PROM^2 for Girls 2025

Individual Round

April 26, 2025

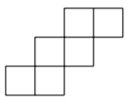
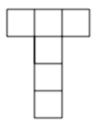
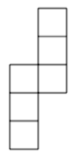
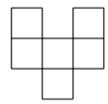
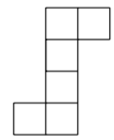
Problem 1

Evaluate $2025 - (20 + 25)^2$.

(A) 0 (B) 1 (C) 25 (D) 425 (E) 800

Problem 2

Which of the following patterns below could **not** be unfolded from a cube?

(A)  (B)  (C)  (D)  (E) 

Problem 3

Anna thought of four distinct positive integers. The product of the smallest and largest numbers is 32. The product of the two remaining numbers is 14. What is the sum of all four numbers?

(A) 27 (B) 33 (C) 42 (D) 46 (E) 47

Problem 4

A string of letters is called an *interesting word* if it contains the five letters ‘P’, ‘R’, ‘O’, ‘M’, and ‘M’ in some order, and only contains those five letters. How many interesting words exist?

(A) 1 (B) 30 (C) 32 (D) 60 (E) 120

Problem 5

A drawer contains 5 red socks, 7 blue socks, and 9 green socks. If you pull out socks blindly, what is the minimum number of socks you need to pull out to guarantee two matching pairs?

(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

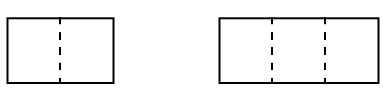
Problem 6

Find the remainder when 2025^{25} is divided by 125.

(A) 0 (B) 1 (C) 5 (D) 25 (E) 100

Problem 7

Joker has several identical rectangular cards. If he attaches 2 cards together as shown below, the perimeter of the shape is 56 cm; if he attaches 3 cards together, the perimeter is 72 cm. What is the perimeter of one single card?



(A) 24 (B) 28 (C) 32 (D) 36 (E) 40

Problem 8

Let a and b be positive integers. If the greatest common divisor of a and b is 12, and the least common multiple of a and b is 720, what is the minimum possible value of $a + b$.

(A) 192 (B) 204 (C) 216 (D) 228 (E) 240

Problem 9

Alan is the leader of the PRISMS Chess Club. What is the maximum possible number of kings that Alan may place on an 8×8 chessboard such that no two kings are in neighboring squares? (Two squares are neighbors if they share a common edge or a common vertex.)

(A) 16 (B) 17 (C) 18 (D) 30 (E) 32

Problem 10

PRISMS students are actively involved in community service. The PRISMS Math Club regularly hosts fun math activities for young children at the Princeton Public Library. In this month's event, they tried sorting kids into groups. When putting them into groups of 6, there were 4 kids left over. When trying groups of 7, 3 kids still wouldn't fit. Which of the following could be the number of kids in that event?

(A) 31 (B) 39 (C) 46 (D) 52 (E) 60

Problem 11

Minnie, Daisy, and Clarabelle are playing a game: each of them is either telling the truth or telling a lie.

Minnie says, "Daisy tells a lie."

Daisy says, "Clarabelle tells the truth."

Clarabelle says, "Minnie tells a lie."

If at most one of them tells a lie, who is the liar?

(A) Minnie (B) Daisy (C) Clarabelle (D) Nobody (E) Can't be determined

Problem 12

David found that he could write the same positive integer into each square in the following equation to make both sides equal:

$$25\times\square-(\square\times\square+20\times\square)\div\square=700$$

What is the integer David found?

(A) 28 (B) 30 (C) 35 (D) 140 (E) 175

Problem 13

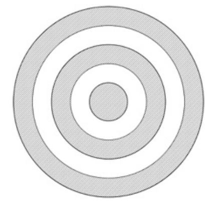
During a community volunteer event, Allen the Elf needed to help pack greeting cards into envelopes. By 8:40 am, he had packed 90 envelopes. By 10:10 am, he had packed a total of 360 envelopes. Allen packs envelopes at a constant pace. At 9:30 am, Terry the Reindeer had come and taken away all the envelopes that Allen had packed by that time. How many envelopes did Terry take?

(A) 195 (B) 210 (C) 225 (D) 240 (E) 255

Problem 14

Let $d_1 > d_2 > d_3 > \cdots > d_n$ be all the positive divisors of 2025. Find the value of $d_2 - d_3$.
(A) 2 (B) 180 (C) 270 (D) 450 (E) 1350

Problem 15
The figure shows five concentric circles with radii 1, 2, 3, 4, and 5 units, respectively. The shaded regions form alternating rings between the circles, starting with the innermost circle being shaded. Calculate the total area of the shaded regions.



(A) 10π (B) 15π (C) 16π (D) 25π (E) 30π

Problem 16
The 6-digit number, $\overline{a2025b}$, is a multiple of 99. What is the value of $a + b + a \times b$?
(A) 17 (B) 23 (C) 27 (D) 29 (E) 305

Problem 17
If $x + \frac{1}{x} = 3$, what is the value of $x^3 + \frac{1}{x^3}$?
(A) 15 (B) 18 (C) 21 (D) 24 (E) 27

Problem 18
Sophia qualified for MOP (Mathematical Olympiad Program) last year. Starting from day *n*, Sophia practiced geometry problems. She solved *n* geometry problems on that day, and she always solved one more problem than she did on the previous day (so she solved *n*+1 problems on the next day). After she solved *n*+10 problems on day *n*+10, she decided to focus on algebra and didn't practice geometry anymore. If she solved 165 geometry problems on those days, what is the value of *n*?
(A) 9 (B) 10 (C) 11 (D) 12 (E) 13

Problem 19
Sigma is a PRISMS student who has a wide range of interests. He regularly attends 3 clubs: History, Linguistics and Math. He attends History Club every 4 days, Linguistics Club every 5 days and Math Club every 6 days. On January 1st, 2025, he attended all 3 clubs. On how many days in May of 2025 he will attend at least 2 clubs?
(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

Problem 20
In trapezoid *ABCD*, *AB*//*CD*, *AB* = 5, *BD* = 13, *CD* = 10, *AD* = 12. Find the length of *BC*.
(A) 6 (B) 9 (C) 10 (D) 12 (E) 13

Problem 21
How many ways can you arrange the six little ponies, Applejack, Rainbow Dash, Twilight Sparkle, Pinkie Pie, Fluttershy, and Rarity in a row if Twilight Sparkle does not want to stand at the edge, and Pinkie Pie and Fluttershy want to stand next to each other?

(A) 72 (B) 144 (C) 160 (D) 192 (E) 200

Problem 22

100 lamps are labelled 1, 2, …, 100, all turned off at the beginning. At the first round, every lamp is turned on. For any $1 \leq n \leq 100$, at the n_{th} round, all the lamps that are labelled with a multiple of n change the status. After 100 rounds, how many lamps are turned on at the end?

(A) 0 (B) 10 (C) 50 (D) 90 (E) 100

Problem 23

60 people took turns speaking. The first three speakers said the same thing: "I have always told the truth!" The following 57 speakers also said the same phrases: "Among the previous three speakers, exactly two told the truth." What is the maximum possible number of speakers who told the truth?

(A) 20 (B) 30 (C) 40 (D) 45 (E) 60

Problem 24

A regular 18-gon and a regular 24-gon are inscribed in the same circle. A point is *common* if it lies on both the boundaries of two polygons. Denote m as the minimum possible number of common points, and n as the maximum possible number of common points. Find the value of $m+n$.

(A) 66 (B) 69 (C) 72 (D) 75 (E) 78

Problem 25

Mr. Nallbani, the popular art teacher at PRISMS, plans to color a 3×3 window. For each of the 9 unit squares, he will choose one color from red, yellow, or green. For any two adjacent unit squares, two colors must be different (2 unit squares are adjacent if and only if they share one common edge). How many possible coloring results does Mr. Nallbani have?

(A) 6 (B) 48 (C) 108 (D) 156 (E) 294