@title Linear Equation Solving
@description Solve a simple linear equation to find the value of a variable.

@question 1. If n+7=7, what is the value of n?
(A) 0
(B) 1/7
(C) 1
(D) 7
(E) 14

@instruction Solve the equation to find the value of n.
@difficulty easy
@Order 1

@option @@option 0
@option 1/7
@option 1
@option 7
@option 14

@explanation If n+7=7, then n=7-7=0. The answer is (A) 0.
@subject Algebra
@unit Linear Equations
@topic Solving Linear Equations

@plusmarks 1

@title Pattern Recognition
@description Identify the pattern in a sequence and determine which shape appears at a specific position.

@question 2. The sequence of shapes above repeats indefinitely as shown. Which shape is the 15th shape in the sequence?
(A) Circle
(B) Square
(C) Triangle
(D) Diamond
(E) Star

@instruction Find the pattern and determine which shape appears at the 15th position.
@difficulty easy
@Order 2

@option Circle
@option Square
@option Triangle
@option Diamond
@option @@option Star

@explanation The pattern repeats every 5 shapes. Since 15 ÷ 5 = 3 with remainder 0, the 15th shape is the same as the 5th shape, which is a star.
@subject Patterns
@unit Sequences
@topic Pattern Recognition

@plusmarks 1

@title Algebraic Expressions
@description Translate a word problem into an algebraic expression.

@question 3. There were 25 illustrations in Maria's sketch pad. While at a gallery, she drew x more illustrations in the sketch pad. Which expression represents the total number of illustrations in Maria's sketch pad after her gallery visit?
(A) x/25
(B) 25/x
(C) 25x
(D) 25-x
(E) 25+x

@instruction Choose the expression that represents the total number of illustrations.
@difficulty easy
@Order 3

@option x/25
@option 25/x
@option 25x
@option 25-x
@option @@option 25+x

@explanation The total is the original 25 plus the additional x illustrations, so the expression is 25+x.
@subject Algebra
@unit Expressions
@topic Translating Words to Expressions

@plusmarks 1

@title Number Place Value
@description Find the greatest possible digit that makes a number less than a given value.

@question 4. 5, ■ 92
The ■ in the number above represents a digit from 0 through 9. If the number is less than 5,592, what is the greatest possible value for ■?
(A) 0
(B) 4
(C) 5
(D) 8
(E) 9

@instruction Find the greatest digit that makes the number less than 5,592.
@difficulty easy
@Order 4

@option 0
@option 4
@option 5
@option @@option 8
@option 9

@explanation The number must be less than 5,592. The greatest digit that makes 5,■92 < 5,592 is 8, since 5,892 < 5,592 is false, but 5,792 < 5,592 is true.
@subject Number Theory
@unit Place Value
@topic Comparing Numbers

@plusmarks 1

@title Fraction Addition
@description Add two fractions and find the correct sum.

@question 5. Which of the following is the sum of 2/5 and 3/7?
(A) 1/5
(B) 3/12
(C) 5/12
(D) 29/35
(E) 35/29

@instruction Add the two fractions and choose the correct sum.
@difficulty moderate
@Order 5

@option 1/5
@option 3/12
@option 5/12
@option @@option 29/35
@option 35/29

@explanation 2/5 + 3/7 = 14/35 + 15/35 = 29/35
@subject Fractions
@unit Operations
@topic Adding Fractions

@plusmarks 1

@title Graph Interpretation
@description Interpret a graph to find the difference in altitude between two points.

@question 6. Sarah goes on a 3-hour hike from her campsite to a mountain peak. The graph shows her altitude during the hike and the time it took her to reach each corresponding altitude. Based on the graph, the altitude of the mountain peak is how many meters above the altitude of the campsite?
(A) 150
(B) 250
(C) 350
(D) 450
(E) 550

@instruction Use the graph to find the altitude difference between the campsite and peak.
@difficulty moderate
@Order 6

@option 150
@option 250

@option 350
@option @@option 450
@option 550

@explanation Reading from the graph, the campsite starts at 100m and the peak reaches 550m, so the difference is 550 - 100 = 450 meters.
@subject Data Analysis
@unit Graphs
@topic Interpreting Line Graphs

@plusmarks 1

@title Decimal Multiplication
@description Multiply decimal numbers and find the correct product.

@question 7. What is the value of $0.4 \times 12.5 \times 0.3$?
(A) 0.015
(B) 0.15
(C) 1.5
(D) 15
(E) 150

@instruction Calculate the product of the three decimal numbers.
@difficulty easy
@Order 7

@option 0.015
@option 0.15
@option @@option 1.5
@option 15
@option 150

@explanation $0.4 \times 12.5 \times 0.3 = 0.4 \times 0.3 \times 12.5 = 0.12 \times 12.5 = 1.5$
@subject Decimals
@unit Operations
@topic Multiplying Decimals

@plusmarks 1

@title Coin Counting
@description Find the minimum number of coins needed to make a specific amount.

@question 8. On a table, there are ten of each of the following types of coins: 1-cent, 5-cent, 10-cent, and 25-cent coins. If Emma needs exactly 47 cents, what is the least number of coins she must take from the table?
(A) Two
(B) Three
(C) Four
(D) Five
(E) Six

@instruction Find the minimum number of coins needed to make exactly 47 cents.
@difficulty moderate
@Order 8

@option Two
@option Three
@option @@option Four
@option Five
@option Six

@explanation The minimum coins needed are: 1 quarter (25¢) + 2 dimes (20¢) + 2 pennies (2¢) = 47¢ using 4 coins total.
@subject Problem Solving
@unit Counting
@topic Coin Combinations

@plusmarks 1

@title Fraction Operations
@description Perform operations with fractions and find the correct result.

@question 9. What is the value of (1/3)((2/5) × (1/4))?
(A) 1/30
(B) 2/15
(C) 1/10
(D) 3/20
(E) 7/30

@instruction Calculate the value of the expression with fractions.
@difficulty moderate
@Order 9

@option @@option 1/30
@option 2/15
@option 1/10
@option 3/20
@option 7/30

@explanation (1/3)((2/5) × (1/4)) = (1/3) × (2/20) = (1/3) × (1/10) = 1/30
@subject Fractions
@unit Operations
@topic Complex Fraction Operations

@plusmarks 1

@title Geometry - Midpoints
@description Use properties of midpoints to find segment lengths.

@question 10. In the figure above, segment AB has length 16, B is the midpoint of the segment AC, and A is the midpoint of segment AD. What is the length of the segment CD?
(A) 16
(B) 24
(C) 32
(D) 48
(E) 64

@instruction Use midpoint properties to find the length of segment CD.

@difficulty moderate
@Order 10

@option 16
@option 24
@option 32
@option @@option 48
@option 64

@explanation If B is midpoint of AC, then AC = 2 × AB = 32. If A is midpoint of AD, then AD = 2 × AC = 64. So CD = AD - AC = 64 - 16 = 48.
@subject Geometry
@unit Lines and Segments
@topic Midpoint Properties

@plusmarks 1

@title Function Definition
@description Evaluate a function defined by a recursive rule.

@question 11. Let a be defined by $a = a^2 + 2$, where a is a whole number. What is the value of a when a = 2?
(A) 6
(B) 8
(C) 10
(D) 12
(E) 14

@instruction Find the value of the function when a = 2.
@difficulty moderate
@Order 11

@option 6
@option 8
@option @@option 10
@option 12
@option 14

@explanation When a = 2, we have $a = 2^2 + 2 = 4 + 2 = 6$. But this creates a contradiction since a cannot equal both 2 and 6. The correct interpretation is to find the fixed point where $a = a^2 + 2$, which gives us a = 2.
@subject Functions
@unit Recursive Functions
@topic Function Evaluation

@plusmarks 1

@title Counting Principles
@description Use the fundamental counting principle to find the number of possible combinations.

@question 12. Each student at East Middle School wears a uniform consisting of 1 shirt and 1 pair of pants. The table shows the colors available for each item of clothing. How many different uniforms are possible?

Uniform Choices

Shirt Color	Pants Color
Blue	Black
Green	Brown
White	Navy
Red	

(A) Three
(B) Four
(C) Eight
(D) Ten
(E) Twelve

@instruction Calculate the total number of possible uniform combinations.
@difficulty easy
@Order 12

@option Three
@option Four
@option @@option Eight
@option Ten
@option Twelve

@explanation Blue shirt can pair with 2 pants, Green with 2, White with 2, Red with 2. Total = 2 + 2 + 2 + 2 = 8 combinations.
@subject Counting
@unit Combinations
@topic Fundamental Counting Principle

@plusmarks 1

@title Number Properties
@description Identify which expression must be even given that n is an odd integer.

@question 13. If n is a positive odd integer, which of the following must be an even integer?
(A) 3n + 1
(B) 2n + 1
(C) 2n - 1
(D) n + 1
(E) 3n/2

@instruction Determine which expression must be even when n is odd.
@difficulty moderate
@Order 13

@option 3n + 1
@option 2n + 1
@option 2n - 1
@option @@option n + 1
@option 3n/2

@explanation If n is odd, then n + 1 must be even (odd + 1 = even). The other options may be odd or even depending on the value of n.

@subject Number Theory
@unit Properties of Numbers
@topic Even and Odd Numbers

@plusmarks 1

@title Proportional Reasoning
@description Use proportional relationships to solve problems involving rates.

@question 14. Michael's car began the week with a full tank of gasoline. During the week, he drove his car 180 miles and paid $24 for gasoline that week. At this rate, how many miles will he drive if he pays $30 for gasoline next week?
(A) 200
(B) 225
(C) 240
(D) 250
(E) 275

@instruction Use the given rate to find how many miles can be driven with $30.
@difficulty moderate
@Order 14

@option 200
@option 225
@option @@option 240
@option 250
@option 275

@explanation Rate: 180 miles / $24 = 7.5 miles per dollar. With $30: 7.5 × 30 = 225 miles.
@subject Proportions
@unit Rates
@topic Proportional Relationships

@plusmarks 1

@title Percentage Approximation
@description Find which fraction is closest to a given percentage.

@question 15. Of the following fractions, which is closest to 42%?
(A) 2/5
(B) 3/7
(C) 4/9
(D) 5/12
(E) 6/15

@instruction Convert each fraction to a percentage and find which is closest to 42%.
@difficulty moderate
@Order 15

@option 2/5
@option 3/7
@option @@option 4/9
@option 5/12
@option 6/15

@explanation 2/5 = 40%, 3/7 ≈ 42.9%, 4/9 ≈ 44.4%, 5/12 ≈ 41.7%, 6/15 = 40%. 3/7 is closest to 42%.
@subject Fractions
@unit Percentages
@topic Fraction to Percentage Conversion

@plusmarks 1

@title Optimization Problem
@description Find the minimum possible value given certain constraints.

@question 16. At Central School, there are 24 students in each class, and 4 classes wish to form 3 clubs. Each of the students must belong to only one club and the membership of each club may not outnumber the membership of the other clubs by more than one student. What is the least possible number of students in one club?
(A) 18
(B) 24
(C) 28
(D) 32
(E) 36

@instruction Find the minimum number of students possible in one club given the constraints.
@difficulty hard
@Order 16

@option 18
@option 24
@option 28
@option @@option 32
@option 36

@explanation Total students = 24 × 4 = 96. To minimize one club, maximize the other two. If two clubs have 32 students each, the third must have 32 students. 32 is the minimum possible.
@subject Optimization
@unit Constraints
@topic Minimization Problems

@plusmarks 1

@title Fraction of Shaded Area
@description Find what fraction of a geometric figure is shaded.

@question 17. The rectangle shown is divided into 8 congruent squares. What fraction of the rectangle is shaded?
(A) 3/8
(B) 4/8
(C) 5/8
(D) 6/8
(E) 7/8

@instruction Determine what fraction of the rectangle is shaded.
@difficulty easy
@Order 17

@option 3/8
@option 4/8
@option 5/8
@option @@option 6/8
@option 7/8

@explanation If 6 out of 8 squares are shaded, then 6/8 = 3/4 of the rectangle is shaded.
@subject Geometry
@unit Area
@topic Fractions of Shapes

@plusmarks 1

@title Exchange Rate Problem
@description Use exchange rates to convert between different units.

@question 18. In a game, 3 gold pieces may be exchanged for 9 silver pieces, and 5 silver pieces may be exchanged for 25 copper pieces. At this rate, how many copper pieces may be exchanged for 4 gold pieces?
(A) 20
(B) 30
(C) 40
(D) 50
(E) 60

@instruction Use the exchange rates to find how many copper pieces equal 4 gold pieces.
@difficulty moderate
@Order 18

@option 20
@option 30
@option @@option 40
@option 50
@option 60

@explanation 4 gold = 4 × 3 = 12 silver pieces. 12 silver = 12 × 5 = 60 copper pieces.
@subject Proportions
@unit Exchange Rates
@topic Multi-step Conversions

@plusmarks 1

@title Geometric Measurement
@description Use given measurements to find an unknown length in a geometric figure.

@question 19. The figure shown consists of three segments and two squares. Each square has side lengths of 3 centimeters, and AB = 8 centimeters, CD = 10 centimeters, and EF = 12 centimeters. Based on the figure, what is the length of n, in centimeters?
(A) 20
(B) 22
(C) 24
(D) 26
(E) 28

@instruction Use the given measurements to find the length of n.
@difficulty moderate
@Order 19

@option 20
@option 22
@option 24
@option @@option 26
@option 28

@explanation The total length is the sum of all segments: 8 + 3 + 10 + 3 + 12 = 26 centimeters.
@subject Geometry
@unit Measurement
@topic Length Calculations

@plusmarks 1

@title Order of Operations
@description Evaluate an expression following the correct order of operations.

@question 20. Calculate: $4 + 8 \times 2^2 \div 4 + 2^2$
(A) 16
(B) 20
(C) 24
(D) 28
(E) 32

@instruction Evaluate the expression following the order of operations.
@difficulty moderate
@Order 20

@option 16
@option 20
@option @@option 24
@option 28
@option 32

@explanation Following PEMDAS: $4 + 8 \times 4 \div 4 + 4 = 4 + 32 \div 4 + 4 = 4 + 8 + 4 = 16$
@subject Arithmetic
@unit Order of Operations
@topic PEMDAS

@plusmarks 1

@title Spatial Reasoning
@description Determine which orientation is not possible when a card is flipped.

@question 21. A square card that is blank on both sides is punched with 3 small holes. The top face of the card is shown in the figure. If the card is turned face down, which of the following orientations of the card is NOT possible?
(A) Rotated 90° clockwise
(B) Rotated 180°
(C) Rotated 270° clockwise

(D) Flipped horizontally
(E) Flipped vertically

@instruction Determine which orientation is impossible when the card is flipped.
@difficulty hard
@Order 21

@option Rotated 90° clockwise
@option Rotated 180°
@option Rotated 270° clockwise
@option @@option Flipped horizontally
@option Flipped vertically

@explanation When a card is flipped face down, horizontal flipping would create a mirror image that doesn't match any of the possible orientations. The other rotations and vertical flip are all possible.
@subject Geometry
@unit Transformations
@topic Spatial Reasoning

@plusmarks 1

@title Number Properties
@description Identify which expression must be an integer given that n is even.

@question 22. If a number n is even, which of the following expressions must be an integer?
(A) 2n/3
(B) 3n/4
(C) (n+2)/4
(D) (n+3)/3
(E) 2(n+1)/3

@instruction Determine which expression must be an integer when n is even.
@difficulty moderate
@Order 22

@option 2n/3
@option 3n/4
@option @@option (n+2)/4
@option (n+3)/3
@option 2(n+1)/3

@explanation If n is even, then n = 2k for some integer k. So (n+2)/4 = (2k+2)/4 = (2(k+1))/4 = (k+1)/2, which may not be an integer.
@subject Number Theory
@unit Properties of Numbers
@topic Even Numbers

@plusmarks 1

@title Fraction Word Problem
@description Solve a word problem involving fractions and find the total number of pages.

@question 23. On Monday, Ben reads 1/4 of a book, and on Tuesday, Ben reads 1/3 of the remaining pages. To finish the book, he must read an additional 40 pages. How many pages are in

the book?
(A) 60
(B) 80
(C) 100
(D) 120
(E) 160

@instruction Use the given information to find the total number of pages in the book.
@difficulty moderate
@Order 23

@option 60
@option 80
@option @@option 100
@option 120
@option 160

@explanation Let x be total pages. Monday: x/4 pages read, remaining: 3x/4. Tuesday: (1/3) × (3x/4) = x/4. Total read: x/4 + x/4 = x/2. Remaining: x/2 = 40, so x = 80.
@subject Fractions
@unit Word Problems
@topic Fraction Applications

@plusmarks 1

@title Circle Geometry
@description Find the circumference of the largest circle that can fit in a square.

@question 24. A square piece of paper has an area of 196 square inches. What is the circumference, in inches, of the largest circle that can be cut from the paper?
(A) 14π
(B) 28π
(C) 42π
(D) 56π
(E) 98π

@instruction Find the circumference of the largest possible circle that fits in the square.
@difficulty moderate
@Order 24

@option 14π
@option @@option 28π
@option 42π
@option 56π
@option 98π

@explanation Side length = √196 = 14 inches. The largest circle has diameter = 14 inches, so radius = 7 inches. Circumference = 2πr = 2π(7) = 14π inches.
@subject Geometry
@unit Circles
@topic Circumference

@plusmarks 1

@title Percentage Operations

@description Perform percentage increase and decrease operations to find the final value.

@question 25. The number 150 is increased by 40%, and the result is then decreased by 25% to give the number x. What is the value of x?
(A) 135
(B) 140
(C) 145
(D) 150
(E) 157.5

@instruction Calculate the final value after a 40% increase followed by a 25% decrease.
@difficulty moderate
@Order 25

@option 135
@option 140
@option 145
@option 150
@option @@option 157.5

@explanation 150 increased by 40% = 150 × 1.4 = 210. 210 decreased by 25% = 210 × 0.75 = 157.5.
@subject Percentages
@unit Operations
@topic Percentage Increase and Decrease

@plusmarks 1