CAȘH CIDE BREAKERS An Algebra Adventure

Teacher's Guide





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Introduction

Summary of the experience

Welcome to *Cash Codebreakers: An Algebra Adventure.* This is an educational and interactive escape-room activity in which students are trapped inside a museum dedicated to U.S. currency security features. They must solve seven puzzles and algebra problems to exit. Each time they solve a puzzle, they'll earn a piece of a \$100 bill, which they will use as a key to escape.



The Goal of the Game

Your students will learn about U.S. currency security features and sharpen their algebra skills by solving seven puzzles to escape the museum.



Regular Mode, Classroom Mode and Code Generator

What is Regular Mode?

In "Regular Mode", students can select their own difficulty levels. Each puzzle has two parts. The first part tests students on their knowledge of U.S. currency security features. After a student answers this part correctly, they are given an algebra problem to solve using a mathpad. Choosing a different difficulty level changes the algebra problems for each puzzle.

Algebra problems will automatically be adjusted to the student's level of difficulty, based on how quickly they solve the equations. Choose classroom mode so all your students can solve the same problems as a group.

What is Classroom Mode?

"Classroom Mode" has been designed so that teachers can select the same difficulty level for an entire class, easily provide assistance in person or remotely, and make sure each member of the class gets the same algebra problems for instructional purposes.



Select this button to turn on classroom mode

Another way this mode can be used, is by selecting an appropriate difficulty level for individual students and generating a unique classroom key/code for that group.



How it works

Customize the game for students and generate a unique key/code:

- Each of the seven digits in the code relates to a puzzle inside the game (see screenshot below).
- Each puzzle has 27 possible algebra problems.
- Each problem has a letter or symbol assigned to it.
- Selecting one letter or symbol for each puzzle will create the final seven-digit code.
- You will create this code and give it to your students. They will then enter it in the game to solve the final seven problems that you have selected.



Understanding the Letter Key

Each puzzle has 27 algebra problems for you to choose from. When choosing the letter to input for each puzzle, use the following guide to select the difficulty level:

Level 1: Grade 6

Easy problems: A, B, C Normal problems: D, E, F Hard problems: G, H, I Hardest possible grade 6 problem: #

Level 2 : Grade 7

Easy problems: J, K, L Normal problems: M, N, O Hard problems: P, Q, R Hardest possible grade 7 problem: @

Level 3 : Grade 8

Easy problems: S, T, U Normal problems: V, W, X Hard problems: Y, Z, \$ Hardest possible grade 8 problem: !



Example

If you are instructing a grade 6 class and want to have a combination of easy, medium, hard, and challenging problems, you might select the sequence ACFEGD#:

- Choosing A would generate an easy Portraits puzzle. (Consult the image above to see which box represents which puzzle. The letter column in the table below displays which letter represents the difficulty level of the problem in the column that's to its left).
- Choosing C would generate an easy Lenticular puzzle.
- Choosing F would generate a medium-difficulty Watermark puzzle.
- Choosing E would generate a medium-difficulty Microprinting puzzle.
- Choosing G would generate a hard UV light puzzle.
- Choosing D would generate a medium-difficulty Feel puzzle.
- Choosing # would generate a challenging Serial Number puzzle.

After the code is created, it would be given to the students, who would then enter it in the game to solve the seven problems selected by you.

Math Problems Selection

Please see all equations and word problems below:

Level 1 / Grade 6

Level of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Challenge	#	2y+2y=28	Three times the sum of a number and 12 equals 45. What is the number?	5.3+b=-8.1	There are 8 sweet potatoes in a blue basket. There are 2 times that plus 4 in the orange basket. How many sweet potatoes are in the orange basket? Solve for x, where x represents the number of sweet potatoes in the orange basket.	19m=57	33=3p+3	25r=80-5

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Level 1 / Grade 6

evel of ifficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Easy	A	7+y=15	In a class of 26 children there are 13 boys. How many girls are there? Solve for x, where x represents the number of girls in the class.	b-2=23	Darius sells tickets to a concert for \$12 each. He does not remember how many he sold, but he knows that he collected \$372. How many tickets did Darius sell? Solve for x, where x represents the number of tickets Darius sold.	m+8=14	p-9=0	r+17=53
Easy	В	y+7=8	Five less than a number equals 30. What is the number?	3=b-17	There were some dog bones in a basket. Spot ate 4 of them, and there were 9 left in the basket. How many bones were in the basket originally? Solve for x, where x represents the number of bones originally in the basket.	19+m=32	9=p-9	r+9=16
Easy	С	y+12=8	Mika earned \$24 on Tuesday and earned more money on Wednesday. He earned a total of \$53. How much did Mika earn on Wednesday? Solve for x, where x represents the amount of money Mika earned on Wednesday.	15=8+b	A number added to 13 equals 19. What is the number?	8=m-15	ρ+6=6	r-15=20
Normal	D	86=12+y	Bill received 81 points on his second history test. That was 7 more points than he scored on his first test. What was Bill's score on his first history test? Solve for x, where x represents the score Bill received on his first history test.	b-1.6=2	Kia baked 6 loaves of pumpkin bread that each weighed the same amount. The total weight of all the loaves was 84 ounces. How much did each loaf weigh? Solve for x, where x represents the weight of each loaf of pumpkin bread.	42+m=69	ρ-19=44	89+r=207



Level 1 / Grade 6

Level of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Normal	E	y-12=101	Kevin bought two things at the store that cost a total of \$10.16. One item he bought was a box of rice for \$3.18 and the other was a package of chicken. How much did the chicken cost? Solve for x, where x represents the cost of the chicken.	3.2=6.8+b	On Thursday, Jose ran 17.6 miles more than Philip. Jose ran a total of 41.3 miles. How many miles did Philip run? Solve for x, where x represents how many miles Philip ran.	m-44=3	24=p+13	r-46=25
Normal	F	y-27=15	Hazel collected 36 eggs from the hens in her backyard. How many dozens of eggs is that? Solve for x, where x represents how many dozens of eggs Hazel collected.	77=43+b	In twelve years, Gina will be 20 years old. How old is she now? Solve for x, where x represents how old Gina is now.	5.78=m-3	10+p=70	73+r=113
Нагд	G	7y=42	Gabriella spent \$56 on some colored markers to use while creating a comic book. She bought seven different colors, but they were all the same price. How much did each marker cost? Solve for x, where x represents the cost of each marker.	2b=80	At band practice there were 8 rows of students, with 3 students, in each row. There were also more students in the back of the room. There were a total of 29 students in the band. How many students were in the back of the room? Solve for x, where x represents the number of students in the back of the band room.	54=7.5m	18+24= 5ρ+2ρ	6r=84
Hard	н	102=6y	How many boxes of crackers can you buy with \$33 if each box costs \$3? Solve for x, where x represents the number of boxes of crackers you can buy.	27.4b=82.2	Jade was baking a cake. The recipe called for 3.3 cups of flour. Accidentally, she put in 4.7 cups of flour. How much extra flour did she add? Solve for x, where x represents the amount of extra flour put into the cake.	5m-3m=36	96=8p	4r=84



Level 1 / Grade 6

Level of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Hard	Ι	-12=y-6	Three times the sum of a number and 12 equals 45. What is the number?	5b=100	Jay bought a bottle of water for \$2, 8 bags of peanuts for \$.50 each, and some candy. He spent a total of \$8.59. How much did the candy cost? Solve for x, where x represents the cost of the candy.	2.9+4.7=1m	102.8= ρ+66.09	7r=112

Level 2 / Grade 7

evel of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Challenge	0	-4+8y-6y -5+20y =145	In one weekend, Todd earned 3 times as much money as Tim. Tom earned \$5 more than Tim. In all, they earned \$60. How much did Todd earn? Solve for x, where x represents the amount of money Todd earned.	21-5+3b-8 +4b=106	Twice a number is 500 more than 6 times the number. What is the number?	8(m+2)+3 (m-2)=76	5.2(8.4- -9.5ρ) =10.4-7.8ρ	5 ² +2(2r-r) =102+43
Easy	J	10y=130	Sierra made some cookies. She took 24 to school for a bake sale. She has 30 left. How many cookies did she make? Solve for x, where x represents the amount of cookies Sierra made.	37+b=58	Rory took a test at school and she completed it in an hour. The test was broken into two parts. It took her 25 minutes to finish the first part. How long did it take Rory to complete the second part of the test? Solve for x, where x represents the minutes it took Rory to complete the second part of the test.	20=m-40	-6p=54	r-19=14
Easy	К	-7y=7	Zena sold 7 pencils for \$1.80 each at the bookstore. How much money did she make? Solve for x, where x represents the amount of money Zena made selling pencils.	23=b-261	Twice a number is 272. Find the number.	m+21=51	6ρ=78	r-8=23
Easy	L	-15y=60	Twenty-five percent of a number is -60. Find the number.	b+42=41	Six identical graphic novels cost \$72. What is the cost of each graphic novel? Solve for x, where x represents the cost of each graphic novel.	54=m-37	13p=143	r-24=-19



Level 2 / Grade 7

Level of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Normal	М	6y+13=25	Nellie had two boxes of erasers, with fourteen erasers in each box. She gave six erasers to her brother. How many erasers did Nellie have left? Solve for x, where x represents the number of erasers Nellie had left.	2-3b=14	A woodworker sold each of his stools for \$50 at the craft fair. How many stools did he sell if he earned a total of \$1,850? Solve for x, where x represents how many stools the woodworker sold.	6(m-4)=18	17.6+p =36.4	24-15r=54
Normal	N	72=5y+2	The sum of three consecutive odd numbers is 147. What is the largest of the three numbers?	b+7.8=26.6	The product of 12 and a number is 72. Find the number.	2(m-3)=12	ρ-(-8.9)= 19.12	9r+8=80
Normal	0	y+13.3= 19.23	A toy train that had cost \$63 is on sale for 15% off. How much does the train cost now? Solve for x, where x represents the sale price of the train.	8(b-1)=8	The perimeter of a square patio is 48 feet. What is the length of one side? Solve for x, where x represents the length of the side of the patio.	4m+10m =28	3p-15 = -6	8.61+r =14.73
Hard	Ρ	(.06)y =17.58	Roman had \$239 to spend on buying 8 identical blankets. After buying them, he had \$7 left. How much did each of the blankets cost? Solve for x, where x represents the costs of each blanket.	8(2)-b=-30	Jake bought 8 bags of popcorn. Each bag was on sale for \$1 off. If all of the bags of popcorn cost \$24, what was the original price of each bag of popcorn? Solve for x, where x represents the original cost of each bag of popcorn.	49=m²	7-(5p-13) =-25	r+4 ² =28

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Level 2 / Grade 7

Level of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Hard	Q	7(y-6)+8 =15	In a bag of 40 marbles, 30% are green. How many are not green? Solve for x, where x represents the number of marbles that are not green.	6(b+3) =66+6	The length of a rectangle is 1 yard more than twice the width. The perimeter is 218 yards. What is the length of the rectangle? Solve for x, where x represents the length of the rectangle.	m-(-33.5)= 32.5	ρ²=121	13+7(r+2)=62
Hard	R	-6y+1-13y =-18	The perimeter of a trapezoid is 14 inches. The left and right sides are the same. If the length of the bottom is twice the length of the side and the length of the top is 1 inch less than the length of the side, what is the length of the bottom? Solve for x, where x represents the length of the bottom of the trapezoid.	11(6-2)=11	Julia's new watch cost \$30 more than twice as much as her old one. She paid \$160 for her new watch. How much did she pay for her old watch? Solve for x, where x represents the cost of Julia's old watch.	-109.61 =11.3m	ρ²=64	6(8+r)=60

Level 3 / Grade 8

Level of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Challenge	1	-5-(15y-1)= 2(7y-16)-y	Each of the equal sides of an isosceles triangle is 4 times the third side. The perimeter of the triangle is 144 inches. Find the length of ane of the equal sides of the triangle.	12b-3 ² -10-4b= 8b-6b+46+1	If 3 times a number is increased by 22, the result is 14 less than 7 times the number. What is the number?	-4.8-5 (2m-0.9) =2.5(m+9. 6)	2 ² +3ρ -2(10+4ρ) =-(6ρ+2)	4+11 (10+13r) =13r-2(r+9)
Easy	S	4+8y= -268	If seven identical candy bars cost \$20.72, how much is one candy bar? Solve for x, where x represents how much each candy bar costs.	26+56-7= 13+36	If you multiply a number by 8 and add 12 you get 60. What is the number?	0.1+3.3m =-120.35	-3(ρ- -7)+2 =20	3-4r+6r+12 =7r



Level 3 / Grade 8

evel of ifficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Number
Easy	Т	36+19y= 24y+6	It took Renee 25 minutes longer to do her social studies homework than to do her science homework. She spent a total of 2.25 hours on both subjects. How mony minutes did she spend on social studies? Solve for x, where x represents the minutes Renee spent doing social studies homework.	-3(7b+5) =27	A number decreased by 50% of the number is four. Find the number.	-18=-6-4m	42+5ρ =8ρ	-25.5=8r+2. 2r
Easy	U	2(2-2y)=20	The perimeter of an equilateral triangle is 24 inches. Find the length of a side of the triangle. Solve for x, where x represents the length of one side of the triangle.	16b-15 =13b	A customer at the Yummy Sombrero Restaurant placed an order for 3 burrito plates that cost x each. He also ordered a tray of tacos for \$12.96 and was charged a total of \$32.46 for all of his food. How much was each burrito plate? Solve for x, where x represents the cost of each burrito plate.	m+4= 3m-16	-28=2p+ 12p	9=r-5+8
Normal	V	12+4 (2y+4) =68	Three hundred twenty-five kids went on a trip to the museum. All 8 buses were filled and 5 students had to travel in cars. How many students were on each bus? Solve for x, where x represents the number of students on each bus.	3(b-4)+6= 3	The product of 2 and the difference between 'x' and 1 is 14. What does x equal?	7m-3 (4m+8) =11-4m	ρ²+7=56	9(r-5)+2r= 98
Normal	W	y+(y+1)+(y +2)+(y+3) =22	Wanda won 121 candy corn pieces at the fall party. Later she gave four pieces to each of her friends. She had only 9 pieces of candy corn left at the end of the day. How many friends does she have? Solve for x, where x represents how many friends Wanda has.	5(b-7)= 7b-5	The sales tax rate in Penny's state is 8%. If she buys a couch for \$672.50, how much would it cost with the sales tax included? Solve for x, where x represents the total cost of the couch.	5(m-1) =-5(m+4) +15	6(3ρ- 5)-7ρ =15+2ρ	-3r+11.6r= -22.3+1+11.1r+



Level 3 / Grade 8

Level of Difficulty	Letter / Code to Use	Portraits	Lenticular	Watermark	Microprint	UV light	Feel	Serial Numbe
Normal	X	-48+y= -8(7+y)+10y	Six more than seven times o number is 34. Find the number.	3b-2(6 b-3)=42	Zack earns \$2 for every magazine he sells and gets a salary of \$10 a week. How many magazines will he have to sell in order to earn at least \$40 in one week? Solve for x, where x represents the number of magazines that Zack must sell in one week.	-2(5+6m) +16= -90+4m	4ρ-8= -4(11+2ρ)	8(3r-8)= 10r+48
	Y							
Hard		-3(y-1) +8(y-3)= 6y+7-5y	The length of a rectangle is 9cm and the width is (x-7)cm. Find the value of "x" if the area of the rectangle is 54cm ² .	5 (-6+b) =4b+6	A rectangular window has a diagonal of 25 inches. It is 15 inches tall. How wide is it? Solve for x, where x represents the width of the window.	3(-m+3)= 5(m+6)+11	-3ρ -4(4ρ-8)= 3(-8ρ-1)	5.2 (8.4-9.5r) =10.4-7.8r
Hard	Z	-2(4+3y) =-2(4+y)	Four times the sum of twice a number and six is thirty-two. Find the number.	56+17 =9(-6+ 12+36)	Find the length of the hypotenuse of a right triangle if the lengths of the other sides are 6 inches and 8 inches.Solve for x, where x represents the length of the hypotenuse of the right triangle.	3(m+1) -7m+10 =m-7	13ρ =-(9- 12ρ)-5	-1.8r-7.3 (7.5r-5) =-r-30.16
Нагд	\$	5(6+4y -2)+12y =-172	Find the length of one side of a right triangle if the length of the hypotenuse is 15cm and the length of the other side is 9cm. Solve for x, where x represents the length of the missing side of the right triangle.	2b-6-6b =10-2b+4	Ray's Cycle Shop rents bikes for \$10.93, plus \$3.71 per hour. Jane paid \$40.61 to rent a bike. How many hours did she rent the bike for? Solve for x, where x represents the number of hours Jane rented the bike in total.	-18+m =6(2-3m +10)+m	-2(2p-4) =10p-20	-13(r-6) =-5r+2 (5r+12)



U.S. Currency Security Feature Puzzles Answer Key

In this section we will explain how to solve the U.S. currency security features part of the experience.

NOTE: Students don't have to solve the puzzles in a specific order. As part of the escape-room element of the experience, we want students to navigate through the whole museum, find tools and hints, and go back and forth between the exhibits to solve all of the puzzles.

Portraits

This is the first puzzle that students will encounter once the game has been launched. It offers a tutorial to familiarize them with the game and its unique elements.

In this puzzle, students need to:

1. Drag and drop each statesman portrait onto the correct corresponding bill. Once a portrait is successfully matched with a note, a number/symbol, that is part of the hidden equation, will be automatically and immediately revealed.

2. After completing all the portraits, students need to pick up the UV light (located towards the puzzle's bottom right) and shine it over the portrait panels to reveal the path connecting all the numbers and symbols.

3. Once all the portraits are matched and the path is revealed, the problem and the mathpad will be unlocked.



Portraits



Answer key:

\$100 - Franklin \$50 - Grant \$20 - Jackson \$10 - Hamilton \$5 - Lincoln \$2 - Jefferson \$1 - Washington

After the user solves these puzzles, they can navigate through the rooms with the left and right arrows. They can also use the minimap on the top left corner of the experience to "jump" between rooms in any order.



Lenticular

In this puzzle, students need to:

1. Rotate the structure in the middle either by clicking on the left and right arrows or by clicking on the structure and dragging it.

2. Reveal the phrases that are hidden in the puzzle by precisely rotating and pausing on the angle where they line up.



Each time students reveal a part of the word problem, a pop-up containing the sentence will appear around the structure and a check mark will reveal which of the four parts has been unlocked. Once students unlock all four parts, the math problem will be revealed and the mathpad will be unlocked.

This puzzle requires no tools to its solution.



Watermark

In this puzzle, students need to:

1. Collect the tools: the flashlight (which can be found in the Serial Number exhibit) and the magnifying glass (see image below).

2. Use the flashlight to reveal the path on the map.*

3. Use the magnifying glass to reveal the equation.*



2. Use the flashlight to reveal the path

3. Use magnifying glass to find the equation

The tools are intentionally scattered in different exhibits to prompt students to solve the experience in a nonlinear way – to navigate around, search through the museum, and return to solve the puzzle once they have all the tools they need.



Microprinting

In this puzzle, students need to:

1. Use the magnifying glass (which can be collected from the Watermark exhibit).

2. Magnify all four images to find the phrases hidden among the tiny words that make up each image.



Magnify the 4 images to reveal hidden phrases

Each time students reveal a part of the word problem, a pop-up containing the sentence will appear around the exhibit and a check mark will reveal which of the four parts has been unlocked. Once students unlock all four parts, the math problem will be revealed and the mathpad will be unlocked.



UV light

In this puzzle, students need to:

1. Shine the UV light (which can be collected from the Portraits exhibit) on the 3D cube to reveal the numbers and a path.

2. Rotate the cube while shining the UV light to reveal the full path, which then becomes the equation.



1. Shine the UV light to reveal the path

2. Use these arrows to rotate the cube

Each time students reveal a part of the equation, a pop-up containing the number/symbol revealed will appear under the cube and a check mark will reveal which of the four parts has been unlocked. Once students unlock all four parts, the math problem will be revealed and the mathpad will be unlocked.



Feel

In this puzzle, students need to:

- 1. Use the flashlight (which can be found in the Serial Number exhibit) to shine a light on the wall.
- 2. Find the full equation hidden across the wall.



The tools are intentionally scattered in different exhibits to prompt students to solve the experience in a nonlinear way – to navigate around, search through the exhibits, and return to solve the puzzle once they have all the tools they need.



Serial Number

This is the final puzzle and needs to be completed in multiple steps:

1. Students will come to this exhibit to collect the flashlight, which is needed for other puzzles in the museum.

2. Students need to use the flashlight to reveal an "on" button, which they will select to turn on the machine and reveal this puzzle. This puzzle cannot be completed until all the other puzzles are solved.

3. Upon completion of all the other puzzles, students will come back and drag and drop all the icons from the top row to the bottom one to reveal the final equation.*





*If students visit this exhibit before solving all the other puzzles and collecting all the tools, they can drag and drop the hints they have collected so far into the bottom row, but that won't by itself reveal the full puzzle.



Exit Door

Before the puzzles are solved

If students visit this part of the museum before all seven puzzles have been solved, they will find a locked door and a machine blocking them from proceeding.



Once all the puzzles have been solved

Once the students have completed all of the puzzles, they should come to the exit room to complete the game.

Here there are no puzzles; the students should simply click on the door or the machine to the right of the door to complete the game and receive their certificates.

CA\$H CIDE BREAKERS AN ALGEBRA ADVENTURE

THANK YOU!