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DETECTIVE ACADEMY: 10 LOGIC MISSIONS

Hello, Future Mathmann Detective! 🕵️✨

Welcome to your official logic training pack. Inside this book, you will solve **10 thrilling mysteries** using pure logical power, structural reasoning, and pattern discovery!

Note for Parents & Teachers: This workbook focuses on foundational relational reasoning. A verified, structurally stable **Answer Key with Explanations** is located at the back of this document to support guided learning.

● LEVEL 1: ROOKIE MISSIONS (CONFIDENCE BUILDERS)

 **Mission 1: The Shape Shifter's Code**

Score: 10 XP

The Story: Mathmann has discovered a locked digital vault. To crack its code, you must decode the repeating cyclical pattern of these geometric shapes.

Which shape belongs in place of the question mark?

▲ → ■ → ● → ▲ → ■ → ?

Options: (A) ▲ Triangle (B) ● Circle (C) ■ Square

**Mission 2: The Multi-Color Line-Up****Score: 20 XP**

The Story: Four young detectives—Arif, Ben, Chloe, and Dan—are standing in a straight line. They are wearing Red, Blue, Green, and Yellow t-shirts. Review the established rules carefully:

- Ben is standing at the very front of the line (1st) and is wearing a **Red** t-shirt.
- Chloe is standing at the very end of the line (4th) and is wearing a **Yellow** t-shirt.
- Arif is standing directly behind Ben (2nd), and his t-shirt is **Blue**.

The Challenge: What color t-shirt is Dan wearing, and what is his exact position in the line?

**LEVEL 2: SUPER-SLEUTH MISSIONS (DEDUCTIVE LOGIC)****Mission 3: The Secret Number Bond Pyramid****Score: 30 XP**

The Story: You have discovered an ancient stone pyramid. The mathematical law inscribed on the wall states that adding two adjacent blocks below reveals the exact total value of the block resting directly above them.

The Challenge: Find the value that belongs at the top of the pyramid:

**Mission 4: The Toy Weight Mystery****Score: 40 XP**

The Story: Mathmann is checking balance equations to calibrate weights on a balanced scale system. He notes down two firm relational laws:

- The weight of **1 Toy Bear** equals exactly **2 Toy Cars**.
- The weight of **1 Toy Car** equals exactly **3 Marbles**.

The Challenge: Calculate how many marbles are required to perfectly balance 1 Toy Bear.

**Mission 5: The Missing Footsteps****Score: 50 XP**

The Story: A target path contains numbered footsteps following a strict addition interval rule. One footstep's value has faded away.

$$3 \rightarrow 7 \rightarrow 11 \rightarrow 15 \rightarrow ? \rightarrow 23$$

🎯 The Challenge: What missing value must replace the question mark to complete the tracking sequence?

🌐 LEVEL 3: MASTER SLEUTH MISSIONS (RELATIONAL MATRIX)

**Mission 6: The Time-Travel Clock****Score: 60 XP**

The Story: A high-tech clock gains time due to an internal systemic acceleration. Every 1 real hour that passes, the clock ticks forward an extra 5 minutes relative to standard time.

- At 12:00 PM (Start), the clock perfectly shows **12:00**.
- At 1:00 PM, the clock displays **1:05**.
- At 2:00 PM, the clock displays **2:10**.
- At 3:00 PM, the clock displays **3:15**.

🎯 The Challenge: What time will this accelerated clock show when the actual real-world time is exactly 5:00 PM?

**Mission 7: The Apple Orchard Dilemma****Score: 70 XP**

The Story: Three individuals—Sam, Tom, and Jerry—logged their item counts in an inventory sheet according to specific quantitative relations:

- Sam collected exactly **double (2x)** the quantity that Tom collected.
- Jerry collected exactly **3 fewer** items than Tom.
- Tom collected exactly **5 items**.

🎯 The Challenge: Determine the individual values for Jerry and Sam, and calculate the combined grand total.

**Mission 8: The Alien House Matrix****Score: 80 XP**

The Story: Three adjacent structures are colored Red, Blue, and Green. Their ID codes are 10, 20, and 30, distributed according to three unique constraints:

- The Red structure's ID code is **not 30**.
- The Green structure has the **lowest ID code** among all structures.
- The Blue structure sits **directly adjacent** to the Red structure.

The Challenge: Pair each colored structure with its correct numerical code based on these rules.

LEVEL 4: MATHMANN GENIUS MISSIONS (ELITE TIER)**Mission 9: The Codebreaker's Clue****Score: 95 XP**

The Story: Decode a secure 3-digit access sequence by evaluating the logical feedback constraints provided below:

- **6 - 8 - 2:** One digit is correct and is positioned in its exact proper slot.
- **6 - 1 - 4:** One digit is correct but is positioned in an incorrect slot.
- **2 - 0 - 6:** Two digits are correct but both are positioned in incorrect slots.
- **7 - 3 - 8:** All digits in this specific string are completely invalid.

The Challenge: What is the single valid 3-digit code that satisfies all criteria?

**Mission 10: The Balance Scale Masterclass****Score: 100 XP**

The Story: Solve this simultaneous symbolic system by determining the absolute weight of each individual shape asset.

- $\bullet + \bullet = 10$
- $\bullet + \blacksquare = 9$
- $\blacksquare - \blacktriangle = 2$

The Challenge: Calculate the precise value of the combined system expression below:

$$\bullet + \blacksquare + \blacktriangle = ?$$

**PARENTS' & TEACHERS' ANSWER KEY****Mission 1 Answer: (B) • Circle**

Pedagogical Value: Pattern Recognition.

Explanation: The system operates on a 3-step repeating cycle: Triangle → Square → Circle. Since the sequence resets directly following the square, a circle completes the pattern.

Mission 2 Answer: Dan is 3rd in line and wearing a Green t-shirt.

Pedagogical Value: Matrix Elimination & Spatial Placement.

Explanation: Ben occupies slot 1 (Red). Arif stands directly behind him in slot 2 (Blue). Chloe is at the terminal position, slot 4 (Yellow). This structurally leaves slot 3 for Dan. Since Red, Blue, and Yellow are claimed, Dan must be paired with Green.

Mission 3 Answer: 16

Pedagogical Value: Hierarchical Addition & Summation.

Explanation: The middle layer values are determined by summing the adjacent lower elements: $3 + 4 = 7$, and $4 + 5 = 9$. Applying this rule to the next layer yields the apex calculation: $7 + 9 = 16$.

Mission 4 Answer: 6 Marbles

Pedagogical Value: Pre-Algebraic Variable Substitution.

Explanation: Given $1 \text{ Bear} = 2 \text{ Cars}$, and $1 \text{ Car} = 3 \text{ Marbles}$. Substituting the car variable into the primary relation yields: $2 \text{ Cars} \times 3 \text{ Marbles} = 6 \text{ Marbles}$.

Mission 5 Answer: 19

Pedagogical Value: Arithmetic Progressions & Constant Intervals.

Explanation: The terms increase by a uniform difference of $+4$ at each transition step ($3+4=7$, $7+4=11$, $11+4=15$). Therefore, the unknown term is $15 + 4 = 19$.

Mission 6 Answer: 5:25

Pedagogical Value: Rate-of-Change Analysis & Accumulation Rates.

Explanation: The mechanism gains a net 5 minutes per standard elapsed hour. Over a 5-hour operational span (from 12:00 to 5:00), the accrued deviation equals $5 \text{ hours} \times 5 \text{ minutes} = 25 \text{ minutes}$. The readout will show 5:25.

Mission 7 Answer: Jerry = 2, Sam = 10; Grand Total = 17 items.

Pedagogical Value: Quantitative Dependencies & Multi-Step Systems.

Explanation: Tom = 5. Sam's value is twice Tom's baseline ($5 \times 2 = 10$). Jerry's value is 3 units below Tom ($5 - 3 = 2$). Summing all components: $5 + 10 + 2 = 17$.

Mission 8 Answer: Green House = 10, Red House = 20, Blue House = 30.

Pedagogical Value: Constrained Sorting & Logical Deduction.

Explanation: The minimum code is 10, isolating Green = 10. The Red structure cannot be assigned to 30, which forces Red = 20. The remaining value is assigned to Blue = 30.

Mission 9 Answer: 042

Pedagogical Value: Exclusions, Contradictions & Intersection Matrices.

Explanation: String 4 isolates 7, 3, and 8 as invalid elements. In String 1, since 8 is invalid, either 6 or 2 is the valid element. String 3 identifies 2 and 0 as correct but misplaced elements, which logically disqualifies 6. Since 2 is valid and was correctly positioned in String 1, the sequence must terminate in (2). String 3 establishes that 0 is valid but misplaced, positioning it at the start (0 2). String 2 confirms 4 is valid but misplaced, positioning it in the center slot. The unique solution is 042.

Mission 10 Answer: 11

Pedagogical Value: Visual Algebraic Reduction.

Explanation: Since two identical circles sum to 10, 1 Circle (●) = 5. Substituting this into the second expression yields $5 + \text{Square} = 9$, meaning Square (■) = 4. The third expression yields $4 - \text{Triangle} = 2$, meaning Triangle (▲) = 2. The final system summation is $5 + 4 + 2 = 11$.

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