

Where applicable, "E) NOTA" indicates that none of the above answers is correct.

1. Solve for x : $2x - 7 = 5$

- A) 1 B) 6 C) 7 D) 8 E) NOTA

2. Find the solutions to the equation $x^2 - 9 = 0$.

- A) ± 3 B) -3 C) 3 D) 0 and 3 E) NOTA

3. Solve for x : $\frac{3}{x} = 6$

- A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) 2 D) 18 E) NOTA

4. Find the solution to the inequality: $|x - 4| < 3$

- A) $(-1, 7)$ B) $(1, 7)$ C) $(-3, 4)$ D) $(0, 8)$ E) NOTA

5. Solve for x : $2^x = 16$

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

6. Solve for x : $\log_2(x+1) + \log_2(x-1) = 3$

- A) 2 B) 3 C) 5 D) 7 E) NOTA

7. Find the sum of the solutions to the equation $\sin(2x) = \sin x$ on the interval $[0, 2\pi)$.

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

8. Solve the inequality: $\frac{x^2 - 9}{x - 2} > 0$

- A) $(2, 3)$ B) $(-\infty, -3) \cup (2, 3)$ C) $(-3, 2) \cup (3, \infty)$ D) $(-\infty, -3) \cup (3, \infty)$
E) NOTA

9. If $2^x = 5$, then what is the value of $2^{x+2} - 2^{x-1}$?

- A) 15 B) 16 C) 18 D) 20 E) NOTA

10. Solve the system for (x, y) :
$$\begin{cases} x + y = 5 \\ x^2 + y^2 = 13 \\ x < y \end{cases}$$

- A) (2,3) B) (1,4) C) (3,2) D) (4,1) E) NOTA

11. Which of the following quadratic equations has solutions that are the squares of the solutions of the quadratic equation $3x^2 - 7x + 2 = 0$?

- A) $9x^2 - 14x + 4 = 0$ B) $9x^2 - 49x + 4 = 0$ C) $9x^2 - 49x + 6 = 0$ D) $9x^2 - 37x + 4 = 0$
E) NOTA

12. Solve the equation: $\log_3(x^2 - 1) = 2$

- A) ± 2 B) ± 4 C) $\pm\sqrt{10}$ D) $\pm\sqrt{11}$ E) NOTA

13. Find the sum of the solutions to the equation $\cos(2x) = \frac{1}{2}$ on the interval $[0, 2\pi)$.

- A) $\frac{4\pi}{3}$ B) $\frac{8\pi}{3}$ C) 3π D) 4π E) NOTA

14. Solve the inequality: $\frac{x^2 - 4}{x + 1} \leq 0$

- A) $[-2, 2]$ B) $(-\infty, -2] \cup [2, \infty)$ C) $(-1, 2]$ D) $[-2, -1) \cup (-1, \infty)$
E) NOTA

15. The solutions to the equation $x^2 - kx + k = 0$ are both positive and differ by 2. Find the numerical value of k .

- A) 3 B) $1 + \sqrt{2}$ C) $2 + 2\sqrt{2}$ D) $3 + 2\sqrt{2}$ E) NOTA

16. Find the least integral value $n > 2026$ such that the equation $3^x - 3^{x-1} - 3^{x-2} = n$ has an integral solution for x .

- A) 2187 B) 2456 C) 2916 D) 3645 E) NOTA

17. Find the sum of the reciprocals of the solutions to the equation $2x^3 - 7x^2 + 5x - 20 = 0$.

- A) 1 B) $\frac{1}{4}$ C) $\frac{5}{2}$ D) $\frac{7}{20}$ E) NOTA

18. If $\tan \theta = \frac{3}{4}$ for $\pi < \theta < \frac{3\pi}{2}$, find the value of $\cos(3\theta)$.

- A) $\frac{44}{125}$ B) $\frac{117}{125}$ C) $-\frac{44}{125}$ D) $-\frac{117}{125}$ E) NOTA

19. Find the sum of the positive real solutions to the equation $x^4 - 13x^2 + 36 = 0$.

- A) 3 B) 5 C) 7 D) 9 E) NOTA

20. Find the sum of the real solutions to the equation $\frac{2}{x-1} + \frac{3}{x+2} = 1$.

- A) 2 B) $2 + \sqrt{7}$ C) 4 D) $4 + \sqrt{7}$ E) NOTA

21. The equation $x^3 - 6x^2 + 11x - 6 = 0$ has solutions a , b , and c . Find the value of $a^2 + b^2 + c^2$.

- A) 14 B) 16 C) 18 D) 20 E) NOTA

22. Let p and k be real numbers. The equation $x^2 - px + k = 0$ has solutions a and b . Find the value of $a^2 + b^2$ in terms of p and/or k .

- A) $k^2 - 2$ B) $p^2 - 2$ C) $k^2 - 2p$ D) $p^2 - 2k$ E) NOTA

23. Which of the following describes the solutions to the equation $x^4 - 4x^3 + 5x^2 - 4x + 1 = 0$?

- A) 2 positive, 2 negative B) 4 positive C) 2 positive, 2 imaginary
D) 4 imaginary E) NOTA

24. Find the sum of the fifth powers of the solutions to the equation $2x^2 + 3x + 4 = 0$.

- A) $-\frac{79}{32}$ B) $\frac{79}{32}$ C) $-\frac{123}{32}$ D) $\frac{123}{32}$ E) NOTA

25. Find the sum of the real solutions to the equation $\log_2 x + \log_2 (x-2) = 3$.

- A) 4 B) 5 C) 6 D) 8 E) NOTA

26. If $f(1-x) = 3x^2 + 7x - 11$, find the product of the roots of $f(x)$.

- A) $-\frac{11}{3}$ B) $\frac{7}{3}$ C) $-\frac{13}{3}$ D) $-\frac{1}{3}$ E) NOTA

27. Find the least real solution to the equation $3x^2 + 5|x| - 3 = 0$.

- A) $\frac{5+\sqrt{61}}{6}$ B) $\frac{5-\sqrt{61}}{6}$ C) $\frac{-5+\sqrt{61}}{6}$ D) $\frac{-5-\sqrt{61}}{6}$ E) NOTA

28. How many integers are in the domain of the function $f(x) = \sqrt{\frac{63+86x-120x^2}{66x^2+37x-133}}$?

- A) 3 B) 7 C) 12 D) an infinite number E) NOTA

29. Find the sum of the real solutions to the equation: $\log_x (6x^2 - 8x - 3) = 3$.

- A) 3 B) 4 C) 5 D) 6 E) NOTA

30. The three altitudes to the three sides of a triangle have lengths $\frac{168}{13}$, 12, and $\frac{56}{5}$. Find the perimeter of the triangle.

- A) 36 B) 42 C) 72 D) 84 E) NOTA