Carnegie Mellon University Qatar

Pi Day Math Competition

Final Round 2025

Question 1

Calculate the sum $1^3 + 2^3 + \cdots + 9^3$.

Question 2

Simplify the expression $\frac{(9+\frac{1}{3})^{2025}}{3^{2023}\times(3+\frac{1}{9})^{2024}}$.

Question 3

Line 1 has the equation $y = 7x - 2025$. Line 2, which passes through the origin, is perpendicular to Line 1. If the two lines intersect at the point (a, b), what is the value of $a + b$?

Question 4

When the 4 players on a team compared the points they scored, they discovered that Player A scored twice as many points as Player B, three times as many points as Player C, and four times as many points as Player D. What percentage of the team's total points has been scored by Player A?

Question 5

Ahmed leaves his house and walks in a straight line at a speed of 1m/s. Exactly 60 seconds later, his brother Kamal leaves the house and runs towards Ahmed at a speed of 3m/s. How much time (in seconds) will it take Kamal to reach Ahmed if Ahmed keeps walking at the same pace?

Question 6

Recall that $2025 = 45^2$ is a perfect square.

Of all the perfect squares from 1 up to and including 2025, how many of them are divisible by 12?

Question 7

Recall that the **floor** of a real number x, denoted $\lfloor x \rfloor$, is the greatest integer less than or equal to x (for example, $\lfloor \pi \rfloor = 3$ and $\lfloor 7 \rfloor = 7$.)

Determine the following sum:

$$\left\lfloor \frac{1}{5} \right\rfloor + \left\lfloor \frac{2}{5} \right\rfloor + \cdots + \left\lfloor \frac{99}{5} \right\rfloor .$$

Question 8

Let x be a $6-$digit integer formed by using each of the integers $1, 2, 3, 4, 5, 6$ exactly once. What is the probability that x is divisible by 6?

Question 9

If $x^2 - ax + 2025 = 0$ has two positive integer roots, what is the smallest possible value of a?

Question 10

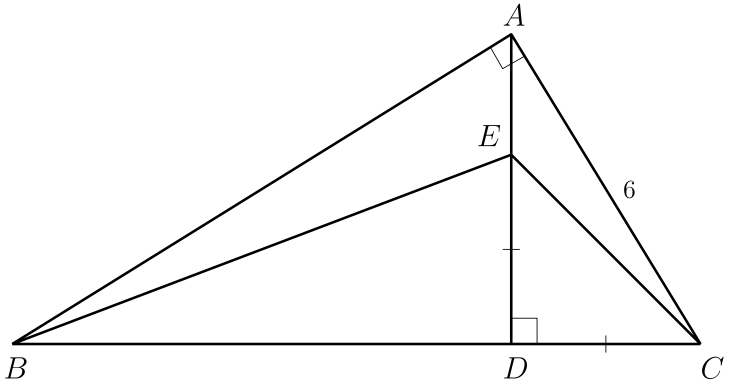
A right pyramid has a square base with sides of length 6m. The height of the pyramid is 4m. What is the surface area of the pyramid?

Question 11

Find the number of nonnegative integer pairs (x, y) such that $\sqrt{x} + \sqrt{y} = \sqrt{52}$.

Question 12

Let ABC be a right triangle such that $|ED| = |DC|$ and $|AC| = 6$. Moreover the line segments AB and AC are perpendicular and also the line segments AD and BC are perpendicular. What is the area of the triangle EBC?



Question 13

Ali randomly selects one number from the set $\{1, 2, 3, \ldots, 10\}$.

Bashir randomly selects one number from the set $\{1, 2, 3, \ldots, 20\}$.

What is the probability that Bashir's number is strictly larger than Ali's number?

Question 14

How many ways are there to write 2025 as a sum of 4s and 7s?

In other words, how many ways are there to write

$$2025 = 4a + 7b$$

where a and b are nonnegative integers?

For example, one way is

$$2025 = \underbrace{4 + 4 + \cdots + 4}_{\text{501 times}} + (7 + 7 + 7) = 501 \times 4 \; + \; 3 \times 7.$$

Question 15

If $a + b = 20$ and $a^2 + b^2 = 340$, what is the value of $a^3 + b^3$?

Question 16

Determine the sum of all values of x that satisfy the equation

$$||||x-1|-2|-3|-4|=0.$$