Rocket City Math League 2021-2022

Interschool Test - Junior

1. **Answer:**
   Volume of MATH=(6)(6)(6)=216
   Volume of RULES=(6)(7)(5.5)=231
   |V of MATH – V of RULES| = |216 – 231| = **15** $\boldsymbol{ft^3}$

2. **Answer:**
   x=$ spent before coupon and taxes
   74.76 = 1.05(.45x+.8(.55x))
   74.76 = 1.05(.89x)
   74.76 = .9345x
   80 = x
   $80.00

3. **Answer:**
   # of hours worked total = 30+1.10(30)+1.10(1.10(30))
   = 30+33+36.3
   =99.3
   Total $ made this month = 99.3(12)=1,191.6
   = **$1,191.60**

4. **Answer:**
   Calculate the amount of fuel in each tank
   $$Tank\ M = \frac{126}{300} + \frac{67}{12} = \frac{252}{600} + \frac{3350}{600} = \frac{3602}{600} = 6.00333 \ldots units$$
   $$Tank\ A = \frac{82}{17} + \frac{7}{102} = \frac{492}{102} + \frac{7}{102} = \frac{499}{102} = 4.8922\ units$$
   $$Tank\ \theta = \frac{97}{24} + \frac{183}{200} = \frac{4850}{1200} + \frac{1098}{1200} = \frac{5948}{1200} = 4.95666 \ldots units$$
   Tanks M and θ are the largest, so add their totals
   $$\frac{3602}{600} + \frac{5948}{1200} = \frac{7204}{1200} + \frac{5948}{1200} = \frac{13152}{1200} = \boldsymbol{\frac{274}{25}} units$$

5. **Answer:**
   Use Pythagorean theorem: $15^2 + 13^2 = x^2$
   $225 + 169 = x^2$
   $x = \sqrt{394} \approx 20$
   (19*19 = 361, 20*20 = 400; 400 is closer to 394, so the answer is **20 ft**.)

6. **Answer:**
   Solve for x: $\frac{3(80)+5x}{8} = 75$
   x=72
   72%

7. **Answer:**
   Calculate Grug's times for each leg
   $$20\ cm \times \frac{12\ cm}{1\ hr} = \frac{5}{3} hr$$
   $$40\ cm \times \frac{16\ cm}{1\ hr} = \frac{5}{2} hr$$
   Combine the times
   $$\frac{5}{3} + \frac{5}{2} = \frac{25}{6} hours$$
   Calculate Grug's average speed
   $$\frac{60\ cm}{\frac{25}{6} hrs} = \frac{360\ cm}{25\ hrs} = \frac{72\ cm}{5\ hrs}$$

   Calculate Glorp's times for each leg and combine
   $$20\ cm \times \frac{15\ cm}{1\ hr} = \frac{4}{3} hr$$
   $$40\ cm \times \frac{12\ cm}{1\ hr} = \frac{10}{3} hr$$
   Combine the times
   $$\frac{4}{3} + \frac{10}{3} = \frac{14}{3} hr$$
   Calculate Glorp's average speed
   $$\frac{60\ cm}{\frac{14}{3} hrs} = \frac{180\ cm}{14\ hrs} = \frac{90\ cm}{7\ hrs}$$

   Find the difference between both aliens' average speeds
   $$\frac{72}{5} - \frac{90}{7} = \frac{504}{35} - \frac{450}{35} = \boldsymbol{\frac{54}{35} cm/hr}$$

8. **Answer:**
C= # of chickens G=# of goats S=# of sheep
C = .9(20) = 18 C=2G → 2G=18 → G=9
G=3S=9 → S=3
3 sheep

9. **Answer:**
$$\frac{6x^3y + 12x^2y^2 + 4x - 3y}{10x - 5y}$$
$$\frac{6(2)^3(-3) + 12(2)^2(-3)^2 + 4(2) - 3(-3)}{10(2) - 5(-3)}$$
$$\frac{6(8)(-3) + 12(4)(9) + 4(2) - 3(-3)}{10(2) - 5(-3)}$$
$$\frac{-144 + 432 + 8 + 9}{20 + 15} = \frac{305}{35} = \mathbf{\frac{61}{7}}$$

10. **Answer:**
.7(90) = 63 red apples /basket
.3(90) = 27 green apples /basket
Green apples needed = 10(6) = 60 →3 baskets
189/8= 23 trays w/ **5 red apples left over**

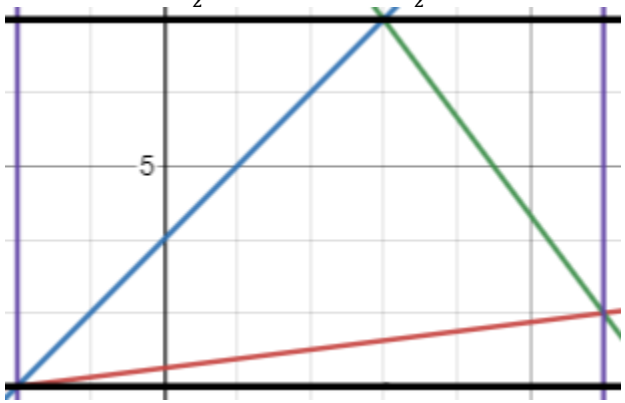
11. **Answer:**
Rewrite each number as a power to the power of four:

Then compare the bases of the powers to the fourth:
A=243^4 B=125^4 C=121^4 D=256^4
Your list should read:
D, A, B, C

12. **Answer:**
$$\left(x + \frac{1}{x}\right) = 5a$$
$$\left(x + \frac{1}{x}\right)^3 = 125a^3$$
Expand the equation:
$$x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right) = 125a^3$$
Substitute 5a:
$$x^3 + \frac{1}{x^3} + 3(5a) = 125a^3$$
Rearrange the equation:
$$x^3 + \frac{1}{x^3} = \mathbf{125a^3 - 15a}$$

13. **Answer:**
List the results:
1, 1, 3, 4, 4, 4, 4, 4, 5, 5, 6, 6
Add up all of these numbers and divide by the number of results: 47/12
Median: 4 Mode: 4 Mean: 47/12
Add up these three stats: (4=48/12)
$$= \frac{48}{12} + \frac{48}{12} + \frac{47}{12} = \frac{143}{12} = \mathbf{11\frac{11}{12}}$$

14. **Answer:**
Number the equations 1, 2, and 3, respectively:
1. 2x+y-4z=25
2. x-3y+2z=3
3. 3x-2y+5z=42

Then, perform these operations on the equations:
2*1+3: 7x-3z=92
3*1+2: 7x-10z=78
Subtract these equations to get this difference:
7z=14 → z=2
Plug in the value of z to find x and y: x=14, y=5
Thus, xy/z = (14)(5)/2 = **35**

15. **Answer:**
Students can find the points where the three lines intersect: (3, 7), (6, 3), and (-2, 2). Then, they can plot the triangle and a rectangle with sides connecting the vertices of the triangle as shown below. Find the area of the rectangle by counting the units then subtract the combined areas of the three right triangles from it.
$$\boldsymbol{A = 5(8) - \frac{1}{2}(8 + 12 + 25) = \frac{35}{2} = 17.5}$$