OU Math Day 2023

Algebra II Test

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1. Find the x-coordinate of the intersection of the two lines $y = 3x + 2$ and $y = -2x + 10$.

   (A) .4 (B) 1.6 (C) 6.8 (D) No intersection (E) None of the above

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2. Which of the following numbers is the smallest?

   (A) $\frac{6}{11}$ (B) $\frac{7}{12}$ (C) $\frac{8}{13}$ (D) $\frac{9}{14}$

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3. If you grab two pieces of fruit at random from a bag that has 2 apples and 2 oranges, what is the probability you will get two of the same type of fruit (two apples or two oranges)?

   (A) 1 in 4; that is, 25% (B) 1 in 3; that is, $33.\overline{3}\%$ (C) 1 in 2; that is, 50%

   (D) 1 in 1; that is, 100% (E) None of the above

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4. What is the sum of all solutions to the equation $x^2 = x + 1$?

   (A) 0 (B) 1 (C) $\frac{1+\sqrt{5}}{2}$ (D) $\sqrt{5}$ (E) None of the above

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5. If $5^x = 24$, which of the following following could be x?

   (A) $\log(5) - \log(24)$ (B) $\frac{\log(24)}{\log(5)}$ (C) $\frac{\log(5)}{\log(24)}$

   (D) $\log(5) + \log(24)$ (E) None of the above

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6. Which of the following is equal to $(x+1)^4$?

(A) $x^4+x^3+x^2+x+1$ (B) $x^4+2x^3+3x^2+2x+1$ (C) $x^4+2x^3+3x^2+4x+5$

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

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7. How many times does the line $y=x+3$ intersect the parabola $y=x^2+3x+4$?

(A) 0 (B) 1 (C) 2 (D) Infinitely many (E) None of the above

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8. What is the largest y-coordinate of any point on the graph of $(x-2)^2+(y+1)^2=4$?

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

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9. Which of the following fractions is equal to the repeating decimal $1.\overline{18}$?

(A) 19/15 (B) 25/21 (C) 13/11 (D) 38/33 (E) None of the above

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10. If $f(x)=ax-2$ for some number a and $f(f(1))=3$, which of the following could be a?

(A) $2-\sqrt{3}$ (B) 2 (C) $1+\sqrt{6}$ (D) 3 (E) None of the above

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11. If $(Ax^2 + Bx + C)(3x + 2) = 6x^3 - 5x^2 - 3x + 2$, what is $A + B + C$?

(A) -2 (B) 0 (C) 1 (D) 6 (E) None of the above

12. What is the largest positive number c with the property that $c + \frac{1}{c} \leq 10$?

(A) $\sqrt{24}$ (B) $7 + \sqrt{3}$ (C) $5 + 2\sqrt{6}$ (D) 10 (E) None of the above

13. Which of the following numbers is equal to $\frac{24}{\sqrt{17}+\sqrt{5}}$?

(A) $8\sqrt{3}$ (B) $\frac{\sqrt{17}+\sqrt{5}}{2}$ (C) $2\sqrt{12}$ (D) $2(\sqrt{17} - \sqrt{5})$ (E) None of the above

14. If a and b are real numbers with $a + b = 6$ and $ab = 7$, which of the following could be a?

(A) $\frac{1+\sqrt{5}}{2}$ (B) $2 + \sqrt{5}$ (C) 3 (D) $3 + \sqrt{2}$ (E) None of the above

15. Which of the following polynomials is a factor of $x^4 + 4x^3 - 9x^2 - 16x + 20$?

(A) $x - 1$ (B) x (C) $x + 1$ (D) $x + 3$ (E) None of the above

16. Which of the following functions $f(x)$ has a global maximum; that is, a value which is greater than or equal to the value at all other points in its domain?

(A) $f(x) = -x^3 + 3x + 2$ (B) $f(x) = \log_{10}(x)$ (C) $f(x) = x^4 - x^2 + 2x$
(D) $f(x) = \sqrt{1 - x^2}$ (E) None of the above

17. How many minutes are in one week?

(A) 8760 (B) 10080 (C) 36524 (D) 86400 (E) None of the above

18. Which of the following numbers is the largest?

(A) 13^4 (B) 9^8 (C) 8^9 (D) 4^{11}

19. What day of the week will it be in 2^{2023} days?

(A) Wednesday (B) Thursday (C) Friday (D) Saturday (E) None of the above

20. How many integers between 1 and 1000 are divisible by 5 but do not contain 1 as a digit?

(A) 160 (B) 161 (C) 162 (D) 163 (E) None of the above

21. Anne, Ben, and Sadako are folding paper cranes. Anne takes 6 minutes to fold a crane, Ben takes 3 minutes to fold a crane, and Sadako takes 2 minutes to fold a crane. How long does it take them to fold 1000 paper cranes?

(A) 16 hours and 15 minutes (B) 16 hours and 40 minutes (C) 16 hours and 42 minutes
(D) 16 hours and 45 minutes (E) None of the above

Answers for the 2023 Algebra II Test:

1–5: BABBB

6–10: DBCCC

11–15: BCDDA

16–20: DBCDB

21: C