

Name: _____

School: _____

**University of Houston
High School Contest – Spring 2008
Algebra I Test**

Directions: You have 50 minutes to complete this exam. Calculators are not permitted. Choose the correct answer for each question by clearly and boldly circling the answer choice. There is no penalty for guessing. In the case of a tie, students' work will be used to determine the winner – so show all work clearly on either your exam or on scrap paper. Write your name and school on top of each page in the blanks provided.

1. Give one factor of the polynomial. The variables used as exponents represent positive integers.

$$-24u^{3m}v^n + 4u^{2m}v^{2n} + 48v^{3n}u^m$$

- a. $(2u^m - 3v^n)$
- b. This polynomial cannot be factored.
- c. $u^{3m}v^{3n}$
- d. $4u^{3m}v^{3n}$
- e. $(-2u^m - 3v^n)$

2. Perform the indicated operation. Simplify completely. The variable in the exponents represents positive integers.

$$\frac{x^{2k} - 9}{3x^{k+3} + 9x^3} \div \frac{x^{k+2} - 3x^2}{6x^{k+5}}$$

- a. $2x^k$
- b. $\frac{2x^k(x^k + 3)}{x^k + 9}$
- c. $\frac{(x^k - 3)^2}{18x^{k+6}}$
- d. $\frac{1}{2}x^{k-6}$
- e. $2k$

Name: _____

School: _____

3. Replace k in the following trinomial by a number that makes the trinomial a perfect square trinomial.

$$ks^2 - 24s + 9$$

- a. 4
- b. 3
- c. 16
- d. 9
- e. 12

4. Simplify. $1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{x}}}}$.

- a. $\frac{3x+2}{x}$
- b. $\frac{5x+3}{3x+2}$
- c. x
- d. $\frac{4x+1}{x}$
- e. $\frac{2x+6}{x+4}$

5. Give a real solution to the equation $12x^3 + 16x^2 - 5x - 3 = 0$ given that $-\frac{3}{2}$ is a root.

- a. $-\frac{1}{3}$
- b. 0
- c. No other real solutions exist.
- d. 2
- e. $-\frac{1}{2}$

Name: _____

School: _____

6. One day you went canoeing. You learned that the current in the river was 2 miles per hour. If it took you the same amount of time to travel 10 miles downstream as 2 miles upstream, determine the speed at which your canoe would travel in still water.

- a. 3 miles per hour
- b. 0.5 mile per hour
- c. 5 miles per hour
- d. 1 mile per hour
- e. 2 miles per hour

7. Given $2x^2 + 3x + c = 0$, find all values of c that will result in the equation having no real number solution.

a. It is not possible to find all values of c .

- b. $c < \frac{9}{8}$
- c. $c \geq 1$
- d. $c > \frac{9}{8}$
- e. $c < 1$

8. Simplify.

$$\frac{\sqrt{90x^4y}}{\sqrt{2x^5y^5}}$$

- a. $\frac{3\sqrt{5}}{y^2}$
- b. $\frac{3\sqrt{5x}}{2xy^2}$
- c. $\frac{15}{xy^2}$
- d. $\frac{3\sqrt{x^5y^6}}{x^3y^5}$
- e. $\frac{3\sqrt{5x}}{xy^2}$

Name: _____

School: _____

9. A storeowner wants to set up a rectangular display area outside his store. He will use one side of the building (which is 25 feet long) as part of one side of the display area. He has 230 linear feet of fencing material to use to fence in the display area. Write a function which expresses the total area of the display area in terms of the length x of the side of the display area opposite the building.

a. $A(x) = \frac{255}{2}x + x^2$

b. $A(x) = \frac{255}{2}x - x^2$

c. $A(x) = \frac{253}{2}x^2$

d. $A(x) = \frac{253}{2}x$

e. $A(x) = 230x - 25$

10. Solve for x .

$$|x^2 + 6x + 1| = 8$$

a. $x = -7, x = 1$

b. $x = -7, x = -3$

c. $x = -7, x = -3, x = 1$

d. $x = -3, x = 1$

e. $x = 1$

11. Give a factor of $x^4 - 10,000$ over real numbers.

a. This polynomial cannot be factored over real numbers.

b. $x^2 + 10$

c. $x^4 - 100$

d. $x - 10$

e. $x^4 + 100$

Name: _____

School: _____

12. Simplify.

$$\frac{\sqrt{x}}{\sqrt{2} - \sqrt{x}}$$

- a. $\frac{\sqrt{2x} + x}{2 - x}$
- b. \sqrt{x}
- c. $\frac{2\sqrt{x} + x}{4 - x}$
- d. $\frac{\sqrt{x} - x}{2 + x}$
- e. $\frac{\sqrt{2x} - x}{2 - x}$

13. Larry, a chemistry student, needs 10% acetic acid solution for a chemistry experiment. He realizes he only has 5% and 20% acetic acid solutions available. He decides to make the 10% solution by combining the 5% and 20% solutions. How many liters of the 5% solution must he add to 8 liters of the 20% solution to get a solution that is 10% acetic acid?

- a. 16.5 liters
- b. 32 liters
- c. 16 liters
- d. 8.5 liters
- e. 24 liters

14. For exercise, Carrie and Amanda run from their home to a nearby park. Carrie runs $3\frac{1}{2}$ miles per hour. Amanda runs $7\frac{1}{4}$ miles per hour. When Amanda arrives at the park, Carrie is $5\frac{5}{8}$ miles away. How far is the park from their house?

- a. 11.78125 miles
- b. 10.875 miles
- c. 9.125 miles
- d. 1.5 miles
- e. 1.625 miles

Name: _____

School: _____

15. A ball is dropped from a height of 128 feet. Its height s , in feet, at time t , in seconds, is given by $s(t) = -16t^2 + 96t + 128$. When will the ball hit the ground?

- a. after 2 seconds
- b. after $6 + 2\sqrt{17}$ seconds
- c. after $2\sqrt{2}$ seconds
- d. after $3 + \sqrt{17}$ seconds
- e. after 4 seconds

Problems 16 - 25 start on the next page!!

(16) Solve the following system for x and y :

$$\frac{7}{x} + \frac{2}{y} = 5$$
$$\frac{1}{x} + \frac{4}{y} = -3$$

- (a) Infinitely many solutions
 - (b) $\{(\frac{15}{7}, \frac{15}{13})\}$
 - (c) $\{(\frac{15}{13}, \frac{15}{7})\}$
 - (d) No solutions
 - (e) $\{(1, -1)\}$
 - (f) None of the above.
- (17) Jim can't remember the last digit of his best friend's phone number. He plans to just dial the number and guess the last digit. What's the probability that he'll dial the correct number in the first 2 tries?
- (a) $\frac{1}{10}$
 - (b) $\frac{1}{45}$
 - (c) $\frac{17}{10}$
 - (d) $\frac{1}{5}$
 - (e) $\frac{2}{5}$
 - (f) None of the above.
- (18) Jeanini bought a ring in 1990 for \$200. By 1995 it had lost 3% of its value. In 2000 it was worth 33% more than in 1995. By 2005 it had lost 10% of its value from 5 years earlier. What was the ring worth in 2005 (in nearest whole dollars)?
- (a) \$232
 - (b) \$229
 - (c) \$227
 - (d) \$213
 - (e) \$221
 - (f) None of the above.

- (19) Find the real number solutions: $\sqrt{3x+1} + \sqrt{x-4} = 3$.
- (a) 5
 - (b) 8
 - (c) 5,8
 - (d) No real number solutions.
 - (e) 4,5,8
 - (f) None of the above.
- (20) Find the remainder of $x^8 + 1$ divided by $x - 1$.
- (a) 1
 - (b) -1
 - (c) 2
 - (d) -2
 - (e) 0
 - (f) None of the above.
- (21) Find the largest number that always divides the difference of the squares of two consecutive even numbers.
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
 - (e) None of the above.
- (22) Jim buys pixie sticks at 4 for 10 cents. He sells them at 4 for 15 cents. How many does he have to sell in order to make a profit of \$1.00?
- (a) 80
 - (b) 40
 - (c) 8
 - (d) 125
 - (e) 25
 - (f) None of the above.

- (23) Instead of walking along the adjacent sides of a rectangular field, Joe took a shortcut along the diagonal and saved a distance equal to half the length of the longer side. Find the ratio of the longer side to the shorter side of the field.
- (a) 5:3
 - (b) 3:2
 - (c) 2:3
 - (d) 5:2
 - (e) 4:3
 - (f) None of the above.
- (24) Write 25.25 in base 2.
- (a) 1011.01
 - (b) 1101.01
 - (c) 11001.001
 - (d) 1101.001
 - (e) 11001.01
 - (f) None of the above.
- (25) There are 500 red and blue balls in a jar. 1% of the balls are blue. Some red balls, but no blue balls, are withdrawn. Then 2% of the balls are blue. How many balls are still in the jar?
- (a) 490
 - (b) 495
 - (c) 485
 - (d) 250
 - (e) 245
 - (f) None of the above.