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University of Houston
High School Contest – Spring 2006
Algebra I Test

1. Give the axis of symmetry for the quadratic function $f(x) = -9x^2 - 11x + 1$.

2. Simplify $\frac{f(x+h) - f(x)}{h}$ for the function $f(x) = -1 - 9x$.

3. Factor $64r^6 - s^6$.

4. Assume *x*, *y* and *z* are positive real numbers. Rewrite the expression $\sqrt{\frac{\left(\sqrt[3]{x}\right)\left(\sqrt[4]{y^3}\right)}{\sqrt[5]{z^4}}}$ using positive rational exponents.

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5. Solve the equation $\frac{5}{x} - \frac{4}{x+2} = \frac{1}{5} + \frac{1}{5x}$.

6. Solve the following equation for *b*: $\frac{1}{a} + \frac{1}{b} = \frac{1}{c}$.

7. Find all real solutions to the equation $x^{-2} + x^{-1} - 6 = 0$.

8. Find all real solutions to the equation $(y^2 + y)^2 - 8(y^2 + y) + 12 = 0$.

9. Give the values for *p* and *q* so that the points (-1, 1), (-2, -5), (2, 2), and (*p* , *q*) are the vertices of a parallelogram.

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10. The solution of the system $\begin{matrix} 2x - Dy = 6 \\ Cx + 4y = 14 \end{matrix}$ is (6, 2). Find *C* and *D*.

11. Suppose *n* is a natural number. Expand the product $(x^n + y^n)(x^{2n} - x^n y^n + y^{2n})$.

12. Sally sells lemonade at a carnival. A customer can order a small or large size lemonade. The small size sells for $3.50 and the large size sells for $5.50. By the end of the day she loses track of the number of lemonades of each size she sold. However, by looking at her receipts she knows that she sold a total of 31 lemonades for a total of $152.50. Determine the number of large size lemonades she sold that day.

13. A long distance provider has two plans available – Plan A and Plan B. Plan A costs $3.99 each month and each call is 7 cents per minute. Plan B has no monthly charge and each call is 13 cents per minute. How many minutes of long distance calling in a month would result in both plans having the same monthly cost?

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14. A bicyclist rides his bike each day on a trail not far from his house. During the first part of the ride he is pedaling mostly uphill and his average speed is 6 miles an hour. After a certain point, he is traveling mostly downhill and averages 15 miles per hour. If the total distance he travels is 30 miles and the total time he rides is 4 hours, how long did he ride at each speed?

15. Two lines pass through the point (-2,1). One of these lines also passes through the point (3,2), and the other line is perpendicular to this line. Give the slope intercept form of the line with the least slope.

16. The graph of a quadratic function has *x* intercepts at -3 and 5/2, and *y* intercept at 10. Give the function.

17. Give the largest value *n* so that *n* of the points

$$\left(1,\frac{1}{6}\right),\left(-2,\frac{7}{6}\right),\left(5,-\frac{7}{6}\right),\left(1,\frac{19}{6}\right),\left(-2,-\frac{5}{6}\right),\left(5,-\frac{13}{6}\right),\left(3,-\frac{5}{2}\right),\left(-1,-\frac{13}{6}\right)$$

lie on the same line. Identify the points on this line and give the equation of the line.

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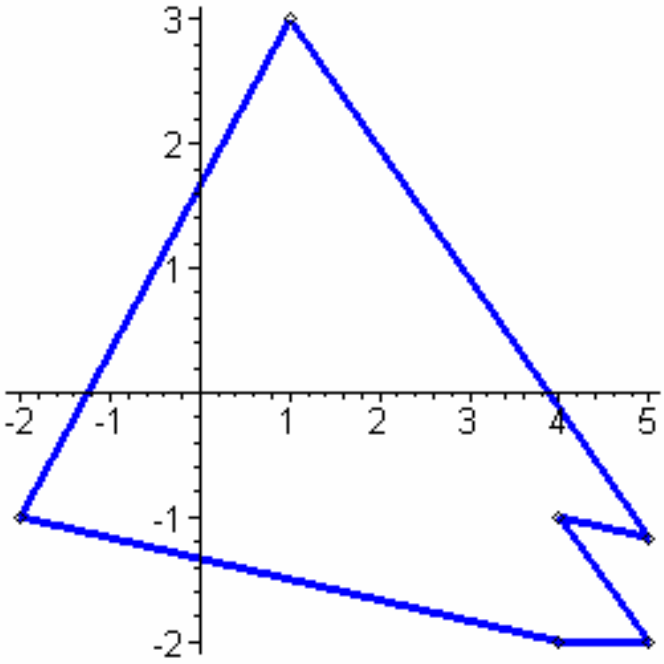
18. The set *A* consists of 10 distinct integers. The smallest of these integers is -6, and the largest is 5. The sum of the integers is 1. Give all possible choices for the set *A*.

19. It is well known that the area of a triangle with vertices $(a,b),(c,d),(e,f)$ is given by $\frac{1}{2}\left|(c-a)(f-b)-(d-b)(e-a)\right|$. Give the area of the polygon shown below.



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Answer Sheet - Algebra I Exam

Place your answers on this sheet. The work on your exam will only be graded in case of a tie breaker.

1.	**11.**
2.	**12.**
3.	**13.**
4.	**14.**
5.	**15.**
6.	**16.**
7.	**17.**
8.	**18.**
9.	**19.**
10.	