Mathemagicians

Make people think that you're a mind reader when you're really just using algebra skills!

This activity is a great way to practice translating word problems into algebraic equations and to develop understanding of the concept of inverse operations. Students will be amazed at first by what appears to be magic, but they will come to understand that the tricks can be explained using algebra. Students can come up with their own magic examples to impress their friends and family and become true mathemagicians!

MATERIALS NEEDED

- Mathemagicians handout (one per student or group)
- Scratch paper and pencil (one per student)
- Whiteboard/overhead projector (optional—for the Club Leader to explain tricks to the club)

PART 1: THE MAGIC TRICKS

For each magic trick, the mathemagician gives a volunteer a series of commands. The mathemagician will then "guess" the final number. To some the guess will seem like mind reading, but really a little algebra can reveal the secret behind the trick.

Start the activity by performing a trick for the club. Read the following commands out loud, and have club members follow along. Some may want to use scratch paper and a pencil to perform the calculations required. Before guessing the final number, let the suspense build and pretend you are actually trying to read students' minds!

Think of a number between 1 and 50.
Double your number.
Add 6 to your new number.
Divide by 2.
Subtract your original number.
Is your new number...3?

How did you know the final number was 3? People say that "a magician never reveals the secret," but your students have all the math knowledge they need to figure out this trick! Just rewrite each of the commands from the trick as an expression or an equation to see how this "magic" is really just math! The math is shown at the top of the next page.

Pass out the Mathemagicians handout to the club. There are four tricks on the handout. You have the option to distribute it intact or cut it apart into pairs of tricks or single tricks. Cutting it apart will be more fun, allowing different students or groups to mystify each other with different tricks! At the end, go over the algebra for all four tricks.

PART 2: THE ALGEBRA BEHIND THE TRICKS

To reveal the secret behind a trick, you simply need to write out the mathemagician's commands as algebraic expressions or equations using variables for any unknowns. The following pages show the example trick from above, as well as the ones included on the Mathemagicians handout, with the algebra written out. Go through the example trick with the students, working as a club to show how the algebra reveals the mathemagician's "guess." Next, allow students to go through the other tricks by writing out the algebra, and have them figure out what the answers will be so they can be the mathemagicians! Tell students or groups not to share their work yet, to preserve the magic of the tricks.

The Magic Trick	The Algebra	The Explanation
Example:	*Example:*	*Example:*
▪ Think of a number between 1 and 50.	N	▪ Since we do not know what number the student picked, we use a variable to represent the number.
▪ Double your number.	$2N$	▪ Here we ask the student to double the number. We will later use inverse operations to undo this so we can cancel out the unknown.
▪ Add 6 to your new number.	$2N + 6$	▪ Adding 6 here will allow us to have a remainder (our "guess") when we cancel out the original number.
▪ Divide by 2.	$(2N + 6) \div 2 = N + 3$	▪ Dividing by 2 undoes the doubling from before.
▪ Subtract your original number.	$N + 3 - N =$ **3**	▪ Subtracting the original number cancels out the variable. The remaining number is the mathemagician's "guess."
1.	**1.**	**1.**
▪ Pick a number between 1 and 100.	N	▪ Use a variable here since we do not know the volunteer's number.
▪ Multiply it by the number of wheels on a bicycle.	$2N$	▪ Use statements like this to suggest a number. We all know this will be 2, but referring to an object makes the trick sound more interesting!
▪ Divide by your original number.	$2N \div N = 2$	▪ Dividing by the original number cancels out our variable. We now know the value is 2.
▪ Add the number of U.S. states	$2 + 50 = 52$	▪ The number of states is 50, so we now know the value is 52.
▪ Divide by 4.	$52 \div 4 =$ **13**	▪ Dividing by 4 gives us our "guess" of 13.
2.	**2.**	**2.**
▪ Think of a number between 1 and 100.	N	▪ Use a variable here since we do not know the volunteer's number.
▪ Multiply it by 4.	$4N$	▪ This puts a coefficient in front of our variable, which we will get rid of later.
▪ Add a number that is unlucky if it lands on a Friday.	$4N + 13$	▪ The number that the volunteer should come up with is 13.
▪ Add the number of dwarfs with Snow White.	$4N + 13 + 7 = 4N + 20$	▪ The number is 7 which will give us a total of 20 added to the end, a total that can be divided easily.
▪ Multiply by 2.	$2(4N + 20) = 8N + 40$	▪ This changes our coefficient from 4 to 8.
▪ Divide by 8.	$(8N + 40) \div 8 = N + 5$	▪ Dividing by 8 removes the coefficient from our term with the variable.
▪ Subtract your original number.	$N + 5 - N =$ **5**	▪ Subtracting the original number cancels out our variable and leaves us with a "guess" of 5.
3.	**3.**	**3.**
▪ Think of a number between 1 and 15.	N	▪ Use a variable here since we do not know the volunteer's number.
▪ Square your number.	N^2	▪ We asked for a number between 1 and 15 so it wouldn't be difficult to square.
▪ Add your original number.	$N^2 + N$	▪ Adding the original number gives us a polynomial.

▪ Divide by your original number.	$(N^2 + N) \div N = N + 1$	▪ Dividing by the original number gets us back to the original number plus 1.
▪ Add the smallest two-digit odd number.	$N + 1 + 11 = N + 12$	▪ The smallest odd two-digit number is 11. This gives us our original number plus 12, a number that is easily divisible.
▪ Subtract your original number.	$N + 12 - N = 12$	▪ Subtracting the original number leaves us with 12.
▪ Divide by the number of sides of a triangle.	$12 \div 3 =$ **4**	▪ Dividing by 3 gives us a "guess" of 4.

4.	**4.**	**4.**
▪ Think of a year when a memorable event in your life occurred.	Y	▪ Use a variable here. We cannot know what year the volunteer will pick.
▪ Add the current year.	$Y + 2016$	▪ This activity was written in 2016, so we will write this number here (change this if current year is different).
▪ Add the number of years since the year of that memorable event.	$Y + 2016 + (2016 - Y) = 4032$	▪ The trick here is that students need to write this as the current year minus the variable and not use a second variable. The variable then cancels out. The number here will always be 2 times the current year.
▪ Add the number of days in a non-leap year.	$4032 + 365 =$ **4397**	▪ The number of days in a non-leap year is 365. The "guess" is 4397 (2 times current year plus 365; adjust answer if current year is different).

DO MORE WITH THIS ACTIVITY

Have students create their own tricks! The can work individually or in groups. The key is to focus on inverse operations. Have them write the commands and the accompanying algebra, and then let them try out their tricks on each other to see if they work! Students will have plenty of tricks to practice on their friends and family and to show that they are true mathemagicians!

Mathemagicians

The Magic Trick	The Algebra

1. Pick a number between 1 and 100. _____

Multiply it by the number of wheels on a bicycle. _____

Divide by your original number. _____

Add the number of U.S. states. _____

Divide by 4. _____ **Ans:**

2. Think of a number between 1 and 100. _____

Multiply it by 4 _____

Add a number that is unlucky if it lands on a Friday. _____

Add the number of dwarfs with Snow White. _____

Multiply by 2. _____

Divide by 8. _____

Subtract your original number. _____ **Ans:**

3. Think of a number between 1 and 15. _____

Square your number. _____

Add your original number. _____

Divide by your original number. _____

Add the smallest two-digit odd number. _____

Subtract your original number. _____

Divide by the number of sides of a triangle. _____ **Ans:**

4. Think of a year when a memorable event in your life occurred. _____

Add the current year. _____

Add the number of years since the year of that memorable event. _____

Add the number of days in a non-leap year. _____ **Ans:**