41st Annual Dick Schaff Math Superbowl

Level 4 (Algebra II) Huddle

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

1. Expand $(3x - 2y)^2$.

A) $9x^2 + 4y^2$ B) $9x^2 - 4y^2$ C) $9x^2 - 6xy + 4y^2$ D) $9x^2 - 12xy + 4y^2$ E) N.O.T.

2. 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.

3. Let $f(x) = \frac{\sqrt{x-4}}{x-8}$. What is the domain of $f(x)$?

A) $(4, \infty)$ B) $[4, \infty)$ C) $(8, \infty)$ D) $[8, \infty)$ E) N.O.T.

4. 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.

5. Simplify $\log_2(3) \times \log_3(4) \times \log_4(5) \times \ldots \times \log_{2013}(2014)$.

A) log(1007) B) ln(1007) C) ln(2014) D) $\log_2(2014)$ E) N.O.T.

6. 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.

7. 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.

8. 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.

9. Evaluate $\begin{vmatrix} -1 & 0 & 7 \\ 2 & 5 & -3 \\ 0 & 4 & 10 \end{vmatrix}$.

A) 6 B) -6 C) 64 D) -64 E) N.O.T.

10. What is the equation of the line passing through (2, 3) and perpendicular to $y = 2x - 6$.

A) $x + 2y = 8$ B) $x - 2y = -4$ C) $2x + y = 7$ D) $2x - y = 1$ E) N.O.T.

11. Let $x^2 - 4y^2 + 4 = 0$. Which of the following is an asymptote of this hyperbola?

A) $y = 2x$ B) $y = -2x$ C) $y = \frac{1}{2}x$ D) $y = \frac{1}{4}x$ E) N.O.T.

12. What is the solution set to $\frac{2x}{x-3} = 3x + \frac{6}{x-3}$?

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

13. Let $f(x) = 2x - 8$. What is $f^{-1}(x)$?

A) $f^{-1}(x) = \frac{1}{2x-8}$ B) $f^{-1}(x) = \frac{x+8}{2}$ C) $f^{-1}(x) = \frac{x}{2} - 8$ D) $f^{-1}(x) = \frac{x}{2} + 8$ E) N.O.T.

14. What is a solution to the system $\begin{cases} 2x + 5y + 3z = 10 \\ 3x + 6y + 4z = 13 \\ 5x + 11y + 7z = 24 \end{cases}$?

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

15. Let $f(x) = x^2 - 4x$, and let $g(x) = 3x + 5$. Find $f(g(x))$.

A) $9x^2 + 18x + 5$ B) $9x^2 + 3x + 5$ C) $9x^2 - 12x + 5$ D) $x^2 - x + 5$ E) N.O.T.

16. What is the remainder when $x^3 - 4x^2 + 7x - 5$ is divided by $x - 2$?

A) 1 B) 2 C) 3 D) 4 E) N.O.T.

17. Which of the following is NOT an intercept of $y = 2x^2 - 5x + 2$?

A) (2, 0) B) (½, 0) C) (0, 2) D) (0, ½) E) N.O.T.

18. Let $f(x) = 2^x - 3$. What is the equation of the asymptote of the graph of $y = f(x)$?

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

19. Simplify $(2 + i)^{-1}$.

A) $0.4 + 0.2i$ B) $0.4 - 0.2i$ C) $0.2 + 0.4i$ D) $0.2 - 0.4i$ E) N.O.T.

20. 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.

21. 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.

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

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

23. 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.

24. What is the solution to $\frac{x+1}{x-2} \geq 1$?

A) $(-1, \infty)$ B) $[-1, \infty)$ C) $(2, \infty)$ D) $[2, \infty)$ E) N.O.T.

25. Simplify $\frac{4}{x-4} - \frac{4}{x}$.

A) $\frac{16}{x(x-4)}$ B) $\frac{-16}{x(x-4)}$ C) $\frac{8}{x-4}$ D) 0 E) N.O.T.

26. What is the coefficient of the quadratic term of $(x-2)^5$?

A) 80 B) – 80 C) 32 D) – 32 E) N.O.T.

27. Expand $(5-4i)^2$

A) 9 B) 34 C) 9 – 40i D) 34 – 40i E) N.O.T.

28. $1 + 2 + 3 + \ldots + 2014 =$

A) 2020 B) 2,029,105 C) 4,056,196 D) 4,058,210 E) N.O.T.

29. 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.

30. Where is the center of $x^2 + y^2 + 7x - 9y - 40 = 0$?

A) (7, – 9) B) (7, 9) C) (– 7, – 9) D) (– 7, 9) E) N.O.T.