Oklahoma Math Day

November 10, 2022

Algebra I

INSTRUCTIONS:

1. Do not begin the test until told to do so.
2. Calculators are not permitted.
3. Mark your answers on the separate answer sheet.
4. Please remain in your seat until time is called.

OU Math Day 2022

Algebra I Test

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1. Simplify the expression $\dfrac{4-(7-(-9))}{3(-2+4)}$

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

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2. Find the value of k given that $3k+5=2(k-1)+1$.

   (A) -8 (B) -16 (C) -5 (D) -6 (E) None of the above

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3. Determine the remainder when 3325 is divided by 97.

   (A) 34 (B) 96 (C) 13 (D) 27 (E) None of the above

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4. Find the cube root of eight squared.

   (A) 4 (B) 2 (C) $\sqrt{2}$ (D) 16 (E) None of the above

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5. If the price of a stock increased by 32% in 2020 then decreased by 25% in 2021, what was the overall effect on the price after two years?

   (A) -7% (B) -1% (C) $+7\%$ (D) $+8\%$ (E) None of the above

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6. Which number is largest?

   (A) $1^{70}-70^1$ (B) $2^{70}-70^2$ (C) $3^{70}-70^3$ (D) 70^1-1^{70} (E) 70^2-2^{70}

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7. Which of the following equals the reciprocal of $4 - \sqrt{15}$?

   (A) 1 (B) $-4 - \sqrt{15}$ (C) $4 + \sqrt{15}$ (D) -1 (E) None of the above

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8. A 200 yard piece of rope is cut into four pieces. The second piece is 12 yards shorter than the first piece. The third piece is twice as long as the second piece, and the fourth piece is 8 yards more than half the size of the second. How many yards long is the longest of the four pieces of rope?

   (A) 80 (B) 200/3 (C) 52 (D) 40 (E) None of the above

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9. If it is 10 AM now, what time of day will it be after 2022 hours?

   (A) 4 AM (B) 8 PM (C) 4 PM (D) 8 AM (E) None of the above

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10. Find the factorization of the quadratic polynomial $2x^2 - 9x - 5$.

    (A) $(2x + 1)(x + 5)$ (B) $(2x - 1)(x + 5)$ (C) $(2x + 1)(x - 5)$
    (D) $(2x - 1)(x - 5)$ (E) None of the above

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11. Suppose x and y are positive real numbers such that $x + y = xy = x^2 - y^2$. Find the value of $x - y\sqrt{5}$.

    (A) -2 (B) -1 (C) $4 - \sqrt{5}$ (D) 2 (E) None of the above

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12. On a certain math test the scores of 9 of the 10 students who took the test were

$$85, 84, 69, 91, 80, 77, 92, 96, \text{ and } 76\ .$$

If the mean score for all ten students was 83, what grade did the tenth student make?

(A) 80 (B) 83 (C) 90 (D) 84 (E) None of the above

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13. Expand and simplify the polynomial expression $(x-2)(x-1)^2(x+1)^2(x+2)$.

(A) $x^6 - 6x^4 + 9x^2 - 4$ (B) $x^3 - 4x^2 + 5x - 2$ (C) $x^4 - 5x^2 + 4$
(D) $x^6 - 64$ (E) None of the above

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14. Determine the product of all of the solutions to the equation $(x-2)(x-1)^2(x+1)^2(x+2) = 0$.

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

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15. Regarding the positive integer $N = 2022$ which of the following is true?

(A) N is a perfect square
(B) $N^2 - 25$ is a prime number
(C) $N/2$ is a prime number
(D) $N/2 + 1$ is odd
(E) None of the above

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16. Which of the following is **NOT** equal to $\frac{5}{20} + \frac{6}{15}$?

(A) $\frac{1}{3} + \frac{19}{60}$ (B) $\frac{1}{2} + \frac{3}{20}$ (C) $\frac{5}{4} - \frac{3}{5}$ (D) $\frac{11}{20} - \frac{1}{10}$ (E) None of the above

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17. Find the sum of all of the integer solutions of the inequality $|x-1| < 5$.

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

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18. How many digits does the positive integer 2022^7 have?

(A) 21 (B) 22 (C) 23 (D) 24 (E) None of the above

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19. When expanded out the integer 2022^{2022} has $6,685$ digits. Determine its final digit.

(A) 2 (B) 4 (C) 6 (D) 8 (E) None of the above

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20. What is the smallest positive integer which is both odd and has five distinct prime factors. (To illustrate: since $40,600 = 2^3 \times 5^2 \times 7 \times 29$, it has four distinct prime factors.)

(A) 243 (B) 1155 (C) 10395 (D) 15015 (E) None of the above

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21. Suppose you answer the last three questions on this test at random. What is the most likely number of these three questions that you will answer correctly? (note: there are 5 possible answers for each question.)

(A) 0 (B) 1 (C) 2 (D) 3 (E) It is impossible to determine.

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22. How many positive integer divisors of $49,000,000$ are perfect squares?

(A) 117 (B) 100 (C) 32 (D) 9 (E) None of the above

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23. In how many three digit numbers are at least two of the digits the same?

(A) 18 (B) 100 (C) 164 (D) 252 (E) None of the above
