

2026 PSIA MIDDLE SCHOOL CALCULATOR APPLICATIONS CHAMPIONSHIP EXAM – OFFICIAL SCORING KEY

CANONICAL ANSWERS (3 SIGNIFICANT DIGITS) • SCIENTIFIC NOTATION • GRADING TOLERANCES [PAGE 1 OF 5]

#	OFFICIAL CONTEST ANSWER (3 SIG FIGS)	SCIENTIFIC NOTATION	ACCEPTANCE INTERVAL (±2 UNITS)
1	193	1.93×10^2	[191, 195]
2	360	3.60×10^2	[358, 362]
3	24.6	2.46×10^1	[24.4, 24.8]
4	232	2.32×10^2	[230, 234]
5	23 [INT]	2.30×10^1	[23]
6	45.0	4.50×10^1	[44.8, 45.2]
7	126	1.26×10^2	[124, 128]
8	15 [INT]	1.50×10^1	[15]
9	\$318.25	3.18×10^2	[316, 320]
10	32 [INT] mpg	3.20×10^1	[32]
11	0.958	9.58×10^{-1}	[0.956, 0.960]
12	0.560	5.60×10^{-1}	[0.558, 0.562]
13	0.625	6.25×10^{-1}	[0.623, 0.627]
14	0.0957	9.57×10^{-2}	[0.0955, 0.0959]
15	143	1.43×10^2	[141, 145]
16	25.2	2.52×10^1	[25.0, 25.4]
17	21.1	2.11×10^1	[20.9, 21.3]
18	117 [INT]	1.17×10^2	[117]
19	85.4 cm	8.54×10^1	[85.2, 85.6]
20	64.5 lbs	6.45×10^1	[64.3, 64.7]
21	53.8	5.38×10^1	[53.6, 54.0]
22	30.3	3.03×10^1	[30.1, 30.5]
23	9.55	9.55×10^0	[9.53, 9.57]
24	4.43	4.43×10^0	[4.41, 4.45]
25	\$117.00	1.17×10^2	[115, 119]

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CANONICAL ANSWERS (3 SIGNIFICANT DIGITS) • SCIENTIFIC NOTATION • GRADING TOLERANCES [PAGE 2 OF 5]

#	OFFICIAL CONTEST ANSWER (3 SIG FIGS)	SCIENTIFIC NOTATION	ACCEPTANCE INTERVAL (±2 UNITS)
26	279	2.79×10^2	[277, 281]
27	23.8	2.38×10^1	[23.6, 24.0]
28	1260 [INT]	1.26×10^3	[1260]
29	26.5 cm	2.65×10^1	[26.3, 26.7]
30	123 m ²	1.23×10^2	[121, 125]
31	112	1.12×10^2	[110, 114]
32	6.90	6.90×10^0	[6.88, 6.92]
33	71.6	7.16×10^1	[71.4, 71.8]
34	0.00943	9.43×10^{-3}	[0.00941, 0.00945]
35	8.69×10^4	8.69×10^4	$[8.67, 8.71] \times 10^4$
36	$5.42 \times 10^3 \text{ cm}^3$	5.42×10^3	$[5.40, 5.44] \times 10^3$
37	$1.06 \times 10^3 \text{ cm}^3$	1.06×10^3	$[1.04, 1.08] \times 10^3$
38	$3.59 \times 10^3 \text{ cm}^3$	3.59×10^3	$[3.57, 3.61] \times 10^3$
39	$2.39 \times 10^3 \text{ cm}^3$	2.39×10^3	$[2.37, 2.41] \times 10^3$
40	1.80 hrs	1.80×10^0	[1.78, 1.82]
41	30.2	3.02×10^1	[30.0, 30.4]
42	60.9	6.09×10^1	[60.7, 61.1]
43	5.54	5.54×10^0	[5.52, 5.56]
44	1.39	1.39×10^0	[1.37, 1.41]
45	92.1	9.21×10^1	[91.9, 92.3]
46	28.0	2.80×10^1	[27.8, 28.2]
47	15.1	1.51×10^1	[14.9, 15.3]
48	36.6	3.66×10^1	[36.4, 36.8]
49	942 cm ³	9.42×10^2	[940, 944]
50	12.6 hrs	1.26×10^1	[12.4, 12.8]

STACKCALC32 RPM BENCHMARK: 347 KEYSTROKES vs. 507 ALGEBRAIC (SAVING 160 KEYS, 31.6% FASTER)

GRADER 1 INITIALS: _____ GRADER 2 INITIALS: _____ CONTEST DIRECTOR: _____

SCORING RULE: +5 points for each correct answer; -4 points for each error or skipped question up to last attempted.

PART II: DETAILED WORD PROBLEM & GEOMETRY WORKED SOLUTIONS

Formal Mathematical Modeling, Formula Setups & StackCalc RPN Keystroke Workflows

PROBLEM 9 • MULTI-ITEM CALCULATOR & COMPONENT ORDERS**ANSWER: \$318.25**

A school robotics club purchases 12 StackCalc educational calculators at \$24.50 each. If state sales tax is 8.25%, what is the total cost in dollars?

GOVERNING MODEL: Total Cost = $(n_1 \times p_1) + (n_2 \times p_2)$

NUMERICAL SETUP: Total = $(\text{Count}_1 \times \text{Price}_1) + (\text{Count}_2 \times \text{Price}_2)$

STEP-BY-STEP MATHEMATICAL REASONING:

Compute subtotal for each item type (calculator, modular blocks, sensors) by multiplying count by unit price, then sum together. Round currency to two decimals [\$].

CALCULATOR FLOW: [12] [ENTER] [24.5] [×] [1.0825] [×] -> \$318.25

PROBLEM 10 • UNIT RATE: MOBILE TESTING ROVER EFFICIENCY**ANSWER: 32 [INT] mpg**

A battery-powered mobile electronics testing cart travels 240 miles on 7.50 gallons of fuel equivalent. How many miles per gallon did the vehicle achieve?

GOVERNING MODEL: Efficiency (Mi/Gal-Eq) = Total Miles / Consumed Energy

NUMERICAL SETUP: Efficiency = Miles / Gallons

STEP-BY-STEP MATHEMATICAL REASONING:

Divide total distance traveled in miles by volume of fuel or battery equivalent energy units consumed to obtain vehicle efficiency.

CALCULATOR FLOW: [240] [ENTER] [7.5] [÷] -> 32 [INT] mpg

PROBLEM 19 • CHASSIS FACEPLATE & BUILD MAT PERIMETER**ANSWER: 85.4 cm**

A 3D printed calculator chassis faceplate has length 28.5 cm and width 14.2 cm. Calculate its perimeter in centimeters.

GOVERNING MODEL: Perimeter = $2 \times (\text{Length} + \text{Width})$

NUMERICAL SETUP: $P = 2 \times (L + W)$

STEP-BY-STEP MATHEMATICAL REASONING:

Perimeter of the rectangular chassis faceplate or silicone build mat is twice the sum of length and width: $P = 2 \cdot (L + W)$. Add dimensions and multiply by 2.

CALCULATOR FLOW: [28.5] [ENTER] [14.2] [+] [2] [×] -> 85.4 cm

PROBLEM 20 • PRECISION BALANCE: MULTI-PART COMPONENT MASS SUM**ANSWER: 64.5 lbs**

A warehouse shipping crate holds 48 packaged mechanical tactile key switch modules weighing 1.25 pounds each. If the empty crate weighs 4.50 pounds, what is the total shipping weight in pounds?

GOVERNING MODEL: Total Mass = Count × Mass per Item [or Sum of Components]

NUMERICAL SETUP: Mass_total = Sum(m_i) or Count × Unit_Mass

STEP-BY-STEP MATHEMATICAL REASONING:

Compute total mass by summing individual component housing masses measured on precision digital balance.

CALCULATOR FLOW: [48] [ENTER] [1.25] [×] [4.5] [+] -> 64.5 lbs

PROBLEM 29 • RIGHT TRIANGLE TRIGONOMETRY**ANSWER: 26.5 cm**

RIGHT TRIANGLE: In the right triangle shown, hypotenuse $c = 45.0$ cm and acute angle $\theta = 36.0^\circ$. Find the vertical leg a in centimeters.

GOVERNING MODEL: $a = c \times \sin(\theta)$ or $b = c \times \cos(\theta)$

NUMERICAL SETUP: $a = 45.0 \times \sin(36.0^\circ)$

STEP-BY-STEP MATHEMATICAL REASONING:

In a right triangle, the opposite leg equals hypotenuse c multiplied by $\sin(\theta)$. With $c = 45.0$ and acute angle $\theta = 36.0^\circ$, calculate in Degree mode and round non-integers to 3 significant figures.

CALCULATOR FLOW: [DEG] [45.0] [ENTER] [36.0] [SIN] [×] -> 26.5 cm

PROBLEM 30 • CIRCULAR SECTOR AREA**ANSWER: 123 m²**

CIRCULAR SECTOR: A circular sector has radius $r = 14.0$ m and central angle $\theta = 72.0^\circ$. Calculate the sector area in square meters.

GOVERNING MODEL: $\text{Area} = \pi \times r^2 \times (\theta / 360^\circ)$

NUMERICAL SETUP: $\text{Area} = \pi \times (14.0)^2 \times (72.0^\circ / 360^\circ)$

STEP-BY-STEP MATHEMATICAL REASONING:

A circular sector represents a fraction $(\theta / 360^\circ)$ of a full circle. Square radius $r = 14.0$, multiply by angle $\theta = 72.0^\circ$, multiply by π , and divide by 360.

CALCULATOR FLOW: [14.0] [x²] [72.0] [×] [π] [×] [360] [÷] -> 123 m²

PROBLEM 39 • RIGHT CIRCULAR CYLINDER VOLUME**ANSWER: 2.39 × 10³ cm³**

RIGHT CIRCULAR CYLINDER: A cylinder has base radius $r = 6.50$ cm and vertical height $h = 18.0$ cm. Calculate its volume in cubic centimeters.

GOVERNING MODEL: $V = \pi \times r^2 \times h$

NUMERICAL SETUP: $V = \pi \times (6.5)^2 \times (18.0)$

STEP-BY-STEP MATHEMATICAL REASONING:

The cylinder volume equals circular base area multiplied by height. Square radius $r = 6.5$, multiply by height $h = 18.0$, and multiply by constant π .

CALCULATOR FLOW: [6.5] [x²] [18.0] [×] [π] [×] -> 2.39 × 10³ cm³

PROBLEM 40 • AUTONOMOUS ROBOTICS & AGV KINEMATICS**ANSWER: 1.80 hrs**

Two automated conveyor carriages in an electronics assembly plant separated by 180 miles travel toward each other on parallel tracks at constant speeds of 45.0 mph and 55.0 mph. In how many hours will they meet?

GOVERNING MODEL: Closing Speed = $v_1 + v_2$; Time = Distance / Closing Speed

NUMERICAL SETUP: $t = \text{Distance} / (v_1 + v_2)$ [or Separation = $(v_1 + v_2) \times t$]

STEP-BY-STEP MATHEMATICAL REASONING:

For autonomous robotic shuttles or gantry carriages moving relative to each other, closing velocity is $v_{\text{rel}} = v_1 + v_2$. Divide initial distance by closing speed to find encounter time, or multiply combined speed by time for separation distance.

CALCULATOR FLOW: [180] [ENTER] [45] [ENTER] [55] [+] [÷] -> 1.80 hrs

PROBLEM 49 • RIGHT CIRCULAR CONE VOLUME**ANSWER: 942 cm³**

RIGHT CIRCULAR CONE: A cone has base radius $r = 7.50$ cm and vertical height $h = 16.0$ cm. Calculate its volume in cubic centimeters.

GOVERNING MODEL: $V = (1/3) \times \pi \times r^2 \times h$

NUMERICAL SETUP: $V = (1/3) \times \pi \times (7.5)^2 \times (16.0)$

STEP-BY-STEP MATHEMATICAL REASONING:

The cone volume equals one-third base area times vertical height. Square base radius $r = 7.5$, multiply by vertical height $h = 16.0$, multiply by π , and divide by 3.

CALCULATOR FLOW: [7.5] [x^2] [16.0] [x] [π] [x] [3] [+] -> 942 cm³

PROBLEM 50 • PARALLEL PROCESSING & VACUUM CHAMBER EVACUATION**ANSWER: 12.6 hrs**

A circuit board ultrasonic cleaning tank is filled by intake line A in 4.50 hours and drained by outlet valve B in 7.00 hours. If both valves remain open simultaneously, in how many hours will the empty tank fill?

GOVERNING MODEL: $1/t_{\text{total}} = 1/t_A + 1/t_B \Rightarrow t_{\text{total}} = 1 / (1/t_A + 1/t_B)$

NUMERICAL SETUP: $t_{\text{total}} = 1 / [(1 / t_A) + (1 / t_B)]$

STEP-BY-STEP MATHEMATICAL REASONING:

Each degassing pump, printer, or resin dispenser operates at rate $1/t$. Running concurrently, their combined rate is $R = 1/t_A + 1/t_B$. Time to complete is reciprocal $1 / R$. In RPM: enter t_A , press $[1/x]$, enter t_B , press $[1/x]$, add $[+]$, and invert with $[1/x]$.

CALCULATOR FLOW: [4.5] [1/x] [7] [1/x] [-] [1/x] -> 12.6 hrs