

The acronym NOTA denotes that “none of the above answers is correct.” All answers are rationalized, simplified, and exact unless otherwise stated. Good luck and have fun!

1. The function $g(x)$ is a parabola with real integer coefficients. The vertex of $g(x)$ is in Quadrant III and the focus of $g(x)$ is in Quadrant II. Which of the following must be true about $g(x)$?

I. The directrix is in Quadrant II and III

II. The maximum of $g(x)$ is in Quadrant I

III. The leading coefficient of $g(x)$ is positive

- A. I only B. II and III only C. I and II only D. III only E. NOTA

2. What is the shortest distance between the lines $6x - 4y = 4$ and $2y - 3x = 2$?

- A. $\frac{4\sqrt{13}}{13}$ B. 1 C. $\frac{6\sqrt{10}}{13}$ D. $\sqrt{2}$ E. NOTA

3. Solve for x : $10^{(2x-1)} = 20$

- A. $\log(\sqrt{2})$ B. $\log(10\sqrt{2})$ C. $\log(4\sqrt{5})$ D. $\log(2)$ E. NOTA

4. The quantity $\frac{8-3i}{4+5i}$ can be expressed in the form $A - Bi$, where A and B are positive rational numbers. What is the value of $(A - B)$?

- A. $-\frac{35}{41}$ B. $\frac{35}{9}$ C. $\frac{23}{3}$ D. $\frac{69}{41}$ E. NOTA

5. Given the center of the conic defined by the equation $x^2 - 3y^2 + 4x + 6y = 18$ is (x, y) . What is $(x + y)$?

- A. -3 B. -1 C. 1 D. 3 E. NOTA

6. Lambert built a rectangular enclosure around her vegetable garden using 72 yards of fencing. Find the maximum possible area of Lambert's garden. (*disregard units*)

- A. 180 B. 243 C. 275 D. 324 E. NOTA

7. Which of the following is equivalent to $(\sqrt{1200})(\sqrt{800})$?

- A. $400\sqrt{6}$ B. $40\sqrt{3}$ C. $200\sqrt{6}$ D. $40\sqrt{6}$ E. NOTA

8. Find the standard form of the ellipse with major axis endpoints at (3,8) and (3,-4), and foci at (3,5) and (3,-1).

- A. $\frac{(x-3)^2}{36} + \frac{(y-2)^2}{45} = 1$ C. $\frac{(x-3)^2}{36} + \frac{(y-2)^2}{27} = 1$ E. NOTA
B. $\frac{(x-3)^2}{27} + \frac{(y-2)^2}{36} = 1$ D. $\frac{(x-3)^2}{45} + \frac{(y-2)^2}{36} = 1$

9. Using interval notation, solve the inequality: $|x^3 - 3| < 51$

- A. $(-2\sqrt[3]{3}, -3\sqrt[3]{2})$ B. $(-2\sqrt[3]{6}, 2\sqrt[3]{3})$ C. $(-2\sqrt[3]{6}, 3\sqrt[3]{2})$ D. $(-\infty, -3\sqrt[3]{2}) \cup (3\sqrt[3]{2}, \infty)$ E. NOTA

10. Which of the following functions, where defined, are one-to-one?

- I. $f(x) = x^5 + 1$ II. $g(x) = \log(|x|)$ III. $h(x) = \frac{1}{x}$

- A. III only B. I and III only C. II only D. I, II, and III E. NOTA

11. What is the remainder when $2x^3 + 7x^2 - 3x + 6$ is divided by $(x + 3)$?

- A. -120 B. -12 C. 24 D. 114 E. NOTA

12. Which of the following is an approximation of $\log_5 \left(\sqrt[4]{5\sqrt{50}} \right)$, using $\log_5(2) \approx 0.40$?

- A. $\frac{5}{8}$ B. $\frac{3}{10}$ C. $\frac{9}{20}$ D. $\frac{11}{20}$ E. NOTA

13. Let $f(x) = ax^2 + bx + c$ be a quadratic function, where a , b , and c are integers. Given $f(x + 1) - 2 = f(x) - 6x$, which of the following is equivalent to ab ?

- A. -15 B. -3 C. 15 D. 48 E. NOTA

14. Solve for x : $8^{\log_8(x\sqrt{32})} = 8\sqrt{2}$

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

15. Triangle MAO has side lengths $(3x + 1)$, $(4x + 5)$, and $(8x - 3)$. Find the number of the possible integer values of x .

- A. 4 B. 6 C. 7 D. 9 E. NOTA

16. Find the length of the minor axis of $12x^2 - 8y^2 + 72x - 16y = -4$.

- A. $2\sqrt{2}$ B. $4\sqrt{2}$ C. $4\sqrt{3}$ D. 16 E. NOTA

17. What is the units digit of $(13^{81} + 8^{23})$?

- A. 9 B. 8 C. 7 D. 5 E. NOTA

18. Find the ordered pair (a, b) that represents the focus of $2x - 5y^2 = 6x - 5$.

- A. $\left(\frac{5}{4}, 0\right)$ B. $\left(\frac{29}{20}, 0\right)$ C. $\left(\frac{21}{20}, 0\right)$ D. $\left(\frac{5}{4}, -\frac{1}{5}\right)$ E. NOTA

19. Solve for x : $e^{4x} - 23 = 41$

A. $\ln(4\sqrt[4]{2})$

B. $\ln(4\sqrt{2})$

C. $\ln(2\sqrt[4]{2})$

D. $\ln(2\sqrt{2})$

E. NOTA

20. The graph of $f(x) = e^{(x+5)}$ is translated six units rightward. The graph of $f(x)$ is reflected about the y-axis. Next the graph of $f(x)$ is then translated six units upward. Which of the following represents the new graph of $f(x)$?

A. $f(x) = 6 - e^{(x+11)}$

C. $f(x) = 6 - e^{(x-1)}$

E. NOTA

B. $f(x) = e^{(1-x)} + 6$

D. $f(x) = e^{-(x+11)} + 6$

21. Given $(x - 5) = 2y$ and $\frac{x}{y} = 3$, what is the value of xy ?

A. 75

B. 15

C. 1

D. -3

E. NOTA

22. Solve for x : $\frac{x}{6} + \frac{x}{8} = 7$

A. 346

B. 48

C. 28

D. 24

E. NOTA

23. Find the y-intercept of the line perpendicular to the line $4x + 7y = 3$ and passing through the point $(-2, 5)$.

A. $(0, \frac{17}{2})$

B. $(0, \frac{3}{2})$

C. $(0, -\frac{27}{4})$

D. $(0, -\frac{43}{4})$

E. NOTA

24. Solve for x : $\frac{3x}{x-1} + \frac{8-2x}{x-4} = 2$

A. $x = -4$

B. $x = -2$

C. $x = \frac{4}{7}$

D. $x = 4$

E. NOTA

25. Which of the following is true about the system of equations $\begin{cases} 4y - 2x = 12 \\ x + 2y = 10 \end{cases}$?

- I. This is a dependent system II. This is an independent system III. This is an inconsistent system IV. This is a consistent system

A. II and IV only B. I and III only C. I and IV only D. II and III only E. NOTA

26. Given $h(x) = 9^x$, what is the value of $h^{-1}(27)$?

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

27. Using interval notation, find the range of the function $f(x) = \sqrt{7 - 6x - x^2}$

- A. $(-\infty, 4]$ B. $[0, 16]$ C. $[4, \infty)$ D. $[0, 4]$ E. NOTA

28. What is the distance between the points $(6, 3)$ and $(2, -3)$?

- A. 4 B. $2\sqrt{13}$ C. $\sqrt{82}$ D. 10 E. NOTA

29. Solve for x : $\log(3x^2) = \log(x(x + 4))$

- A. $x = 2$ B. $x = \{0, 1\}$ C. $x = \{-2, 0\}$ D. $x = -2$ E. NOTA

30. Which of the following statements about all non-degenerate conic sections is/are true?

- I. A parabola is a locus of points equidistant from a given point, the vertex, and line, the directrix
II. A hyperbola has two asymptotes and the slopes of the asymptote equations are negative reciprocals.
III. Eccentricity cannot be negative

A. I, II, and III B. III only C. I and II only D. I and III only E. NOTA