



## Eureka!'s Cross-reference to Mathematical Thinking

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*Mathematical thinking* refers to a broad array of mental processes that address our ability to conceptualize, quantify, identify, and manipulate an abstract representation of reality. This type of thinking is critically important to understand and succeed at many endeavors. Another important capability is the ability to look at problems from many perspectives, properly understand the situation, and then derive an applicable solution. Successful problem solving frequently requires the ability to create temporary abstractions of the problem, and then abandon them for different abstractions as warranted. This ability is what we refer to as *Flexibility of Mind*.

Some individuals are able to sit with challenging problems for long periods of time as they work through and eventually solve them. But, far too often, problems get abandoned, not just put aside until later, but just abandoned. This point, at which problems are abandoned, is how we define the *Frustration Threshold*.

Research has shown that discrete thinking processes, such as those which support mathematical thinking, can be strengthened through solving puzzles and game play. This author has previously outlined methodologies using graduated puzzles and games for increasing the *Frustration Threshold* and developing *Flexibility of Mind*. This current paper categorizes many of these commercially available puzzles or games by an assessment of the specific mathematical processes they enhance.

Thinking Processes	Game Categories	Single-player games	Multi-player games
Number Sense, arithmetic	Number games, dice games, domino games	<i>Game of Chips, Shut the Box</i>	<i>Number Chase, Pass the Pigs, Yahtzee, Conceptual Bingo, Mad Math, Make 7, Russian Cross, Rummikub, 8 ½, 24, 99, Mathable (all versions), Rat-a-tat Cat, Exact Change,</i>
Abstract representation	Equation based games, graduated puzzles which use symbols as placeholders for variables	<i>Zoo Logic, Animal Logic, Chocolate Fix, Metaforms, Logic Links,</i>	<i>Equate, 'SMath, Conceptual Bingo (Algebra Focus)</i>
Pattern recognition	Pattern matching games and puzzles	<i>Lonpos, Knoodle, Acuity, TriSpy, Set, Zoki, IQ Twist, Scrambled Squares, Hoppers, Think and Jump, Pixi Cubes, Cheese Puzzle, Utopia, Brain Blocks, D-Box, IQ-Fit, Bend-it</i>	<i>Zoki, , Pohaku, Set, Jungle Speed, Blink, Reflection , Trixio, Pente, Go, Chess, Checker, Backgammon</i>
Reasoning	Logic, strategy, logic problems, lateral thinking problems	<i>Metaforms, Logix II, ZooLogic, Titanic, Rush Hour, Chocolate Fix, Visual</i>	<i>Mindtrap, Clue, Scotland Yard, 333 Baker Street, Spy Alley, Simply Suspects, Alibi, Mr Jack,</i>

Thinking Processes	Game Categories	Single-player games	Multi-player games
		<i>Logic, numerous lateral and logic thinking problem books, Turnstile, Solitaire Chess, 36 Cube</i>	
Sequencing	Number games, jigsaw puzzles, mechanical puzzles, sliding puzzles, 3D puzzles, most board games, card games, all twisty puzzles	<i>Rush Hour, River Crossing, Tip Over, Tavern Puzzles, burr and string puzzles, 15 Puzzle, Eni Puzzle, Apple and the Worm, Bronco, Chicken Shuffle, Monsters, Alcatraz, Anti Virus, Turnstile, Tilt, Solitaire Chess, UnHinged, Amaze, Athen, Perilous Pipes, Hedgehog Escape, Dig it, Oops, Rubik's Cube, Bend-it, Temple Trap</i>	<i>Rummikub, Labyrinth, Sequence, Guillotine, Poker, Gobbler, Tree House, Blokus, Rumis, Exago, Othello, Rolit, Hive, Quarto, Abalone, Four in a Square</i>
Spatial Orientation	Geometric games, maze games, geographic games, tangrams, train games, territorial games, packing puzzles,	<i>Lonpos, Soma cubes, jigsaw puzzles, Tangramino, Architecto, Clicko, Equilibrio, tangrams, Hide &amp; Seek series, IQ Twist, Penguins on Ice, Anaconda, Trio, Block by Block, Brick by Brick, Square by Square, Shape by Shape, Tilt, Cobra Cube, Hedgehog Escape, Perilous Pipes, Utopia, IQ Fit, Bend-it</i>	<i>Blokus, Rumis, Shapes Up, Quoridor, , Ticket To Ride, Empire Builder, Scotland Yard, Go, Exago, Othello, Rolit, Hive, Pente, Go, Carcassonne, Abalone, Cobra Twist, Chocoly, Paradisi, Four in a Square</i>
Data Assessment or Analysis	Probability, estimation	<i>Color Code, Stenzzles, Swish</i>	<i>Perudo, Numero, Bohnanza, Zero, Poker</i>
Strategic Assessment	Games with chance and strategy, war games, cooperative games, Economic games, Resource Management games		<i>Risk, Stratego, Pandemic, , Bohnanza, Diplomacy, Alexandrus, Settlers of Catan, Carcassonne, Small World, Agricola, Castle Panic, Evo, Automobile, Las Vegas, Hey That's My Fish, Smatrix, Octi</i>