- How does math tell a story? In your class, see if you can get creativity and tell a story integrating math concepts.
- When faced with a problem or challenge, what do you do? How do you approach solving the problem? How do logic and creative factor into problem-solving?

As you watch the show:
- How does Bradley Fields involve the audience during the show? How does this interactive element impact your experience?
- How does Bradley use humor in the show? What did he do that you found funny or amusing?

After you see the show:
- Bradley Fields uses magic and history and theater to help people understand math concepts. What are some other methods people use to understand math?
- What was one of the most intriguing things you learned during the show? What happened that was unexpected?
- How do you think magic tricks are invented? Alone or in small groups, try to create a magic trick using some mathematical element. Share it with classmates.

Some Fun and Interesting Math Facts!

- The numerical digits we use today such as 1, 2 and 3 are based on the Hindu-Arabic numeral system developed over 1000 years ago.

- 2 and 5 are the only prime numbers that end with a 2 or a 5.

- Here is Pi written to 100 decimal places:
  3.1415926535897932384626433832795028841971693993751
  05820974944592307816406286208998628034825342117067 9

- What comes after a million, billion and trillion? A quadrillion, quintillion, sextillion, septillion, octillion, nonillion, decillion and undecillion.

- 111111111 x 111111111 = 12345678987654321

- It is believed that Ancient Egyptians used complex mathematics such as algebra, arithmetic and geometry as far back as 3000 BC.

- It wasn't until the 16th century that most mathematical symbols were invented. Before this time math equations were written in words, making it very time consuming.

- Cutting a cake into 8 pieces is possible with just 3 slices, can you work out how?

- An icosagon is a shape with 20 sides.

- The smallest ten prime numbers are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29.

- The name of the popular search engine 'Google' came from a misspelling of the word 'googol', which is a very, very large number (the number one followed by one hundred zeros to be exact).

- A 'googolplex' is the number 1 followed by a googol zeros, this number is so big that it can't be written because there isn't enough room in the universe to fit it in! It would also take a length of time far greater than the age of the universe just to write the numbers.

- The number Pi (the ratio of the circumference to the diameter of a circle) can't be expressed as a fraction, this means it is an irrational number. When written as a decimal it never repeats and never ends.

Some Fun and Interesting Magic Facts!

- By the 16th century, magicians began to perform as they do today. They did card tricks, made objects disappear, and performed mind reading.

- One of the most famous illusionists was Baron Wolfgang von Kempelen. In 1770 he devised an automated chess player that took on all challengers. Benjamin Franklin played against the machine in 1783 and lost.

- Harry Houdini died on Halloween in 1926, in Detroit, Michigan. The official cause of his death was peritonitis caused by appendicitis. Houdini is still considered the world's best known magician.

- Today, the magic tricks and illusions are done by magicians who perform for huge audiences throughout the world. The tricks and illusions they perform are spectacular. Some make airplanes disappear, levitate cars, and squeeze people into a tiny box. Some of the better known magicians today are: David Copperfield, Siegfried and Roy, Lance Burton, Doug Henning, David Blane, Penn and Teller, and Derren Brown.

- American Magician, Illusionist and Endurance artist David Blaine has broken several world records and astonished millions of people. He has been encased in ice for 63hours 42minutes and 15seconds, sealed in a transparent case for 44 days, hung upside down for 60 hours and held his breathe for 17minutes 4 1/2 seconds to name a few of his endurance acts.

- David Copperfield is the first living magician to have a star on the famous Hollywood Walk of Fame. The only other magician so honored is Harry Houdini, who received a star after his death.

- The world's fastest magician is Eldon D. Wigton (Dr. Eldoonie). He performed 255 tricks in 2 minutes.

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Paper Pass Through

For this "trick" you'll need a piece of paper and scissors. This activity encourages creative, out of the box thinking and challenging our assumptions.

- Tell the kids that you will pass your body through a piece of paper.

- Pass the paper around and ask your audience to inspect it. Ask for observations about the paper. Is there anything special about the paper of is it just a normal piece of paper?

- Once everyone has looked at the paper, take it back and fold it in half so the short ends meet. Cut a narrow rectangle from the fold. Then cut alternating lines into the paper, start from the folded side. Don't cut all the way through the paper.

- Unfold the paper. You will have a large loop of paper.

- With great gusto, step through and give a big "tada!"

Ask students to share their responses to the trick. How did it challenge their expectations? How did the paper change to allow you to pass through?

Teach students how to do the trick. If your students are younger, you could create templates using the example below.

FOLD ←
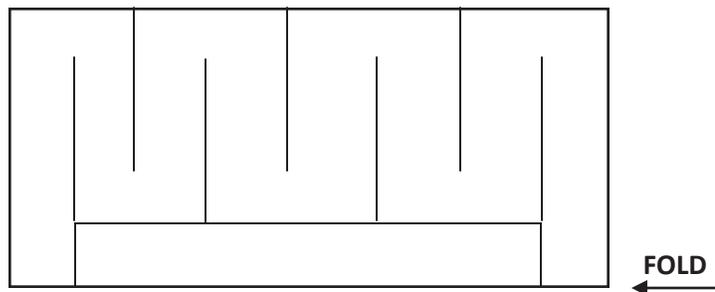
Mind-Reading Math

Fantastic Five: this trick uses basic mathematical operations to reveal a hidden constant result. Begin by telling students that you can read their minds. Choose a student volunteer.

- Now ask them to think of any number. You may want to warn them it may be easier for them if they choose a smaller or even number. But really, any number will work.

- Now tell them to double the number. Add 10. Divide it in half. Then, subtract the original number.

- Make a show of really thinking hard and trying to read their minds and then say, "Five!" If all the calculations have been done correctly, you'll have read their minds! (The answer will always be five!)

- Do the trick again with other students and see how quickly they pick up the secret.

Afterwards, have the kids write out the equations they did in their head to see how it works.

Birthday Magic: This trick will allow you to guess the age and birth-month of your student. Ask for a student volunteer, and tell them to concentrate on the number that corresponds to their birthday month, January=1, February=2, etc. (Example, someone with a January birthday who is 10)

- Then tell them to do the following calculations, but keep them hidden from you.

- Multiply that number by 2 (1 X 2= 2)

- Add 5 (2 + 5= 7)

- Multiply by 50 (7 X 50= 350)

- Add their age (350 + 10=360)

- Subtract 365 (360 – 365= -5)

- Add 115 and tell you the final answer (-5 + 115= 110)

- Once you have that final answer, you can reveal the birthday month: January & age: 10

Secret: The first digit is the birthday month, the remaining digits reveal age.

Adding 100 Numbers

Two hundred years ago in Germany, the teacher of an unruly class set his students a task designed to keep them quiet for the rest of the day: Add all the numbers from zero to one hundred. Instantly, one six-year-old came up with the solution. He was Karl Friedrich Gauss who went on to become one of the world's great mathematicians. Here's how to duplicate Gauss's trick and solve a tedious equation with magical speed!

Secret:

Arrange the numbers in fifty pairs, each adding up to 101: 1+100=101

2+ 99=101

3+ 98=101

4+ 97=101

etc.

to: 50+51=101

Since you have 50 pairs of numbers which equal 101, simply multiply: 50 X 101=5,050

To multiply by 50 with mathemagical speed, first multiply by 100 (add two zeros), then divide by 2.

Hint: To make the trick more mystifying (after all, you could have easily memorized 5,050), invite the audience to give you any starting number and add the 100 numbers from there.

Example: To add the hundred numbers starting 25 and ending with 124

a) Add 25+124=149

b) Multiply 149 X 100 = 14,900

c) Divide 14,900 / 2=7,450

Mysterious Dice

Defy the laws of probability! Using a simple game die, perform this magical guessing trick for your students.
Of the six possible numbers on a game die, you guess the two your student is thinking of.

- Ask for a student volunteer, and tell them to choose any two sides on a die, but keep them secret (Example: 3 & 2)

- Now, ask them to do the following calculations and keep them secret until they have their final answer. (These can absolutely be done on paper or in small groups)

- Multiply one of the numbers by 5. (3 X 5 = 15)

- Add 7 to that product. (15 + 7 = 22)

- Double that sum. (22 X 2 = 44)

- Add the other number chosen from die. (44 + 2 = 46)

- Ask the student to tell you their final answer. (46)

- Now reveal the original secret numbers. (3 & 2)

Secret:

- Subtract 14 from the final result. (46-14 = 32)

- The two digits will be the original numbers. (3 & 2)