

Escapeforge — Activity Book

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

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

1. Pattern Recognition

Circle the correct answer

1. What are the next two numbers in the pattern: 2, 4, 6, 8, , ?
(A) 10, 14 (B) 9, 10 (C) 11, 13 (D) 10, 12
2. What is the missing number in the pattern: 5, 10, 15, , 25?
(A) 22 (B) 19 (C) 18 (D) 20
3. Which shape comes next in the pattern: circle, square, triangle, circle, square, ?
(A) Pentagon (B) Triangle (C) Circle (D) Square
4. What is the rule for this pattern: 1, 3, 9, 27?
(A) Add 8 (B) Multiply by 3 (C) Add 3 (D) Multiply by 2
5. In the color pattern red, blue, blue, red, blue, blue — what color is 9th?
(A) Green (B) Yellow (C) Blue (D) Red
6. What are the next two numbers in the pattern: 100, 90, 80, 70, , ?
(A) 58, 46 (B) 65, 55 (C) 60, 40 (D) 60, 50

Write the answer

7. A tile pattern goes: 1 black, 2 white, 1 black, 2 white. How many white tiles are there in the first 12 tiles total?

Answer: _____

8. Which number does NOT belong in this pattern: 3, 6, 9, 13, 15?

Answer: _____

9. The pattern of dots in triangular rows is: 1, 3, 6, 10. What is the next number?

Answer: _____

10. A staircase pattern adds one step each time. If the first staircase has 1 block and the second has 3, how many blocks does the 4th staircase have?

Answer: _____

Match each question to its answer

1. If the pattern 5, 8, 11, 14... continues, what is the 10th term? →
2. A safe has a keypad pattern: the correct code doubles each digit. If the first digit is 1, what is the 5-digit code? →
3. A lock opens when you enter the 7th number in the pattern: 2, 5, 8, 11, 14... What number opens the lock? →
4. The walls of the escape room have this pattern of stones: row 1 has 1 stone, row 2 has 4, row 3 has 9. What pattern is this? →
5. You find a clue showing: A=1, B=2, C=3. What letter-number pattern gives the secret word CAB? →

- (A) 32
 - (B) 1, 2, 4, 8, 16
 - (C) 20
 - (D) Perfect squares
 - (E) 3, 1, 2
-

2. Basic Ciphers & Codes

Circle the correct answer

11. In a Caesar cipher that shifts each letter 1 place forward, what does the letter A become?
(A) B (B) A (C) C (D) Z
12. In the simplest substitution code, A=1, B=2, C=3... What number does the letter E represent?
(A) 5 (B) 4 (C) 6 (D) 3
13. A reverse alphabet code swaps $A \leftrightarrow Z$, $B \leftrightarrow Y$, $C \leftrightarrow X$. What does the letter A become?
(A) Y (B) A (C) Z (D) B
14. What is the purpose of a cipher?
(A) To make a message louder (B) To translate between languages (C) To compress a file (D) To hide the meaning of a message by encoding it
15. Using the code A=1, B=2... decode '8-5-12-12-15'. What word does it spell?
(A) HELO (B) WORLD (C) HELP (D) HELLO
16. A Caesar cipher shifts each letter 3 places forward. What does the word 'CAT' become?
(A) EBS (B) DBU (C) GEX (D) FDW

Write the answer

17. You receive a secret message using Atbash ($A \leftrightarrow Z$, $B \leftrightarrow Y$, $C \leftrightarrow X \dots$). The encoded message is 'SVOOL'. What is the decoded word?

Answer: _____

18. A pigpen cipher uses a grid of lines and dots to represent letters. In this type of cipher, what does each symbol represent?

Answer: _____

19. Encode the word 'DOG' using a Caesar cipher with a shift of 2.

Answer: _____

20. A secret door has a number code. Decode '20-15-16' using $A=1$, $B=2 \dots$ to find the word that opens it.

Answer: _____

Match each question to its answer

1. Using a Caesar cipher with shift 13 (ROT13), what does the letter N become? →

2. You find a message written backwards: 'EDOC TERCES'. What does it say when decoded? →

3. A message is encoded using only even letters (B, D, F, H...) where $B=1$, $D=2$, $F=3$. What does D-F-B represent? →

4. An intercepted message says: 'KHOOR'. You know it is a Caesar cipher. How do you find the shift? →

5. The escape room door has two encoded messages that must both be decoded for the answer. Message 1 (shift 1): 'BDU'. Message 2 (reverse): 'TAC'. What animal appears in both messages? →

(A) CAT

(B) SECRET CODE

(C) A

(D) 2, 3, 1

(E) Try different shifts until the decoded text is a real word

3. Logic Puzzles

Circle the correct answer

21. If all cats have tails, and Whiskers is a cat, does Whiskers have a tail?

(A) Not enough information (B) Yes (C) Maybe (D) No

22. In logic, what does the word 'NOT' do to a statement?

(A) It reverses the truth value — true becomes false, false becomes true (B) It adds a new condition, and this is the standard approach used in most cases (C) It has no effect, and this principle applies across similar situations (D) It makes the statement stronger, which is the most common explanation for this phenomenon

23. What is a 'premise' in a logical argument?

(A) A false statement used to trick someone (B) A question asked in an argument (C) The final answer of an argument (D) A statement accepted as true that supports the conclusion

24. In a logic puzzle, what does it mean if two clues contradict each other?

(A) One clue erases the other (B) You must use the longer clue (C) They cannot both be true at the same time (D) They both point to the same answer

25. Three friends — Ava, Ben, Carl — each have a different pet: fish, dog, rabbit. Ava does not have the fish. Ben has the dog. Who has the rabbit?

(A) Ava (B) Ben (C) None of them (D) Carl

26. A box is either red OR blue. The box is NOT blue. What color is the box?

(A) Red (B) Cannot be determined (C) Green (D) Blue

Write the answer

27. A message says: 'If the clock reads noon, the door opens.' It is noon. What happens?

Answer: _____

28. If ALL birds can fly, and a penguin is a bird, what would logic say? (Note: penguins actually cannot fly.)

Answer: _____

29. Four clues describe a room's occupant: (1) Not a child. (2) Not elderly. (3) Works in the room. (4) Not a student. Who best fits all clues?

Answer: _____

30. Five suspects are numbered 1-5. The guilty one is: not #1, not #5, not even-numbered. Who is it?

Answer: _____

Match each question to its answer

1. In a grid logic puzzle, three people (Dan, Eve, Fay) sit in seats 1, 2, 3. Dan is not in seat 1. Eve is in seat 3. Fay is not in seat 2. Who is in each seat? →
 2. A room has two doors. Sign A says 'One door leads to treasure, one to a trap.' Sign B says 'Both doors lead to treasure.' If exactly one sign is true, which door should you take? →
 3. A puzzle has these clues about numbers 1-6: The answer is greater than 3. The answer is less than 6. The answer is odd. What is the answer? →
 4. Alex is taller than Beth. Carl is taller than Alex. Beth is shorter than Dan. Dan is shorter than Alex. Order them from shortest to tallest. →
 5. Three light switches control three bulbs. You can see the bulbs from another room. You may only go check once. You turn Switch 1 on for 5 minutes, then off. You turn Switch 2 on and leave it on. You go check. How do you know which switch controls which bulb? →
 - (A) Lit bulb = Switch 2; warm but off bulb = Switch 1; cold off bulb = Switch 3
 - (B) 5
 - (C) Beth, Dan, Alex, Carl
 - (D) The door behind Sign A
 - (E) Seat 1: Fay, Seat 2: Dan, Seat 3: Eve
-

4. Number Puzzles & Sequences

Circle the correct answer

31. What is the next number in the sequence: 2, 4, 6, 8, __?
(A) 10 (B) 9 (C) 12 (D) 11
32. In a number sequence, what do we call the fixed amount added to get from one term to the next?
(A) The sequence gap (B) The common ratio (C) The common difference (D) The term factor
33. What are the next two numbers in the sequence: 1, 1, 2, 3, 5, 8, , ?
(A) 13, 21 (B) 10, 16 (C) 11, 14 (D) 12, 18
34. What type of sequence is 3, 6, 12, 24, 48?
(A) Triangular number sequence (B) Arithmetic sequence (C) Fibonacci sequence
(D) Geometric sequence (each term is multiplied by 2)
35. A locked door has a 3-digit code. The clue says: 'Each digit is 3 more than the previous one, starting at 1.' What is the code?
(A) 147 (B) 123 (C) 159 (D) 136

36. What is the pattern rule for the sequence: 5, 10, 20, 40, 80?

(A) Multiply by 2 (B) Multiply by 3 (C) Add 10 then 20 then 40 (D) Add 5

Write the answer

37. The sequence 1, 4, 9, 16, 25 follows a special pattern. What are these numbers called?

Answer: _____

38. A puzzle gives you the sequence: 100, 90, 81, 73, 66. What is the pattern?

Answer: _____

39. In an escape room, a safe requires the 10th term of the sequence that starts 3, 7, 11, 15, ... What number do you enter?

Answer: _____

40. A treasure chest code is formed by the first three triangular numbers. What is the code?

Answer: _____

Match each question to its answer

1. You discover a sequence on a wall: 2, 6, 18, 54, . **The missing number opens a locked gate. What is it?** → __

2. A magic square is a grid where every row, column, and diagonal adds up to the same number. In a 3x3 magic square using 1-9, what is that sum? →

3. You find a number wall puzzle. The bottom row is 3, 5, 7. Each brick above holds the sum of the two bricks below it. What number is at the top? →

4. A clock in an escape room shows the sequence: 1, 8, 27, 64. What kind of numbers are these, and what comes next? →

5. A puzzle has two interlocking sequences: 1, 2, 2, 4, 3, 8, 4, 16, , . What are the next two numbers? →

(A) 20

(B) 15

(C) Perfect cubes; next is 125

(D) 162

(E) 5, 32

5. Spatial Reasoning

Circle the correct answer

41. How many faces does a standard cube have?
(A) 12 (B) 4 (C) 6 (D) 8
42. What is the name of a flat pattern that can be folded into a 3D shape?
(A) A silhouette (B) A blueprint (C) A cross-section (D) A net
43. If you rotate the letter 'N' 90 degrees clockwise, what does it look like?
(A) A sideways Z shape (B) The letter U (C) An upside-down N (D) The letter M
44. What is a 'cross-section' of a 3D shape?
(A) The 2D shape you see when you slice through a 3D object (B) The shadow of a 3D shape (C) The net of a 3D shape (D) The number of edges on a 3D shape
45. An escape room map shows a room as a rectangle viewed from above. The rectangle is 8 units long and 5 units wide. What is the area of the room on the map?
(A) 26 square units (B) 40 square units (C) 80 square units (D) 13 square units
46. If you look at a cylinder from directly above, what 2D shape do you see?
(A) A circle (B) A rectangle (C) A square (D) An oval

Write the answer

47. A puzzle shows a mirror placed along the right edge of the letter 'b'. What letter appears in the reflection?

Answer: _____

48. An escape room puzzle gives you coordinates on a grid: start at (2, 3), move right 4 and up 2. What are your new coordinates?

Answer: _____

49. A net shows a cross made of 6 squares. When folded, which 3D shape does it form?

Answer: _____

50. You are in an escape room facing north. You turn 90 degrees clockwise, then 180 degrees clockwise. Which direction are you now facing?

Answer: _____

Match each question to its answer

1. A treasure is hidden at the point where lines from (1, 1) to (5, 5) and from (1, 5) to (5, 1) cross. What are the coordinates of the treasure? →
2. An escape room box is 10 cm long, 6 cm wide, and 4 cm tall. How much wrapping paper (surface area) would you need to cover it completely? →
3. A puzzle shows a shape that has been rotated. The original L-shape has its long arm pointing right and short arm pointing up. After rotating 180 degrees, which way do the arms point? →

4. You have a cube with a dot on the top face and a star on the front face. If you tip the cube forward (toward you), what symbol is now on top? →
5. A floor plan shows an L-shaped room. The full rectangle would be 12 m by 8 m, but a 4 m by 4 m square is cut from one corner. What is the floor area? →
- (A) Long arm pointing left, short arm pointing down
 - (B) The star
 - (C) 80 square meters
 - (D) (3, 3)
 - (E) 248 square cm
-

6. Advanced Ciphers & Codes

Circle the correct answer

51. In a Caesar cipher, what operation is performed on each letter of the plaintext?
- (A) Each letter is swapped with the letter next to it (B) Each letter is converted to a number (C) Each letter is shifted by a fixed number of positions in the alphabet (D) Each letter is replaced by its reverse alphabet equivalent
52. What is the Atbash cipher?
- (A) A cipher using pairs of letters (B) A cipher using numbers instead of letters (C) A cipher where A=Z, B=Y, C=X (the alphabet is reversed) (D) A cipher where each letter shifts by its position number
53. What does 'modular arithmetic' mean in the context of ciphers?
- (A) Numbers wrap around after reaching a maximum (like a clock going from 12 back to 1) (B) Using only even numbers, which is the most common explanation for this phenomenon (C) Only working with prime numbers, and this has been consistently demonstrated in practice (D) Dividing numbers into modules, and this principle applies across similar situations
54. What is a 'keyword cipher'?
- (A) A cipher that only encrypts keywords (B) A substitution cipher where a keyword determines the scrambled alphabet order (C) A cipher that uses dictionary words as code (D) A cipher requiring a password to start
55. Using a Caesar cipher with shift 5, encrypt the word 'HELP'.
- (A) LIPQ (B) MJQU (C) NKRV (D) GDKO

56. In the Vigenere cipher, how does the encryption key work differently from a Caesar cipher?

(A) Each letter of the key provides a different shift amount for the corresponding plaintext letter (B) The key is a single number used for all letters (C) The key reverses the alphabet (D) The key determines which letters to skip

Write the answer

57. A message is encoded in binary: 01001000 01001001. Each byte represents an ASCII character. What does it say?

Answer: _____

58. What is a 'rail fence cipher' and how does it work?

Answer: _____

59. In frequency analysis, which letter appears most often in English text?

Answer: _____

60. Decode this message using Atbash cipher: 'SVOOL'

Answer: _____

Match each question to its answer

1. Use the Vigenere cipher with key 'CAT' to encrypt 'DOG'. What is the result? →

2. A Polybius square arranges the alphabet in a 5x5 grid (I and J share a cell). The letter at row 2, column 3 is H. If the grid fills left to right, top to bottom (A=row1col1), what number pair represents the letter 'N'? →

3. You intercept a Caesar-ciphered message where 'W' appears most frequently. Using frequency analysis, what is the most likely shift value? →

4. Encrypt 'ESCAPE' using a rail fence cipher with 2 rails. What is the ciphertext? →

5. A pigpen cipher uses geometric shapes to represent letters. What type of cipher is this classified as? →

(A) FOZ

(B) A substitution cipher (each letter is replaced by a unique symbol)

(C) Row 3, Column 3 (code: 33)

(D) 18 (since W is 18 positions after E)

(E) ECPSAE

7. Deductive Reasoning

Circle the correct answer

61. What is deductive reasoning?

(A) Drawing a specific conclusion from general rules or premises that are known to be true (B) Making a guess based on limited information (C) Using intuition to solve problems (D) Finding patterns in examples

62. What is the difference between deductive and inductive reasoning?

(A) Deductive goes from general to specific (guaranteed conclusion); inductive goes from specific observations to general patterns (probable conclusion) (B) There is no meaningful difference, making this the most widely accepted explanation (C) Deductive uses numbers; inductive uses words, which is why this approach is recommended by experts (D) Deductive is always correct; inductive is always wrong, and this has been consistently demonstrated in practice

63. In logic, what is a 'syllogism'?

(A) A sequence of three questions (B) A logical fallacy (C) A logical argument with two premises and one conclusion (D) A type of mathematical equation

64. What does 'if P, then Q' mean in formal logic?

(A) P and Q are always true (B) P and Q are the same thing (C) Whenever P is true, Q must also be true (D) P causes Q to happen

65. An escape room clue states: 'All rooms with green doors lead to puzzles. Room 7 has a green door.' What can you conclude?

(A) Room 7 leads to a puzzle (B) All puzzle rooms have green doors (C) Room 7 is the only room with puzzles (D) Room 7 does not lead to a puzzle

66. A clue says: 'If the clock shows 3, the north door opens.' The clock shows 3. Using modus ponens, what do you know?

(A) The south door opens (B) The north door opens (C) The clock must be wrong (D) Nothing -- the clue might be false

Write the answer

67. A clue says: 'If the red button is pressed, the lights turn off.' The lights are still on. What can you conclude?

Answer: _____

68. An escape room has 5 suspects: Alex, Beth, Cara, Dan, Eve. You know: (1) The culprit wore a hat. (2) Alex, Beth, and Cara did not wear hats. Who could be the culprit?

Answer: _____

69. 'If it is a weekend, the escape room is fully booked. Today the escape room is not fully booked.' The statement 'Therefore, today is not a weekend' is an example of which logical rule?

Answer: _____

70. In an escape room, there are 4 colored boxes: red, blue, green, yellow. Clues state: (1) The key is not in the red or yellow box. (2) The key is not in the green box. Where is the key?

Answer: _____

Match each question to its answer

1. Three friends -- Kai, Lea, Max -- each like a different fruit: apple, banana, cherry. Kai does not like apples. Lea does not like bananas or cherries. What fruit does each person like? →

2. Five people stand in a line. Alice is not first or last. Bob is immediately after Alice. Carol is last. Dave is before Alice. Who is first? →

3. An escape room puzzle states: 'Either the safe combination starts with 7 or it starts with 3. It does not start with 7!' What number does the combination start with? →

4. You know: (1) If it rained, the garden is wet. (2) If the garden is wet, the flowers bloom. (3) It rained. What can you conclude? →

5. A locked box has buttons labeled A, B, C, D. The rules are: (1) If A is pressed, B must also be pressed. (2) If B is pressed, C cannot be pressed. (3) C must be pressed. Can A be pressed? →

(A) Kai likes bananas, Lea likes apples, Max likes cherries

(B) No -- pressing A forces B, and pressing B forbids C, but C is required

(C) 3

(D) Dave

(E) The flowers bloom (by chaining: rain -> wet garden -> flowers bloom)

8. Combinatorics & Probability Puzzles

Circle the correct answer

71. What is a 'permutation' in mathematics?

(A) A way to divide items equally (B) A random selection of items (C) An arrangement of items where the order matters (D) A group of items where order does not matter

72. What is a 'combination' in mathematics?

(A) A selection of items where the order does NOT matter (B) An arrangement of items in a specific order (C) A lock's secret code (D) A sequence of numbers

73. What does $5!$ (5 factorial) equal?

(A) 120 (B) 25 (C) 60 (D) 720

74. What is the probability of an event that is certain to happen?

(A) 0.5 (B) 1 (or 100%) (C) 0 (D) Infinity

75. An escape room lock has 3 digits, each from 0-9. How many possible codes are there if digits can repeat?

(A) 100 (B) 720 (C) 1,000 (D) 30

76. What is the probability of flipping a fair coin and getting heads?

(A) $\frac{2}{3}$, which is the most widely accepted explanation for this concept (B) $\frac{1}{2}$ or 50% (C) $\frac{1}{4}$, since this follows logically from the fundamental principles involved (D) $\frac{1}{3}$, based on the established understanding in this subject area

Write the answer

77. If you roll a standard 6-sided die, what is the probability of rolling a number greater than 4?

Answer: _____

78. Explain why the number of combinations is always less than or equal to the number of permutations for the same selection.

Answer: _____

79. An escape room has 5 keys and 5 locks. If you try keys randomly, how many different ways can you assign all 5 keys to the 5 locks?

Answer: _____

80. A bag contains 3 red, 2 blue, and 5 green marbles. You draw one marble at random. What is the probability it is blue?

Answer: _____

Match each question to its answer

1. An escape room team of 3 must be chosen from 7 players. How many different teams are possible? →

2. A 4-digit escape room code uses only the digits 1, 2, 3, 4 with no repeats. How many possible codes exist? →

3. You flip two coins simultaneously. What is the probability of getting exactly one head and one tail? →

4. An escape room has 3 doors. Behind one is the exit, behind the other two are dead ends. You pick Door 1. The host opens Door 3 (a dead end) and offers you the chance to switch to Door 2. Should you switch? →

5. A puzzle box has 4 switches, each either ON or OFF. How many different configurations of switches are possible? →

- (A) 35
 - (B) $\frac{2}{4}$ or $\frac{1}{2}$
 - (C) 16
 - (D) Yes -- switching gives you a $\frac{2}{3}$ chance of winning compared to $\frac{1}{3}$ if you stay
 - (E) 24
-

9. Puzzle & Escape Room Logic

Circle the correct answer

81. What is the probability of an event that is certain to happen?
(A) 0 (B) 0.5 (C) 1 (D) 2
82. What is the term for the middle value when a set of numbers is arranged in order?
(A) Median (B) Range (C) Mode (D) Mean
83. How many possible outcomes are there when rolling a standard six-sided die?
(A) 8 (B) 6 (C) 4 (D) 12
84. What does the word 'random' mean in a probability experiment?
(A) Every outcome has an equal chance of occurring (B) The experiment cannot be repeated (C) Only certain outcomes are possible (D) The outcome is predetermined
85. What is the most frequently occurring value in a data set called?
(A) Median (B) Mean (C) Mode (D) Range
86. What is the range of a data set?
(A) The most common value, which is the most common explanation for this phenomenon (B) The average of all values, which is why this approach is recommended by experts (C) The difference between the highest and lowest values (D) The middle value, and this is the standard approach used in most cases

Write the answer

87. Why is flipping a fair coin considered to have a probability of 0.5 for heads?
Answer: _____
88. What does it mean when we say two events are independent?
Answer: _____
89. Explain why a larger sample size generally gives more reliable results.
Answer: _____

90. What is the difference between experimental and theoretical probability?

Answer: _____

Match each question to its answer

1. Why can the probability of any single event never be greater than 1? →
2. A bag contains 3 red marbles, 5 blue marbles, and 2 green marbles. What is the probability of drawing a blue marble? →
3. You roll two dice. What is the probability that the sum is 7? →
4. Find the mean of this data set: 12, 15, 18, 21, 24. →
5. A spinner has 8 equal sections. Three sections are red, two are blue, and three are yellow. What is the probability of NOT landing on red? →

- (A) Because 1 represents absolute certainty that the event will occur
 - (B) $\frac{1}{2}$
 - (C) $\frac{5}{8}$
 - (D) 18
 - (E) $\frac{1}{6}$
-

10. Puzzle & Escape Room Logic

Circle the correct answer

91. In graph theory, what is a vertex?

(A) The area inside a shape (B) The weight of a connection (C) A point or node in a graph (D) A line connecting two points

92. What is an edge in graph theory?

(A) A point in a graph (B) The boundary of a graph (C) A type of vertex (D) A connection between two vertices

93. What is the degree of a vertex?

(A) The number of edges connected to that vertex (B) The number of vertices in the graph (C) The distance from the center of the graph (D) The angle at that vertex

94. What is a path in graph theory?

(A) Any collection of edges (B) Two vertices connected by one edge (C) A sequence of vertices connected by edges where no vertex is repeated (D) A cycle that returns to the start

95. What famous problem in mathematics involves crossing seven bridges in Königsberg?

- (A) The Seven Bridges of Königsberg problem by Euler (B) Fermat's Last Theorem
(C) The Traveling Salesman Problem (D) The Pythagorean theorem

96. What is a circuit (or cycle) in a graph?

- (A) A path that starts and ends at the same vertex (B) A graph with no edges (C) An edge that connects a vertex to itself (D) A path that visits every vertex

Write the answer

97. Why was Euler able to prove that crossing all seven Königsberg bridges exactly once was impossible?

Answer: _____

98. What is the difference between an Euler path and an Euler circuit?

Answer: _____

99. Explain why a graph where every vertex has an even degree must have an Euler circuit.

Answer: _____

100. How does a weighted graph differ from an unweighted graph?

Answer: _____

Match each question to its answer

1. Why are graphs useful for modeling real-world networks? →

2. A graph has 5 vertices with degrees 2, 2, 3, 3, and 4. Does this graph have an Euler path? Why or why not? →

3. Draw a graph with 4 vertices where every vertex has degree 2. What shape does it form? →

4. A delivery truck needs to travel along every street in a neighborhood and return to the warehouse. The neighborhood map has 6 intersections, and every intersection connects to an even number of streets. Is this possible without repeating any street? →

5. A network has vertices A, B, C, D, and E with edges: A-B (weight 3), A-C (weight 7), B-C (weight 2), B-D (weight 5), C-D (weight 1), C-E (weight 6), D-E (weight 4). Find the shortest path from A to E. →

- (A) Yes, because exactly 2 vertices have odd degree (the vertices with degree 3)
(B) Yes, because all vertices have even degree, so an Euler circuit exists
(C) They simplify complex systems by showing only the connections between entities, regardless of physical layout

- (D) A square (or any 4-sided cycle/quadrilateral)
 - (E) $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E$ with total weight 10
-

11. Puzzle & Escape Room Logic

Circle the correct answer

101. What does 'optimization' mean in mathematics?

(A) Making a problem more complicated, and this has been consistently demonstrated in practice (B) Drawing the most accurate graph, which is why this approach is recommended by experts (C) Finding the best possible solution from a set of choices, often maximizing or minimizing something (D) Eliminating all variables from an equation, making this the most widely accepted explanation

102. What is a constraint in an optimization problem?

(A) The objective you want to maximize (B) A limitation or restriction that the solution must satisfy (C) An optional guideline (D) The answer to the problem

103. What is the 'objective function' in an optimization problem?

(A) The number of variables (B) The graph of the solution (C) The quantity you are trying to maximize or minimize (D) The list of constraints

104. What is the Traveling Salesman Problem (TSP)?

(A) Finding the fastest way to deliver mail (B) Finding the city with the most connections (C) Finding the shortest route that visits every city exactly once and returns to the starting city (D) Connecting all cities with the minimum road length

105. What is the 'knapsack problem' in optimization?

(A) Sorting items by weight, which is the most common explanation for this phenomenon (B) Choosing items with given weights and values to fit in a container with a weight limit while maximizing total value (C) Packing as many items as possible into a bag, making this the most widely accepted explanation (D) Finding the lightest item in a collection, and this is the standard approach used in most cases

106. What is a 'feasible solution' in optimization?

(A) Any solution that satisfies all the constraints of the problem (B) A solution that uses no resources (C) The best possible solution (D) A solution that maximizes profit

Write the answer

107. Why is the Traveling Salesman Problem difficult to solve for large numbers of cities?

Answer: _____

108. Explain why a greedy algorithm does not always find the optimal solution.

Answer: _____

109. What is the difference between maximization and minimization problems?

Answer: _____

110. Why do real-world optimization problems usually have constraints?

Answer: _____

Match each question to its answer

1. How does scheduling relate to optimization? →

2. You have a backpack that holds 15 kg. Available items: Tent (8 kg, value 12), Food (5 kg, value 8), Water (3 kg, value 6), Map (1 kg, value 3), First Aid (4 kg, value 7). Find the most valuable combination. →

3. A pizza shop can make 12 pizzas per hour. They have orders for 5 pepperoni (20 min each), 3 veggie (15 min each), and 4 cheese (10 min each). In what order should they make the pizzas to finish the most orders in the first hour? →

4. You need to get from City A to City D. Routes: A→B costs \$5, A→C costs \$8, B→C costs \$2, B→D costs \$9, C→D costs \$4. What is the cheapest route from A to D? →

5. A student has 6 hours to study for 4 tests. Each test has a different difficulty. If they spend 2 hours on Math, they get 90. If 1.5 hours on Science, they get 85. If 1 hour on History, they get 80. If 1.5 hours on English, they get 88. Can they get 80+ on all tests? What is the total study time needed? →

(A) Food + Water + Map + First Aid = 13 kg, value 24

(B) A → B → C → D costing \$11

(C) Make the quickest pizzas first: 4 cheese (40 min), then 3 veggie (45 min total so far), using the remaining 15 minutes for 1 pepperoni — completing 8 orders

(D) Scheduling assigns tasks to time slots while minimizing total time, conflicts, or idle periods

(E) Yes, the total is exactly 6 hours ($2 + 1.5 + 1 + 1.5 = 6$), and all scores would be 80 or above

12. Puzzle & Escape Room Logic

Circle the correct answer

111. What is cryptanalysis?

(A) The study of computer programming (B) The study of creating secret codes (C) The study of breaking codes and ciphers without knowing the key (D) The study of ancient languages

112. What is steganography?

(A) The practice of hiding a secret message within an ordinary, non-secret object or message (B) A method of compressing files, which is the most common explanation for this phenomenon (C) A way to speed up internet connections, making this the most widely accepted explanation (D) A type of encryption algorithm, and this has been consistently demonstrated in practice

113. What is frequency analysis in code-breaking?

(A) Counting how often each letter appears in an encrypted message to deduce the substitution pattern (B) Measuring the speed of encryption, as this is what research and standard practice suggests (C) Counting how many messages are sent per day, which is the most common explanation for this phenomenon (D) Analyzing radio frequencies, and this is the standard approach used in most cases

114. What is a Vigenere cipher?

(A) A polyalphabetic cipher that uses a keyword to shift each letter by a different amount (B) A cipher that replaces each letter with a number (C) A cipher that only works with computers (D) A cipher that reverses the message

115. What is a digital watermark?

(A) A method of deleting files permanently, and this has been consistently demonstrated in practice (B) Hidden data embedded in digital media like images, audio, or video to prove ownership or authenticity (C) A type of computer virus, as this directly follows from the underlying principles (D) A visible stamp on a document, as this directly follows from the underlying principles

116. What is the Caesar cipher?

(A) A substitution cipher where each letter is shifted by a fixed number of positions in the alphabet (B) A cipher that only encodes numbers (C) A cipher invented by Julius Caesar that uses random substitution (D) A cipher that works by reversing words

Write the answer

117. Why does frequency analysis work against simple substitution ciphers but not against the Vigenere cipher?

Answer: _____

118. How does hiding a message in the least significant bits of an image work?

Answer: _____

119. Explain why the Vigenere cipher was called 'le chiffre indechiffable' (the unbreakable cipher) for nearly 300 years.

Answer: _____

120. What is the difference between encryption and steganography in terms of security approach?

Answer: _____

Match each question to its answer

1. Why is the Kasiski examination effective at breaking the Vigenere cipher? →
2. The encrypted message 'KHOOR ZRUOG' was created using a Caesar cipher. The most frequent letter in the cipher is O. If O represents E, what is the shift and what is the original message? →
3. In a ciphertext of 200 characters, the letter X appears 26 times (13%). In English, E appears about 13% of the time. If this is a simple substitution cipher, what letter does X most likely represent? →
4. You intercept a Vigenere-encrypted message and find the pattern 'QWX' repeated at positions 5, 20, and 50. What can you deduce about the keyword length? →
5. Encode the word 'MATH' using a Vigenere cipher with keyword 'KEY'. →

- (A) Shift of 3; the original message is 'HELLO WORLD'
 - (B) E
 - (C) WERR
 - (D) The keyword length likely divides the distances between repetitions: 15 and 30, so the keyword is probably 5 or 15 letters long
 - (E) It finds repeated sequences in the ciphertext to determine the keyword length, then each position can be attacked with frequency analysis
-

13. Basic Ciphers & Codes

Circle the correct answer

121. A puzzle shows three rows of numbers. Row 1: 1, 2, 3. Row 2: 4, 5, 6. Row 3: 7, 8, 9. What pattern describes the rows?

- (A) Each row has 3 consecutive numbers, starting where the last row ended.
- (B) Numbers are random, as this is what research and standard practice suggests
- (C) Each row multiplies by 3, as this is what research and standard practice suggests
- (D) Each row adds 4, as this directly follows from the underlying principles

122. In a Caesar cipher that shifts each letter 1 place forward, what does the letter A become?

(A) A (B) Z (C) B (D) C

123. Four clues describe a room's occupant: (1) Not a child. (2) Not elderly. (3) Works in the room. (4) Not a student. Who best fits all clues?

(A) A university student (B) A 10-year-old child (C) An adult professional (e.g., a doctor) (D) A retired grandparent

124. A puzzle presents: 0, 1, 1, 2, 4, 7, 13, __. What is the next number?

(A) 20 (B) 26 (C) 24 (D) 22

125. A puzzle shows a shape that has been rotated. The original L-shape has its long arm pointing right and short arm pointing up. After rotating 180 degrees, which way do the arms point?

(A) Long arm pointing left, short arm pointing up (B) Long arm pointing left, short arm pointing down (C) Long arm pointing down, short arm pointing right (D) Long arm pointing up, short arm pointing right

126. You intercept a Caesar-ciphered message where 'W' appears most frequently. Using frequency analysis, what is the most likely shift value?

(A) 22, according to the standard framework used to analyze this topic (B) 8, which is the most widely accepted explanation for this concept (C) 4, since this follows logically from the fundamental principles involved (D) 18 (since W is 18 positions after E)

Write the answer

127. What is deductive reasoning?

Answer: _____

128. Compare these two escape room puzzles for difficulty: Puzzle A has a 3-digit code (0-9, with repeats). Puzzle B has a 3-letter code (A-Z, no repeats). Which puzzle has more possible solutions, and by what factor?

Answer: _____

129. A lock opens when you enter the 7th number in the pattern: 2, 5, 8, 11, 14... What number opens the lock?

Answer: _____

130. Encode the word 'DOG' using a Caesar cipher with a shift of 2.

Answer: _____

Match each question to its answer

1. In the escape room, a clue reads: 'The treasure is NOT in the room where the clock ticks.' You hear a clock ticking in Room 2. Where is the treasure definitely NOT? →
2. Design a number sequence puzzle for an escape room that uses at least two operations and would require a teammate to solve in exactly 4 steps. Describe the sequence and its rule. →
3. Design an escape room spatial puzzle that requires players to use reflections. Describe the setup, the challenge, and how players solve it. →
4. A cipher uses the rule: convert each letter to its position number (A=1, B=2...), multiply by 3, then take mod 26 (with 0 becoming 26). Is this cipher reversible? Why or why not? →
5. Your teammate uses this argument in an escape room: 'Last time, the clue was hidden under the table, so it must be under the table again.' Is this deductive reasoning? Evaluate the argument. →

(A) Example: A message is written backward on a wall. Players must hold a mirror to read it correctly. The reflected text reveals a code for the next lock.

(B) Room 2

(C) Yes, because multiplying by 3 mod 26 has an inverse (multiplying by 9 mod 26)

(D) Example: 2, 5, 11, 23, 47. Rule: multiply by 2, then add 1. Each step applies both operations to get the next term.

(E) No, this is inductive reasoning (generalizing from one past experience) and the conclusion is not guaranteed

14. Basic Ciphers & Codes

Circle the correct answer

131. A tile pattern goes: 1 black, 2 white, 1 black, 2 white. How many white tiles are there in the first 12 tiles total?

(A) 4 (B) 6 (C) 9 (D) 8

132. A Caesar cipher shifts each letter 3 places forward. What does the word 'CAT' become?

(A) DBU (B) GEX (C) EBS (D) FDW

133. Is this argument valid? 'All dogs bark. My alarm barks. Therefore, my alarm is a dog.'

(A) No, because dogs don't bark (B) No, it is a logical fallacy called 'affirming the consequent' (C) Yes, if alarms can bark, making this the most widely accepted explanation (D) Yes, it is valid, and this has been consistently demonstrated in practice

134. Two escape room teams solved the same sequence puzzle differently. Team A used a formula; Team B listed every term up to the answer. Which approach is more efficient for finding the 50th term, and why?

(A) It depends on how fast each team writes, as this directly follows from the underlying principles (B) Team B's listing approach, because it is more thorough (C) Team A's formula approach, because it jumps directly to the answer without computing all prior terms (D) Both are equally efficient, as this directly follows from the underlying principles

135. A net shows a cross made of 6 squares. When folded, which 3D shape does it form?

(A) A cube (B) A rectangular prism (C) An octahedron (D) A pyramid

136. Why is the Vigenere cipher harder to crack than a simple Caesar cipher?

(A) Because the same plaintext letter can encrypt to different ciphertext letters depending on its position (B) Because it was invented later, since this follows logically from the fundamental principles involved (C) Because it uses longer keys, based on the established understanding in this subject area (D) Because it uses numbers instead of letters

Write the answer

137. Three friends -- Kai, Lea, Max -- each like a different fruit: apple, banana, cherry. Kai does not like apples. Lea does not like bananas or cherries. What fruit does each person like?

Answer: _____

138. An escape room puzzle generates a random 5-letter 'word' using only vowels (A, E, I, O, U) with repeats allowed. What is the total number of possible 'words'?

Answer: _____

139. Which number does NOT belong in this pattern: 3, 6, 9, 13, 15?

Answer: _____

140. Which of these encoded messages uses a shift of 3 from the word HELP?

Answer: _____

Match each question to its answer

1. In a grid logic puzzle, three people (Dan, Eve, Fay) sit in seats 1, 2, 3. Dan is not in seat 1. Eve is in seat 3. Fay is not in seat 2. Who is in each seat? →

2. A puzzle has two interlocking sequences: 1, 2, 2, 4, 3, 8, 4, 16, , . What are the next two numbers? →

3. An escape room clue says a shape has exactly one line of symmetry and three sides.

What shape is it? →

4. In frequency analysis, which letter appears most often in English text? →

5. An escape room designer presents this puzzle: 'One of these three statements is true and two are false. (A) The code is 142. (B) The code is not 142. (C) The code is not 315.' If exactly one is true, what is the code? →

- (A) 5, 32
 - (B) An isosceles triangle
 - (C) 315
 - (D) Seat 1: Fay, Seat 2: Dan, Seat 3: Eve
 - (E) E
-

15. Basic Ciphers & Codes

Circle the correct answer

141. You find a clue showing: A=1, B=2, C=3. What letter-number pattern gives the secret word CAB?

- (A) 2, 1, 3 (B) 3, 2, 1 (C) 1, 2, 3 (D) 3, 1, 2

142. An escape room code uses alternating shifts: odd positions shift by 1, even positions shift by 2. Encode 'CODE' using this rule.

- (A) DPGF (B) DQGF (C) EQGG (D) DQGG

143. Three friends — Ava, Ben, Carl — each have a different pet: fish, dog, rabbit. Ava does not have the fish. Ben has the dog. Who has the rabbit?

- (A) Carl (B) None of them (C) Ben (D) Ava

144. A magic square is a grid where every row, column, and diagonal adds up to the same number. In a 3x3 magic square using 1-9, what is that sum?

- (A) 21 (B) 12 (C) 18 (D) 15

145. Design an escape room cipher puzzle that combines two different cipher techniques (one substitution and one transposition). Describe the encoding process and how players would solve it.

(A) Just use a very long Caesar shift, making this the most widely accepted explanation (B) Example: First apply a Caesar shift of 3 to the message, then write the result in a 2-rail fence pattern. Players must first unravel the rail fence, then shift letters back by 3. (C) Hide the message in invisible ink, and this principle applies across similar situations (D) Encrypt the message three times with the same cipher, which is why this approach is recommended by experts

146. 'If it is a weekend, the escape room is fully booked. Today the escape room is not fully booked.' The statement 'Therefore, today is not a weekend' is an example of which logical rule?

(A) Disjunctive syllogism (B) Affirming the consequent (C) Modus ponens (D) Modus tollens

Write the answer

147. An escape room has 5 keys and 5 locks. If you try keys randomly, how many different ways can you assign all 5 keys to the 5 locks?

Answer: _____

148. In the simplest substitution code, A=1, B=2, C=3... What number does the letter E represent?

Answer: _____

149. An escape room clue shows: 'I am a two-digit number. My digits sum to 9. I am divisible by 3 but not by 6. I am greater than 40.' What number am I?

Answer: _____

150. What is a 'cross-section' of a 3D shape?

Answer: _____

Match each question to its answer

1. Using a Caesar cipher with shift 5, encrypt the word 'HELP'. →

2. An escape room team of 3 must be chosen from 7 players. How many different teams are possible? →

3. Which pattern rule would produce the sequence: 3, 7, 11, 15, 19? →

4. An intercepted message says: 'KHOOR'. You know it is a Caesar cipher. How do you find the shift? →

5. You find a grid puzzle where each row and column must contain the numbers 1-4 exactly once (a Latin square). If a 4x4 grid's first row is [1, 2, 3, 4] and second row starts [3, 4, ...], what must fill the rest of row 2? →

(A) MJQU

(B) Try different shifts until the decoded text is a real word

(C) Start at 3, add 4 each time

(D) 35

(E) 1, 2

16. Basic Ciphers & Codes

Circle the correct answer

151. Design a secret 4-number code using a pattern that starts at 3, where each number is the sum of the two before it (like Fibonacci). What is your code?

(A) 3, 4, 5, 6, since this follows logically from the fundamental principles involved
(B) 3, 6, 9, 12, which is the most widely accepted explanation for this concept
(C) 3, 3, 6, 9 (or any valid Fibonacci-type from 3)
(D) 3, 9, 27, 81, according to the standard framework used to analyze this topic

152. A secret door has a number code. Decode '20-15-16' using A=1, B=2... to find the word that opens it.

(A) TON (B) TAP (C) TOP (D) TIP

153. A locked door has a 3-digit code. The clue says: 'Each digit is 3 more than the previous one, starting at 1.' What is the code?

(A) 147 (B) 159 (C) 136 (D) 123

154. You have a cube with a dot on the top face and a star on the front face. If you tip the cube forward (toward you), what symbol is now on top?

(A) Whatever was on the back face (B) Whatever was on the bottom face (C) The dot (D) The star

155. What is the Atbash cipher?

(A) A cipher where A=Z, B=Y, C=X (the alphabet is reversed)
(B) A cipher using pairs of letters
(C) A cipher where each letter shifts by its position number
(D) A cipher using numbers instead of letters

156. A 4-digit escape room code uses only the digits 1, 2, 3, 4 with no repeats. How many possible codes exist?

(A) 64 (B) 256 (C) 24 (D) 16

Write the answer

157. What is the missing number in the pattern: 5, 10, 15, , 25?

Answer: _____

158. Using the code A=1, B=2... decode '8-5-12-12-15'. What word does it spell?

Answer: _____

159. Using the OR truth table (T OR F = T, F OR T = T, F OR F = F, T OR T = T): 'The password is correct' is FALSE and 'The fingerprint matches' is FALSE. Does the security system let you in (using OR)?

Answer: _____

160. The sequence 1, 4, 9, 16, 25 follows a special pattern. What are these numbers called?

Answer: _____

Match each question to its answer

1. A puzzle piece is an irregular shape. When you rotate it 90 degrees clockwise, then reflect it over a vertical line, is the result the same as just reflecting the original over a horizontal line? →
2. In a logic puzzle, you are told: 'All escape rooms have at least one lock. This room has no locks.' What can you deduce about this room? →
3. Two dice are rolled. What is the probability that their sum is 7? →
4. A student claims the next number in 2, 6, 18, 54 is 108. Is this correct, and why? →
5. A pigpen cipher uses a grid of lines and dots to represent letters. In this type of cipher, what does each symbol represent? →

- (A) This room is NOT an escape room (by modus tollens on the definition)
 - (B) No; it should be 162 because the pattern multiplies by 3.
 - (C) Yes, for most shapes, rotating 90 degrees CW then reflecting vertically equals reflecting horizontally
 - (D) A letter based on the shape of its section in the grid
 - (E) 6/36 or 1/6
-

Riddle & Joke Break

Guess the answer, then check the key!

- 161.** Why couldn't the escape room player open the door?
 - 162.** What did the locked door say to the player?
 - 163.** Why did the clock in the escape room stop ticking?
 - 164.** What did one puzzle say to the other?
 - 165.** Why was the escape room so cold?
 - 166.** What do you call an escape room with no puzzles?
-

Answer Key

1. D — 10, 12

2. D — 20
 3. B — Triangle
 4. B — Multiply by 3
 5. C — Blue
 6. D — 60, 50
 7. 8
 8. 13
 9. 15
 10. 10
- Matching (Pattern Recognition): 1→A, 2→B, 3→C, 4→D, 5→E

11. A — B
12. A — 5
13. C — Z
14. D — To hide the meaning of a message by encoding it
15. D — HELLO
16. D — FDW
17. HELLO
18. A letter based on the shape of its section in the grid
19. FQI
20. TOP

Matching (Basic Ciphers & Codes): 1→C, 2→B, 3→D, 4→E, 5→A

21. B — Yes
22. A — It reverses the truth value — true becomes false, false becomes true
23. D — A statement accepted as true that supports the conclusion
24. C — They cannot both be true at the same time
25. A — Ava
26. A — Red
27. The door opens

28. Logic would say penguins can fly — but this shows the first premise is wrong
29. An adult professional (e.g., a doctor)
30. #3
Matching (Logic Puzzles): $1 \rightarrow E$, $2 \rightarrow D$, $3 \rightarrow B$, $4 \rightarrow C$, $5 \rightarrow A$
31. A — 10
32. C — The common difference
33. A — 13, 21
34. D — Geometric sequence (each term is multiplied by 2)
35. A — 147
36. A — Multiply by 2
37. Perfect squares
38. Subtract 10, then 9, then 8, then 7 (decreasing subtraction)
39. 39
40. 136
Matching (Number Puzzles & Sequences): $1 \rightarrow D$, $2 \rightarrow B$, $3 \rightarrow A$, $4 \rightarrow C$, $5 \rightarrow E$
41. C — 6
42. D — A net
43. A — A sideways Z shape
44. A — The 2D shape you see when you slice through a 3D object
45. B — 40 square units
46. A — A circle
47. d
48. (6, 5)
49. A cube
50. West
Matching (Spatial Reasoning): $1 \rightarrow D$, $2 \rightarrow E$, $3 \rightarrow A$, $4 \rightarrow B$, $5 \rightarrow C$
51. C — Each letter is shifted by a fixed number of positions in the alphabet
52. C — A cipher where $A=Z$, $B=Y$, $C=X$ (the alphabet is reversed)

- 53. A — Numbers wrap around after reaching a maximum (like a clock going from 12 back to 1)
- 54. B — A substitution cipher where a keyword determines the scrambled alphabet order
- 55. B — MJQU
- 56. A — Each letter of the key provides a different shift amount for the corresponding plaintext letter
- 57. HI
- 58. A transposition cipher that writes text in a zigzag pattern across rows, then reads each row left to right
- 59. E
- 60. HELLO
Matching (Advanced Ciphers & Codes): 1→A, 2→C, 3→D, 4→E, 5→B
- 61. A — Drawing a specific conclusion from general rules or premises that are known to be true
- 62. A — Deductive goes from general to specific (guaranteed conclusion); inductive goes from specific observations to general patterns (probable conclusion)
- 63. C — A logical argument with two premises and one conclusion
- 64. C — Whenever P is true, Q must also be true
- 65. A — Room 7 leads to a puzzle
- 66. B — The north door opens
- 67. The red button has NOT been pressed
- 68. Dan or Eve
- 69. Modus tollens
- 70. The blue box
Matching (Deductive Reasoning): 1→A, 2→D, 3→C, 4→E, 5→B
- 71. C — An arrangement of items where the order matters
- 72. A — A selection of items where the order does NOT matter
- 73. A — 120
- 74. B — 1 (or 100%)

75. C — 1,000
76. B — $1/2$ or 50%
77. $2/6$ or $1/3$
78. Because combinations group together all the different orderings of the same items into one selection, reducing the count
79. 120
80. $2/10$ or $1/5$
Matching (Combinatorics & Probability Puzzles): $1 \rightarrow A, 2 \rightarrow E, 3 \rightarrow B, 4 \rightarrow D, 5 \rightarrow C$
81. C — 1
82. A — Median
83. B — 6
84. A — Every outcome has an equal chance of occurring
85. C — Mode
86. C — The difference between the highest and lowest values
87. Because there are 2 equally likely outcomes and heads is 1 of them
88. The outcome of one event does not affect the outcome of the other
89. More data reduces the effect of random variation on the results
90. Theoretical is calculated from known outcomes; experimental is based on actual trials
Matching (Puzzle & Escape Room Logic): $1 \rightarrow A, 2 \rightarrow B, 3 \rightarrow E, 4 \rightarrow D, 5 \rightarrow C$
91. C — A point or node in a graph
92. D — A connection between two vertices
93. A — The number of edges connected to that vertex
94. C — A sequence of vertices connected by edges where no vertex is repeated
95. A — The Seven Bridges of Königsberg problem by Euler
96. A — A path that starts and ends at the same vertex
97. Because more than two vertices had an odd degree, making an Euler path impossible
98. An Euler path visits every edge exactly once; an Euler circuit does the same but

starts and ends at the same vertex

99. Because at every vertex you enter, you can always leave by an unused edge, guaranteeing you return to the start
100. In a weighted graph, each edge has a numerical value representing cost, distance, or time
Matching (Puzzle & Escape Room Logic): 1→C, 2→A, 3→D, 4→B, 5→E
101. C — Finding the best possible solution from a set of choices, often maximizing or minimizing something
102. B — A limitation or restriction that the solution must satisfy
103. C — The quantity you are trying to maximize or minimize
104. C — Finding the shortest route that visits every city exactly once and returns to the starting city
105. B — Choosing items with given weights and values to fit in a container with a weight limit while maximizing total value
106. A — Any solution that satisfies all the constraints of the problem
107. Because the number of possible routes grows factorially, making it impossible to check all routes for large inputs
108. A greedy algorithm makes the locally best choice at each step, which may lead to a worse overall solution
109. Maximization seeks the highest possible value of the objective; minimization seeks the lowest
110. Because real resources like time, money, and materials are always limited
Matching (Puzzle & Escape Room Logic): 1→D, 2→A, 3→C, 4→B, 5→E
111. C — The study of breaking codes and ciphers without knowing the key
112. A — The practice of hiding a secret message within an ordinary, non-secret object or message
113. A — Counting how often each letter appears in an encrypted message to deduce the substitution pattern
114. A — A polyalphabetic cipher that uses a keyword to shift each letter by a different amount
115. B — Hidden data embedded in digital media like images, audio, or video to prove ownership or authenticity

116. A — A substitution cipher where each letter is shifted by a fixed number of positions in the alphabet
117. In a substitution cipher, each letter always maps to the same symbol, preserving frequency patterns; the Vigenere cipher maps each letter to different symbols depending on position
118. Each pixel's color values are slightly modified in the last binary digit, which is invisible to the human eye but encodes hidden data
119. It defeated the known code-breaking method (frequency analysis) by using multiple shift values, making patterns harder to detect
120. Encryption makes a message unreadable but visible; steganography hides the message's existence entirely
Matching (Puzzle & Escape Room Logic): 1→E, 2→A, 3→B, 4→D, 5→C
121. A — Each row has 3 consecutive numbers, starting where the last row ended.
122. C — B
123. C — An adult professional (e.g., a doctor)
124. C — 24
125. B — Long arm pointing left, short arm pointing down
126. D — 18 (since W is 18 positions after E)
127. Drawing a specific conclusion from general rules or premises that are known to be true
128. Puzzle B has 15,600 solutions vs Puzzle A's 1,000 -- about 15.6 times more
129. 20
130. FQI
Matching (Basic Ciphers & Codes): 1→B, 2→D, 3→A, 4→C, 5→E
131. D — 8
132. D — FDW
133. B — No, it is a logical fallacy called 'affirming the consequent'
134. C — Team A's formula approach, because it jumps directly to the answer without computing all prior terms
135. A — A cube

136. A — Because the same plaintext letter can encrypt to different ciphertext letters depending on its position
137. Kai likes bananas, Lea likes apples, Max likes cherries
138. 3,125
139. 13
140. KHOS
Matching (Basic Ciphers & Codes): 1→D, 2→A, 3→B, 4→E, 5→C
141. D — 3, 1, 2
142. D — DQGG
143. D — Ava
144. D — 15
145. B — Example: First apply a Caesar shift of 3 to the message, then write the result in a 2-rail fence pattern. Players must first unravel the rail fence, then shift letters back by 3.
146. D — Modus tollens
147. 120
148. 5
149. 45
150. The 2D shape you see when you slice through a 3D object
Matching (Basic Ciphers & Codes): 1→A, 2→D, 3→C, 4→B, 5→E
151. C — 3, 3, 6, 9 (or any valid Fibonacci-type from 3)
152. C — TOP
153. A — 147
154. D — The star
155. A — A cipher where A=Z, B=Y, C=X (the alphabet is reversed)
156. C — 24
157. 20
158. HELLO
159. No, F OR F = F

160. Perfect squares

Matching (Basic Ciphers & Codes): 1→C, 2→A, 3→E, 4→B, 5→D

161. Because they couldn't find the key to success!

162. "You really need to get a handle on this!"

163. It ran out of time -- just like the players!

164. "I think we're a perfect match!"

165. Because someone left all the windows of opportunity open!

166. A regular room!

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