HIGHER ALGEBRA TEST

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1. For what values of the variable c does $p(x) = 3x^2 - 2x + c$ have two real roots?

   (A) $0 < c < \frac{2}{3}$ (B) $0 \leq c \leq 13$ (C) $c \geq 6$ (D) $c < \frac{1}{3}$ (E) $c > -\frac{1}{6}$

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2. What is the slope of a line that is perpendicular to the line $3x + 5y = -1$?

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

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3. Suppose $a \geq 0$. What does $\sqrt{a\sqrt[3]{a\sqrt[4]{a}}}$ equal?

   (A) $a\sqrt{a}$ (B) $\sqrt[8]{a}$ (C) $\sqrt[8]{a^3}$ (D) $\sqrt[24]{a^{17}}$ (E) None of the above.

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4. If $x = 2$ is a solution to the equation $x^3 + 3x^2 + Ax - 3 = 0$ then what must A equal?

   (A) $23/2$ (B) $-23/2$ (C) 2 (D) $-17/2$ (E) None of the above.

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5. An electronics store is having a 30% off sale. A DVD player is on sale for $203. What would the same DVD player sell for if it were on sale at only 20% off?

   (A) $210.12   (B) $213   (C) $223.30   (D) $232   (E) None of the above.

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6. Which of the following equalities is guaranteed by the *distributive law*?

(A) $a + b = b + a$ (B) $(a + b) + c = a + (b + c)$ (C) $(ab)c = a(bc)$

(D) $a(b + c) = ab + ac$ (E) None of the above.

7. If $\log A = 17/10$, $\log B = 31/10$, and $\log C = 21/5$, evaluate $\log(AB^2/C)$.

(A) 37/10   (B) 121/10   (C) 18/5   (D) 7/10   (E) None of the above.

8. Given $f(x) = x^2 + 4$ and $g(x) = 6x - 1$ find $f(g(x)) - g(f(x))$.

(A) 0   (B) 78   (C) 104   (D) 125   (E) None of the above.

9. Add $\dfrac{3x}{x^2 - 9} + \dfrac{4x^2}{x^2 - 5x + 6}$

(A) $\dfrac{x(4x^2 + 15x - 6)}{x^3 - 2x^2 - 9x + 18}$ (B) $\dfrac{19x^2 - 6x}{x^3 - 2x^2 - 9x + 18}$ (C) $\dfrac{4x^2 + 15x - 6}{x^3 + 2x^2 - 9x - 18}$ (D) None of the above.

10. Which of the following correctly describes the solutions to the equation $x^3 + x^2 + 2x = 0$?

(A) 3 real solutions   (B) 2 real solutions   (C) 1 real solution   (D) no real solution
(E) None of the above.

11. Find the coefficient of x^9y in the expansion of $(2y - 4x^3)^4$.

(A) -512 (B) -64 (C) -32 (D) 128   (E) None of the above.

12. On a highway trip a driver travels at 60 miles per hour for the first 100 miles and at 65 miles per hour for the second 100 miles. What is the average speed over the entire trip?

(A) 64 mph   (B) 125/2 mph   (C) 312/5 mph   (D) 63 mph   (E) None of the above.

13. What is the distance between the points $(3, 2)$ and $(-1, -4)$?

   (A) $2\sqrt{13}$ (B) $2\sqrt{5}$ (C) $2\sqrt{2}$ (D) $2\sqrt{10}$ (E) None of the above.

14. The sum of the solutions to the equation $2x^2 - 6x - 3 = 0$ equals:

   (A) $9/4$ (B) $3/2$ (C) 3 (D) 6 (E) None of the above.

15. An integer N is written in base 2 as $N = 10110110$. What is the base 10 expression for N?

   (A) 364   (B) 182   (C) 38   (D) 50550550   (E) None of the above.

16. The product of two positive numbers is 108 and their difference is 3. What is the sum of the two numbers?

   (A) 3   (B) 7   (C) 9   (D) 21   (E) None of the above.

17. The graph of the equation $|x| + |y| = 4$ is a

   (A) ray   (B) line   (C) circle   (D) square   (E) None of the above.

18. The graph of $f(x) = 7 - (x + 1)^2$ does not pass through which of the quadrants?

   (A) I   (B) II   (C) III   (D) IV   (E) None of the above.

19. Which of the following equals $\frac{1}{9} - \frac{1}{4}$?

    (A) $-\frac{1}{5}$ (B) $\frac{1}{5}$ (C) $\frac{5}{36}$ (D) $-\frac{5}{36}$ (E) None of the above.

20. How many times do the graphs of the equations $y = 3x^2 + 1$ and $y = x^3 + 3x$ intersect in the Cartesian plane?

    (A) 0   (B) 1   (C) 2   (D) 3   (E) None of the above.

21. Of the integers between 1 and 1000 how many are divisible by all of the numbers 3, 4, 5 and 6?

    (A) 14   (B) 15   (C) 16   (D) 17   (E) None of the above.

22. Simplify the expression $\sqrt[3]{16x^6y^4z^2}$

    (A) $4x^3y^2z$ (B) $2x^3y\left(\sqrt[3]{4xyz}\right)$ (C) $2x^2y\left(\sqrt[3]{2yz^2}\right)$ (D) $2x^2yz\left(\sqrt[3]{4yz^2}\right)$ (E) None of the above.

23. Find the minimum value of $1 \circ 2 \circ 3 \circ 4 \circ 5 \circ 6 \circ 7 \circ 8 \circ 9$ where each "$\circ$" represents either "+" (addition) or "·" (multiplication).

    (A) 36   (B) 40   (C) 44   (D) 45   (E) None of the above.

24. Simplify $\dfrac{15!}{13!5!}$

    (A) 15   (B) 7/8   (C) 7/4   (D) 13/5   (E) None of the above.