

Name \_\_\_\_\_



## Rocket City Math League Apollo Test

**2017-2018  
Round 1**

Answers must be written inside the adjacent answer boxes. All answers must be written in exact, reduced, simplified, and rationalized form. All decimals and mixed numbers must be written as improper fractions. **No calculators, books, or other aids may be used.**

**Time Limit: 45 minutes**

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|--|--|
| 1. Given $f(x) = 9x^2 - 4$ and $g(x) = \frac{\sqrt{x}}{3}$ , find $f(g(36))$ . <span style="float: right;"><i>(3 points)</i></span>  |  |
| 2. What is the value of $\frac{a}{b}$ if $\sqrt{1944x^3y^2z}$ is expressed in simplest radical form as $a\sqrt{b}$ ? (Assume all variables are positive.) <span style="float: right;"><i>(3 points)</i></span>   |  |
| 3. Xavier is a space-crusading alien. He is currently caught in the gravitational pull of an ominous and deadly planet. He knows how to leave the orbit, but first needs to find out the equation of the elliptical shape of his orbit. He finds that if he chooses (0, 0) to be the center of the ellipse, the vertex of his orbit on an xy-plane would be (0, 12), and his co-vertex would be (-8, 0). Find $5a + 2b$ if the equation of the ellipse is $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ . <span style="float: right;"><i>(3 points)</i></span> |  |
| 4. Bill and Greg are space cowboys and are lassoing space cows. Bill can lasso 4 space cows in one hour. Greg can lasso 3 space cows an hour, and he has already lassoed 7 space cows. How many space cows will have been lassoed in total when both Bill and Greg have the same number of space cows lassoed? <span style="float: right;"><i>(3 points)</i></span>  |  |
| 5. The password to enter the Galaxy Gang Headquarters is the determinant of $\begin{bmatrix} 9 & -2 & 5 \\ 7 & 13 & -3 \\ 11 & 3 & 4 \end{bmatrix}$ . What is the password? <span style="float: right;"><i>(4 points)</i></span>   |  |
| 6. What is the value of $g(f(g(5)))$ if $g(x) = 2x + 1$ and $f(x) = g(x) + 3$ ? <span style="float: right;"><i>(4 points)</i></span>   |  |
| 7. What is the distance between the midpoint of (6, 4) and (8, 2) and the midpoint of (11, 1) and (7, -1)? <span style="float: right;"><i>(4 points)</i></span>  |  |
| 8. If $f(x) = 3^x - 2$ , find the product of $f^{-1}(241)$ and $f(-2)$ . <span style="float: right;"><i>(5 points)</i></span>  |  |
| 9. What is the radius of the circle with equation $-x^2 = y^2 + 16x + 12y - 21$ ? <span style="float: right;"><i>(5 points)</i></span>   |  |
| 10. Find all values of $a$ that satisfy the equation $2^{2a+1} - 17 \cdot 2^a + 2^3 = 0$ . <span style="float: right;"><i>(6 points)</i></span>  |  |

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