

*2008 Invitational Mathematics Competition*  
*Algebra II Individual Test*

**Algebra II Individual Test**

December 18, 2008

Directions: No calculators. Answer the questions by bubbling in the best choice on your answer sheet. If **no** correct answer is given then bubble e)NOTA for "none of these answers".

- Simplify  $5 - 3(6 - 4^2) - |-2|^3$ 
  - 69
  - 27
  - 29
  - 43
  - NOTA
- Find the solution set of the inequality  $-13 \leq -4x - 1 < 27$ 
  - $\frac{-7}{2} \leq x < \frac{13}{2}$
  - $\frac{-13}{2} < x \leq \frac{7}{2}$
  - $-7 < x \leq 3$
  - $x < -7$  or  $x \geq 3$
  - NOTA
- Find the equation whose zeros are  $\left\{\frac{4}{3}, \frac{-1}{2}\right\}$ 
  - $x^2 + \frac{5}{6}x = \frac{2}{3}$
  - $6x^2 + 5x = 4$
  - $6x^2 - 5x = 4$
  - $x^2 - \frac{2}{3} = 0$
  - NOTA
- Find the solution set of  $|4x - 3| = -5$ 
  - $\left\{\frac{-1}{2}\right\}$
  - $\{2\}$
  - $\left\{\frac{-1}{2}, 2\right\}$
  - $\left\{\frac{-1}{2}, \frac{1}{2}, 2\right\}$
  - NOTA
- Determine k so that the slope of a line is -3 when the line goes through the points (7, 0) and  $\left(8, \frac{1}{k}\right)$ 
  - 3
  - $\frac{-1}{3}$
  - $\frac{1}{3}$
  - 3
  - NOTA
- Let  $P(x) = 2x^3 + 3x^2 - 4x + 5$ . Find the remainder when P(x) is divided by  $x + 2$ .
  - 31
  - 15
  - 9
  - 25
  - NOTA
- If Sandra can text 12 words in  $2\frac{1}{4}$  seconds how many words does she text in half a minute?
  - $2\frac{2}{3}$
  - 6
  - 160
  - 320
  - NOTA

8. A linear graph contains the points (3, -4) and (8, 11). If (-7, b) is also a point on the graph, what is the value of b?
- a) -34                      b) -10                      c) 10                      d) 34                      e) NOTA
9. Factor  $(x+1)^3 - 27$
- a)  $(x-2)(x-2)(x-2)$     b)  $(x-2)(x^2 + 5x + 13)$     c)  $(x+1)(x+2)(x-3)$     d)  $(x+1)(x^2 - 27)$     e) NOTA
10. If 3 skips equal 4 hops and 1 jump equals 2 skips, then how many jumps equal “a hop , a skip, and a jump”?
- a)  $1\frac{7}{8}$                       b)  $2\frac{1}{4}$                       c)  $3\frac{3}{4}$                       d) 5                      e) NOTA
11. Assume the expression is defined over the real numbers, simplify  $\sqrt{-2x} \cdot \sqrt{-8x}$
- a) 4x                      b) -4x                      c) |4x|                      d) -|4x|                      e) NOTA
12. Solve  $a(bx - c) = x - b(x + a)$  for x
- a)  $\frac{c+b}{2b-1}$                       b)  $\frac{ac+ab}{ab+b}$                       c)  $\frac{ac+ab}{ab+b-1}$                       d)  $\frac{ac-ab}{ab+b-1}$                       e) NOTA
13. Given  $i = \sqrt{-1}$ , then if  $(2x - 3i) + (1 + yi) = 5 - 7i$ , find x + y.
- a) -2                      b) -1                      c) 2                      d) 4                      e) NOTA
14. Successive discounts of 20% and 25% are equivalent to a single discount of:
- a) 22 ½ %                      b) 30%                      c) 40%                      d) 45%                      e) NOTA
15. Given  $\begin{cases} 2x + 5y = -4 \\ x - 3z = -3 \\ 2y - z = -6 \end{cases}$  find xyz.
- a) -12                      b) -7                      c) 7                      d) 12                      e) NOTA

16. Find the solutions for  $x^2 - 4x < 12$
- a)  $0 < x < 4$       b)  $-2 < x < 6$       c)  $x < 0$  or  $x > 4$       d)  $x < -2$  or  $x > 6$       e) NOTA
17. Sam invests \$100,000 in three different funds. The first is a bond fund paying 7% interest annually. Sam wants to invest twice as much in the second fund, which is a mutual fund paying 5% annual interest. He will invest the rest in a money market fund paying 4% annual interest. If Sam wants to earn 5½% all together on his investment, how much should he invest in the money market fund?
- a) \$ 0      b) \$10,000      c) \$14,000      d) \$15,000      e) NOTA
18. Arrange the  $1, [x], \sqrt{x}, \frac{1}{x}, \frac{1}{\sqrt{x}}$  in order from smallest to largest given  $0 < x < 1$
- a)  $[x], \sqrt{x}, \frac{1}{x}, \frac{1}{\sqrt{x}}, 1$       b)  $[x], \sqrt{x}, \frac{1}{\sqrt{x}}, \frac{1}{x}, 1$       c)  $\sqrt{x}, 1, \frac{1}{\sqrt{x}}, \frac{1}{x}, [x]$       d)  $[x], \sqrt{x}, 1, \frac{1}{\sqrt{x}}, \frac{1}{x}$       e) NOTA
19. If  $f(x)$  and  $g(x)$  are functions such that  $f(x) = 3x - 2$  and  $f(g(x)) = x$ , then  $g(x)$  is equal to:
- a)  $g(x) = \frac{x+2}{3}$       b)  $g(x) = \frac{x-2}{3}$       c)  $g(x) = \frac{x+3}{-2}$       d)  $g(x) = 3x - 2$       e) NOTA
20. Simplify  $\frac{1 - \frac{3}{x}}{1 - \frac{2}{x} - \frac{3}{x^2}}$
- a)  $\frac{x^2-3x}{x^2-2x-3}$       b)  $\frac{x-3}{x^2-2x-3}$       c)  $\frac{x}{x-1}$       d)  $\frac{x}{x+1}$       e) NOTA
21. If  $0.03\bar{5}$  is written as a fraction in lowest terms, find the sum of the numerator and denominator.
- a) 187      b) 207      c) 233      d) 1031      e) NOTA
22. Two high school classes take the same test. One class of 30 students has an average of 80%. The other class of 20 students had an average of 90%. What is the average grade for all of the students?
- a) 84%      b) 84.5%      c) 85%      d) 86%      e) NOTA

23. If  $y = \frac{5}{3}x + 12$ , then  $y = x$  only if  $x + y =$
- a) -48                      b) -36                      c) -18                      d) 0                      e) NOTA
24. Simplify  $(\sqrt[3]{4} + \sqrt[3]{32})^3$
- a) 36                      b) 54                      c) 72                      d) 108                      e) NOTA
25. Find the value of k so that  $\begin{vmatrix} 1 & 2 \\ 3 & k \end{vmatrix} = 5k + 4$
- a)  $\frac{-5}{2}$                       b)  $\frac{-1}{2}$                       c) -1                      d) 1                      e) NOTA
26. If  $x^2 + y^2 = 20$  and  $xy = 22$ , then one value for  $x + y$  is
- a)  $3\sqrt{11}$                       b) 8                      c) 13                      d) 23                      e) NOTA
27. Find the sum of the roots if  $5^{x^2+1} = \frac{5^{7x}}{5^{11}}$
- a) 2                      b) 5                      c) 7                      d) 11                      e) NOTA
28. Given  $i = \sqrt{-1}$ , then  $i^{2008} - i^{2007} =$
- a) 1                      b)  $i$                       c)  $1 - i$                       d)  $1 + i$                       e) NOTA
29. A 4<sup>th</sup> degree polynomial function  $f(x)$  has roots at  $x = -4$ ,  $x = -1$ ,  $x = 1$  and  $x = 2$ . The function  $g(x) = f(x) + h$  and has only one root at  $x = k$ . What is the minimum value of  $f(x)$ ?
- a) k                      b) -k                      c) h                      d) -h                      e) NOTA
30. Determine the equation of the line with an x intercept of  $\frac{3}{4}$  and perpendicular to the line  $3x - 5y = 4$ .
- a)  $12x - 20y = 15$       b)  $20x + 12y = 15$       c)  $12x - 20y = 9$       d)  $20x + 12y = 9$       e) NOTA