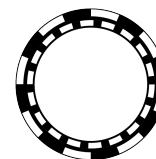


Mustang Math Tournament 2023

Risky Riding Stallion Round



Basic Format

- This round contains 16 problems to be solved in 30 minutes.
- Every problem is multiple choice with exactly one correct answer.
- The problems are separated into four sets (Algebra x , Combinatorics $\{ \}$, Geometry Δ , and Number Theory \equiv) of 4 problems.
- Circling the correct answer to a problem on the answer sheet (backside) will grant you 2 points.
- *The poker chips are for grading purposes only, where graders will put 1s and 0s to mark correct and incorrect.*

Shooting The Moon

- Every problem has a “moonshine” answer, which is defined as the answer choice that is numerically furthest away from the correct answer.
 - For example, if the answer choices were $\{1, 2, 4, 8\}$ and 4 was the correct answer, 8 would be the moonshine answer as 4 is numerically furthest away from 8 than all other answer choices.
- For any given set, you may attempt to “shoot the moon” by circling the moonshine answer instead of the correct answer for all four problems.
- Successfully shooting the moon grants 12 points for the entire set. Unsuccessful attempts will be graded normally (2 points per correct answer, 0 points per incorrect answer).
- **Do not** circle multiple answers on a single problem, your answer will be invalidated.



Grader 1 Grader 2

2
 x

332

528

x
C

3
 x

35

37

40

x
C

4
 x

120 512

720 1024

x
C

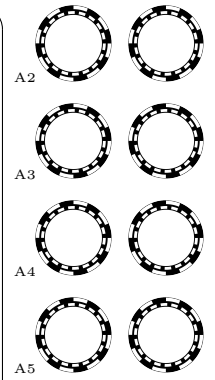
5
 x

512 $512\sqrt{2}$

$32\sqrt{1023}$

1024 $1024\sqrt{2}$

x
C



2
 $\{$

120

121

$\{$
C

3
 $\{$

2

$\frac{9}{4}$

$\frac{9}{2}$

$\{$
C

4
 $\{$

140 196

210 300

$\{$
C

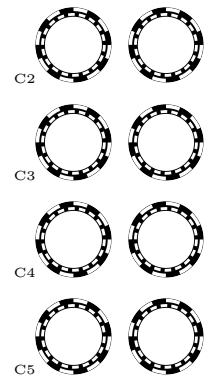
5
 $\{$

79 81

173

175 256

$\{$
C



2
 Δ

$\frac{1}{4}$

$\frac{3}{8}$

∇
C

3
 Δ

20

$24\sqrt{3}$

$21\sqrt{5}$

∇
C

4
 Δ

1 3

5 7

∇
C

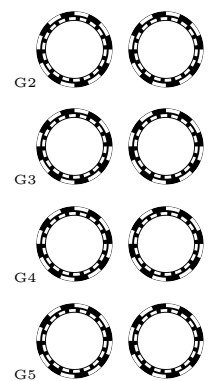
5
 Δ

$\frac{21}{4}$ 7

$\frac{21}{2}$

$\frac{63}{4}$ 21

∇
C



2
 \equiv

144

225

\equiv
C

3
 \equiv

$\frac{3379}{42}$

$\frac{247}{2}$

$\frac{1077}{7}$

\equiv
C

4
 \equiv

3 4

6 7

\equiv
C

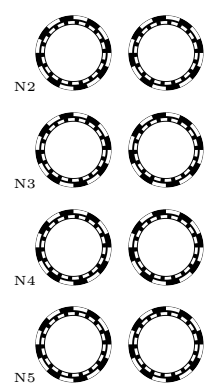
5
 \equiv

302 407

526

563 599

\equiv
C



**Algebra x**

- A2. 10 numbers, a_1, a_2, \dots, a_{10} are written in a row on a blackboard. For any integer s in the range $1 \leq s \leq 10$, the average of the first s numbers is equal to s^2 . What is $a_5 + a_{10}$?
- (A) 332 (B) 528
- A3. Cameron the Colt went galloping every day over the last 7 days. He galloped at least 3 miles every day and at most 10 miles over any 2 consecutive days. What is the maximum possible number of miles that Cameron the Colt could have galloped over all 7 days?
- (A) 35 (B) 37 (C) 40
- A4. What is the value of $\frac{11 \times 12 \times 13 \times 14 \times \dots \times 20}{1 \times 3 \times 5 \times 7 \times \dots \times 19}$?
- (A) 120 (B) 512 (C) 720 (D) 1024
- A5. A cricket starts at the point $(1, 1)$ on the coordinate plane. Every minute, if the cricket is on the point (x, y) and its distance to the origin $(0, 0)$ is r , it hops to the point $(x + y - r, x + y + r)$. How far is the cricket from the origin after 9 hops?
- (A) 512 (B) $512\sqrt{2}$ (C) $32\sqrt{1023}$ (D) 1024 (E) $1024\sqrt{2}$

Combinatorics $\{\}$

- C2. How many ways are there to arrange the letters in *BANANAS* such that two *A*'s never appear next to each other?
- (A) 120 (B) 121
- C3. Gerald rolls a standard six-sided die and lands on the number k . He then rerolls the dice k times. What is the expected number of primes that Gerald rolls, including his initial roll?
- (A) 2 (B) $\frac{9}{4}$ (C) $\frac{9}{2}$
- C4. At a party, $\frac{7}{17}$ of the people are wearing green jackets. An additional 300 people arrive on a bus. Now, $\frac{7}{12}$ of the people are wearing green jackets. What is the smallest possible number of people that were wearing green jackets on the bus?
- (A) 140 (B) 196 (C) 210 (D) 300
- C5. A 5 by 5 grid of square cells is initially empty. How many ways can four identical kings be placed on the grid such that every empty cell shares at least one corner with a cell occupied by a king? Rotations and reflections are considered distinct.
- (A) 79 (B) 81 (C) 173 (D) 175 (E) 256

**Geometry \triangle**

G2. In square $ABCD$, midpoints E and F are drawn on \overline{BC} and \overline{CD} respectively. Compute the ratio between the area of $\triangle AEF$ to $ABCD$.

- (A) $\frac{1}{4}$ (B) $\frac{3}{8}$

G3. Let Ω be a circle of radius 21. Circles ω_1 of radius 6 and ω_2 of radius 8 are internally tangent to Ω and externally tangent to each other. A chord of Ω with length L is tangent to both ω_1 and ω_2 , which are on opposite sides of the chord. What is L ?

- (A) 20 (B) $24\sqrt{3}$ (C) $21\sqrt{5}$

G4. Let $\triangle ABC$ be a triangle with $AB = 11$, $BC = 12$, and $CA = 13$. Let D be a point on side \overline{BC} , and let I_1 and I_2 be the incenters (centers of the circles inscribed in) triangles ADB and ADC . If $\overline{I_1I_2}$ is perpendicular to \overline{AD} , what is the length of \overline{BD} ?

- (A) 1 (B) 3 (C) 5 (D) 7

G5. Let $\triangle ABC$ have $AB = 13$, $BC = 14$, and $AC = 15$. Let M and N be the midpoints of \overline{AB} and \overline{AC} . If a point P is uniformly randomly selected inside $\triangle ABC$, what is the expected area of $\triangle MNP$?

- (A) $\frac{21}{4}$ (B) 7 (C) $\frac{21}{2}$ (D) $\frac{63}{4}$ (E) 21

Number Theory \equiv

N2. The *importance* of a point (x, y) in the coordinate plane is $4x - 3y$. How many lattice points (a, b) with $1 \leq a, b \leq 100$ are there with importance values that are positive factors of 100?

- (A) 144 (B) 225

N3. Let a and b be not necessarily distinct positive divisors of 42. What is the sum of the distinct possible values of $\frac{a}{b}$?

- (A) $\frac{3379}{42}$ (B) $\frac{247}{2}$ (C) $\frac{1077}{7}$

N4. What digit O makes the 5-digit number $2O23O$ divisible by every answer choice except O ?

- (A) 3 (B) 4 (C) 6 (D) 7

N5. A *meaningful* number is a number whose prime factors sum to 42. What is the sum of the two smallest meaningful numbers?

- (A) 302 (B) 407 (C) 526 (D) 563 (E) 599