

For all questions, answer choice "E) NOTA" means none of the above answers is correct.

1. If $f(x) = 3x^2 - 4x + 1$ and $g(x) = 2f(x-1) + 3$, find the value of $g(2)$.

- A) -2 B) 0 C) 2 D) 3 E) NOTA

2. Find the sum of the x - and y -coordinates across all points of intersection of the graphs of $f(x) = 3x - 2$ and $k(x) = 2x^2 - x - 5$.

- A) 2 B) 4 C) 6 D) 8 E) NOTA

3. When using Descartes' Rule of Signs, what are the possible number combinations of real zeros of the function $f(x) = 5x^4 - 3x^3 + 2x - 1$?

- A) 4, 2, or 0 positive; 2 or 0 negative B) 5 positive; 5 negative
C) 1 positive; 3 or 1 negative D) 3 or 1 positive; 1 negative E) NOTA

4. Which of the following is a zero of the function $f(x) = 2x^3 - 11x^2 + 11x - 3$?

- A) $\frac{3}{2}$ B) -3 C) $\frac{5 + \sqrt{13}}{2}$ D) $\frac{5 + \sqrt{13}}{4}$ E) NOTA

5. Find the minimum value of the function $y = 4x^2 - 4x - 3$.

- A) -3 B) -4 C) $-\frac{13}{4}$ D) $-\frac{3}{4}$ E) NOTA

6. If $y + \frac{1}{x} = 2$ and $y^2 + \frac{1}{x^2} = 3$, find the value of $y^4 + \frac{1}{x^4}$.

- A) $\frac{1}{2}$ B) $\frac{13}{4}$ C) $\frac{23}{4}$ D) $\frac{17}{2}$ E) NOTA

7. Find the inverse of the function $g(x) = \frac{2}{1 - \frac{1}{2x}}$.

- A) $g^{-1}(x) = \frac{2}{2x-1}$ B) $g^{-1}(x) = \frac{2x}{x-2}$ C) $g^{-1}(x) = \frac{x}{2x-4}$ D) $g^{-1}(x) = \frac{x}{x-4}$ E) NOTA

8. The point $(-1, 2)$ lies on the graph of $y = g(x)$. If $k(x) = g(x-1) - 3$, find the translation of this point onto the graph of $y = k(x)$.

- A) $(-2, 5)$ B) $(0, -1)$ C) $(1, 5)$ D) $(1, -1)$ E) NOTA

9. Evaluate $g(5)$ if $g(x) = \sum_{i=1}^x \frac{2i-1}{i}$.

- A) $463/60$ B) $135/12$ C) $357/60$ D) $-17/60$ E) NOTA

10. Find the coefficient of the 4th-degree term in the expansion of $(2x-1)^7$.

- A) 35 B) 560 C) -35 D) -560 E) NOTA

11. If two of the zeros of the polynomial $f(x) = x^4 + ax^3 + bx^2 + cx + d$, which has rational coefficients, are $-2i$ and $2 - \sqrt{3}$, find the value of $a + b + c + d$.

- A) -21 B) -14 C) -11 D) -3 E) NOTA

12. Which of the following is an asymptote of $g(x) = \frac{x^3 - 2x - 4}{x - 2}$?

- A) $x = 2$ B) $y = x^2$ C) $y = x - 2$ D) $y = x^2 + 2x + 2$ E) NOTA

13. Find all values of x for which $1 - \frac{2}{x-1} \leq \frac{1}{x}$.

- A) $(0, 1)$ B) $[2 - \sqrt{3}, 2 + \sqrt{3}]$ C) $(0, 2 - \sqrt{3}] \cup (1, 2 + \sqrt{3}]$ D) $(1, 2 + \sqrt{3}]$ E) NOTA

14. Which of the following is not a possible rational root of $f(x) = 24x^5 - 13x^3 - 4$?

- A) $1/6$ B) $1/3$ C) $1/4$ D) $2/3$ E) NOTA

15. If f is a quadratic function with $f(2) = 4$, $f(-3) = -1$, and $f(-4) = 5$, evaluate $f(0)$.

- A) -23 B) -17 C) -13 D) -5 E) NOTA

16. If $g(x) = \frac{x}{2x-1}$ and $h(x) = \frac{x^2}{x+1}$, find $3g(x) - 2h(x)$.

- A) $\frac{-4x^3 + 7x^2 + 3x}{2x^2 + x - 1}$ B) $\frac{-4x^3 + 5x^2 + 3x}{2x^2 - x - 1}$ C) $\frac{-4x^3 + 5x^2 + 3x}{2x^2 + x - 1}$ D) $\frac{-4x^3 + 7x^2 + 3x}{2x^2 - x - 1}$ E) NOTA

17. Which of the following is an imaginary zero of the function $f(x) = 4x^4 + 8x^2 + 9$?

- A) $1 + 2\sqrt{5}i$ B) $1 + \sqrt{5}i$ C) $\frac{1}{4} + \frac{\sqrt{5}}{4}i$ D) $\frac{1}{2} + \frac{\sqrt{5}}{2}i$ E) NOTA

18. If $f(x) = x^2 + 2$ and $g(x) = x - 1$ for all real x , find the largest value of a such that $f(g(-a)) = g(f(a))$.

- A) -3 B) -2 C) 1 D) 3 E) NOTA

19. Find the area of the region defined by the inequalities $y \geq |2x + 1|$ and $y \leq -|x - 1| + 5$.

- A) $\frac{25}{3}$ B) $\frac{41}{6}$ C) $\frac{85}{24}$ D) $\frac{5}{3}$ E) NOTA

20. What is the largest possible number of imaginary roots of the polynomial

$$f(x) = 4x^5 + 3x^4 - 2x^3 + x^2 - x + 5?$$

- A) 2 B) 3 C) 4 D) 5 E) NOTA

21. If $f(x) = 2ax^2 - 4bx - 2$ with $f(2) = 0$ and $f(-3) = 1$, what is the value of $2a - 3b$?

- A) $\frac{3}{5}$ B) $\frac{11}{20}$ C) $\frac{6}{5}$ D) $\frac{9}{20}$ E) NOTA

22. What is the smallest value the expression $x^2 + 2xy + 2y^2 - 10y + 3$ may obtain?

- A) -22 B) -14 C) -12 D) 3 E) NOTA

23. Find the coefficient of x^7 in the expansion of $(x^2 - x + 4)(x - 2)^9$.

- A) 2488 B) 2492 C) 3164 D) 3264 E) NOTA

24. If $f(x) = \begin{cases} 2x+5, & \text{if } x \leq -3 \\ 5, & \text{if } -3 < x < 1 \\ x^2-1, & \text{if } x \geq 1 \end{cases}$, evaluate $f(f(f(f(-4))))$.

- A) 1 B) 5 C) 24 D) 575 E) NOTA

25. Find all values of x such that $-2x+1 \leq 3x^2-4x+1$.

- A) $(0, \frac{2}{3})$ B) $(-\infty, 0] \cup (\frac{2}{3}, \infty)$ C) $[0, \frac{2}{3}]$ D) $(-\infty, 0] \cup [\frac{2}{3}, \infty)$ E) NOTA

26. If $f(n) = 3f(n-1) - f(n-2)$, where $f(1) = 1$ and $f(2) = \frac{1}{3}$, evaluate $f(7)$.

- A) -7 B) -9 C) $-\frac{29}{3}$ D) -12 E) NOTA

27. Given $f(x) = 3x^2 - 2$, $g(x) = f(x+2)$, and $h(x) = g(x-1)$, find the sum of all real numbers x such that $g(x) = h(x)$.

- A) -1 B) $-\frac{3}{2}$ C) $\frac{11}{6}$ D) $\frac{17}{6}$ E) NOTA

28. Which point on the line $y = 2x + 3$ is closest to the point $(1, 3)$?

- A) $(0, 3)$ B) $(-\frac{1}{2}, 2)$ C) $(\frac{1}{5}, \frac{17}{5})$ D) $(\frac{1}{2}, 4)$ E) NOTA

29. Find the least solution of the equation $(x-3)^3 + (x+4)^3 = (2x+1)^3$.

- A) $-\frac{1}{2}$ B) -2 C) 3 D) -4 E) NOTA

30. Given $f(x) = \sum_{i=3}^x \frac{3}{i^2 - 3i + 2}$, evaluate $f(50)$.

- A) $\frac{25}{392}$ B) $\frac{144}{49}$ C) $\frac{149}{50}$ D) $\frac{47}{16}$ E) NOTA