

Name \_\_\_\_\_



## Rocket City Math League Apollo Test

**2018-2019  
Round 1**

Answers must be written inside the adjacent answer boxes. All answers must be written in exact, reduced, simplified, and rationalized form. **No calculators, books, or other aides may be used.**

**Time Limit: 45 minutes**

1. Evaluate: $(8 + 4i)(5 - 3i)$ . Answer in $a + bi$ form. <span style="float: right;"><i>(3 points)</i></span>	
2. Today, Juda from Jupiter decided to map out where his house, his favorite restaurant, and his school are located on the $xy$ -plane. He figured out that his house is at the point $(0,0)$ , his school is at $(8,0)$ , and his favorite restaurant is at $(4,8)$ . Juda draws straight lines from place to place, creating a closed area. Juda sees that the shape created is a triangle, and now he wants to find the area. What is the area of the triangle Juda charted? <span style="float: right;"><i>(3 points)</i></span>	
3. If $\cot \theta = -\frac{15}{20}$ and $90^\circ < \theta < 180^\circ$ , find the value of $\sin \theta$ . <span style="float: right;"><i>(3 points)</i></span>	
4. Find the determinant of the matrix below. $\begin{bmatrix} 2 & -1 & 4 \\ -1 & -2 & 1 \\ 3 & 6 & 2 \end{bmatrix}$ <span style="float: right;"><i>(3 points)</i></span>	
5. A space dog named Hector is tethered by a leash to the center of the curve with equation: $x^2 + y^2 - 8x - 6y = 0$ , where $x$ and $y$ are measured in feet. If Hector's friend, Sam, adds 4 feet of length to Hector's leash, what is the new area where Hector can play? (Leave answers in terms of $\pi$ .) <span style="float: right;"><i>(4 points)</i></span>	
6. Sally from Saturn runs an ice cream truck. She sells 21 vanilla ice creams and 7 chocolate ice creams on the first day of business. On the second day, she sells 30 vanilla and 18 chocolate ice creams, and on the third day, she sells 39 vanilla and 29 chocolate ice creams. If Sally continues this pattern, (each flavor following an arithmetic sequence) on what day will she sell the same number of chocolate and vanilla ice creams? <span style="float: right;"><i>(4 points)</i></span>	
7. Evaluate: $\sin^2 \frac{13\pi}{3} + \cos^2 \frac{13\pi}{3} + \sin^2 \frac{14\pi}{3}$ <span style="float: right;"><i>(4 points)</i></span>	
8. Find the remainder when the function $f(x) = 7x^5 - 5x^3 + 3x - 1$ is divided by $x + 2$ . <span style="float: right;"><i>(5 points)</i></span>	
9. Agatha the Alien bought 3 different types of space snacks from her local bakery. Mars Macaroons cost 3 coins each, Mini Pavlovas cost 4 coins each, and Nova Bites cost 5 coins each. Agatha bought a quantity of Nova Bites equal to a third of the sum of the quantity of the other two snacks. If Agatha bought 68 space snacks and paid 260 coins, how many coins did she pay for all of the Nova Bites? <span style="float: right;"><i>(5 points)</i></span>	
10. Solve for $x$ : $\log_{1/3}(\log_{64}(\log_2(x + 1))) + \log_{25} 2 = \log_{25} 10 + \log_{49} 7$ <span style="float: right;"><i>(6 points)</i></span>	

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