OU Math Day 2018

Algebra II Test

(edited with answers on the last page)

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1. Express $\left(\dfrac{(2-4)^3}{4^2}\right)^{-5}$ as a rational number in lowest terms.

   (A) $-1/2$ (B) $1/8$ (C) -32 (D) $-1/8$ (E) None of the above

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2. If 2 and -5 are solutions to the quadratic equation $ax^2 + bx + c = 0$, what are the solutions to $ax^2 - bx + c = 0$?

   (A) $\{10, -4\}$ (B) $\{5, -2\}$ (C) $\{4, -10\}$ (D) $\{2, -5\}$ (E) None of the above

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3. A chess board is an 8×8 grid made up of 64 small squares. How many 2×2 squares does the chess board contain? (Each 2×2 square is comprised of 4 small squares in the grid.)

   (A) 36 (B) 16 (C) 64 (D) 49 (E) None of the above

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4. Samuel tosses four nickels and four dimes in the air. What is the probability that the total value of the coins that land heads up is exactly 20 cents? Express the answer as a rational number in lowest terms.

   (A) 3/25 (B) 1/4 (C) 5/32 (D) 31/128 (E) None of the above

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5. Which of the following equals $\dfrac{2018! - 2019!}{2018! + 2019!}$?

(A) $-2017/2020$ (B) $1/2018$ (C) 2018 (D) $-1009/1010$ (E) None of the above

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6. What is the sum of the four solutions to the equation $(x^2 - 8x - 1)^2 - 64 = 0$?

(A) 0 (B) 8 (C) 16 (D) -72 (E) None of the above

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7. The digits in the integer 2018 can be rearranged in 7 different ways to obtain a 4-digit integer n with $n \leq 2018$. What is the largest power of 2 that can divide one of these rearrangements?

(A) 2^1 (B) 2^2 (C) 2^3 (D) 2^8 (E) 2^{10}

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8. Express $\dfrac{\sqrt{700} + \sqrt{28} - \sqrt{63}}{\sqrt{700} + \sqrt{28} + \sqrt{63}}$ as a rational number in lowest terms.

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

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9. Among all real numbers x, what is the largest value $|x - 1| - |1 - 2x| + |x + 3|$?

(A) 4 (B) 3 (C) 1 (D) 5 (E) None of the above

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10. Find the smallest integer larger than $\left(\sqrt{5}+\sqrt{2}\right)^4$.

(A) 178 (B) 169 (C) 151 (D) 168 (E) None of the above

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11. How many digits does the integer $25^8\,8^7$ have?

(A) 17 (B) 18 (C) 19 (D) 20 (E) None of the above

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12. Solve the equation $625^{t-4} = 25^{t+5}$ for t.

(A) $t = 14$ (B) $t = 13$ (C) $t = -13$ (D) $t = 22$ (E) None of the above

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13. The domain of the real valued function $f(x) = \sqrt{1-\sqrt{2-\sqrt{3-x}}}$ is the interval:

(A) $[-1, 3]$ (B) $[-1, 2]$ (C) $[2, 3]$ (D) $(-\infty, 3]$ (E) None of the above

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14. Consider the parabola with equation $y = x^2 + x + 1$ and the line with equation $y = 5x - 3$. Find any points of intersection.

(A) The only point of intersection is $(2, 7)$
(B) There are exactly two points of intersection, one of which is $(2, 7)$
(C) There are at least three points of intersection, one of which is $(2, 7)$
(D) The two curves do not intersect
(E) None of the above

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15. A man saved \$2.50 in buying some lumber on sale. If he spent \$25 for the lumber, which of the following is closest to the percentage he saved?

(A) 8% (B) 9% (C) 10% (D) 11% (E) None of the above

16. What is the smallest prime number with two sevens in it?

(A) 77 (B) 177 (C) 277 (D) 377 (E) None of the above

17. For what values of a would the equation $ax^2 + 24x - 4 = 0$ have exactly one solution for x?

(A) 0 and -13 (B) 0 and 36 (C) 0 and 13 (D) 0 and -36 (E) None of the above

18. How many integers between 1918 and 2118 are perfect squares?

(A) 1 (B) 3 (C) 5 (D) 7 (E) None of the above

19. In the decimal expansion of $1/7$ what is the 2018th digit to the right of the decimal point?

(A) 4 (B) 1 (C) 7 (D) 8 (E) None of the above

20. If $f(x) = \dfrac{x-1}{x}$ then the composition of $f(x)$ with itself 2018 times will equal

(A) $\dfrac{x^{2018}-1}{x^{2018}}$ (B) $\dfrac{x-1}{x}$ (C) x (D) $\dfrac{1}{1-x}$ (E) None of the above

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21. How many real solutions does the equation

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

have (not counting multiplicity)?

(A) 4 (B) 5 (C) 6 (D) 7 (E) None of the above

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22. If the values of x which satisfy both $|x-4| > 5$ and $|x-5| < 6$ are precisely the values of x which satisfy $a < x < b$, what does $a+b$ equal?

(A) 2 (B) 8 (C) 10 (D) 20 (E) None of the above

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23. If $x^{2/3} - 6x^{1/3} = 7$ then what does x equal?

(A) 21 or -3 (B) 7 or -1 (C) 343 or -1 (D) 8 (E) None of the above

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24. For how many integers n is $\dfrac{5n+26}{2n+3}$ also an integer?

(A) 5 (B) 3 (C) 1 (D) 2 (E) None of the above

Answers for the 2018 Algebra II Test:

1-4: CBDE

5-9: DCDAA

10-14: ABBBA

15-19: BCDBA

20-24: CADCE