



The Case of the Missing Masterpiece Pencils

Grade 8 math · Exponents, Square roots, Pythagorean theorem, Order of operations, Two-step equations · Reading level grades 7-9

Detective: _____ Date: _____

During the National Sketching Finals, the legendary Masterpiece Pencil Set was stolen from the display case. The Lead Curator needs your math skills to examine the clues left behind in the studio and catch the culprit from the twenty-four finalists.

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 Pencil Thief is _____

Possible suspects

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

NAME	SIGNATURE TECHNIQUE	SECRET GEAR	ERASER WEAR PATTERN	PENCIL SMUDGE	ARTISTIC WEAKNESS
Keith Haring	Soft Shading	Flexible Curve	Flat Wear	Pastel Pink Smudge	Dull Lead
Georgia O'Keeffe	Cross Hatching	Chamois Cloth	Angled Wear	Pastel Pink Smudge	Dull Lead
Banksy	Soft Shading	Mechanical Clutch	Angled Wear	Pastel Pink Smudge	Smudged Edge
Henri Matisse	Contour Sketching	Flexible Curve	Angled Wear	Charcoal Black Smudge	Dull Lead
Jackson Pollock	Soft Shading	Mechanical Clutch	Flat Wear	Charcoal Black Smudge	Smudged Edge
Pablo Picasso	Contour Sketching	Battery Eraser	Angled Wear	Pastel Pink Smudge	Dull Lead
Rembrandt	Cross Hatching	Dual Sharpener	Angled Wear	Pastel Pink Smudge	Torn Paper
Claude Monet	Soft Shading	Flexible Curve	Angled Wear	Pastel Pink Smudge	Torn Paper
Bob Ross	Gesture Drawing	Battery Eraser	Angled Wear	Pastel Pink Smudge	Smudged Edge
Rene Magritte	Stippling	Battery Eraser	Flat Wear	Graphite Grey Smudge	Dull Lead
Frida Kahlo	Soft Shading	Chamois Cloth	Angled Wear	Charcoal Black Smudge	Dull Lead
Salvador Dali	Soft Shading	Dual Sharpener	Angled Wear	Pastel Pink Smudge	Dull Lead
Auguste Rodin	Cross Hatching	Battery Eraser	Flat Wear	Charcoal Black Smudge	Torn Paper
Mary Cassatt	Cross Hatching	Battery Eraser	Flat Wear	Pastel Pink Smudge	Torn Paper
Yayoi Kusama	Gesture Drawing	Battery Eraser	Flat Wear	Graphite Grey Smudge	Smudged Edge
Edgar Degas	Cross Hatching	Flexible Curve	Angled Wear	Pastel Pink Smudge	Dull Lead
Edvard Munch	Stippling	Battery Eraser	Flat Wear	Charcoal Black Smudge	Smudged Edge
Marc Chagall	Contour Sketching	Flexible Curve	Angled Wear	Pastel Pink Smudge	Dull Lead
Michelangelo	Gesture Drawing	Mechanical Clutch	Flat Wear	Graphite Grey Smudge	Smudged Edge
Leo DaVinci	Soft Shading	Flexible Curve	Flat Wear	Pastel Pink Smudge	Torn Paper
Yoko Ono	Contour Sketching	Dual Sharpener	Flat Wear	Pastel Pink Smudge	Smudged Edge

CLUE 1 Exponents

The security lock on the sketch vault requires calculating the exponential growth of the automated lead-dispensing bins over time.

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

T																T
144	441	121	64	81	289	289	484	81	32	729	400	121	216	32	400	144
						T	T									
49	216	121	484	100	484	144	144	121	8	36	121	8	484	216	121	8

$12^2 = \square \rightarrow$ T	$11^2 = \square \rightarrow$ E	$17^2 = \square \rightarrow$ L	$21^2 = \square \rightarrow$ H
$9^3 = \square \rightarrow$ D	$22^2 = \square \rightarrow$ A	$2^5 = \square \rightarrow$ N	$4^3 = \square \rightarrow$ V
$10^2 = \square \rightarrow$ B	$6^2 = \square \rightarrow$ Y	$20^2 = \square \rightarrow$ O	$7^2 = \square \rightarrow$ U
$2^3 = \square \rightarrow$ R	$6^3 = \square \rightarrow$ S	$9^2 = \square \rightarrow$ I	

Scratch space:

CLUE 2 Square roots

To map the crime scene grid, you must find the square root of the total area of the studio floor to find its side lengths.

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

T																	
3	7	17	16	21	16	6	17	18	3	10	17	4	23	17	16	4	12
												T	T				
4	12	11	10	17	2	13	17	4	22	6	4	3	3	17	22	12	

$\text{sqrt}(9) = \square \rightarrow \text{T}$	$\text{sqrt}(441) = \square \rightarrow \text{U}$	$\text{sqrt}(144) = \square \rightarrow \text{N}$
$\text{sqrt}(121) = \square \rightarrow \text{G}$	$\text{sqrt}(36) = \square \rightarrow \text{P}$	$\text{sqrt}(169) = \square \rightarrow \text{W}$
$\text{sqrt}(484) = \square \rightarrow \text{R}$	$\text{sqrt}(100) = \square \rightarrow \text{L}$	$\text{sqrt}(256) = \square \rightarrow \text{S}$
$\text{sqrt}(289) = \square \rightarrow \text{E}$	$\text{sqrt}(49) = \square \rightarrow \text{H}$	$\text{sqrt}(16) = \square \rightarrow \text{A}$
$\text{sqrt}(4) = \square \rightarrow \text{D}$	$\text{sqrt}(529) = \square \rightarrow \text{V}$	$\text{sqrt}(324) = \square \rightarrow \text{C}$

Scratch space:

CLUE 3

Pythagorean theorem

To trace the quick getaway path of the suspect across the studio, you must use the Pythagorean theorem to find the diagonal distance between two desks.

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

T			T									T					
68	51	58	68	51	25	58	20	74	26	17	17	68	5	75	75	58	15
82	40	26	15	85	37	37	37	58	26	15							

legs 32 and 60, hypotenuse = → **T**

legs 3 and 4, hypotenuse = → **O**

legs 10 and 24, hypotenuse = → **A**

legs 40 and 42, hypotenuse = → **E**

legs 18 and 80, hypotenuse = → **B**

legs 9 and 12, hypotenuse = → **D**

legs 24 and 32, hypotenuse = → **Y**

legs 24 and 45, hypotenuse = → **H**

legs 24 and 70, hypotenuse = → **W**

legs 15 and 20, hypotenuse = → **I**

legs 21 and 72, hypotenuse = → **P**

legs 40 and 75, hypotenuse = → **U**

legs 12 and 35, hypotenuse = → **L**

legs 12 and 16, hypotenuse = → **F**

legs 8 and 15, hypotenuse = → **S**

Scratch space:

CLUE 4

Order of operations

The master digital art archives require you to enter an access code solved using the exact order of operations to view the suspect registry.

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

A		A														
29	40	29	51	44	82	28	40	60	78	36	51	91	9	64	63	82

	A											
112	29	51	28	82	90	44	24	82	13	60	78	64

$8 \times 6 - 19 = \square \rightarrow \boxed{\text{A}}$

$54 + 2 \times 3 = \square \rightarrow \boxed{\text{I}}$

$48 + 7 \times 6 = \square \rightarrow \boxed{\text{F}}$

$12 \times 6 - 8 = \square \rightarrow \boxed{\text{D}}$

$7 \times 9 - 19 = \square \rightarrow \boxed{\text{T}}$

$2 \times 9 - 9 = \square \rightarrow \boxed{\text{U}}$

$12 + 2 \times 8 = \square \rightarrow \boxed{\text{L}}$

$10 \times 8 - 17 = \square \rightarrow \boxed{\text{G}}$

$7 \times 11 - 26 = \square \rightarrow \boxed{\text{S}}$

$11 \times 12 - 20 = \square \rightarrow \boxed{\text{W}}$

$63 + 7 \times 4 = \square \rightarrow \boxed{\text{M}}$

$7 \times 8 - 16 = \square \rightarrow \boxed{\text{P}}$

$18 + 2 \times 9 = \square \rightarrow \boxed{\text{K}}$

$11 \times 2 - 9 = \square \rightarrow \boxed{\text{H}}$

$62 + 8 \times 2 = \square \rightarrow \boxed{\text{N}}$

$10 \times 3 - 6 = \square \rightarrow \boxed{\text{B}}$

$66 + 8 \times 2 = \square \rightarrow \boxed{\text{E}}$

Scratch space:

CLUE 5**Two-step equations - the last clue**

The final lockbox contains a scrap of evidence, which you can retrieve by solving a two-step equation representing the shared art supplies.

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:

$5x + 10 = 15, x = \boxed{}$

$4x + 3 = 23, x = \boxed{}$

$2x + 11 = 33, x = \boxed{}$

$3x + 1 = 19, x = \boxed{}$

$4x + 7 = 47, x = \boxed{}$

$5x + 5 = 15, x = \boxed{}$

$5x + 1 = 41, x = \boxed{}$

$5x + 7 = 67, x = \boxed{}$

$2x + 11 = 25, x = \boxed{}$

$6x + 1 = 19, x = \boxed{}$

$5x + 4 = 49, x = \boxed{}$

Step 2 - cross out the sentence with each answer:

1. The villain traces the contour lines, then bends a flexible curve.
2. The villain shades the background softly, then activates a battery eraser.
3. The villain sketches a rapid gesture drawing, then empties a dual sharpener.
4. The villain shades the background softly, then empties a dual sharpener.
5. The villain cross hatches the canvas, then buffs with a chamois cloth.
6. The villain cross hatches the canvas, then activates a battery eraser.
7. The villain traces the contour lines, then buffs with a chamois cloth.
8. The villain traces the contour lines, then empties a dual sharpener.
9. The villain traces the contour lines, then activates a battery eraser.
10. The villain stipples the design, then activates a battery eraser.
11. The villain cross hatches the canvas, then bends a flexible curve.
12. The villain shades the background softly, then bends a flexible curve.

Answer Key

The Case of the Missing Masterpiece Pencils

Culprit: Salvador Dali

Soft Shading · Dual Sharpener · Angled Wear · Pastel Pink Smudge · Dull Lead

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

Clue 1 (Exponents): "THE VILLAIN DOES NOT USE A BATTERY ERASER"

$12^2 = 144$ (T) · $11^2 = 121$ (E) · $17^2 = 289$ (L) · $21^2 = 441$ (H) · $9^3 = 729$ (D) · $22^2 = 484$ (A) · $2^5 = 32$ (N) · $4^3 = 64$ (V) · $10^2 = 100$ (B) · $6^2 = 36$ (Y) · $20^2 = 400$ (O) · $7^2 = 49$ (U) · $2^3 = 8$ (R) · $6^3 = 216$ (S) · $9^2 = 81$ (I)

Clue 2 (Square roots): "THE SUSPECT LEAVES AN ANGLED WEAR PATTERN"

$\sqrt{9} = 3$ (T) · $\sqrt{441} = 21$ (U) · $\sqrt{144} = 12$ (N) · $\sqrt{121} = 11$ (G) · $\sqrt{36} = 6$ (P) · $\sqrt{169} = 13$ (W) · $\sqrt{484} = 22$ (R) · $\sqrt{100} = 10$ (L) · $\sqrt{256} = 16$ (S) · $\sqrt{289} = 17$ (E) · $\sqrt{49} = 7$ (H) · $\sqrt{16} = 4$ (A) · $\sqrt{4} = 2$ (D) · $\sqrt{529} = 23$ (V) · $\sqrt{324} = 18$ (C)

Clue 3 (Pythagorean theorem): "THE THIEF WAS STOPPED BY A DULL LEAD"

legs 32 and 60, hypotenuse = 68 (T) · legs 3 and 4, hypotenuse = 5 (O) · legs 10 and 24, hypotenuse = 26 (A) · legs 40 and 42, hypotenuse = 58 (E) · legs 18 and 80, hypotenuse = 82 (B) · legs 9 and 12, hypotenuse = 15 (D) · legs 24 and 32, hypotenuse = 40 (Y) · legs 24 and 45, hypotenuse = 51 (H) · legs 24 and 70, hypotenuse = 74 (W) · legs 15 and 20, hypotenuse = 25 (I) · legs 21 and 72, hypotenuse = 75 (P) · legs 40 and 75, hypotenuse = 85 (U) · legs 12 and 35, hypotenuse = 37 (L) · legs 12 and 16, hypotenuse = 20 (F) · legs 8 and 15, hypotenuse = 17 (S)

Clue 4 (Order of operations): "A PASTEL PINK SMUDGE WAS LEFT BEHIND"

$8 \times 6 - 19 = 29$ (A) · $54 \div 2 \times 3 = 60$ (I) · $48 \div 7 \times 6 = 90$ (F) · $12 \times 6 - 8 = 64$ (D) · $7 \times 9 - 19 = 44$ (T) · $2 \times 9 - 9 = 9$ (U) · $12 \div 2 \times 8 = 28$ (L) · $10 \times 8 - 17 = 63$ (G) · $7 \times 11 - 26 = 51$ (S) · $11 \times 12 - 20 = 112$ (W) · $63 \div 7 \times 4 = 91$ (M) · $7 \times 8 - 16 = 40$ (P) · $18 \div 2 \times 9 = 36$ (K) · $11 \times 2 - 9 = 13$ (H) · $62 \div 8 \times 2 = 78$ (N) · $10 \times 3 - 6 = 24$ (B) · $66 \div 8 \times 2 = 82$ (E)

Clue 5 (Two-step equations): surviving statement is box 4 → Salvador Dali

$5x + 10 = 15, x = 1$ · $4x + 3 = 23, x = 5$ · $2x + 11 = 33, x = 11$ · $3x + 1 = 19, x = 6$ · $4x + 7 = 47, x = 10$ · $5x + 5 = 15, x = 2$ · $5x + 1 = 41, x = 8$ · $5x + 7 = 67, x = 12$ · $2x + 11 = 25, x = 7$ · $6x + 1 = 19, x = 3$ · $5x + 4 = 49, x = 9$