2021 Gauss Math Tournament

Division II Target Round

Instructions

Welcome to the 9th annual Gauss Mathematics Tournament! Please make sure that you are in the correct division. You are about to take the Division III Sprint and Target rounds for students in grades 5-6. If you are not in these grades, please let us know right away and we will help you find your proper division.

You will first take the **Sprint Round**, which will be a 50 minute contest consisting of 40 short-answer problems. The problems are in increasing difficulty order and are worth one point each.

After a short break following the end of the Sprint Round, you will take the **Target Round**, which will consist of 8 problems to be solved in 20 minutes. The problems are in increasing difficulty order and are worth two points each.

The ten highest total scorers on the Sprint and Target rounds will advance to the **Countdown Round**, an exciting head-to-head buzzer contest. More details will be given at the beginning of the Countdown Round.

You may use a calculator on both the Sprint and Target Rounds. However, other aids, such as books, notes, other people, magic crystal balls, etc. are prohibited.

Please read the section below regarding important formatting instructions. These rules are important to remember while taking the test as you may not receive credit for an improperly formatted answer.

Good luck, and may the odds be ever in your favor!

Formatting

For both the Sprint and Target Rounds, your answers will be collected on a Google Form. The answer to each question will be a rational number. If your answer is an integer, it should be input as such. For example, if a question asks "What is $1 + 2$?" the correct input is

$$3$$

If your answer is a rational number, you should input it as an **improper fraction in lowest terms**. If you answer as a mixed number or decimal, or is not in lowest terms, your answer will be marked wrong. For example, if a question asks "What is 57 divided by 6 in simplest form?" the **only** acceptable answer is:

$$19/2$$

The following answers will **not** be accepted:

$$57/6 \qquad 9\ 1/2 \qquad 9.5$$

If any answer is negative, simply enter a minus sign (dash) in front of the number, but **do not leave any space between the minus sign and the number**. For example, an answer of $-\frac{3}{4}$ should be input as:

$$-3/4$$

and not as:

$$-\ 3/4$$

Please keep these rules in mind as you answer the problems!

1. Liv and Jackie have a playdate, where Liv brings her rabbit(s) and Jackie brings her guinea pig(s). Guinea pigs have four limbs, and rabbits have two limbs; each animal has one head. In all, there are 3 heads and 10 limbs. How many rabbit(s) does Liv have?

2. Mr. Krabs LOVES money; in particular, he loves coins. What is the least number of coins he must use in order to pay SpongeBob his daily salary of $0.97? (The allowable coins are pennies, nickels, dimes, and quarters.)

3. Three siblings Alex, Andrew, and Adrian are discussing their family.

   - Alex says, "I have four older siblings and two younger ones."
   - Andrew says, "I have an equal number of older and younger siblings."

   Find the sum of the possible numbers of older siblings that Adrian can have.

4. For a Gauss Math discussion, Albert, Bethany, and four other people are going to gather around a table in a circle with seats numbered 1 through 6. So they do not distract each other, Albert and Bethany do not want to be adjacent to each other nor face-to-face on opposite spots around the circular table. How many ways can the people seat themselves?

5. Two candles have different heights and thicknesses. The longer candle can burn for 10 hours, and the shorter one can burn for 7 hours. After burning for 4 hours, the longer candle is five times the height of the short candle. What is the ratio between the initial height of the long candle and the initial height of the short candle?

6. Find the exact value of $3\sqrt{3 + 2\sqrt{3 + 2\sqrt{3 + 2\sqrt{3 + \cdots}}}}$.

7. If SpongeBob can flip one burger every 10 seconds, and each side of a burger must be cooked for at least 1 minute (not necessarily 1 consecutive minute) to be considered fully cooked (assume no burgers will ever be burnt). What is the least number of seconds for SpongeBob to be able to fully cook 6 burgers?

8. Isosceles triangle ABC has an obtuse angle at C. The perpendicular bisector of segment AC intersects the circumcircle of triangle ABC at a point D such that D and B are on the same side of line AC. Let H be the foot of the perpendicular from C to BD. If $HB = 2$ and $AD = 10$, find the length of AB. Express your answer as a common fraction in simplest radical form.