Algebra Tiebreaker

Please circle or box your final answer AND **write your name** on the top right corner.

Reminder: scores are determined from accuracy and speed, w/ accuracy valued over speed. If two scores are the same, the person who submitted answers first will be placed higher.

1) A far, far away galaxy contains 60 Aliens from planet A, 40 Bliens from planet B, and 98 Cliens from planet C. The three species have a galactic fight. 3 times as many Cliens are killed as Bliens, 23 less Cliens are killed than 2 times the number of Aliens killed, and 5 Bliens were killed. How many total Aliens, Bliens, and Cliens survived?

2) If $x + \frac{1}{y} = 1$, and $y + \frac{1}{z} = 1$, what is the value of xyz?

3) Cara wants to buy a toy spaceship that costs $2.50. She has 19 coins that are some combination of quarters and dimes. If she has 15 cents left after she buys the toy spaceship, what is the largest amount of dimes she could have started with?

Geometry Tiebreaker

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1) Two observation towers on a moon base stand 120 meters apart. From the left tower, the angle of elevation from the base to a hovering drone is 30°, and from the right tower it is 60°. How high above the surface is the drone? Express your answer in simplest radical form. (Assume both towers are the same height.)

   $30\sqrt{3}$

2) An escape pod has a conical nose with a radius of 4 meters and a slant height of 10 meters. What is the lateral surface area of the cone(surface area not including base)? Express your answer in terms of π. The formula for a cone's surface area is $SA = \pi r^2 + \pi r s$ r is the radius, s is the slant height of the cone.

3) A rectangular star map is displayed on a holographic screen measuring 1.2 meters by 2 meters. The map is enlarged so the diagonal becomes exactly 3 meters. By what scale factor is the map enlarged? Express your answer as a decimal to the nearest hundredth.

Number Theory Tiebreaker

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1) Alien Armstrong landed on Kepler-1625b's Moon on Tuesday, July 19th, 2022. His return back to the planet is annually celebrated 94 days after he landed on the Moon. A week in Kepler-1625b lasts the same time on Earth: 7 days. What day of the week is his return celebrated in 2022?

2) A signal from a distant star repeats every 84 seconds and another repeats every 108 seconds. How long until both signals beep at the same time again?

3) Two asteroid-mining drones return to the main station with ore samples. One drone carries 72 units, and the other carries 120 units. The station wants to pack both samples into identical crates with no leftovers.
   What is the largest crate size they can use?

Overall Tiebreaker

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1) Chloe and Daron are in a race to the moon. Chloe's distance from the earth can be modeled by the function c(t)=at, where a is a constant. Daron's distance is described by the function d(t)=t^2+bt, where b is constant. Given that they reach the moon at the same time, what is the distance between the earth and the moon (in terms of a and b)?

2) A regular hexagon with our glorious king Lebron James's face on it is inscribed in a circular satellite. The hexagon side length is 8 miles long. Engineers need to paint the solar panels located on the empty space of the satellite (the region inside the circle but outside the hexagon). Find the area of the region inside the circle but outside the hexagon. Express your answer in terms of pi and in simplest radical form.

3) Luke wants to duplicate his cheese wheels. He starts with one cheese wheel, and throws it into a wormhole which has an equal chance of giving him back 1-3 cheese wheels. He throws in his cheese wheel, then takes all of the new cheese and throws it back in. What is the probability that he has 4 pieces of cheese?