Dick Schaff Math Superbowl XLIII
Level 4B: Algebra II Huddle

Directions: 1. Select the most correct answer for each question and mark it on your Scantron™ form.
2. N.O.T. stands for "None of These."

1. What is the axis of symmetry of $y = 3x^2 - 12x + 7$?

A) $x = -12$ B) $x = 2$ C) $x = 3$ D) $x = 7$ E) N.O.T.

2. What is a solution to the system $\begin{cases} 2x + 5y + 3z = 10 \\ 3x + 6y + 3z = 12 \\ 5x + 11y + 7z = 24 \end{cases}$?

A) (5, 0, 0) B) (0, 2, 0) C) (1, 1, 1) D) (4, – 2, 4) E) N.O.T.

3. An accident with a cup of coffee and a startled housecat leads to a potted plant being launched from a penthouse balcony. The height of this plant above the ground (h, in feet) may be modeled as a function of time (t, in seconds) by the formula $h = -16t^2 + 16t + 60$. How long does it take until this houseplant hits the ground below?

A) 1 second B) 1.5 seconds C) 2 seconds D) 2.5 seconds E) N.O.T.

4. $1 + 2 + 3 + \ldots + 2016 =$

A) 2032 B) 2,032,128 C) 2,033,136 D) 4,066,272 E) N.O.T.

5. What is y if $x = \frac{1}{y-2} + 3$?

A) $y = \frac{1}{x-2} + 3$ B) $y = \frac{1}{x+2} - 3$ C) $y = \frac{1}{x-3} + 2$ D) $y = \frac{1}{x+3} - 2$ E) N.O.T.

6. What is $\log(xy^2)$ written as a combination of simpler logarithmic expressions?

You may assume $x, y > 0$.

A) $2\log(x) + \log(y)$ B) $2\log(x) - \log(y)$ C) $\log(x) + 2\log(y)$ D) $\log(x) - 2\log(y)$ E) N.O.T.

7. Solve $81^{x+1} = 27$.

A) $x = 3$ B) $x = -1$ C) $x = 1.75$ D) $x = -0.25$ E) N.O.T.

8. Let k be a positive integer. Which of the following could NOT be a solution to $x^2 - 4x + k = 0$?

A) 4 B) $2+\sqrt{3}$ C) $2+\sqrt{2}$ D) 3 E) N.O.T.

9. Where is the vertex of $y = -x^2 + 4x - 6$?

A) $(2, -2)$ B) $(2, 2)$ C) $(-2, -2)$ D) $(-2, 2)$ E) N.O.T.

10. Evaluate i^{-21016}, where $i = \sqrt{-1}$.

A) i B) $-i$ C) 1 D) -1 E) N.O.T.

11. Let $f(x) = x^2 - 1$. Find $f(f(x))$.

A) $x^4 + 1$ B) $x^4 - 1$ C) $x^4 + 2x^2$ D) $x^4 - 2x^2$ E) N.O.T.

12. Solve $\ln(\ln(\ln(x))) = 0$ for x.

A) 0 B) 1 C) e D) e^e E) N.O.T.

13. Find the equation of the line passing through (3, 5) perpendicular to $2x - 7y = 13$.

A) $2x - 7y = -29$ B) $2x + 7y = 41$ C) $7x - 2y = 11$ D) $7x + 2y = 31$ E) N.O.T.

14. If $(2x - 3)$ is a factor of $6x^2 + kx + 12$, where k is an integer, which of the following could also be a factor of $6x^2 + kx + 12$?

A) $(3x + 2)$ B) $(3x - 2)$ C) $(x + 3)$ D) $(x - 3)$ E) N.O.T.

15. Find the center of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$.

A) (3, 2) B) (3, – 2) C) (– 3, 2) D) (– 3, – 2) E) N.O.T.

16. Find the radius of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$.

A) $\sqrt{5}$ B) $\sqrt{12}$ C) 5 D) 25 E) N.O.T.

17. Simplify $2^x(2^x + 2^x)$.

A) 8^x B) 2^x C) 2^{2x} D) 2^{2x+1} E) N.O.T.

18. In which direction does the parabola $x + y^2 + 1 = 0$ open?

A) Left B) Right C) Up D) Down E) N.O.T.

19. How many Real roots does $2x^3 + x^2 + 5x = 0$ have?

A) 0 B) 1 C) 2 D) 3 E) N.O.T.

20. Evaluate $-36^{\frac{-3}{2}}$.

A) 54 B) 216 C) $\frac{1}{216}$ D) $\frac{-1}{216}$ E) N.O.T.

21. Which is equivalent to $x^5 - x^4 + x^3 - x^2 + x - 1$?

A) $\frac{x^6 - 1}{x - 1}$ B) $\frac{x^6 - 1}{x + 1}$ C) $\frac{x^6 + 1}{x - 1}$ D) $\frac{x^6 + 1}{x + 1}$ E) N.O.T.

22. The length of the diagonal of a square is $2\sqrt{5}$. What is the perimeter of this square?

A) $\sqrt{10}$ B) $4\sqrt{10}$ C) $4\sqrt{5}$ D) $8\sqrt{5}$ E) N.O.T.

23. What is the solution set to $|2x - 5| = 1$?

A) $\{3\}$ B) $\{3, -3\}$ C) $\{3, 2\}$ D) $\{3, -2\}$ E) N.O.T.

24. Evaluate $\begin{vmatrix} -2 & 5 & 0 \\ 5 & 1 & 0 \\ 3 & 4 & 0 \end{vmatrix}$.

A) -12 B) 0 C) 13 D) 16 E) N.O.T.

25. Solve $5 = e^{x+3}$ for x.

A) $\ln(5) - 3$ B) $\ln(5) + 3$ C) $\ln(3) - 5$ D) $\ln(3) + 5$ E) N.O.T.

26. Let $g(x) = x^2 - 5x + 3$. What is $g(x + 1)$?

A) $x^2 - 5x + 4$ B) $x^2 - 4x + 4$ C) $x^2 - 3x + 4$ D) $x^2 - 3x - 1$ E) N.O.T.

27. Simplify $\log_2(3) \times \log_3(4) \times \log_4(5) \times \ldots \times \log_{2015}(2016)$.

A) $\log(1008)$ B) $\ln(1008)$ C) $\log(2016)$ D) $\log_2(2016)$ E) N.O.T.

28. An accident with a cup of coffee and a startled housecat leads to a potted plant being launched from a penthouse balcony. The height of this plant above the ground (h, in feet) may be modeled as a function of time (t, in seconds) by the formula $h = -16t^2 + 16t + 60$. What is the maximum height of this houseplant?

A) 60 feet B) 64 feet C) 68 feet D) 72 feet E) N.O.T.

29. Which of the following is NOT a solution to $x^4 - 8x^2 + 12 = 0$?

A) $\sqrt{2}$ B) $-\sqrt{2}$ C) $\sqrt{3}$ D) $\sqrt{6}$ E) N.O.T.

30. What is the equation of the asymptote of $y = \log(x + 2) + 3$?

A) $x = 2$ B) $x = -2$ C) $x = 3$ D) $x = -3$ e) N.O.T.