Rocket City Math League

2021-2022

Interschool Test

Junior

Write the answers on the answer sheet provided. All answers must be written in exact, reduced, simplified, and rationalized form. Leave answers in terms of π unless otherwise specified. **No calculators, books, or other aids may be used.** **Time: 30 minutes**

1. The satellite MATH is in the shape of a cube with edge length 6 feet. The satellite RULES is in the shape of a rectangular prism that is 6 feet long, 7 feet wide, and 5.5 feet tall. What is the difference between the satellites' volumes in cubic feet? *(3 points)*

2. Mithri paid $74.76 for her groceries at the store. Mithri used a coupon which took 20% off all produce purchased, and 55% of Mithri's total haul was produce. The rate of sales tax in her state is 5%. What was Mithri's total before taxes and the coupon? (Assume that the coupon was applied before the sales tax.) *(3 points)*

3. Bhavia worked for 30 hours the first week of the month. She increased her time by 10% each week for the next two weeks. She earns $12 an hour. After three weeks, she went on vacation for the rest of the month, not earning anything during that time. How much did Bhavia make this month? (Note: Bhavia gets paid for each minute; for example, if she were getting paid for 1 hour and 30 minutes of work, she would get paid $18.00.) *(3 points)*

4. Sparky gets to choose two containers of super fuel for her spaceship out of a set of three. They are labeled with the amount of fuel in each one, but the amounts are written as sums. If she wants the maximum amount of fuel, and chooses the two tanks with the most fuel, how much fuel will she have? Write your answer as a fraction in simplest form.

Tank M= $\left(\frac{126}{300}+\frac{67}{12}\right)$ Tank A = $\left(\frac{82}{17}+\frac{7}{102}\right)$ Tank Θ = $\left(\frac{97}{24}+\frac{183}{200}\right)$ *(3 points)*

5. Ana and AJ were playing kickball when they kicked too high and got the ball stuck on the roof. They were playing 15 feet away from their house, and the roof of their house is 13 feet from the ground. How far would they have had to kick the ball, from the kicker to the roof, in order to get it stuck? Round to the nearest whole foot. *(3 points)*

6. In a certain math class of 7th and 8th graders, the ratio of 7th graders to 8th graders is 3:5. If the average grade of the 7th graders is 80%, and the average grade of all the students in the class is 75%, what is the average grade of the 8th graders? *(4 points)*

7. Glug and Glorp are racing each other to see who the fastest alien in the universe is. The race has two legs: a 20-centimeter leg on sand and a 40-centimeter leg on mud. Glug hates the sand; he trudges through it at 12 cm/hour, while he goes 16 cm/hour on the mud. Glorp is a sand-loving alien; she speeds through it at 15 cm/hour but can only manage 12 cm/hour on the mud. What is the (positive) difference between their average speeds (in cm/hour)? *(4 points)*

8. Donovan raises chickens, goats, and sheep. He owns twice as many chickens as goats and three times as many goats as sheep. If Donovan's chicken coop houses a maximum of 20 chickens and the coop is 90% full, how many sheep does Donovan own? *(4 points)*

9. Evaluate if $x = 2$ and $y = -3$ $\quad \frac{6x^3y+12x^2y^2+4x-3y}{10x-5y}$ *(4 points)*

10. Roony wants to buy apples, sold by the basket, at the farmer's market. Each basket has 90 apples in it and each basket has 70% red apples and 30% green apples. Roony wants to use the apples to make 10 pies that require 6 green apples each and trays of tarts that require 8 red apples per tray. If Roony buys the minimum number of baskets she can, and makes the maximum number of trays of tarts that she can, how many red apples will be left over for her teachers? *(4 points)*

11. Put the following expressions in order from greatest to least:
$A = 3^{20}$ $\quad B = 5^{12}$ $\quad C = 11^{8}$ $\quad D = 4^{16}$ *(5 points)*

12. Given that $x + \frac{1}{x} = 5a$, find $x^3 + \frac{1}{x^3}$ in terms of a. *(5 points)*

13. Esperanza rolls a 6-sided die 12 times. She gets 1 twice, 3 once, 4 five times, 5 twice, and 6 twice. What is the sum of the mean, mode, and median of Esperanza's results? *(5 points)*

14. If (x, y, z) is the solution to the system of equations below, what is the value of $\frac{xy}{z}$?
$2x + y - 4z = 25$
$x - 3y + 2z = 3$
$3x - 2y + 5z = 42$ *(5 points)*

15. Astrid, Bob, and Comet live on the planet Triangulos. Their houses are located on a regular (x, y) coordinate plane with dimensions in feet. They each lost a tooth yesterday, so today the tooth fairy is visiting their houses. Their houses are at the intersections of the lines with equations: $y - 2 = \frac{1}{8}(x + 2)$, $y = -\frac{4}{3}x + 11$, and $x - y = -4$. What is the area of the region enclosed by the tooth fairy's paths in square feet? *(5 points)*

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