



The Case of the Fractured Formula

Grade 10 math · Pythagorean theorem, Square roots, Exponents, Order of operations · Reading level grades 7-9

Detective: _____ Date: _____

An unknown rogue equation has infiltrated the Prime Matrix of the Fractal Crypt! The central data vault is locked, threatening to plunge the entire academy into division-by-zero chaos. The Chief Cryptographer needs your mathematical skill to track down the suspect before our digital world completely pixelates.

1. Solve each math problem. The answer is a number, and the letter beside it is what that number stands for.
2. In the clue boxes, write that letter in every box showing the same number, then read the secret clue.
3. Use each clue to cross suspects off the list. The one suspect left at the end is the culprit!

My answer: the the Rogue Equation is _____

Possible suspects

Cross off a row as each clue rules it out. The one left at the end is the culprit.

NAME	MATHEMATICAL MANIPULATION	INFILTRATION TOOL	OBSERVED DETAIL	DIGITAL HAIR	SYSTEM VULNERABILITY
Turing	calculus carving	binary decoder	wears digital watch	shaved silver buzzed	irrational constants
Kepler	vector shifting	abacus blaster	wears digital watch	neon blue spikes	prime numbers
Cantor	matrix warping	infinity visor	wears digital watch	braided copper wire	prime numbers
Lovelace	geometry warping	binary decoder	wears analog watch	shaved silver buzzed	null sets
Fermat	vector shifting	binary decoder	wears analog watch	shaved silver buzzed	irrational constants
Riemann	calculus carving	binary decoder	wears digital watch	shaved silver buzzed	null sets
Cauchy	calculus carving	binary decoder	wears digital watch	braided copper wire	irrational constants
Fibonacci	calculus carving	infinity visor	wears digital watch	shaved silver buzzed	irrational constants
Germain	calculus carving	laser protractor	wears analog watch	shaved silver buzzed	null sets
Descartes	geometry warping	laser protractor	wears analog watch	shaved silver buzzed	irrational constants
Noether	geometry warping	infinity visor	wears digital watch	shaved silver buzzed	prime numbers
Newton	calculus carving	fractal compass	wears digital watch	shaved silver buzzed	irrational constants
Al Khwarizmi	calculus carving	infinity visor	wears analog watch	shaved silver buzzed	null sets
Fourier	vector shifting	abacus blaster	wears digital watch	shaved silver buzzed	irrational constants
Leibniz	matrix warping	infinity visor	wears analog watch	neon blue spikes	null sets
Euler	vector shifting	laser protractor	wears digital watch	shaved silver buzzed	irrational constants
Ramanujan	fraction freezing	laser protractor	wears digital watch	braided copper wire	irrational constants
Kovalevskaya	matrix warping	binary decoder	wears analog watch	neon blue spikes	null sets
Babbage	fraction freezing	infinity visor	wears digital watch	neon blue spikes	prime numbers
Mirzakhani	vector shifting	infinity visor	wears analog watch	shaved silver buzzed	irrational constants
Pascal	geometry warping	laser protractor	wears digital watch	braided copper wire	prime numbers

CLUE 1 Pythagorean theorem

To map the suspect's escape route across the digital courtyard, we had to calculate the exact hypotenuse distance between two security pylons.

Solve each problem, then write its letter in every clue box that shows the same number.

Diagram illustrating a sequence of numbers and markers (T) arranged in two rows. The numbers are: 39, 87, 25, 125, 52, 65, 65, 5, 52, 68, 20, 111, 25, 75, 68, 111, 39, 10, 25, 5, 41, 39, 87, 25, 52, 68, 15, 52, 68, 52, 39, 37, 125, 52, 75, 111, 41. The markers (T) are placed above the first 39, the last 39, the 39 after 41, and the 39 after 52.

legs 15 and 36, hypotenuse = $\rightarrow$ **T**

legs 35 and 120, hypotenuse = $\rightarrow$ **V**

legs 20 and 48, hypotenuse = $\rightarrow$

legs 12 and 16, hypotenuse = → **D**

legs 9 and 40, hypotenuse = → **R**

legs 25 and 60, hypotenuse = → **L**

legs 3 and 4, hypotenuse = $\rightarrow$ **A**

legs 6 and 8, hypotenuse = $\rightarrow$ **W**

legs 36 and 105, hypotenuse = $\rightarrow$

legs 12 and 35, hypotenuse = $\rightarrow$ **Y**

legs 21 and 72, hypotenuse = $\rightarrow$ **S**

legs 15 and 20, hypotenuse = → **E**

legs 9 and 12, hypotenuse = → **F**

legs 60 and 63, hypotenuse = $\rightarrow$ **H**

legs 32 and 60, hypotenuse = → **N**

Scratch space:

CLUE 2 Square roots

The security server room is a perfect square. We had to find its exact side length by taking the square root of the total area to locate the tripped sensor.

Solve each problem, then write its letter in every clue box that shows the same number.

T												T			T			
13	14	8	20	8	16	20	17	3	25	8	13	8	15	13	8	25	4	
				T														
25	24	6	24	13	4	10	25	24	20	2	10	4	19					

$\sqrt{169} = \square \rightarrow \text{T}$	$\sqrt{4} = \square \rightarrow \text{P}$	$\sqrt{225} = \square \rightarrow \text{C}$
$\sqrt{289} = \square \rightarrow \text{O}$	$\sqrt{400} = \square \rightarrow \text{S}$	$\sqrt{36} = \square \rightarrow \text{G}$
$\sqrt{100} = \square \rightarrow \text{L}$	$\sqrt{361} = \square \rightarrow \text{Y}$	$\sqrt{9} = \square \rightarrow \text{R}$
$\sqrt{196} = \square \rightarrow \text{H}$	$\sqrt{576} = \square \rightarrow \text{I}$	$\sqrt{625} = \square \rightarrow \text{D}$
$\sqrt{64} = \square \rightarrow \text{E}$	$\sqrt{16} = \square \rightarrow \text{A}$	$\sqrt{256} = \square \rightarrow \text{N}$

Scratch space:

CLUE 3

Exponents

The corrupted system files are multiplying exponentially. By calculating the base to the power of the elapsed cycles, we unlocked the encrypted data file.

Solve each problem, then write its letter in every clue box that shows the same number.

I					I													
16	36	36	361	125	16	196	216	361	343	81	196	216	128	125	361	216	125	128
	I									I				I				
256	16	128	36	100	400	125	125	9	32	16	36	512	36	16	256			

$4^2 = \square \rightarrow \boxed{\text{I}}$

$10^2 = \square \rightarrow \boxed{\text{U}}$

$2^5 = \square \rightarrow \boxed{\text{E}}$

$19^2 = \square \rightarrow \boxed{\text{A}}$

$20^2 = \square \rightarrow \boxed{\text{P}}$

$6^3 = \square \rightarrow \boxed{\text{N}}$

$8^3 = \square \rightarrow \boxed{\text{G}}$

$7^3 = \square \rightarrow \boxed{\text{L}}$

$2^8 = \square \rightarrow \boxed{\text{D}}$

$6^2 = \square \rightarrow \boxed{\text{R}}$

$2^7 = \square \rightarrow \boxed{\text{S}}$

$3^2 = \square \rightarrow \boxed{\text{H}}$

$5^3 = \square \rightarrow \boxed{\text{T}}$

$14^2 = \square \rightarrow \boxed{\text{O}}$

$3^4 = \square \rightarrow \boxed{\text{C}}$

Scratch space:

CLUE 4 Order of operations

The backup terminal required a strict sequence of math steps. By carefully applying parentheses and order of operations, we bypassed the lock.

Solve each problem, then write its letter in every clue box that shows the same number.

Diagram illustrating a sequence of 20 boxes (10 in the top row and 10 in the bottom row) with numbers below them. The boxes are arranged in two rows. The top row contains 10 boxes, and the bottom row contains 10 boxes. The first box in the top row is orange and contains the letter 'T'. The sixth box in the top row is also orange and contains the letter 'T'. The numbers below the boxes are as follows:

Box	Number
1 (Top Row)	11
2 (Top Row)	118
3 (Top Row)	14
4 (Top Row)	91
5 (Top Row)	72
6 (Top Row)	12
7 (Top Row)	7
8 (Top Row)	11
9 (Top Row)	7
10 (Top Row)	56
11 (Top Row)	14
12 (Top Row)	118
13 (Top Row)	13
14 (Top Row)	87
15 (Top Row)	87
16 (Top Row)	118
17 (Top Row)	13
18 (Top Row)	56
19 (Top Row)	14
20 (Top Row)	43
1 (Bottom Row)	87
2 (Bottom Row)	7
3 (Bottom Row)	47
4 (Bottom Row)	56
5 (Bottom Row)	14
6 (Bottom Row)	18
7 (Bottom Row)	118
8 (Bottom Row)	13
9 (Bottom Row)	7
10 (Bottom Row)	18

$$5 + 3 \times 2 = \boxed{} \rightarrow \boxed{\text{T}}$$

$$3 + 2 \times 2 = \boxed{} \rightarrow \boxed{\text{I}}$$

$$59 + 4 \times 8 = \boxed{} \rightarrow \boxed{\text{F}}$$

$$48 + 2 \times 4 = \boxed{} \rightarrow \boxed{\mathbf{V}}$$

$6 \times 4 - 10 = \boxed{} \rightarrow \boxed{\text{E}}$

$3 + 5 \times 2 = \boxed{} \rightarrow \boxed{\text{A}}$

$$4 + 2 \times 4 = \boxed{} \rightarrow \boxed{\mathbf{G}}$$

$$8 + 2 \times 5 = \boxed{} \rightarrow \boxed{\mathbf{R}}$$

$$9 \times 7 - 20 = \boxed{} \rightarrow \boxed{\mathbf{D}}$$

$$38 + 3 \times 3 = \boxed{} \rightarrow \boxed{\text{L}}$$

$$8 \times 11 - 16 = \boxed{} \rightarrow \boxed{\text{U}}$$

$$39 + 6 \times 8 = \boxed{} \rightarrow \boxed{\text{S}}$$

$$94 + 3 \times 8 = \boxed{} \rightarrow \boxed{\text{H}}$$

Scratch space:

CLUE 5**Square roots - the last clue**

To crack the final firewall, we had to simplify a complex radical. Finding the exact square root of the system load revealed the next clue.

First solve each problem. Then find each answer in the numbered list below and cross that sentence out. One sentence will be left - that is exactly what the villain did!

Step 1 - solve these:

$\text{sqrt}(25) = \boxed{}$

$\text{sqrt}(121) = \boxed{}$

$\text{sqrt}(100) = \boxed{}$

$\text{sqrt}(1) = \boxed{}$

$\text{sqrt}(36) = \boxed{}$

$\text{sqrt}(81) = \boxed{}$

$\text{sqrt}(49) = \boxed{}$

$\text{sqrt}(144) = \boxed{}$

$\text{sqrt}(16) = \boxed{}$

$\text{sqrt}(4) = \boxed{}$

$\text{sqrt}(9) = \boxed{}$

Step 2 - cross out the sentence with each answer:

1. The villain shifts the network vectors, then scans for hidden nodes with an infinity visor.
2. The villain freezes the mainframe with fractions, then disables alarms using an abacus blaster.
3. The villain warps the surrounding geometry, then cracks the locks with a binary decoder.
4. The villain warps the surrounding geometry, then scans for hidden nodes with an infinity visor.
5. The villain carves up the system with calculus, then cracks the locks with a binary decoder.
6. The villain carves up the system with calculus, then slices through security with a laser protractor.
7. The villain disrupts the database matrices, then cracks the locks with a binary decoder.
8. The villain carves up the system with calculus, then draws escape routes with a fractal compass.
9. The villain carves up the system with calculus, then disables alarms using an abacus blaster.
10. The villain shifts the network vectors, then disables alarms using an abacus blaster.
11. The villain shifts the network vectors, then slices through security with a laser protractor.
12. The villain freezes the mainframe with fractions, then scans for hidden nodes with an infinity visor.

Answer Key

The Case of the Fractured Formula

Culprit: Newton

calculus carving · fractal compass · wears digital watch · shaved silver buzzed · irrational constants

Trail: Start 21 → Clue 1 14 → Clue 2 9 → Clue 3 6 → Clue 4 4 → Clue 5 1

Clue 1 (Pythagorean theorem): "THE VILLAIN DOES NOT WEAR THE INFINITY VISOR"

legs 15 and 36, hypotenuse = 39 (T) · legs 35 and 120, hypotenuse = 125 (V) · legs 20 and 48, hypotenuse = 52 (I) · legs 12 and 16, hypotenuse = 20 (D) · legs 9 and 40, hypotenuse = 41 (R) · legs 25 and 60, hypotenuse = 65 (L) · legs 3 and 4, hypotenuse = 5 (A) · legs 6 and 8, hypotenuse = 10 (W) · legs 36 and 105, hypotenuse = 111 (O) · legs 12 and 35, hypotenuse = 37 (Y) · legs 21 and 72, hypotenuse = 75 (S) · legs 15 and 20, hypotenuse = 25 (E) · legs 9 and 12, hypotenuse = 15 (F) · legs 60 and 63, hypotenuse = 87 (H) · legs 32 and 60, hypotenuse = 68 (N)

Clue 2 (Square roots): "THE SENSOR DETECTED A DIGITAL DISPLAY"

$\sqrt{169} = 13$ (T) · $\sqrt{4} = 2$ (P) · $\sqrt{225} = 15$ (C) · $\sqrt{289} = 17$ (O) · $\sqrt{400} = 20$ (S) · $\sqrt{36} = 6$ (G) · $\sqrt{100} = 10$ (L) · $\sqrt{361} = 19$ (Y) · $\sqrt{9} = 3$ (R) · $\sqrt{196} = 14$ (H) · $\sqrt{576} = 24$ (I) · $\sqrt{625} = 25$ (D) · $\sqrt{64} = 8$ (E) · $\sqrt{16} = 4$ (A) · $\sqrt{256} = 16$ (N)

Clue 3 (Exponents): "IRRATIONAL CONSTANTS DISRUPT THEIR GRID"

$4^2 = 16$ (I) · $10^2 = 100$ (U) · $2^5 = 32$ (E) · $19^2 = 361$ (A) · $20^2 = 400$ (P) · $6^3 = 216$ (N) · $8^3 = 512$ (G) · $7^3 = 343$ (L) · $2^8 = 256$ (D) · $6^2 = 36$ (R) · $2^7 = 128$ (S) · $3^2 = 9$ (H) · $5^3 = 125$ (T) · $14^2 = 196$ (O) · $3^4 = 81$ (C)

Clue 4 (Order of operations): "THE FUGITIVE HAS SHAVED SILVER HAIR"

$5 + 3 \times 2 = 11$ (T) · $3 + 2 \times 2 = 7$ (I) · $59 + 4 \times 8 = 91$ (F) · $48 + 2 \times 4 = 56$ (V) · $6 \times 4 - 10 = 14$ (E) · $3 + 5 \times 2 = 13$ (A) · $4 + 2 \times 4 = 12$ (G) · $8 + 2 \times 5 = 18$ (R) · $9 \times 7 - 20 = 43$ (D) · $38 + 3 \times 3 = 47$ (L) · $8 \times 11 - 16 = 72$ (U) · $39 + 6 \times 8 = 87$ (S) · $94 + 3 \times 8 = 118$ (H)

Clue 5 (Square roots): surviving statement is box 8 → Newton

$\sqrt{25} = 5$ · $\sqrt{121} = 11$ · $\sqrt{100} = 10$ · $\sqrt{1} = 1$ · $\sqrt{36} = 6$ · $\sqrt{81} = 9$ · $\sqrt{49} = 7$ · $\sqrt{144} = 12$ · $\sqrt{16} = 4$ · $\sqrt{4} = 2$ · $\sqrt{9} = 3$