

NATIONAL SCIENCE FOUNDATION

JR. PASSPORT

2019 NATIONAL MATH FESTIVAL
WASHINGTON, DC



Welcome to the 2019 National Math Festival!

This passport is packed with exciting math games and activities, all created with the support of the National Science Foundation.

THE NSF JR. PASSPORT CHALLENGE

STEP 1 | In this passport, you will find 5 Essential Challenges that must be completed to win a prize. Look for the activities that have the Essential Challenge symbol (see the key below). Any activity that does not have this symbol does not need to be completed to win a prize.

STEP 2 | You will find an Essential Challenge in each of the following activities:

1. How Right Are You? | p. 1
2. Play Cyber-Sudoku! | p. 2
3. Boredom Buster | p. 4
4. Who's Older? | p. 7
5. Explore Cryptography | p. 8

STEP 2 | Once you have completed all 5 Essential Challenges, bring your passport back to the NSF table for a chance to win a prize.

The first 50 kids to complete the NSF Jr. Passport Challenge will win a prize!

ACTIVITY KEY:



Essential Challenge | Required to win a prize



Bonus Activity | These activities do not need to be completed to win a prize. Take your passport home with you and complete these activities later for even more fun!

How Right Are You?



INSTRUCTIONS | In the space below, write your first name as large as you can, using all capital letters.

Some of the letters in your name create angles.

A **right angle** is exactly 90 degrees. Can you find any right angles?

Label all of the right angles using the following: Γ , \sqcap , \sqcup , \perp .

How many right angles do you have in your name? _____



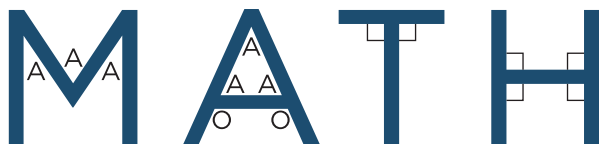
Can you find any other angles in your name?
Remember the following:

An **acute angle** is any angle more than 0 degrees but less than 90 degrees. So, these are smaller than right angles.

An **obtuse angle** is any angle more than 90 degrees but less than 180 degrees. So, these are bigger than a right angle, but not as big as a straight line.

Put an **O** inside any **obtuse angle** and an **A** inside any **acute angle**.

Here's an example:







Are there any letters in your name that don't have any angles? If so, list them here:

Now try this with your last name, or a friend's name.

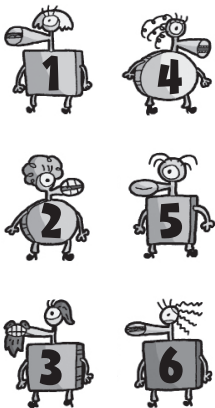
Play Cyber-Sudoku!













ESSENTIAL

The Poddles of Poddleville have their own special game. In this game, only Poddles with numbers **1**, **2**, **3**, and **4** can play. They each have to find a place in the box so they appear only once in each column, row, and box of four. Four of them are in position. Can you place the rest? Grab your pencil and give it a try!

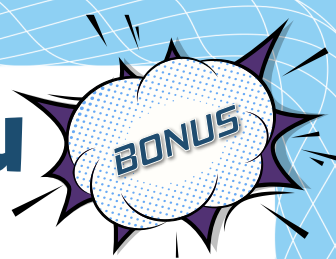
In this game, Poddles with numbers **1**, **2**, **3**, **4**, **5**, and **6** can play. They can appear only once in each column, row, and box of six. Are you up to the challenge?



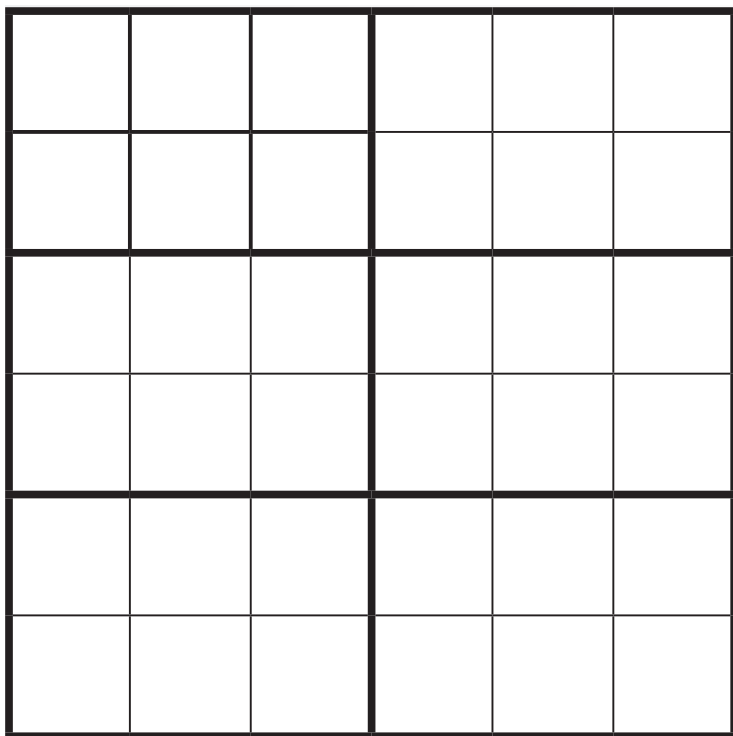
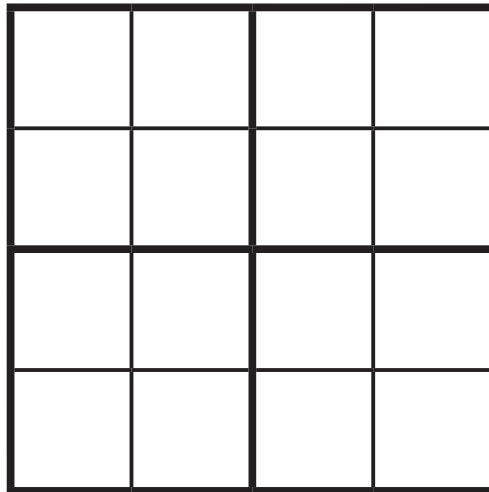
Create Your Own Sudoku

Create your own Sudoku and challenge a friend to complete it!



FOUR-NUMBER SUDOKU

- STEP 1** | Choose four numbers. They can be 1, 2, 3, and 4, like in the essential activity, or you can choose four new numbers.
- STEP 2** | Use your four numbers to fill in the 4x4 Sudoku grid so that each number appears only once in each row, column, and box of four. This will be your answer key.
- STEP 3** | Now, on a separate sheet of paper, draw a new 4x4 Sudoku grid. Pick one of each number from your completed grid and copy them into the new grid in the same position.
- STEP 4** | Challenge a friend to fill in the rest of the blank squares so that each of the four numbers appear only once in each column, row, and box of four.



SIX-NUMBER SUDOKU

Now, choose six numbers, and repeat steps 2-4 using this 6x6 Sudoku grid.

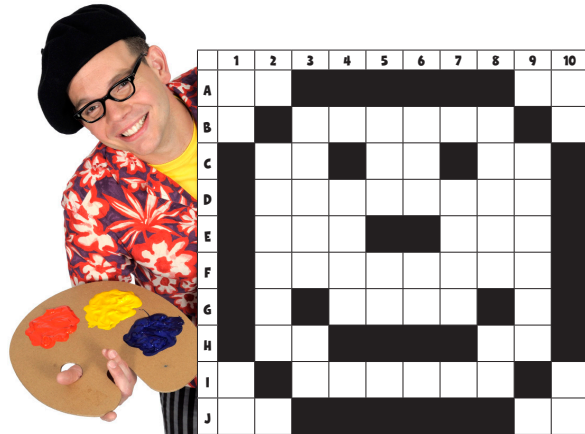
Boredom Buster



Complete steps 1-3 of the Boredom Buster activity by creating your drawing on the next page (look for the Essential Challenge Symbol).

Steps 4-6 are Bonus Activities. If you don't have a friend with you today, you can take it home and ask a friend or family member to play it later.

TIP To find the coordinates of a square, put both fingers on the square. Slide one finger across until you hit a letter. Slide the other finger up until you hit a number. This letter and number are the coordinates (for example, "A4").



Directions

- 1 Print out two copies of the "Boredom Buster" grid. Give one to a friend and keep one.
- 2 Tell your friend not to look. Use a pencil to draw a simple picture (a tree, for example, or a smiley face or an apple) on your grid. **DO NOT LET YOUR FRIEND SEE THE PICTURE!**
- 3 On your grid, color the squares one at a time to make up your picture, like pixels on a screen. Each square can be only **one** color and must be **completely** filled in.
- 4 Keeping your picture hidden, tell your friend the coordinates and color of each square you colored. Using the coordinates, your friend should color the exact same squares on her grid to recreate your picture.
- 5 Can your friend guess what your secret picture is?
- 6 Use the bonus grids on the back to let your friend be the artist!

Boredom Buster Grid



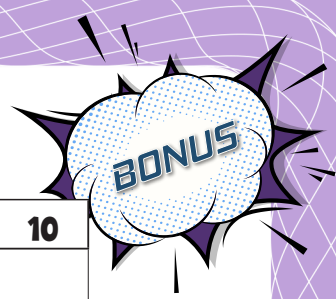
	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										
G										



	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										
G										



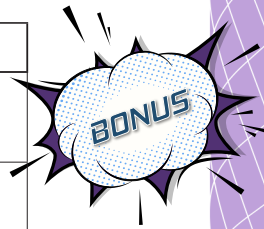
Boredom Buster Grid



	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										
G										



	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										
G										



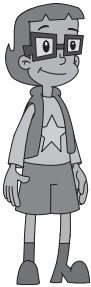
Who's Older?



Is Inez older than Creech? Is Matt older than Fluff?
Find out when you read this graph!

Each dot on the graph marks a character's height and age. To find out who is older, match the height of each character with a dot on the graph.

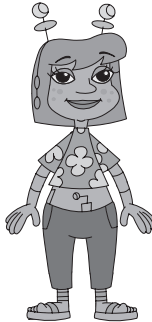
HINT: The farther to the right you move on the graph, the older the character.



Inez



Fluff



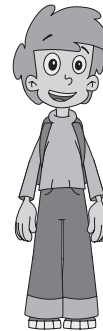
Creech



Slider



TW



Matt



Fill in the blanks below with the names of each person, in order from oldest to youngest.

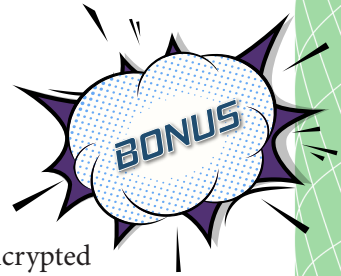
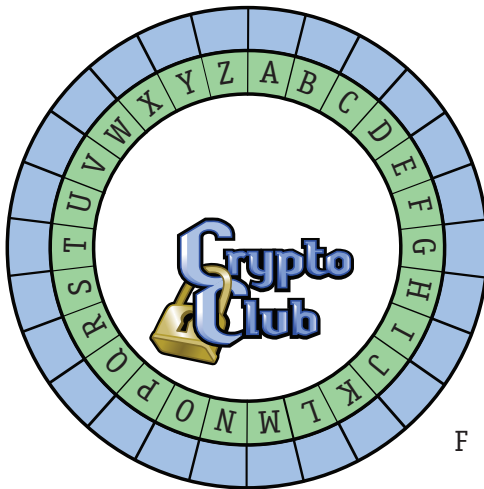
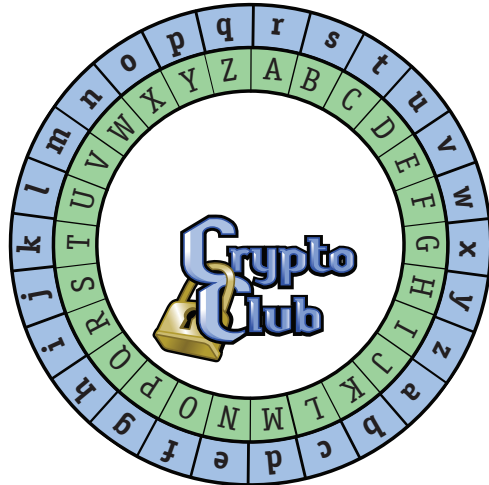
Explore Cryptography



1. Use this cipher wheel to decrypt the punchline to the riddle:

What goes up but not down?

H X D A J P N



2. Guess a few letters of the encrypted fortune below. Use them to help fill in this cipher wheel. Then decrypt your fortune.

F K Z Y Z W J H M F Q Q J S L J

B N Q Q W J X Z Q Y N S

X Z H H J X X.



3. Find a pattern to complete the table. Use the table to decrypt the message.

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		04		06																					

21 16 ^e 06 15 ^c 04 19 00 17 21, 24 ^e 06 ^c 04 09 02 15 08 06 05

^e 13 06 21 21 06 19 20 21 16 15 22 14 03 06 19 20,

21 ^e 09 06 15 02 05 05 ^e 06 05 21 24 16.

4. Find a pattern to complete the table. Use the table to decrypt the message.

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
00			09	12	15		21	24				10	13	16			25	02	05	08		14		20	23

05 21 24 02 05 00 03 07 12 21 00 02 00 19 00 05 05 12 25 13

07 12 15 05 05 16 25 24 18 21 05 00 13 09

00 13 16 05 21 12 25 05 16 19 05 16 03 16 05 05 16 10.

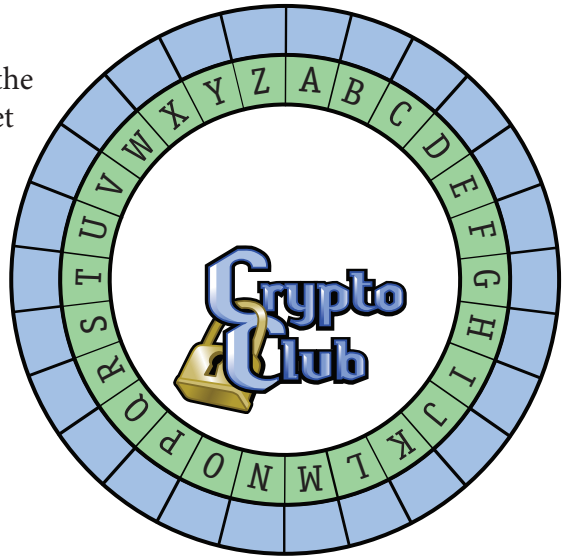
Make your own CIPHER Wheel



INSTRUCTIONS

Create your own cipher wheel by filling in the outside circle with the letters of the alphabet in any way you would like.

Write your own encrypted message, and see if a friend can figure it out using your cipher wheel.



Now, have a friend use the cipher wheel to write an encrypted message for you.

Make a Mobius Strip



YOU NEED

- Tape
- Marker
- Scissors

DIRECTIONS

1. To make a Mobius (*MOH-bee-us*) strip, cut along the dotted lines to create two strips of paper and tape them together to make one long strip of paper.



2. Hold the strip of paper in a loop.

3. Turn over one of the ends to put a twist in the loop. Tape the ends together. (Put tape on both sides.)



4. Draw a continuous line along the center of the strip. Keep going until your line meets where you started.

THINK ABOUT IT...

Did you have to cross the edge of the paper to get back to where you started? How many sides does the strip have?



WAIT, THERE'S MORE!

Ready for another surprise?
Cut the strip along the center line.
What happens?





The activities in this Jr. Passport were created with the support of the following National Science Foundation awards:

DRL 0540279 & DRL 1724481

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Visit pbskids.org/cyberchase to find more fun CyberChase activities like

Cyber-Sudoku | Boredom Buster | Who's Older | Make a Mobius Strip

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Did you like exploring Cryptography?
Visit [CryptoClub.org](https://cryptoclub.org) to learn more about the CryptoClub Project at the University of Chicago.

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ACTIVITY SOLUTIONS

You will find solutions to all activities along with links to further games and activities supported by NSF at:

<https://sites.google.com/view/NSFjrpassport>



National Science Foundation
WHERE DISCOVERIES BEGIN