Cubesensei — Activity Book

A Spark & Anvil activity book — puzzles, questions, and fun from Cubesensei.

Write in the book, circle your answers, and check the Answer Key at the back.

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1. Cube Notation

Circle the correct answer

1. In standard Rubik's Cube notation, what does the letter 'U' stand for?
(A) The upper face of the cube (B) An undo move (C) The under face of the cube (D) The universal rotation

2. What does the letter 'F' represent in Rubik's Cube notation?
(A) The final move in a sequence (B) The front face of the cube (C) The fastest move available (D) A flip of the entire cube

3. How many faces does a standard Rubik's Cube have?
(A) 8 (B) 6 (C) 4 (D) 12

4. In cube notation, what does an apostrophe (') after a letter mean, such as in R'?
(A) Turn that face counterclockwise (the reverse direction) (B) Skip that move entirely (C) Turn the face twice (D) Turn the face very quickly

5. Why is it important that cube notation always describes moves from the perspective of looking directly at that face?
(A) Because the notation was designed for robots, not humans (B) Because the cube looks different from every angle and notation cannot account for that (C) So that every person reading the notation performs the exact same move, no matter how they hold the cube (D) Because only the front face matters in solving

6. When you perform the move U, which layer of the cube rotates?
(A) The bottom layer rotates while the top stays still (B) The entire cube rotates around a vertical axis (C) The top and middle layers both rotate together (D) Only the top layer rotates; the middle and bottom layers stay still

Write the answer

7. What does the number 2 mean when written after a letter, like in R2?
Answer: _____

8. If you perform the move R and then immediately perform R', what happens to the cube?

Answer: _____

9. Why is the back face labeled 'B' rather than something like 'BK' or 'BA' in standard notation?

Answer: _____

10. Look at this algorithm: R U R' U'. How many individual moves does this sequence contain?

Answer: _____

Match each question to its answer

1. You are given the algorithm: F R U R' U' F'. Write this algorithm in reverse order with each move inverted. What is the result? →
2. Your friend tells you to perform: U D' L R' F B'. How many faces of the cube are involved in this sequence? →
3. You need to write down the moves to teach a friend. You turned the left face clockwise, then the bottom face counterclockwise, then the right face twice. What is the correct notation? →
4. A tutorial uses both uppercase and lowercase letters: R means turn the right face, and r means turn the right face plus the middle layer together. What is this type of notation called? →
5. You see two different algorithms that accomplish the same thing: one is 12 moves long and the other is 8 moves long. Both are correct. Why might a speed solver prefer the shorter one? →

(A) Fewer moves generally means less time to execute, which helps achieve faster solve times
(B) 6, because every face is used once
(C) Wide move notation
(D) F U R U' R' F'
(E) L D' R2

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2. Cube Structure

Circle the correct answer

11. How many small colored squares (stickers) are visible on the outside of a standard 3x3 Rubik's Cube?

(A) 27 (B) 48 (C) 36 (D) 54

12. What is the name for the small individual pieces that make up a Rubik's Cube?
(A) Cubies (B) Blocks (C) Pixels (D) Tiles

13. How many center pieces does a standard 3x3 Rubik's Cube have?
(A) 6 (B) 8 (C) 1 (D) 12

14. What is special about the center pieces on a standard 3x3 Rubik's Cube?
(A) They have two colors each (B) They are the hardest pieces to solve (C) They never move relative to each other and define the color of each face (D) They can be removed and swapped between faces

15. Why do corner pieces always have exactly three colored stickers?
(A) Because three is the minimum needed to identify a piece (B) Because the factory paints them with three colors for decoration (C) Because corner pieces are the largest pieces and have room for more stickers (D) Because each corner piece sits at the intersection of three faces, so it shows one color from each face

16. How is an edge piece different from a corner piece on a Rubik's Cube?
(A) An edge piece has two colored stickers and sits between two corners, while a corner piece has three colored stickers (B) Edge pieces do not move when you turn a face, making this the most widely accepted explanation (C) Edge pieces are larger than corner pieces, which is the most common explanation for this phenomenon (D) Edge pieces can only be on the top and bottom faces, and this principle applies across similar situations

Write the answer

17. A 3x3 Rubik's Cube has 26 visible cubies (pieces). What occupies the 27th position at the very center of the cube?
Answer: _____

18. Why is it impossible for a single piece on a 3x3 cube to have the colors white and yellow on it if white and yellow are on opposite faces?
Answer: _____

19. On a standard color scheme Rubik's Cube, the white face is opposite the yellow face, and red is opposite orange. What color is opposite blue?
Answer: _____

20. You are holding a solved Rubik's Cube with white on top and green facing you. If you turn the entire cube so that green is now on top, which color is now on the bottom?
Answer: _____

Match each question to its answer

1. A friend hands you a disassembled Rubik's Cube and asks you to put it back together. How many corner pieces should you look for? →
2. You find a single cubie that has exactly two colored stickers: one red and one blue. What type of piece is it, and where does it belong on the solved cube? →
3. You want to count all the pieces in a 3x3 Rubik's Cube by type. You count 8 corners and 6 centers. How many edge pieces must there be? →
4. Your teacher asks you to count the total number of individual stickers on all edge pieces combined on a 3x3 cube. What is the answer? →
5. On a 3x3 cube, the three layers are called the top layer, middle layer, and bottom layer. Which type of piece exists ONLY in the middle layer? →

(A) 24
(B) 8
(C) It is an edge piece that belongs between the red face and the blue face
(D) 12
(E) The 4 middle-layer edge pieces that have no white or yellow stickers

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3. Beginner Solving

Circle the correct answer

21. What is the very first step in most beginner Rubik's Cube solving methods?
(A) Matching all center pieces to the correct face (B) Solving all the corner pieces first (C) Making a cross on one face by solving four edge pieces (D) Peeling off stickers and rearranging them

22. When building the white cross, what must be true about each edge piece besides having white on the correct face?
(A) Each edge must be placed in alphabetical color order (B) The edges can be in any position as long as white shows (C) The other color on each edge must match the center piece of the adjacent side face (D) The white sticker must face upward at all times

23. After completing the cross, what is the next step in the beginner method?
(A) Removing the cross and starting over with corners (B) Solving the first layer corners to complete the entire first layer (C) Flipping the cube over and starting the last layer (D) Solving the middle layer edges

24. In the beginner method, what does 'F2L' stand for?
(A) First Two Layers (B) Face 2 Left (C) Fast 2 Levels (D) Flip 2 Lines

25. Why do most beginner methods recommend solving the white face first and finishing with the yellow face last?
(A) Because yellow is the hardest color to manufacture on the cube (B) Because white pieces are lighter and easier to turn (C) White is easy to spot and track, and solving bottom-up lets you see unsolved pieces on top (D) Because the cube's mechanism only works in this order

26. When inserting a first-layer corner piece, why do you need to check three colors instead of just one?
(A) Because the cube uses three primary colors (B) A corner piece has three stickers, and all three must match their respective face centers for the corner to be correctly placed (C) Because the algorithm requires three setup moves (D) Because each corner needs to be turned three times to fit

Write the answer

27. In the beginner method, the middle layer edges are inserted using algorithms that move pieces from the top layer down. Why can you not simply push them straight down?
Answer: _____

28. What is the purpose of the 'last layer cross' step in the beginner method?
Answer: _____

29. During last layer solving, you might see a dot, an L shape, or a line of yellow on top before forming the cross. What do these patterns tell you?
Answer: _____

30. You have completed the first two layers and are starting the last layer. You perform the yellow cross algorithm, but the cross does not appear. What should you do?
Answer: _____

Match each question to its answer

1. You successfully built the white cross, but when you check the side colors, one edge's second color does not match its adjacent center. How would you fix this? →
2. You are inserting middle layer edges. The edge you need is currently in the middle layer but in the wrong position. What must you do first? →
3. You are trying to insert a middle layer edge to the right. The algorithm moves it right and down. But you realize the edge needs to go left instead. What should you do? →
4. After forming the yellow cross on the last layer, the next step is to position the yellow edges correctly. You notice that two adjacent edges need to swap. Which approach does the beginner method use? →

5. During the last layer, you have the yellow cross done and edges positioned, but the corners are not in the right spots. What characteristic should you look for to identify correctly positioned corners? →

(A) A corner is correctly positioned when its three colors match the three centers surrounding that corner position, even if it is twisted
(B) Use the insertion algorithm to push the wrong edge out to the top layer, then insert the correct one
(C) Use the mirror version of the algorithm that inserts the edge to the left instead of the right
(D) Remove the misaligned edge by turning that face, reposition it on the top layer, and reinsert it correctly
(E) Apply a specific algorithm that cycles three edges, then adjust the top layer to get all four edges positioned correctly

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4. Pattern Recognition

Circle the correct answer

31. On a solved cube, you perform the move R. How many stickers change position?
(A) 54, because every sticker on the cube moves (B) 6, because only the edge stickers move (C) 20, because 5 pieces move (4 edges and 4 corners cycle, plus the right center stays but stickers around it rotate) (D) 9, because the right face has 9 stickers

32. What is a 'checkerboard pattern' on a Rubik's Cube?
(A) A pattern where each face shows an alternating grid of two colors, like a chess board (B) A random scramble with no recognizable structure (C) A pattern where all six faces show the same single color (D) A pattern where each face has a diagonal stripe

33. If you perform the same single move four times in a row (for example, R R R R), what state will the cube be in?
(A) Back to the exact starting state, because four quarter turns complete a full 360-degree rotation (B) The cube will be in a random new state (C) The face cannot be turned four times in a row (D) The face will be rotated 180 degrees from the start

34. What is the term for the number of times you must repeat a sequence of moves before the cube returns to its starting state?
(A) The difficulty level (B) The algorithm length (C) The scramble depth (D) The order of the sequence

35. You perform R U on a solved cube. Then you perform U' R'. Is the cube now solved again?
(A) Yes, but only if the cube was solved to begin with (B) No, because R U and U' R' affect different pieces (C) No, because two moves cannot undo two other moves (D) Yes, because U' R' is the exact inverse of R U, undoing both moves in reverse order

36. Why does the sequence R U R' U' only affect a small number of pieces rather than scrambling the entire cube?
(A) Because U moves do not affect the right face (B) Because the R and R' moves cancel out for most pieces, leaving only a few pieces in different positions (C) Because the cube's mechanism limits how many pieces can move at once (D) Because the sequence is too short to affect many pieces

Write the answer

37. You are looking at a scrambled cube and want to find where the white-red edge piece is. How would you identify it among all the pieces?
Answer: _____

38. On a scrambled cube, you notice that a corner piece has white facing sideways instead of upward. What does this tell you about the piece?
Answer: _____

39. You perform the algorithm R U R' U' on a solved cube and notice that three corner pieces have cycled positions. If you perform the same algorithm again, what will happen to those three corners?
Answer: _____

40. You are solving a cube and have completed the white cross. You find a white corner piece in the top layer with white facing upward. What should you do to insert it correctly?
Answer: _____

Match each question to its answer

1. You have a scrambled cube and want to count how many white stickers are currently visible on the top face. You count 3. What can you conclude about the state of the cube? →
2. You are teaching a friend and they ask: 'If I perform the moves R U, can I undo it by performing R' U'?' Is their idea correct? →
3. You observe that a particular algorithm creates a 'T' pattern on the front face (center color in the middle with matching colors forming a T shape). What type of pattern recognition skill is being used here? →
4. A cube has been scrambled, and you notice that all four edge pieces in the middle

layer are in their correct positions but two of them are flipped (their colors are swapped). Could this have happened through normal scrambling? →
5. You are watching someone solve a cube and they have completed the first two layers but the last layer has no yellow stickers facing up at all (a 'dot' pattern). What does this tell you about the minimum number of algorithm applications needed to form the yellow cross? →

(A) No, the correct inverse is U' R', because you must reverse the order AND invert each move
(B) Three applications of the cross algorithm are needed: dot to L shape, L shape to line, line to cross
(C) Recognizing the specific arrangement of colors relative to the center to determine which algorithm case you are looking at
(D) Three pieces with white stickers happen to have white facing upward, but this reveals nothing about whether those pieces are in their correct positions
(E) No, having exactly two edges flipped while everything else is correct is impossible through legal moves alone

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5. Speed Solving

Circle the correct answer

41. What is a 'finger trick' in speed cubing?
(A) A method of lubricating the cube with your fingers (B) A technique where you use individual fingers to turn faces quickly without regripping the cube (C) A way to hold the cube with only two fingers (D) A magic trick where you make the cube appear solved

42. What does 'look-ahead' mean in speed cubing?
(A) Looking at the cube from above before starting (B) Checking the timer before starting your solve (C) Planning your next moves while your hands are still executing the current moves (D) Memorizing the entire solution before touching the cube

43. In competition, how long do solvers get to inspect the cube before starting their timed solve?
(A) 30 seconds (B) 5 seconds (C) As long as they want (D) 15 seconds

44. What is the name of the most popular advanced speed solving method that uses Cross, F2L, OLL, and PLL steps?
(A) The ZZ method (B) The Roux method (C) CFOP (also called the Fridrich method) (D) The beginner method

45. Why do speed solvers prefer to solve the cross on the bottom of the cube rather than the top?
(A) With the cross on the bottom, the top layer is visible for tracking the next pieces to solve during F2L (B) Because the bottom turns faster due to gravity (C) Because the white center is always on the bottom (D) Because competition rules require the cross on the bottom

46. What is 'color neutrality' in speed cubing, and why is it considered advantageous?
(A) Using a cube with all faces the same neutral color (B) The ability to start the cross on any of the six colors, allowing the solver to choose whichever cross requires the fewest moves (C) Ignoring colors and solving by piece shape only (D) Solving the cube while blindfolded so colors do not matter

Write the answer

47. In CFOP, what is an 'F2L pair' and why is it important?
Answer: _____

48. Why do speed solvers practice 'turning slowly' as a training technique even though the goal is to solve fast?
Answer: _____

49. During the 15-second inspection, a speed solver plans their entire cross. They determine it will take 6 moves. What can they do to improve their cross efficiency?
Answer: _____

50. You are learning CFOP and can execute algorithms quickly, but your solves average 45 seconds with long pauses between F2L pairs. What should you focus on to improve?
Answer: _____

Match each question to its answer

1. In speed solving, what is a 'rotation' and why do advanced solvers try to minimize them? →
2. A speed solver averages 15 seconds. Their cross takes 2 seconds, F2L takes 8 seconds, OLL takes 2.5 seconds, and PLL takes 2.5 seconds. Which step offers the most potential for improvement? →
3. What is a 'multi-slotting' technique in F2L? →
4. A speed solver chooses to learn the Roux method instead of CFOP. What is the main structural difference between these two methods? →
5. When analyzing a scramble during inspection, a speed solver notices that three cross edges are already adjacent to their correct center. One edge is on the opposite side. Why might they still plan a different cross color? →

(A) Inserting one F2L pair while simultaneously setting up the next pair's pieces for easier insertion
(B) Roux builds two 1x2x3 blocks on opposite sides and then solves the remaining pieces, while CFOP uses a cross and four F2L slots
(C) F2L, because it takes the longest and typically has the most room for efficiency gains through better look-ahead and pair recognition
(D) The single distant edge might require awkward moves, and another color might have all four edges requiring fewer total moves
(E) A rotation turns the entire cube to change which face is in front, and it wastes time because no pieces are actually rearranged

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6. Advanced Algorithms

Circle the correct answer

51. What does OLL stand for in CFOP?
(A) Opposite Layer Logic (B) Orientation of the Last Layer (C) Opening the Last Layer (D) Order of the Last Layer

52. What does PLL stand for in CFOP?
(A) Placement of the Last Layer (B) Position Lock of the Last Layer (C) Pattern of the Last Layer (D) Permutation of the Last Layer

53. How many distinct OLL cases (algorithms) are there in full OLL?
(A) 57 (B) 42 (C) 21 (D) 78

54. How many distinct PLL cases are there in full PLL?
(A) 57 (B) 21 (C) 12 (D) 36

55. In the 2-look OLL method, the last layer orientation is broken into two steps. What does the first step accomplish?
(A) Orienting all corners so yellow faces up (B) Solving the entire last layer in one algorithm (C) Positioning all edges in their correct spots (D) Orienting the four edges so they all have yellow facing up, forming a yellow cross

56. Why is OLL always performed before PLL in the CFOP method?
(A) Because the cube's mechanism requires orientation before permutation (B) Because the letters O and P are in alphabetical order (C) Because OLL algorithms are shorter and should come first (D) Because OLL algorithms can move pieces around, so it would undo any positioning done by PLL if the order were reversed

Write the answer

57. What is an 'algorithm family' in the context of OLL and PLL?
Answer: _____

58. What is the 'Sune' algorithm family in OLL, and why is it one of the first advanced algorithms new CFOP solvers learn?
Answer: _____

59. You recognize an OLL case where all edges are oriented (yellow cross exists) but three corners have yellow facing sideways. How would you identify which specific OLL algorithm to use?
Answer: _____

60. During a solve, you reach the PLL step and notice that all corners are in the correct positions but two pairs of edges need to swap. Which PLL case family is this?
Answer: _____

Match each question to its answer

1. You know the T-perm algorithm and want to learn the J-perm. Your friend tells you the J-perm is related to the T-perm. How would you use this information to learn J-perm faster? →
2. A solver knows 2-look OLL (10 algorithms) and 2-look PLL (6 algorithms). They want to transition to full OLL and PLL (57 + 21 algorithms). What is a good strategy for this transition? →
3. Why do some OLL algorithms for different cases look very similar, differing by only one or two moves? →
4. The PLL cases can be categorized into three types: edge-only, corner-only, and combined edge-and-corner. Why is this categorization useful for a learner? →
5. An OLL algorithm called the 'dot' case requires orienting all four edges and all four corners simultaneously. Why is this generally the longest and most complex OLL case to solve? →

(A) Study how the J-perm modifies the T-perm's structure, since related algorithms share similar move sequences and finger tricks
(B) Because no pieces are pre-oriented, requiring the algorithm to flip all 8 pieces, which requires more moves than cases where some pieces are already correct
(C) It helps with recognition because you can quickly check if corners are solved to narrow down the possible PLL cases
(D) Learn the most common full OLL and PLL cases first, replacing 2-look steps one case at a time while continuing to use 2-look for unlearned cases
(E) Because similar cube states require similar sequences to solve, with small differences in setup or final adjustment

7. Non-Cubic Puzzles

Circle the correct answer

61. What geometric shape is the Pyraminx based on?
(A) A tetrahedron (a pyramid with four triangular faces) (B) A pentagonal prism (five-sided) (C) A cube with rounded corners (D) A regular octahedron (eight faces)

62. How many faces does a Megaminx have?
(A) 8 hexagonal faces (B) 12 pentagonal faces (C) 6 square faces like a Rubik's Cube (D) 20 triangular faces

63. What type of cuts does a Skewb puzzle use?
(A) Circular cuts that create curved pieces (B) Cuts that only separate the top half from the bottom half (C) Horizontal and vertical cuts like a Rubik's Cube (D) Diagonal cuts through the center of the cube, so turns rotate around corner-to-corner axes

64. What makes the Square-1 unique compared to other twisty puzzles?
(A) It is the only puzzle that has exactly one solution (B) It can change shape during scrambling because its pieces are not all the same size (C) It can only be turned in one direction (D) It uses magnets instead of a mechanical core

65. Why is the Pyraminx generally considered easier to solve than a 3x3 Rubik's Cube?
(A) Because the Pyraminx has no algorithms, only intuitive moves (B) Because the Pyraminx was designed specifically for young children (C) Because pyramids are a simpler shape than cubes in general (D) It has far fewer possible states (about 934,000) compared to the Rubik's Cube (43 quintillion), and fewer piece types to manage

66. On a Pyraminx, the four tips can each rotate independently without affecting any other piece. Why does this make them trivially solvable?
(A) Because tips are always solved automatically when the edges are solved (B) Because each tip only has three positions and turning it does not disturb any other piece, so you just match it to its adjacent center color (C) Because tips fall off easily and can be placed back correctly (D) Because the Pyraminx mechanism locks tips in place after one turn

Write the answer

67. How does the Megaminx relate to the 3x3 Rubik's Cube in terms of solving strategy?
Answer: _____

68. The Skewb has a single layer of pieces. Each turn moves exactly half of the puzzle's visible pieces. What mathematical concept does this demonstrate?
Answer: _____

69. You know how to solve a 3x3 Rubik's Cube and want to learn the Pyraminx. What is the most efficient approach?
Answer: _____

70. You want to scramble a Square-1 for practice. Unlike a 3x3, you cannot just randomly turn faces. Why?
Answer: _____

Match each question to its answer

1. The Rubik's Clock is a puzzle with 18 small clock faces arranged in a 3x3 grid on each side. Unlike most twisty puzzles, it has no colored stickers. What do you manipulate instead? →
2. A Mirror Cube (also called a Bump Cube) uses pieces that are all the same color but different shapes. How do you distinguish pieces when solving? →
3. The Pyraminx and 3x3 cube both have a core mechanism, but they work differently. The Pyraminx core connects to what type of pieces? →
4. The 4x4 Rubik's Cube (Rubik's Revenge) introduces 'parity' errors that the 3x3 does not have. What causes these parity issues? →
5. You are comparing the complexity of different twisty puzzles. Arrange these from fewest to most possible states: Pyraminx, 3x3 Rubik's Cube, 2x2 Rubik's Cube, Megaminx. →

(A) You rotate gears and pins to adjust the clock hands on each face until all 18 clocks show 12 o'clock
(B) The 4x4 has identical-looking center and edge pieces that can be swapped invisibly, creating states impossible on a 3x3
(C) By the shape and thickness of each piece, since each piece has a unique size that only fits in one position
(D) The four axial pieces (one at each vertex), which act as fixed reference points similar to 3x3 center pieces
(E) Pyraminx (about 934,000), 2x2 (about 3.7 million), 3x3 (43 quintillion), Megaminx (100 unvigintillion)

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8. Spatial Reasoning & Math

Circle the correct answer

71. In mathematics, what does it mean when we say Rubik's Cube moves form a 'group'?
(A) It means each move can only be done once during a solve (B) It means the cube can only be solved by working in a team of people (C) It means the moves must always be performed in the same fixed order (D) The moves follow specific rules: they can be combined, reversed, done in sequence, and there is a 'do nothing' move

72. What is the mathematical term for rearranging objects in a specific order?
(A) A combination (B) A permutation (C) A transformation (D) A rotation

73. How many axes of rotational symmetry does a standard Rubik's Cube have?
(A) 8 axes, one through each corner (B) 6 axes, one through each face (C) 13 axes: 3 face-to-face, 6 edge-to-edge, and 4 corner-to-corner (D) 3 axes, one for each pair of opposite faces

74. What is the total number of possible positions for a standard 3x3 Rubik's Cube?
(A) Approximately 1 trillion (1,000,000,000,000) (B) Approximately 43 quintillion (43,252,003,274,489,856,000) (C) Exactly 6 to the power of 9 (10,077,696) (D) About 3 billion (3,000,000,000)

75. Why does performing the same move sequence repeatedly on a Rubik's Cube always return it to the solved state eventually?
(A) Because each move cancels out the previous one after enough repetitions (B) Because the cube's springs and mechanism pull it back to alignment (C) Because the cube has a finite number of positions, so repeating any sequence must eventually cycle back to the start (D) Because the colors are magnetic and attract matching stickers

76. What does it mean mathematically when we say two Rubik's Cube algorithms are 'commutative'?
(A) The two algorithms affect completely different pieces of the cube (B) Performing algorithm A then B gives the same result as performing B then A (C) Both algorithms solve the cube in the same number of moves (D) One algorithm is the reverse of the other

Write the answer

77. If a corner piece on a Rubik's Cube can be oriented in 3 different ways in its position, what mathematical concept does this illustrate?
Answer: _____

78. Why is it impossible to twist a single corner piece on a Rubik's Cube while leaving every other piece unchanged?
Answer: _____

79. What is the mathematical relationship between performing a move R and then performing R' (R prime)?
Answer: _____

80. A move sequence needs to be repeated 6 times before the cube returns to its starting state. What is the mathematical 'order' of this sequence?
Answer: _____

Match each question to its answer

1. If you perform the move sequence R U on a solved cube, how would you undo this to return to the solved state? →
2. A Rubik's Cube has 8 corners that can each be in 3 orientations. Ignoring other constraints, how many total corner orientation combinations would be possible? →
3. You discover that performing a sequence S four times returns the cube to its solved state (order 4). After performing S twice, what do you know about the cube's state? →
4. How many distinct positions can the 8 corner pieces of a Rubik's Cube be placed in, ignoring orientation? →
5. If a Rubik's Cube algorithm moves three edge pieces in a cycle (A→B, B→C, C→A), what type of permutation is this called? →

(A) The cube is at the halfway point of the cycle — performing S two more times will solve it
(B) A 3-cycle (also called a cyclic permutation of length 3)
(C) 8! = 40,320 arrangements
(D) Perform U' R' — the inverse of each move in reverse order
(E) 3^8 = 6,561 combinations

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9. F2L Solving

Circle the correct answer

81. What does F2L stand for in CFOP solving?
(A) First Two Layers (B) Final Two Layers (C) Front Two Layers (D) First Two Levels

82. How many F2L slots must be filled to complete the first two layers?
(A) 3 (B) 6 (C) 8 (D) 4

83. What two piece types make up an F2L pair?
(A) A corner and an edge (B) A center and a corner (C) Two corners (D) Two edges

84. In CFOP, which step comes immediately before F2L?
(A) Inspection (B) PLL (C) OLL (D) Cross

85. What is the name of the technique where you pair a corner and edge above the slot, then insert them together?
(A) Pair and insert (B) Lock and drop (C) Twist and place (D) Split and join

86. Where are unsolved F2L pieces typically found before insertion?
(A) In the D (down) layer (B) In the M (middle) slice (C) Inside the cube (D) In the U (upper) layer

Write the answer

87. Why is it more efficient to solve F2L pairs simultaneously rather than solving the first layer corners and second layer edges separately?
Answer: _____

88. What happens to your solved cross if you rotate the D (bottom) layer during F2L?
Answer: _____

89. Explain why cubers often use 'y' rotations (whole cube turns) during F2L.
Answer: _____

90. What does it mean when an F2L pair is described as 'already paired but in the wrong slot'?
Answer: _____

Match each question to its answer

1. Why do advanced cubers learn to solve F2L intuitively rather than memorizing algorithms for every case? →
2. You see a white-red-blue corner in the U layer and the red-blue edge in the U layer. What should you do first? →
3. If an F2L corner is in the correct slot but twisted (oriented incorrectly), what must you do? →
4. You have a corner-edge pair where the corner's white sticker faces the side (not up or down). Which basic F2L case is this? →
5. During F2L, you accidentally insert a pair into the front-left slot instead of the front-right slot. How do you fix this? →

(A) A standard pair case where you can pair them using R U R' or similar
(B) Extract the corner to the U layer, then re-pair and reinsert it correctly
(C) Rotate U to position both pieces so they can be paired
(D) Because understanding the logic lets you handle any situation, even unfamiliar ones
(E) Extract the pair from the wrong slot and reinsert it into the correct slot

10. Last Layer Methods

Circle the correct answer

91. What does OLL stand for in the CFOP method?
(A) Order of the Last Layer (B) Orientation of the Last Layer (C) Opposite Last Layer (D) Outer Layer Logic

92. How many distinct OLL cases exist in full OLL?
(A) 42 (B) 21 (C) 78 (D) 57

93. What is the goal of the OLL step?
(A) To put all top-layer pieces in their correct positions (B) To solve the cross on the top (C) To complete the entire last layer (D) To make all stickers on the top face the same color

94. In 2-look OLL, what do you solve first?
(A) The corners first (B) The side colors (C) The top-face cross (edge orientation) (D) The entire top face

95. What are the three possible edge orientation patterns you can encounter before the first look of 2-look OLL?
(A) Single edge, double edge, triple edge, making this the most widely accepted explanation (B) Cross, T-shape, and square, as this is what research and standard practice suggests (C) Plus, minus, and circle, and this principle applies across similar situations (D) Dot (no edges oriented), L-shape (two adjacent edges), and line (two opposite edges)

96. What algorithm is commonly used to orient edges from a dot case to a cross in 2-look OLL?
(A) R2 D R' U2 R D' R' U2 R' (B) M' U M U M' U M (C) R U R' U R U2 R' (D) F (R U R' U') F' applied multiple times

Write the answer

97. Explain the difference between 'orientation' and 'permutation' in the context of last-layer solving.
Answer: _____

98. Why does 2-look OLL require learning only 9 algorithms instead of 57?
Answer: _____

99. What does it mean when an OLL case is described as having a 'dot' pattern?
Answer: _____

100. Why is it impossible to have exactly one or three edges oriented on the top face during OLL?
Answer: _____

Match each question to its answer

1. Explain why OLL algorithms are designed to affect only the top layer without disturbing F2L. →
2. You see an L-shaped edge pattern on the top face during 2-look OLL. How should you orient the cube before applying the algorithm? →
3. After completing the first look of 2-look OLL (edge cross), you see that all four corners have yellow on the side faces, not on top. Which OLL corner case is this? →
4. You encounter a 'line' edge pattern. You apply F (R U R' U') F' but the edges are still not all oriented. What went wrong? →
5. Apply the Sune algorithm (R U R' U R U2 R') to a case where all corners need orienting. How many times might you need to repeat it? →

(A) Position the L-shape in the back-left corner so the two oriented edges point away from you
(B) Up to 2-3 times, re-checking and adjusting the top layer between applications
(C) The line was not aligned correctly — it must be horizontal (left-right) before applying the algorithm
(D) The 'Headlights' or 'Sune' family case — one of the 7 corner orientation cases
(E) Because OLL algorithms use specific move sequences that temporarily displace F2L pieces but restore them by the end

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11. Last Layer Methods

Circle the correct answer

101. What does PLL stand for in the CFOP method?
(A) Permutation of the Last Layer (B) Pattern of the Last Layer (C) Placement of the Last Layer (D) Position Lock Layer

102. How many distinct PLL cases exist in full PLL?
(A) 13 (B) 57 (C) 21 (D) 36

103. What is 'AUF' in the context of PLL?
(A) Automatic Upper Flip — a special algorithm (B) A Universal Fix — correcting any mistake (C) Adjust U Face — the final U-layer rotation to align the last layer with the rest of the cube (D) All Unsolved Faces — counting unsolved sides

104. Name the two most well-known PLL cases that only swap corner pieces.
(A) H-perm and Z-perm (B) T-perm and Y-perm (C) Ua-perm and Ub-perm (D) Aa-perm and Ab-perm (the A permutations)

105. Which PLL case involves swapping all four edges while leaving corners in place?
(A) F-perm (B) H-perm (C) N-perm (D) T-perm

106. In 2-look PLL, what are the two sub-steps?
(A) First permute edges, then permute corners (B) First permute corners, then permute edges (C) First orient, then permute (D) First solve top, then solve sides

Write the answer

107. Why are there fewer PLL cases (21) than OLL cases (57)?
Answer: _____

108. Explain why the T-perm is often the first full PLL algorithm cubers learn.
Answer: _____

109. What does it mean when two PLL cases are described as 'mirrors' of each other?
Answer: _____

110. Why is the Z-perm considered one of the more difficult PLL cases to execute quickly?
Answer: _____

Match each question to its answer

1. Explain the concept of 'PLL recognition' — how do speed cubers identify which of the 21 cases they have? →
2. You look at the last layer and see matching 'headlights' (two stickers of the same color in a row with a different one between them) on all four sides. Which PLL case is this? →
3. During 2-look PLL, you check the corners and find that two diagonal corners need to be swapped. What algorithm do you use? →
4. You identify a Ua-perm case. How do you determine if it is Ua or Ub before applying the algorithm? →
5. After applying a PLL algorithm, the last layer is solved but rotated 90 degrees clockwise relative to the rest of the cube. What do you do? →

(A) A Y-perm or a corner-swapping algorithm that handles diagonal corner swaps
(B) By looking at the color patterns on two adjacent sides of the last layer to identify headlights, bars, and blocks
(C) Apply AUF: perform a U' move to align the last layer
(D) Check which direction the three edges need to cycle — clockwise is one,

counterclockwise is the other
(E) H-perm (swaps all four edges)

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12. Cubing Culture

Circle the correct answer

111. What does WCA stand for in the context of competitive cubing?
(A) World Championship Authority (B) World Cube Association (C) Worldwide Cube Academy (D) World Cubing Alliance

112. How long is the standard inspection time allowed before a timed solve in WCA competitions?
(A) 30 seconds (B) 10 seconds (C) 15 seconds (D) 60 seconds

113. What is the name of the timing device used in official WCA competitions?
(A) Speedcube timer (B) WCA chronometer (C) Stackmat timer (D) Puzzle clock

114. How many solves are in a standard WCA competition round?
(A) 10 solves averaged, and this has been consistently demonstrated in practice (B) 3 solves with the best time used, which is why this approach is recommended by experts (C) 5 solves, with the best and worst dropped to calculate an average of 3 (D) 1 solve only, and this is the standard approach used in most cases

115. What is a 'DNF' in competition results?
(A) Did Not Fall — the cube stayed intact (B) Digital Number Format — a scoring system (C) Do Not Flip — a rule about cube handling (D) Did Not Finish — the solve is disqualified and does not count

116. What is a '+2' penalty in WCA competitions?
(A) The competitor must wait 2 minutes, making this the most widely accepted explanation (B) 2 extra solves added to the round, and this has been consistently demonstrated in practice (C) The time is doubled, making this the most widely accepted explanation (D) A 2-second penalty added to the solve time when the cube is one move away from being solved when the timer is stopped

Write the answer

117. Why does the WCA use computer-generated scrambles rather than hand-scrambled cubes?
Answer: _____

118. Explain why the 'average of 5' scoring system is considered fairer than using a single best time.
Answer: _____

119. What is 'blind solving' (BLD) and how does it differ from standard speedcubing?
Answer: _____

120. Why do WCA competitions have a delegate (official) present at every event?
Answer: _____

Match each question to its answer

1. Explain why speed cubes used in competition have adjustable tensions and magnets. →
2. You have 15 seconds of inspection time. How should you use this time most effectively? →
3. A competitor's cube pops (a piece flies out) during a timed solve. According to WCA regulations, what should they do? →
4. You are organizing a local speedcubing competition. What is the minimum required to make it an official WCA competition? →
5. A cuber wants to compete in the 'One-Handed' (OH) event. How does their approach need to change from two-handed solving? →

(A) Plan the entire cross solution and identify the first F2L pair's location in the first 10 seconds, then use the remaining 5 seconds to confirm the plan
(B) They must hold and turn the cube with one hand only, typically favoring R and U moves since they are most ergonomic one-handed
(C) Stop the timer, reassemble the cube, and accept a DNF for that solve (or +2 if it is a minor pop depending on the specific regulation)
(D) A WCA delegate must be present, computer-generated scrambles must be used, and results must be submitted to the WCA
(E) Adjustable tensions let cubers customize turning speed and stability for their style, while magnets help pieces snap into aligned positions to reduce lockups

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13. Cube Notation

Circle the correct answer

121. You see two different algorithms that accomplish the same thing: one is 12 moves long and the other is 8 moves long. Both are correct. Why might a speed solver prefer the shorter one?
(A) Fewer moves generally means less time to execute, which helps achieve faster

solve times (B) Longer algorithms risk breaking the cube mechanism (C) The shorter algorithm must be newer and therefore better (D) Shorter algorithms always use easier finger movements

122. A company advertises a Rubik's Cube where you can peel off and rearrange the stickers to 'solve' it instantly. Evaluate whether this is truly solving the cube.
(A) No, but only because it damages the stickers (B) No, because solving means rearranging the pieces through legal moves, not changing the labels on them (C) Yes, because the end result looks the same as a properly solved cube (D) Yes, because there are no official rules about how to solve a cube

123. You have completed the first two layers and are starting the last layer. You perform the yellow cross algorithm, but the cross does not appear. What should you do?
(A) Start the entire solve over from the white cross (B) Take the cube apart and reassemble it correctly (C) Apply the same algorithm again, because some starting patterns require multiple applications (D) Switch to a completely different solving method

124. On a solved cube, you perform the move R. How many stickers change position?
(A) 54, because every sticker on the cube moves (B) 6, because only the edge stickers move (C) 9, because the right face has 9 stickers (D) 20, because 5 pieces move (4 edges and 4 corners cycle, plus the right center stays but stickers around it rotate)

125. Design a 4-week practice plan for a solver who averages 30 seconds and wants to break 20 seconds. They know full CFOP with all OLL and PLL algorithms.
(A) Week 1-2: slow F2L practice for look-ahead, Week 3: cross planning during inspection (plan all 4 edges), Week 4: untimed full solves focusing on fluid transitions between steps (B) Do 500 timed solves per day for 4 weeks to build speed through volume, which is why this approach is recommended by experts (C) Practice only PLL algorithms for 4 weeks since the last step is most visible (D) Learn a completely different method like Roux to start fresh, which is why this approach is recommended by experts

126. The 'ZBLL' system solves both OLL and PLL in a single algorithm when the edges are already oriented. How many algorithms does full ZBLL require?
(A) 57, the same as full OLL alone (B) 78, the same as full OLL plus PLL combined (C) 493 algorithms, which is why very few speed solvers learn the complete set (D) 150, which is double the PLL count

Write the answer

127. The Rubik's Clock is a puzzle with 18 small clock faces arranged in a 3x3 grid on each side. Unlike most twisty puzzles, it has no colored stickers. What do you manipulate instead?
Answer: _____

128. Consider the moves R and U on a Rubik's Cube. If R U produces a different result than U R, what important mathematical property does this demonstrate?
Answer: _____

129. A friend claims that the notation system is unfair because the letter B for the back face is confusing since you cannot see it. Evaluate whether this is a valid criticism of the notation system.
Answer: _____

130. If you could design a cube where each face has 4x4 squares instead of 3x3, how many total visible stickers would your cube have?
Answer: _____

Match each question to its answer

1. Why does the beginner method solve the last layer in multiple separate steps (cross, edge position, corner position, corner orientation) instead of all at once? →
2. On a scrambled cube, you notice that a corner piece has white facing sideways instead of upward. What does this tell you about the piece? →
3. In competition, how long do solvers get to inspect the cube before starting their timed solve? →
4. What does PLL stand for in CFOP? →
5. The Skewb is sometimes described as the 'corner-turning cousin of the 2x2.' What structural similarity supports this description? →

(A) Breaking it into steps reduces the number of algorithms a beginner needs to memorize, trading efficiency for simplicity
(B) Both have 8 corner positions, but the Skewb turns around corner axes while the 2x2 turns around face axes
(C) Permutation of the Last Layer
(D) 15 seconds
(E) The piece is in the correct layer but twisted incorrectly, meaning it needs to be oriented so white faces the white side

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14. Cube Notation

Circle the correct answer

131. In standard Rubik's Cube notation, what does the letter 'U' stand for?
(A) The under face of the cube (B) An undo move (C) The universal rotation (D) The upper face of the cube

132. Someone claims they found a 3x3 Rubik's Cube corner piece with the colors red, orange, and white. Assuming a standard color scheme, what can you conclude?
(A) This corner exists but only on cubes made before 2010 (B) This corner piece cannot exist because red and orange are on opposite faces and can never share a piece (C) This piece belongs in the center of the cube where you cannot see it (D) This is a rare but valid corner piece found on some cubes

133. Design a practice exercise that would help a beginner improve their cross-building speed without learning any new algorithms.
(A) Memorize 50 cross algorithms for every possible starting position (B) Practice turning each face as fast as possible without regard to solving (C) Practice building the cross from increasingly difficult scrambles while trying to plan the first two edge placements before touching the cube (D) Time yourself solving the entire cube and focus on the total time

134. You notice that on a scrambled cube, a particular corner piece has all three of its colors adjacent to their correct center colors, but the corner is twisted clockwise from its correct orientation. How many distinct orientations can a single corner piece have in its correct position?
(A) 4 orientations: matching the four quarter-turn positions (B) 6 orientations: one for each face of the cube (C) 2 orientations: correct or incorrect (D) 3 orientations: correct, twisted clockwise, or twisted counterclockwise

135. In CFOP, what is an 'F2L pair' and why is it important?
(A) Two center pieces that need to be aligned (B) Two edge pieces that are next to each other on the first layer (C) A corner piece and its matching edge piece that are inserted together into the correct slot, solving two pieces simultaneously (D) A pair of matching algorithms used for the first two layers

136. Two different algorithms both cycle three corners. Algorithm A takes 8 moves and Algorithm B takes 12 moves, but they produce the exact same permutation. Which algorithm should a speed solver prefer, and what mathematical principle explains why they produce the same result?
(A) Prefer Algorithm B because longer algorithms are more reliable and less likely to cause errors (B) They cannot produce the same permutation if they have different lengths — the student must have made an error (C) Prefer whichever one uses fewer different face letters, regardless of total move count (D) Prefer Algorithm A (fewer moves). They produce the same result because different paths through the group can reach the same element — many algorithm representations exist for each permutation

Write the answer

137. An algorithm written as (R U R' U') is placed in parentheses and followed by the number 6, like this: (R U R' U')6. What pattern can you identify about what happens when you perform this sequence exactly 6 times?

Answer: _____

138. You want to count all the pieces in a 3x3 Rubik's Cube by type. You count 8 corners and 6 centers. How many edge pieces must there be?

Answer: _____

139. If you wanted to teach someone the beginner method using only written instructions (no videos or demonstrations), what would be the most challenging aspect?

Answer: _____

140. Why does the sequence R U R' U' only affect a small number of pieces rather than scrambling the entire cube?

Answer: _____

Match each question to its answer

1. What is an 'X-cross' in CFOP, and when would a speed solver choose to attempt one? →

2. Why is OLL always performed before PLL in the CFOP method? →

3. Why is the Pyraminx generally considered easier to solve than a 3x3 Rubik's Cube? →

4. How many distinct positions can the 8 corner pieces of a Rubik's Cube be placed in, ignoring orientation? →

5. You need to write down the moves to teach a friend. You turned the left face clockwise, then the bottom face counterclockwise, then the right face twice. What is the correct notation? →

(A) It has far fewer possible states (about 934,000) compared to the Rubik's Cube (43 quintillion), and fewer piece types to manage

(B) 8! = 40,320 arrangements

(C) L D' R2

(D) An extended cross that solves both the cross and one F2L pair simultaneously, attempted when the opportunity appears naturally during inspection

(E) Because OLL algorithms can move pieces around, so it would undo any positioning done by PLL if the order were reversed

15. Cube Notation

Circle the correct answer

141. Some beginner tutorials replace standard notation with arrows and color-coded diagrams. Evaluate whether visual notation is better than letter-based notation for learning.
(A) Both systems are equally effective at all skill levels (B) Letter notation should be learned first because visual aids slow learning down (C) Visual notation can help beginners understand moves initially, but letter notation is essential for communicating algorithms efficiently as skills advance (D) Visual notation is always better because everyone can understand pictures

142. A 3x3 Rubik's Cube has 26 visible cubies (pieces). What occupies the 27th position at the very center of the cube?
(A) A secret 27th cubie with no visible colors (B) An empty space with nothing inside (C) The core mechanism that holds all the pieces together and allows them to rotate (D) A battery that powers the cube's movement

143. What is the purpose of the 'last layer cross' step in the beginner method?
(A) To complete the entire yellow face including corners (B) To orient the last layer edge pieces so they all show yellow on top, forming a yellow cross (C) To move edge pieces to their correct positions around the last layer (D) To solve all last layer pieces at once

144. A speed solver averages 15 seconds. Their cross takes 2 seconds, F2L takes 8 seconds, OLL takes 2.5 seconds, and PLL takes 2.5 seconds. Which step offers the most potential for improvement?
(A) The cross, because it is the first step and sets the pace (B) PLL, because the last step is most important for the final time (C) F2L, because it takes the longest and typically has the most room for efficiency gains through better look-ahead and pair recognition (D) OLL, because it has the most algorithms to optimize

145. How does the Megaminx relate to the 3x3 Rubik's Cube in terms of solving strategy?
(A) The Megaminx uses similar layer-by-layer strategies as the 3x3 but applied to pentagonal faces, so 3x3 skills transfer directly (B) The Megaminx requires completely different algorithms with no relation to 3x3 methods (C) The Megaminx cannot be solved by humans and requires computer assistance (D) The Megaminx is solved by solving each face independently without worrying about adjacent faces

146. How many axes of rotational symmetry does a standard Rubik's Cube have?
(A) 8 axes, one through each corner (B) 3 axes, one for each pair of opposite faces (C) 13 axes: 3 face-to-face, 6 edge-to-edge, and 4 corner-to-corner (D) 6 axes, one through each face

Write the answer

147. Your friend says they 'solved' the cube by completing the white face but none of the side colors match. Evaluate whether the white face is truly solved.
Answer: _____

148. You discover that the sequence R L R' L' repeated 6 times returns the cube to its starting state, while R U R' U' repeated 6 times also returns to the start. Does every 4-move sequence have an order of 6?
Answer: _____

149. The PLL cases can be categorized into three types: edge-only, corner-only, and combined edge-and-corner. Why is this categorization useful for a learner?
Answer: _____

150. The Pyraminx and 3x3 cube both have a core mechanism, but they work differently. The Pyraminx core connects to what type of pieces?
Answer: _____

Match each question to its answer

1. Why does performing the same move sequence repeatedly on a Rubik's Cube always return it to the solved state eventually? →
2. Imagine you are inventing a notation system for a triangular puzzle (like a Pyraminx). The puzzle has 4 faces instead of 6. Design a set of letters you would use and explain your reasoning. →
3. Some people argue that the Rubik's Cube should be called a puzzle, not a toy, because it involves mathematical concepts. Which position is more supported by the cube's structure? →
4. What is the term for the number of times you must repeat a sequence of moves before the cube returns to its starting state? →
5. You are learning CFOP and can execute algorithms quickly, but your solves average 45 seconds with long pauses between F2L pairs. What should you focus on to improve? →

(A) Because the cube has a finite number of positions, so repeating any sequence must eventually cycle back to the start
(B) Use U, L, R, and B for the four faces, choosing letters that match the face positions to stay consistent with the directional naming convention

(C) The order of the sequence
(D) Developing look-ahead during F2L by practicing at a slower, consistent pace without pausing
(E) The puzzle label is well-supported because the cube involves combinatorics, group theory, and spatial reasoning that go beyond simple play

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16. Cube Notation

Circle the correct answer

151. What does 'God's Number' refer to in Rubik's Cube solving?
(A) The total number of possible scrambles of the cube (B) The number of algorithms in the most advanced method (C) The fastest time ever recorded in a competition (D) The maximum number of moves needed to solve any scramble using the most efficient solution, which is 20 for a 3x3

152. You want to create a checkerboard pattern on a solved cube. The algorithm is R2 L2 U2 D2 F2 B2. Why does this algorithm use only half turns (2s) and no quarter turns?
(A) Because half turns are faster than quarter turns (B) Because the checkerboard uses exactly two colors per face, requiring exactly two turns (C) Half turns swap pairs of opposite-colored pieces on each face, creating the alternating pattern without changing their orientation (D) Because quarter turns would break the cube's mechanism

153. What is 'TPS' in speed cubing, and why is it not the only factor that determines solve speed?
(A) TPS is Total Puzzle Score, and it is the only factor because higher scores win (B) TPS is Turns Per Second, measuring how fast you turn, but move count and pauses also affect total time (C) TPS is Timer Precision Standard, and it determines how accurately the timer works (D) TPS is Two-Phase Solving, and it only applies to computer solutions

154. What does the number 2 mean when written after a letter, like in R2?
(A) Turn that face 180 degrees, which is a half turn (B) Turn the right face at double speed (C) Turn the face clockwise two separate times with a pause between them (D) Turn the second layer from the right

155. When you turn the right face (R move), the center piece on the right face stays in position. But on a 4x4 cube, the 'center' pieces DO move. What structural difference explains this?
(A) The 3x3 centers are glued in place while 4x4 centers are not (B) The 4x4 cube is built from weaker materials that let centers move (C) On a 3x3, each face has one

center piece attached to the core, but on a 4x4, there is no single fixed center per face (D) The 4x4 has more stickers, which makes centers heavier and able to slide

156. You successfully built the white cross, but when you check the side colors, one edge's second color does not match its adjacent center. How would you fix this?
(A) Peel off the sticker and swap it with the correct color (B) Start the entire cube solve over from scratch (C) Ignore it because the side colors do not matter for the cross (D) Remove the misaligned edge by turning that face, reposition it on the top layer, and reinsert it correctly

Write the answer

157. You perform the sequence R U R' on a solved cube. Then you perform R U' R'. Are these two sequences inverses of each other?
Answer: _____

158. A speed solver chooses to learn the Roux method instead of CFOP. What is the main structural difference between these two methods?
Answer: _____

159. What is an 'algorithm family' in the context of OLL and PLL?
Answer: _____

160. Competition results show that Pyraminx world records are under 1 second, while 3x3 records are around 3 to 4 seconds. Does this mean the Pyraminx is 3 to 4 times easier than the 3x3?
Answer: _____

Match each question to its answer

1. What is the mathematical term for rearranging objects in a specific order? →
2. How many quarter-turn moves (not counting half turns or cube rotations) exist in standard 3x3 Rubik's Cube notation? →
3. How many center pieces does a standard 3x3 Rubik's Cube have? →
4. In the beginner method, what does 'F2L' stand for? →
5. Design a method to determine whether a Rubik's Cube has been assembled correctly after being taken apart, without solving it completely. →

(A) First Two Layers
(B) 12, because each of the 6 faces can turn clockwise or counterclockwise
(C) A permutation
(D) Count corner twists (must sum to multiple of 3), check edge flips (must be even total), and verify that the piece permutation is even
(E) 6

Riddle & Joke Break

Guess the answer, then check the key!

161. Why did the Rubik's Cube go to therapy?

162. What did the speedcuber say after a personal best?

163. Why did the algorithm refuse to change?

164. What's a cube's favorite letter?

165. Why did the white cross look so proud?

166. What did the scrambled cube say to the solver?

Answer Key

1. A — The upper face of the cube
2. B — The front face of the cube
3. B — 6
4. A — Turn that face counterclockwise (the reverse direction)
5. C — So that every person reading the notation performs the exact same move, no matter how they hold the cube
6. D — Only the top layer rotates; the middle and bottom layers stay still
7. Turn that face 180 degrees, which is a half turn
8. The cube returns to exactly the state it was in before both moves
9. Single letters are faster to read and write, and no two face names start with the same letter
10. 4
    Matching (Cube Notation): 1→D, 2→B, 3→E, 4→C, 5→A
11. D — 54
12. A — Cubies
13. A — 6
14. C — They never move relative to each other and define the color of each face

15. D — Because each corner piece sits at the intersection of three faces, so it shows one color from each face
16. A — An edge piece has two colored stickers and sits between two corners, while a corner piece has three colored stickers
17. The core mechanism that holds all the pieces together and allows them to rotate
18. No piece touches both opposite faces at the same time, so no piece can display colors from two opposite sides
19. Green
20. Blue
    Matching (Cube Structure): 1→B, 2→C, 3→D, 4→A, 5→E
21. C — Making a cross on one face by solving four edge pieces
22. C — The other color on each edge must match the center piece of the adjacent side face
23. B — Solving the first layer corners to complete the entire first layer
24. A — First Two Layers
25. C — White is easy to spot and track, and solving bottom-up lets you see unsolved pieces on top
26. B — A corner piece has three stickers, and all three must match their respective face centers for the corner to be correctly placed
27. Pushing straight down would disrupt the already-solved first layer pieces below
28. To orient the last layer edge pieces so they all show yellow on top, forming a yellow cross
29. They tell you how many edges already have yellow facing up, which determines which algorithm to apply
30. Apply the same algorithm again, because some starting patterns require multiple applications
    Matching (Beginner Solving): 1→D, 2→B, 3→C, 4→E, 5→A
31. C — 20, because 5 pieces move (4 edges and 4 corners cycle, plus the right center stays but stickers around it rotate)
32. A — A pattern where each face shows an alternating grid of two colors, like a chess board
33. A — Back to the exact starting state, because four quarter turns complete a full

360-degree rotation

34. D — The order of the sequence
35. D — Yes, because U' R' is the exact inverse of R U, undoing both moves in reverse order
36. B — Because the R and R' moves cancel out for most pieces, leaving only a few pieces in different positions
37. Look for any edge piece that has both a white sticker and a red sticker, regardless of which face it is on
38. The piece is in the correct layer but twisted incorrectly, meaning it needs to be oriented so white faces the white side
39. They will cycle again, and after several more repetitions they will eventually return to their starting positions
40. Position it above its correct corner slot, then use the algorithm R U2 R' U' R U R' to insert it with white facing down
    Matching (Pattern Recognition): 1→D, 2→A, 3→C, 4→E, 5→B
41. B — A technique where you use individual fingers to turn faces quickly without regripping the cube
42. C — Planning your next moves while your hands are still executing the current moves
43. D — 15 seconds
44. C — CFOP (also called the Fridrich method)
45. A — With the cross on the bottom, the top layer is visible for tracking the next pieces to solve during F2L
46. B — The ability to start the cross on any of the six colors, allowing the solver to choose whichever cross requires the fewest moves
47. A corner piece and its matching edge piece that are inserted together into the correct slot, solving two pieces simultaneously
48. Slow turning forces you to develop look-ahead skills since your eyes have time to plan while your hands move deliberately
49. Search for an alternative cross solution on a different color or different move sequence that uses fewer moves
50. Developing look-ahead during F2L by practicing at a slower, consistent pace

without pausing
Matching (Speed Solving): 1→E, 2→C, 3→A, 4→B, 5→D

51. B — Orientation of the Last Layer
52. D — Permutation of the Last Layer
53. A — 57
54. B — 21
55. D — Orienting the four edges so they all have yellow facing up, forming a yellow cross
56. D — Because OLL algorithms can move pieces around, so it would undo any positioning done by PLL if the order were reversed
57. A group of algorithms that are related by setup moves, mirrors, or inversions, allowing you to learn variations from one base algorithm
58. Sune (R U R' U R U2 R') and its variants orient last-layer corners, and they are short, finger-trick friendly, and foundational for many OLL cases
59. Check the positions and directions of the three misoriented corners relative to the one correctly oriented corner to match a specific OLL case
60. This is an edge-only PLL case, specifically from the Z-perm or H-perm family
Matching (Advanced Algorithms): 1→A, 2→D, 3→E, 4→C, 5→B
61. A — A tetrahedron (a pyramid with four triangular faces)
62. B — 12 pentagonal faces
63. D — Diagonal cuts through the center of the cube, so turns rotate around corner-to-corner axes
64. B — It can change shape during scrambling because its pieces are not all the same size
65. D — It has far fewer possible states (about 934,000) compared to the Rubik's Cube (43 quintillion), and fewer piece types to manage
66. B — Because each tip only has three positions and turning it does not disturb any other piece, so you just match it to its adjacent center color
67. The Megaminx uses similar layer-by-layer strategies as the 3x3 but applied to pentagonal faces, so 3x3 skills transfer directly
68. Binary partition: each move divides the puzzle into exactly two halves along a diagonal axis

69. Learn the few Pyraminx-specific edge algorithms and use your existing spatial reasoning skills, since the puzzle is simpler than a 3x3
70. The top and bottom layers can only be turned when the cut line aligns with a gap between pieces, which depends on the current shape
Matching (Non-Cubic Puzzles): 1→A, 2→C, 3→D, 4→B, 5→E
71. D — The moves follow specific rules: they can be combined, reversed, done in sequence, and there is a 'do nothing' move
72. B — A permutation
73. C — 13 axes: 3 face-to-face, 6 edge-to-edge, and 4 corner-to-corner
74. B — Approximately 43 quintillion (43,252,003,274,489,856,000)
75. C — Because the cube has a finite number of positions, so repeating any sequence must eventually cycle back to the start
76. B — Performing algorithm A then B gives the same result as performing B then A
77. Cyclic symmetry of order 3, because rotating the corner 3 times returns it to its original orientation
78. Because the total corner twist must always be divisible by 3 — a conservation law of the cube
79. R' is the inverse of R — performing R followed by R' returns the cube to its previous state
80. The order is 6
Matching (Spatial Reasoning & Math): 1→D, 2→E, 3→A, 4→C, 5→B
81. A — First Two Layers
82. D — 4
83. A — A corner and an edge
84. D — Cross
85. A — Pair and insert
86. D — In the U (upper) layer
87. It reduces the total number of moves needed
88. The cross edges move out of their correct positions
89. To bring the target slot to the front-right position for easier insertion

90. The corner and edge are connected correctly but sitting in a different slot than where they belong
    Matching (F2L Solving): 1→D, 2→C, 3→B, 4→A, 5→E
91. B — Orientation of the Last Layer
92. D — 57
93. D — To make all stickers on the top face the same color
94. C — The top-face cross (edge orientation)
95. D — Dot (no edges oriented), L-shape (two adjacent edges), and line (two opposite edges)
96. D — F (R U R' U') F' applied multiple times
97. Orientation means making stickers face the correct direction; permutation means moving pieces to the correct positions
98. Because it breaks the 57 cases into two sequential steps, each with a small number of sub-cases
99. No edges on the top face have the top color facing upward
100. Because edge orientation changes in pairs — each algorithm flips an even number of edges
     Matching (Last Layer Methods): 1→E, 2→A, 3→D, 4→C, 5→B
101. A — Permutation of the Last Layer
102. C — 21
103. C — Adjust U Face — the final U-layer rotation to align the last layer with the rest of the cube
104. D — Aa-perm and Ab-perm (the A permutations)
105. B — H-perm
106. B — First permute corners, then permute edges
107. Because permutation has fewer possible arrangements than orientation — there are fewer ways to rearrange 8 pieces than to orient them
108. Because it is short (14 moves), uses only R/U/F moves making it ergonomic, and appears frequently in solves
109. They are the same physical swap pattern but reflected left-to-right, like looking in a mirror

110. Because it requires M-slice moves that are less ergonomic than R/U/F moves for most cubers
Matching (Last Layer Methods): 1→B, 2→E, 3→A, 4→D, 5→C
111. B — World Cube Association
112. C — 15 seconds
113. C — Stackmat timer
114. C — 5 solves, with the best and worst dropped to calculate an average of 3
115. D — Did Not Finish — the solve is disqualified and does not count
116. D — A 2-second penalty added to the solve time when the cube is one move away from being solved when the timer is stopped
117. To ensure fairness — every competitor in a round gets the exact same scramble sequence
118. Because it accounts for consistency — a single lucky solve or unlucky scramble does not determine the result
119. The competitor memorizes the cube's state during inspection, then solves it while blindfolded without seeing the cube
120. To ensure WCA regulations are followed, resolve disputes, and validate that competition results are legitimate
Matching (Cubing Culture): 1→E, 2→A, 3→C, 4→D, 5→B
121. A — Fewer moves generally means less time to execute, which helps achieve faster solve times
122. B — No, because solving means rearranging the pieces through legal moves, not changing the labels on them
123. C — Apply the same algorithm again, because some starting patterns require multiple applications
124. D — 20, because 5 pieces move (4 edges and 4 corners cycle, plus the right center stays but stickers around it rotate)
125. A — Week 1-2: slow F2L practice for look-ahead, Week 3: cross planning during inspection (plan all 4 edges), Week 4: untimed full solves focusing on fluid transitions between steps
126. C — 493 algorithms, which is why very few speed solvers learn the complete set
127. You rotate gears and pins to adjust the clock hands on each face until all 18

clocks show 12 o'clock

128. Non-commutativity — the order in which operations are performed matters

129. The criticism has some practical merit since the back face is harder to visualize, but the notation is still consistent and learnable with practice

130. 96, because each face has 16 stickers and there are 6 faces
Matching (Cube Notation): 1→A, 2→E, 3→D, 4→C, 5→B

131. D — The upper face of the cube

132. B — This corner piece cannot exist because red and orange are on opposite faces and can never share a piece

133. C — Practice building the cross from increasingly difficult scrambles while trying to plan the first two edge placements before touching the cube

134. D — 3 orientations: correct, twisted clockwise, or twisted counterclockwise

135. C — A corner piece and its matching edge piece that are inserted together into the correct slot, solving two pieces simultaneously

136. D — Prefer Algorithm A (fewer moves). They produce the same result because different paths through the group can reach the same element — many algorithm representations exist for each permutation

137. The cube returns to its original solved state because this 4-move sequence cycles back after 6 repetitions

138. 12

139. Communicating the 3D spatial orientation of pieces and moves using only 2D text and images

140. Because the R and R' moves cancel out for most pieces, leaving only a few pieces in different positions
Matching (Cube Notation): 1→D, 2→E, 3→A, 4→B, 5→C

141. C — Visual notation can help beginners understand moves initially, but letter notation is essential for communicating algorithms efficiently as skills advance

142. C — The core mechanism that holds all the pieces together and allows them to rotate

143. B — To orient the last layer edge pieces so they all show yellow on top, forming a yellow cross

144. C — F2L, because it takes the longest and typically has the most room for

efficiency gains through better look-ahead and pair recognition

145. A — The Megaminx uses similar layer-by-layer strategies as the 3x3 but applied to pentagonal faces, so 3x3 skills transfer directly

146. C — 13 axes: 3 face-to-face, 6 edge-to-edge, and 4 corner-to-corner

147. The white face is not truly solved because a correctly solved first layer requires the side colors to match their centers too

148. No, different 4-move sequences can have different orders depending on which pieces they affect and how

149. It helps with recognition because you can quickly check if corners are solved to narrow down the possible PLL cases

150. The four axial pieces (one at each vertex), which act as fixed reference points similar to 3x3 center pieces
Matching (Cube Notation): 1→A, 2→B, 3→E, 4→C, 5→D

151. D — The maximum number of moves needed to solve any scramble using the most efficient solution, which is 20 for a 3x3

152. C — Half turns swap pairs of opposite-colored pieces on each face, creating the alternating pattern without changing their orientation

153. B — TPS is Turns Per Second, measuring how fast you turn, but move count and pauses also affect total time

154. A — Turn that face 180 degrees, which is a half turn

155. C — On a 3x3, each face has one center piece attached to the core, but on a 4x4, there is no single fixed center per face

156. D — Remove the misaligned edge by turning that face, reposition it on the top layer, and reinsert it correctly

157. No, the inverse of R U R' would be R U' R', but these two sequences applied consecutively do not necessarily cancel out because the cube state changes between them

158. Roux builds two 1x2x3 blocks on opposite sides and then solves the remaining pieces, while CFOP uses a cross and four F2L slots

159. A group of algorithms that are related by setup moves, mirrors, or inversions, allowing you to learn variations from one base algorithm

160. No, the time difference reflects the difference in piece count and state complexity, but 'easier' is not a linear relationship with solve time

Matching (Cube Notation): 1→C, 2→B, 3→E, 4→A, 5→D

161. It had too many unresolved issues -- on all six sides!
162. "That was twist-ory in the making!"
163. It had a very specific set of moves and it was sticking to them!
164. F -- because it's always the first move!
165. Because it was the foundation of everything!
166. "I'm all mixed up -- can you help me get it together?"
