



## EDUCATION @ MESA ARTS CENTER



## MESA ARTS CENTER PRESENTS DANNY CARMO'S MATHEMATICAL MYSTERIES

Ikeda Theater | January 22-23 | 9:30AM & 11:45AM | Grades: 2 - 6

## 2018/2019 EDUCATOR RESOURCE GUIDE



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## ABOUT DANNY CARMO...

Prepare to be amazed, dazzled and bewildered by this spectacular show where math, theatre and digital technology collide to create a fun and interactive performance proving that understanding math can be fun! There will be swords in boxes, card tricks, and even a human calculator!

Meet Danny Carmo – it’s not so long ago that he thought school and, in particular, math wasn’t for him. He was more interested in dreaming about a future on the stage and perhaps the big screen – all he ever wanted to be was a famous magician. But when he knuckled down to learn all the tricks of the trade he realized that math was not only essential... it was the SECRET to a whole load of magic.

Danny has put together a show filled with astonishing tricks and unexpected results that are all based on the magic of math. Your students are coming along for the mathematical ride of their life and they will be sure to want to try out all these new tricks on their friends and family. In addition to this study guide, Danny Carmo will provide students with a Mathematical Mysteries booklet after the show to help them understand the math used in the show and to encourage them to try it out themselves. We hope you enjoy this magical, mathematical production!



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## WELCOME!

Dear Educator,

Thank you for selecting a Performing Live for Students! field trip with the Mesa Arts Center. We have a dynamic season planned and we look forward to connecting you to our many artists and performances. With Performing Live, students are able to experience live theatre and make educational connections well beyond the classroom.

We also recognize and appreciate the energy and time spent on your part in coordinating field trips. In this guide we have provided information to help make this the best experience possible.

In addition, the Mesa Arts Center has many open and inviting spaces that make good places to hold a brown bag lunch. No prior arrangements need to be made.

Please contact our offices at [engagement@mesaartscenter.com](mailto:engagement@mesaartscenter.com) or 480-644-6564 should you have any additional questions.

Enjoy the show!

## TEACHER AND CHAPERONE INFORMATION

### Chaperones

- ◆ Assign each chaperone a designated group of students and provide him/her with a written list of the students in that group.
- ◆ Ask chaperones to stay with their assigned group throughout the field trip. Adult chaperones are responsible for the students' conduct and behavior throughout their visit to the Center.
- ◆ Please review theater etiquette rules and responsibilities with all chaperones.
- ◆ Have the phone numbers of every chaperone in your group to quickly access each other in case of emergency.

### Theater Etiquette

- ◆ No Food or Drink inside the theatre (besides bottled water).
- ◆ Students must be accompanied by chaperones at all times.
- ◆ Cameras and recording devices may not be used during the performance.
- ◆ Please silence cell phones and resist the urge to text message.
- ◆ Listening and following the House Managers and Ushers will help the seating and dismissal process.
- ◆ Feel free to laugh, clap and enjoy the show but also to be respectful of those around you.



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## CURRICULUM CONNECTIONS

### Danny Carmo's Mathematical Mysteries

#### Arizona Academic Standards

These standards can be achieved by participating in the discussion questions and/ the study guide activities.

#### Math

2.OA.B.2 — Fluently add and subtract within 20. By the end of Grade 2, know from memory all sums of two one-digit numbers.

2.NBT.B.7 — Demonstrate understanding of addition and subtraction within 1000, connecting objects or drawings to strategies based on place value (including multiples of 10), properties of operations, and/or the relationship between addition and subtraction.

3.NBT.A.2 — Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

4.NBT.B.4 — Fluently add and subtract multi-digit whole numbers using a standard algorithm.

5.NF.A.1 — Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Mathematical Practice 7 (MP.7) — Look for and make use of structure.

#### Writing

Grades 2-6.W.3 — Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

Grades 2-6.W.4 — With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.

#### Speaking and Listening

Grades 2-6.SL.1 — Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Grades 2-6.SL.2 — Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

#### Science

Strand 1 of the Science standards lays out the Inquiry process for students in grades 2-6. Performance objective details vary by grade but the general goals of each Concept are below:

SC-S1C1 — Observe, ask questions, and make predictions.

SC-S1C2 — Participate in planning and conducting investigations, and recording data.

SC-S1C3 — Organize and analyze data; compare to predictions.

SC-S1C4 — Communicate results of investigations.





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### PRE-PERFORMANCE CLASSROOM ACTIVITIES

Included in this resource guide are a variety of activities created to correspond with the Arizona English Language Arts and Performing Arts Standards to enhance the students' growth, reading skills, and overall comprehension.

#### Questions to Ponder....

Question 1 — What is magic? Do any of you know a magic trick? If so, what makes it "magic"?  
(Grades 2-6.SL.1)

Question 2 — How do magicians create magic tricks? Do they have magical powers or are they using science and math to trick us? (Grades 2-6.SL.1)

#### Activities to Explore....

Magicians use the scientific method when they are trying to find out if a magic trick will work. Try the Mobius strip experiment on page 7 to introduce your students to the scientific method if they are not familiar with it. If they already are familiar with the scientific method, the Mobius strip experiment can still be surprising — even for adults!

Standards Implemented: Grades 2-6 SC-S1C1, SC-S1C2, SC-S1C3, SC-S1C4

Approximate time: 45-60 min

Materials needed are detailed on page 7.

Try some mental math magic to get your brains warmed up before the show. Here's a simple one — have students try it first with a number below ten, and then with any number. First, choose a number. Then double it. Next add 6. Then halve your answer. Finally subtract the number you first thought of and if the mental math has been done correctly the answer should always be 3!

Standards Implemented: 2.NBT.B.7, 3.NBT.A.2, 4.NBT.B.4, MP.7

Approximate time: 5 - 10 minutes

Materials Needed: pencil/paper or whiteboards/markers if needed

Math can make card tricks more fun too! Try out the card trick on page 9 on your students and amaze them with your magical skill. Then teach them the simple math problem that is behind this card trick so they can try it out on their friends and family.

Standards Implemented: 2.OA.B.2, MP.7

Approximate time: 10 - 15 minutes

Materials Needed: Deck of cards





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### POST-PERFORMANCE CLASSROOM ACTIVITIES

#### Questions to Discuss

- Question 1 — Now that you've seen the show, what did Danny Carmo use to create tricks? Do you think his tricks always work? (Grades 2-6.SL.1, Grades 2-6.SL.2)
- Question 2 — Which trick was your favorite? Is there one that you think you could try out on your friends? (Grades 2-6.SL.2)
- Question 3 — Which trick was the most surprising? Were you able to figure out how Danny Carmo was using math to create the tricks or is it still a mystery? (Grades 2-6.SL.2)

#### Activities for the Classroom

Wow some of Danny Carmo's tricks were pretty amazing! Ask students, "Which part of the show was your favorite?" Have them write several sentences or a paragraph reflecting on their favorite trick or part of the show. If they were able to figure out how Danny used math in the trick, encourage them to include that in their reflection.

Standards Implemented: Grades 2-6.W.4

Approximate Time: 15 - 20 minutes

Materials Needed: Pencils, paper

In the show, Danny Carmo used the Lowest Common Denominator (LCD) to create an illusion story about 17 camels. In the story, using 18 as the LCD,  $\frac{1}{2} + \frac{1}{3} + \frac{1}{9}$  became  $\frac{9}{18} + \frac{6}{18} + \frac{2}{18} = \frac{17}{18}$  and it turned out 17 camels was just right. Have your students make up their own illusion story about splitting something up using a different LCD and then share them out to the class.

Standards Implemented: Grades 2-6.W.3, 5.NF.A.1

Approximate time: 20 - 30 minutes

Materials Needed: Pencils, writing paper

In the show Danny used a lot of mental math to trick the audience. Amaze your students with your mental powers by trying out "I've Got Your Number" on page 10. This math trick is similar to Danny's Magic of 1089 trick. Then have the students try it themselves and see if they can figure out why and how the trick works.

Standards Implemented: 2.NBT.B.7, 3.NBT.A.2, 4.NBT.B.4, MP.7

Approximate time: 20-30 min

Materials Needed: Directions on page 10, pencils and paper or whiteboards and markers



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### MOBIUS STRIP EXPERIMENT

In this experiment students will go through the scientific method to solve a problem and reach a conclusion.

You will need per student or pair/group of students:

- A sheet of 8.5 x 11 paper, scissors, pencils, tape

#### Observation & Question

If I cut something in half, then I have two separate but equal pieces. This is a fairly basic concept in math that students should be familiar with. Discuss some examples with the students if needed.

Can I cut a strip of paper in half and have a different outcome?

Tell students that they will be making three different rings of paper and predicting the outcome of cutting them in two. One ring will be made with no twist, one ring with half a twist before taping, and the last ring with a full twist before taping.

#### Hypothesis/Experiment

Students will need to create their rings before they can make an informed prediction (hypothesis). To assemble rings follow these steps:

1. Cut three 1 inch strips from the long side of the piece of paper.
2. Create the first ring by just taping it end to end to make a circle.
3. Create the second ring by turning the end of the paper one time before taping the ends together to create a ring. Be sure to tape across the entire width. This is the half twist ring.
4. Create the third ring by turning the end of the paper two times before taping the ends together to create a ring. Be sure to tape across the entire width. This is the full twist ring.
5. Have students draw a line down the middle of each ring and continuing it until it reaches the tape again.

Give students time to look at the rings and explore them before predicting. They can record observations about their rings and then make a hypothesis about what will happen when they cut each ring.

#### Analysis & Conclusion

Now have students fold a small section of the first ring and snip along the line. Then they should unfold the ring and put the scissors through the cut that was made so the line can be cut lengthwise by the scissors following the line all the way around and back to the tape. Have students record the results for the first strip and repeat the steps for cutting with the other two strips.

Discuss the outcomes with students, they may be surprised and confused about the results. Have them compare and analyze their results with their hypothesis. The Mobius strip is the second ring because by creating the half twist the paper only has one edge and one side. Real life applications of the Mobius strip are filmstrips and machinery belts. In the past Mobius strips were used for typewriter ribbon, printer cartridges, and continuous loop recording tapes to make more long lasting products since both sides of would be utilized. Students can research Ferdinand Mobius or topology to find out more!



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### CARD TRICK

1. For this trick, you'll need a deck of cards. Before your trick, sneak a peek at the 10th card in the deck. Memorize it.
2. Now choose a volunteer. Ask him/her to choose a number between 10 and 20. Count out that number of cards to create a smaller deck. Make sure you laid them all face down, one on top of the other. Now pick up the smaller deck.
3. Ask your volunteer to add the first and second digit of their number together. For instance, if they chose 12, the math equation would be  $1 + 2 = 3$ .
4. Now, counting from that smaller deck, hand the volunteer the new number. If they chose 12, you would hand them the third card. Instruct them not to show it to you. It will be the card you memorized.
5. While the volunteer is holding the card, ask them if it's the card you memorized from the deck. Feel free to use a little theater, "Is it red?" "Yes." "I'm sensing something sparkly. Is it... Is it... a diamond?" "Yes!" "Is it (pause for dramatic effect) a 3 of diamonds?" Gasp, "How did you know?" And, cue applause.



This trick boils down to a math problem. While the equation seems random, the answer will always be 10.

I choose the number 11.  $1 + 1 = 2$ . You hand me the second card from the smaller pile. That's the 10th card from the deck.

Let's try it again. I choose the number 13.  $1 + 3 = 4$ . You hand me the 4th card which, you got it, is the 10th card in the deck.

Now teach the kids and have them try it out on another family member or friend.





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### I'VE GOT YOUR NUMBER ACTIVITY

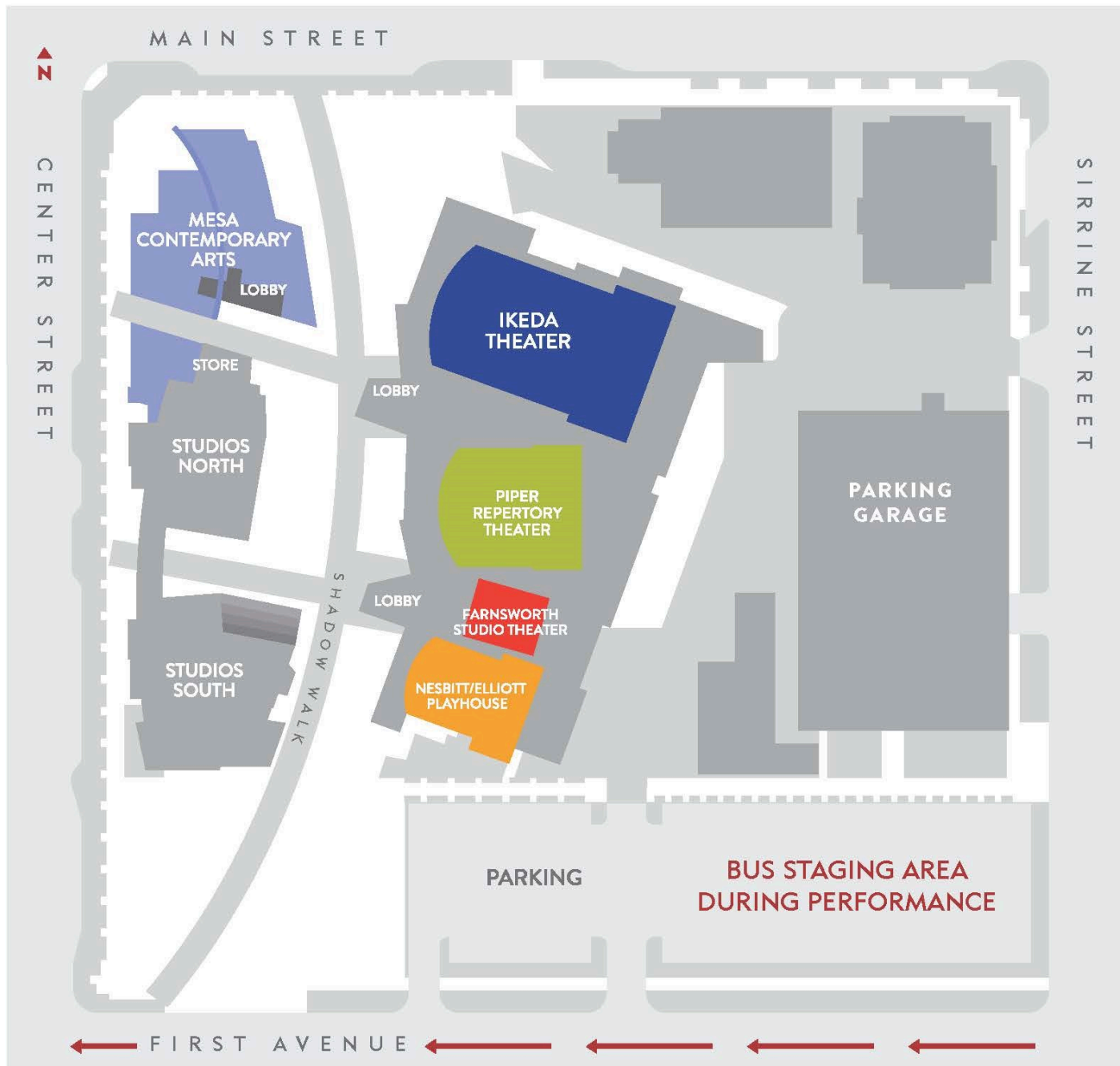
Tell your class that you can read their minds. Use this number pattern trick to make it appear that you know the answer to the math problem they solve secretly.

1. Choose a student volunteer.
2. Have the student secretly write down a three digit number on a piece of paper or whiteboard. The number needs to have all different digits. For example, 573 is okay but 334 is not. If you like the student can show this to the rest of the class as long as you can't see the number.
3. Now have the student reverse the number and write that down as well. So if the number was 573 then the new number is 375.
4. Tell the student to subtract the smaller number from the larger one.
5. Have the student tell you the last digit in the answer and using the information below you should be able to then correctly say the entire answer to the class. The pattern trick: When you take a three digit number, reverse it, and subtract the smaller the middle digit is always 9. Also the two outside digits always add up to 9 so if the student tells you the last digit you can either subtract that from 9 to find the first digit or use fact families for 9 to find the first digit. So with the example number 573 you would subtract 375 and get 198. If the student told you 8 you would already know the middle digit is 9 and find the first digit by solving either  $9-8=1$  or  $8+?=9$ . Then you would know the answer is 198 without knowing either of the other numbers. Amazing! If a student happens to pick a number with a 9 in the middle and consecutive numbers on the number line in the hundreds and the ones (like 695) then the answer will be 99 every time. So if the student says the last digit is 9 then the answer must be 99.
6. After student amazement calms down, teach them the trick and have them try it out themselves. Ask students if they can figure out why the middle digit is always 9! Also see if they can figure out why certain numbers give them the answer of 99.

# BUS PARKING MAP



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## STEPS TO UNLOAD

- 1 Enter the drop off area by coming in westbound on 1st Avenue.
- 2 Pull up to the curb marked with cones and wait until notified to unload passengers.
- 3 Await parking direction from MAC security

## STEPS TO PICK UP

- 1 Passengers will exit the theater and meet buses in the bus parking lot area.
- 2 Wait for clearance to depart.



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SHARE YOUR EXPERIENCE!

We'd love to hear your students' response to our shows.

We especially appreciate pictures and letters!

**THANK YOU!**

Questions? Please contact Engagement at:

P 480-644-6540 | F 480-644-6503

[engagement@mesaartscenter.com](mailto:engagement@mesaartscenter.com)