## $\sqrt{18} + \sqrt{50} \implies \sqrt{9}\sqrt{2} + \sqrt{25}\sqrt{2} \implies 3\sqrt{2} + 5\sqrt{2} \implies 8\sqrt{2} * 3 \& 5$ both have $\sqrt{2}$ so you can add them\* Can split radicals up into 2 nums that multiply to $3\sqrt{8} - 5\sqrt{18}$ $3\sqrt{4}\sqrt{2} - 5\sqrt{9}\sqrt{2}$ $6\sqrt{2} - 15\sqrt{2}$ $-9\sqrt{2}$ \*6 & 15 both have $\sqrt{2}$ so you can This chart is currently being worked on... A Frog fell in a 30ft hole... it climbs 3ft and falls 2ft every day. **What is 7% of 800?** 800 x .07 = 56 \*7% is same as .07 $\sqrt{5^2} = 5 \qquad \sqrt{5}\sqrt{5} = \sqrt{25}$ $(\sqrt{5})^2 = 5$ 3ft - 2ft = 1ft a day... 30/1 = 30 days No it's 28 Rational Expressions (dividing variables) Counting Systems $\frac{3x}{7x^2}$ $\frac{3x}{7}$ $\begin{array}{c|cccc} 35x^5 & 7x^5 & 5x^3 \\ \hline 49x^2 & 9x^2 & 9x^2 \end{array}$ Arithmetic | Basic Math **Exponents vs Square Roots** Rectangle \*rooms, yards... 4 right angles, opposite sides same length Triangle 3 sides Right Triangles "Trigonometry" Base 10 Counting Fraction / Decimal Divide common Subtract Xs letters Square Root / Log $2\sqrt{4^2} = 4 \times 4$ $4^3 = 4 \times 4 \times 4$ $4^4 = 4 \times 4 \times 4 \times 4$ Sine: opposite/hypotenuse % of Y/height in the Hypotenuse 16<sup>5</sup> 16<sup>4</sup> 16<sup>3</sup> 16<sup>2</sup> 16<sup>1</sup> 16<sup>0</sup> Cosine: adjacent/hypotenuse % of X/length in the Hypotenuse Subtract take away 2 from 4 4 - 2 |||| - || = || "difference subtraction" $\frac{72x^8y^7}{64x^5y^4} \quad \frac{9x^3y^3}{8}$ $4^4 = 4 \times 4 \times 4 \times 4$ Base10 to Binary2 Divide how many 2s go into 4 / 2 | | | | / | | = | | "quotient" is division answer $7^{\circ} = 1 \mid \mathbf{x}^{\circ} = 1 \mid 999999^{\circ} = 1$ Square equal sided rectangle hypotenuse is always longest side. Sine, Cosine, and Tangent always equal 0-100% Simplify / Reduce $x^2-8x+15$ (x-5)(x-3) (x-5)(x-3) (x-5) $2x^2-18$ $2(x^2-9)$ 2(x+3)(x-3) 2(x+3)Even: divisible by 2 Odd: not divisible by 2 Divide: Change to multiply Prime: only divisible by itself or 1 Composite: other dividers equal distance from Graph theory Networks Connections make imaginary right triangle Parabolas "Quadratics" polynomials FOIL & Factor **Natural** № 0, 1, 2, 3... lines extending from a point evenly **Eulers Constant** Quadrilaterals left was 2 (22->32)\* 6s repeat (2,8,4,0,6), 8s e = 2.71828... river paths, Geometry 3D, 4D, 5D... Linear Algebra Curve Types **Lines and Angles** polynomials FOIL & Factor Launched a ball from 2 feet ax²+bx+c=0 "Standard Form / Trinomial" Factor "break apart" what 2 nums mult. & add $(x^2-3x-10)$ (x-5)(x+2) [-5,+2 add to -3, and mult to -10] bacteria multiplying waves, light, sound Voltage: Current: electrons/second r: distance from centers. m (meters) Energy: J (joules) Hyperbolic Curves (Hypotenuse of Sin, Cos, Tan) T: temperature K (Kelvin) 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 Watts Volts Current Hanging chains, bridges, ropes... **Audio** Kinematics "motion" polynomial math $3x^{2}-75 = 0$ $3(x^{2}-25)=0$ 3(x+5)(x-5)=0Add & Sub "combine terms" $(5x^2 - 3x + 7) - (4x^2 - 8x - 11)$ $(x^2 + 6x + 8) + (2x^2 + 6x - 2)$ $(5x^2 - 3x + 7) + (-4x^2 + 8x + 11)$ $3x^2 + 12x + 6$ $1x^2 + 5x + 18$ $v = \frac{\text{displacement}}{1}$ Mult. & Divide parentheses matter? since Negative since gives you same answer (x+2)+3) + (x-1) = 2x + 4Positive = moves up (left to right) Negative = moves down (left to right) $-2 \times 2 = -4 *-2$ two times is -4 -2 / 2 = -1discriminant "middle of parabola" d = vtnegative x negative = positive d "distance" -2 x -2 = 2 -2 / -2 = 1 this also means all angles add to **Question Types** d "displacement v "velocity" t "time" -2 - -2 = Quadratic Formula $E = mc^2$ 7 less than twice a number is 10 **Combination Permutation** isolating "x" from x²+x+num or (x+num)(x+num) Exponents and Log How many ways can you make change for 50c. Nickel(5), Dime(10), Quarter(25) gets you this... $KE = \frac{1}{2}mv^2$ $x=(-b\pm\sqrt{b^2-4ac})/2a$ Basic "Equalities" Algebra (equality, inequality) Multiply number by itself... Greater > Greater or Equal ≥ \*minimum There 10 eggs in 3 baskets, brown, red and pink. $4^2 = 4 \times 4 = 16$ The brown has 1 more egg than the red. $\checkmark$ "b = r + 1" $\checkmark$ b + 1 = r Slope Algebra b²-4ac $44 = 4 \times 4 \times 4 \times 4 =$ $Q = m \times Lf$ Calculus (find area under a line, if you know the slope) Less or Equal $\leq *_{\text{maximum, limit}}$ $(5 \leq 5, 2 \leq 8)$ The red has 3 less eggs than the pink. $\mathbf{r} = \mathbf{p} - 3$ " $\mathbf{r} - 3 = \mathbf{p}$ " How many eggs are in each basket? speed limit is 100 at least 3 boxes $s \le 100$ $b \ge 3$ **Factorial** $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$ h: vertex x no more than 5 cats room can hold 3 people b r p together have 10 eggs total. Derive (find area under a line, if you know the slope) Integrate (find area under a line, if you know the slope) How much energy to melt 2mg of snow k: vertex y b + r + p = 10(r + 1) + (p - 3) + p = 10 plug in r and b r + 2p - 2 = 10 plug in r (p-3) + 2p - 2 = 10 3p - 5 = 10Find vertex/middle (x value) **Patterns** Finds Slope at any Point some lines are uneven and don't have a fixed slope Finds Area under line x = -b/2awhen you know the slope $-2 \ge -3x + 4 \ge 13$ \*-4 all sides $-6 \ge -3x \ge 9$ \*/-3 all sides FLIP SIGNS An elevator can hold 2,000lbs. $3x \ge 6$ \*/3 both sides equal for all numbers Currently at 460. y=x² is the slope $w + 460 \le 2000$ slope $\frac{dy}{dx} = \frac{x}{x}$ Absolute Value "Always Positive" Bob is 3 years younger than twice the age of me. How old is Bob? Me: 12 Bob: b neural network control random numbers what's the area Mandelbrot Set B = (12 \* 2) - 3Distance, Weight. what numbers are 3 away from 9? Worley: metal grains, broken glass, **Procedural Generation** 9-3=6. 9+3=12Data Display Perlin Noise: sand, dust, dirt, A boy has the same number of sisters as brothers. add 1 to the slope exponent Gradient: sky, Find Rate (find single unit) 12:00 Started Draining put the exponent underneath, Each of his sisters has only half as many sisters as brothers. ldkkkk: bricks, Comparison, Rank then subtract fraction it by itself. Fill in X coordinates How many brothers and sisters are in the family altogether? 1:30 10ft 3:00 8ft 9|x+8| + 10 < 55 \*-10 both sides River: veins, rivers, More Tricky Smoke: smoke, cloud Functions \*1:30hr = -2ft \*90min = -2ft \*10min = -.22222ft x+8 < 5 -x - 8 > 5**description** Cryptography **description** -x > 13 aka x > -13 Is pool empty by 8:00? Matrix screen What is the value of 2x? variable: 5N + 10D + 25(0) = 50 \*6 2 | 4 | 0 5N + 10D + 25(1) = 50 \*3 0 | 5 | 0 5N + 10D + 25(2) = 50 \*1 0 | 0 | 2 3D Graphics Offspring: family, language, evolution Progress: technology, unlocking, <u>Change</u> 2 points: needed for slope 3 points: needed for growth type (constant?) Number Theory Scatter Line Bob, Chris, Phyllis were comparing ages. Bob (the oldest) said they were all between 10x = 5 \*div. 10 so x is alone Information Storage: DNA 🔗 : X = 5/10 \*simplify 11 and 30. The ages add to 70. Chris (the youngest) pointed out that if they X = 1/2 or 0.5What's the cost of each wrote down the square of each of their ages, all of the digits from 1 to 9 will appear exactly once in the digits of the three squares. How **♣** + **♠** = **♦** + **♦** <u>Value</u> **♦** + **♦** = **♣** - **♦** Average: most common (add all nums $\forall x \diamond = 4 + 4 + 4$ y = 2x + 1**Box Plot** then divide by amount of nums) Add sub... why useful real life. Just computers? **♣**+**♦**+**♦**+**♥**=23 Mean: middle of data "Array" [1, 4, 3, 6] **?** + **b** = **-** + **-** + **-** + Range: **♣**+**♦**+**♦**+**♥**=23 Absolute Value |x| "makes always positive" $\mathbf{Y} + \mathbf{p} = 2 \mathbf{q} + (\mathbf{p} + \mathbf{q})$ "Multidimensional Array" AB Combinatorics AB $\mathbf{Y} = 2\mathbf{\Box} + (\mathbf{\Box})$ **Factorial** 1, 5, 3, 6, 4 2, 3, 6, 3, 5 |-1| = 1 |-3.8| = 3.8 **?** = 3 $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$ R: num of slots Combination locks should be called permutation locks because order matters! 1, 5, 3, 6, 4 2, 3, 6, 3, 5 **1** = 4 2 = (4 )+ How many ways can 7 notes !WTF are these?! be played in a row? Number Sequence C = 6 Why combination doesn't work?? How many ways can 12 notes = 2.5 $S = \{RR, RB, BR, BB\}$ \*total possibilities make a 4 note chord? "Arithmetic" is adding "Geometric" is multiplying $A = \{BR, RR, RR\} *your result$ How many bytes(0,1) can 32bit AB BA CA DA 3, 7, 11, 15, 19, 23, 27... 3, 6, 12, 24, 48, 96, 192... y = |x-3| + 2AC BC CB DB AD BD CD DC BC, BD, CD Probably = outcomes/TotalOutcomes $(2.5) + \Box = 7$ an = a1 + (n-1)dan = a1 (r)n-1 $2^{32} = 4,294,967,296$ the 10th num is ... the 10th num is ... **Bell Curve** Why 2Char, 32Slots |||| = 4|| = 4(4.5) = 18||| = 3|| = 3(4.5) = 13.5**Ratio Problems?** How many total votes were there? Bob 23% How many ways can I travel 6 How many ways can a Coin ERRORS because not possibl 100% : 144,417 WRONG 6270 / 0.23 = 27300 CORRECT How many ways can "ALABAMA" Update this side... Every 10 seconds I climb up 5ft then down 2ft. When will I reach 26ft? 80 seconds How many ways can 6 people(A,B,C,D,E,F) sit in 3 Mantay and Paul "Carson" Winkler. No one **Budget Line:** knows why they called them Nelson and Carson, but everyone did. The wanted poster calling for their arrest indicated that a substantial reward would be offered to the person who caught up to both of them and brought them in for trail. Amazingly, it turned There is a basket with a certain number of 800-meter race. out that the poster contained a great Alma beat Isabel by 7 meters. a = i+7If the eggs are taken from the basket two at a cryptarithm. All who saw the poster realized Sabrina beat Becky by 12 meters. s = b+12time, only one egg remains. this and spent their time solving the puzzle Alma finished 5 meters ahead of Lani but 3 If the eggs are taken from the basket three at rather than looking for Nelson and Carson! meters behind Sabrina. a = L+5, a = s-3a time, only one egg remains. When Nelson and Carson heard the entire Ruby finished halfway between the first and If the eggs are taken from the basket four at a ruckus about the poster, they also tried the last woman. R = x/2...time, only one egg remains. problem. However, they weren't too bright In what order did the women finish? What If the eggs are taken from the basket five at a and ended up visiting their local sheriff for were the distances between them? time, only one egg remains. clue. He told them that N=5, and then If the eggs are taken from the basket six at a arrested them. They solved the problem There's stones in a circle, each time, only one egg remains. during the time they spent in Jail. Each letter stone spaced an equal distance. If the eggs are taken out seven at a time, no in the cryptarithm stands for a different digit The 6th stone is directly eggs remain. Find the digits that the other letters opposite the 17th stone. How many eggs are in the basket? How many stones are in the Set Theory (Grouping things) $A = \{Russia, UK, USA\}$ |A| = 3 $B = \{Germany, Italy, Japan\}$ |B| = 3Proofs? The president was discussing some politics with the vice Order and repeats don't matter president and three of her cabinet members: the secretaries The president, vice president, state secretary, education $A = \{1, 2, 3\}$ of state, education, and the treasury. Using the clues in the secretary, and treasurer. conversation below, determine $B = \{2, 3, 1, 1, 1\}$ Woman named Norma. which woman (one is named Norma) holds which position. Paula: "Ms. President, the state secretary doesn't know what A = BPaula said, "Ms. President, I don't think the secretary of state she is talking about." knows what she is talking about. I think our foreign policy has The state secretary and vice president both shook their deteriorated lately." Treasury secretary: "I agree with Paula. We haven't The secretary of state shook her head, So did the vice set builder notation even talked to Japan lately." president. The secretary of the treasury said, "I agree with Vice president: "Will you two leave Inez alone? She is $N = \{n \mid n \text{ is even}\}$ Georgianne, who had been silent so far said, "Okay, let's get even talked to Japan lately." The vice president jumped in. "Will you two leave Inez alone? She is on to something else." Colleen said, I'm sorry too, Inez. I guess we just got carried away." Inez replied, "That's okay. I know we've all been under on to something else." The secretary of education said, 'I'm $A = \{1, 2, 3, 4, 5, 6\}$ sorry, Inez. Nothing personal." Colleen said, I'm sorry too, a lot of Inez. I guess we just got carried away." Inez replied, "That's okay. I know we've all been under a lot of B⊆A "B is subset of A"