OU Math Day 2008

Higher Algebra Test

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1. What are the solutions of the equation $2x^2 + 20x + 42 = 0$?

   (A) $x = 3$ and $x = 7$ (B) $x = -1$ and $x = -2$ (C) $x = -3$ and $x = -7$
   (D) $x = -4$ and $x = 6$ (E) None of the above

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2. There are 32 different combinations of how five voters can vote either YES or NO on an issue. In how many of these combinations are there either 3 YES and 2 NO votes or 2 YES and 3 NO votes?

   (A) 6 (B) 10 (C) 20 (D) 26 (E) None of the above

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3. What is the smallest positive integer n for which $2n^2 + 1$ is larger than 2008?

   (A) 31 (B) 32 (C) 44 (D) 45 (E) None of the above

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4. The expansion of $(x + 1)^4$ is

   (A) $x^4 + 1$ (B) $x^4 + 4x^3 + 4x^2 + x + 1$ (C) $x^4 + x^3 + x^2 + x + 1$
   (D) $x^4 + 4x^3 + 6x^2 + 4x + 1$ (E) None of the above

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5. How many distinct real number solutions does the equation

   $$(x^2 + 4x + 1)(x^2 + 3x + 1)(x^2 + 2x + 1)(x^2 + x + 1)(x^2 + 1) = 0$$

   have?

   (A) 10 (B) 8 (C) 6 (D) 5 (E) None of the above

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6. On a math test all but 5 students made an A, all but 6 students made a B, all but 7 students made a C, and no student had a grade lower than C. How many students are in the class?

(A) 7 (B) 9 (C) 11 (D) 15 (E) None of the above

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7. If $f(x) = x^2 - 7$ then what does $f(f(f(f(f(3)))))$ equal?

(A) -3 (B) 3 (C) 1853020188851834 (D) 2 (E) None of the above

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8. Which of the following is the fractional form of the repeating decimal $.00\overline{3}$?

(A) 1/3 (B) 1/30 (C) 1/300 (D) 1/3000 (E) None of the above

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9. Let $f(x) = 9x^7 + 3x^5 - 6$. Which of the following is a solution of $f(x) = 0$?

(A) $x = -1$ (B) $x = 1/3$ (C) $x = 2/3$ (D) $x = 9$ (E) None of the above

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10. What number is halfway between 1/4 and 1/3 on the number line?

(A) 1/7 (B) 2/7 (C) 7/24 (D) 3/10 (E) None of the above

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11. During the first nine days in a stretch of ten consecutive days the Oklahoma daily high temperatures were

$$77, 85, 84, 79, 80, 91, 92, 96, \text{ and } 76\ .$$

If the average of all ten daily high temperatures was 84.5, what was high temperature on the tenth day?

(A) 85 (B) 83 (C) 90 (D) 84 (E) None of the above

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12. If the cube root of $A - 5$ equals -2 then what is A?

(A) 9 (B) -2 (C) -3 (D) -13 (E) None of the above

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13. How many solutions (x, y, z) does the system of equations $\{x^2 = yz, y^2 = xz, z^2 = xy\}$ have?

(A) 0 (B) 1 (C) 3 (D) 5 (E) None of the above

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14. Which of these numbers is smallest?

(A) .000001 (B) 2/3 (C) $(2/3)^{100}$ (D) $(2/3)^{-100}$ (E) 1/33

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15. Factor $18x^2 - 9x - 20$ into the form $(Ax + B)(Cx + D)$. What is the value of $A + B + C + D$?

(A) 0 (B) 4 (C) 6 (D) 10 (E) None of the above

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16. If $x = 2.999$ then what whole number is nearest to the value of $\dfrac{2x^2 - 9x + 9}{x - 3}$?

(A) 0 (B) 3 (C) 6 (D) 9 (E) None of the above

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17. Find the sum of all of the integer solutions of the inequality $|5 - 3x| < 10$.

(A) 0 (B) 7 (C) 9 (D) 13 (E) None of the above

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18. The sum of four consecutive integers equals 194, what is the largest of the four integers?

(A) 43 (B) 47 (C) 50 (D) 54 (E) None of the above

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19. Let $x = 4 + \sqrt{3}$ be a zero of the polynomial function $f(x) = x^2 + ax + b$ where a and b are integers. Then $a + b$ equals

(A) 2 (B) 3 (C) 4 (D) 5 (E) None of the above

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20. The two circles $(x+5)^2 + y^2 = 36$ and $(x+2)^2 + y^2 = 9$

(A) do not intersect (B) intersect in exactly one point (C) intersect in exactly two points
(D) intersect in more than two points (E) None of the above

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21. Given that $x + \dfrac{1}{x} = 10$, what is the square of $x - \dfrac{1}{x}$?

(A) 96 (B) 1/10 (C) 25 (D) 0 (E) None of the above

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22. Let ℓ_1 be the line which passes through the points $(-2, -4)$ and $(4, 14)$. Let ℓ_2 be the line through the point $(1, -1)$ with slope $m = -5$. The lines ℓ_1 and ℓ_2 intersect at the point

(A) $(5/16, 1/16)$ (B) $(35/16, -1/16)$ (C) $(1/16, 35/16)$
(D) $(-1/16, 35/16)$ (E) None of the above

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23. What is the remainder when the sum of the squares of the integers from 1 to 2008

$$1^2 + 2^2 + 3^2 + \cdots + 2007^2 + 2008^2$$

is divided by 5?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4
