

Equations and Inequalities Topic Test 2009 (Alpha)

E is None of These

1. Find the solution set of: $\frac{1}{3x-1} + \frac{2}{4x-1} \geq 0$.

- a) $(\frac{3}{5}, \infty)$ b) $[\frac{1}{3}, \infty)$ c) $(\frac{1}{4}, \frac{1}{3})$ d) $(\frac{1}{4}, \frac{3}{10}] \cup (\frac{1}{3}, \infty)$

2. Find the sum of the solutions of $\log_2 x + \log_2(3x + 2) = 0$.

- a) 1 b) $\frac{1}{3}$ c) $-\frac{2}{3}$ d) $\frac{2}{3}$

3. Solve: $2x - 3y - 2z = 5$ and then find $2x - y$.

$$\begin{aligned}x - y + z &= 9 \\2x + y + 3z &= 13\end{aligned}$$

- a) -5 b) -3 c) 4 d) 7

4. If $\frac{2-i}{1-i} + \frac{2}{2+i} = a + bi$; $i = \sqrt{-1}$; find the sum of $a + b$.

- a) $\frac{13}{3}$ b) $\frac{5}{2}$ c) $\frac{12}{5}$ d) 4

5. The sum of three numbers is 70. Three times the second number is 4 less than twice the third number, while twice the first number is 4 more than the third number. Find the second number.

- a) 12 b) 20 c) 28 d) 36

6. Find the sum of the solution(s) to $3^{2x+2} - 3^{x+3} - 3^x + 3 = 0$.

- a) 4 b) 2 c) 1 d) 0

7. Solve: $2 - \frac{1}{2 - \frac{1}{x-2}} = 5$.

- a) 4 b) $\frac{19}{7}$ c) $\frac{11}{7}$ d) 1

8. Find the sum of the solutions to $\left| \frac{2|x|-3}{4|x-1|} \right| = 2$

- a) $\frac{8}{3}$ b) $\frac{29}{15}$ c) 0 d) $-\frac{4}{15}$

9. Find the solution set of $x^3 + x^2 \geq 2x$.

- a) $[-2, 0]$ b) $[-2, 1]$ c) $[-2, 0] \cup [1, \infty)$ d) $(-\infty, 0] \cup [1, \infty)$

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10. If $(a + 1)^2x^2 - 3(a - 2)x + 5 = 6$ when $x = -3$, find a .

- a) $\{2/3, -5/3\}$ b) $\{5/3, -2/3\}$ c) $\{1/3, -2/3\}$ d) $\{1/3, -10/3\}$

11. Find all solutions to: $2\tan y \csc y + 2 \csc y + \tan y + 1 = 0$. $y \in [0, 2\pi]$

- a) $\{\pi/4, 2\pi/3\}$ b) $\{\pi/6, 5\pi/6\}$ $\{2\pi/3, 5\pi/3\}$ c) d) $\{3\pi/4, 7\pi/4\}$

12. $f(x) = 3x^2 - 2x + 1$; $g(f(x)) = 6x^2 - 4x - 1$: find $g(-2)$.

- a) -7 b) 0 c) 3 d) $2x - 1$

13. $2\log_3 \sin 3x - 2\log_3 \cos 3x = 1$, $x \in [0, 180^\circ]$. Which of the following is in the solutions set?

- a) 50 b) 80 c) 110 d) 130

14. Find the value of c if $\sqrt{\frac{3}{2c} + \sqrt{\frac{1}{c}}} - \sqrt{\frac{3}{2c} - \sqrt{\frac{1}{c}}} = \sqrt{2}$

- a) 1 b) 2 c) 3 d) 4

15. The perimeter of an isosceles triangle is 40 and its area is $50\sqrt{2}$. Find the length of the shortest side.

- a) 20 b) 15 c) 10 d) 5

16. If $(x + \sqrt{2})$ is a solution to $2x^2 - 3(a - 2\sqrt{2})x + 5 = 0$, find the value of a .

- a) $\sqrt{2}/2$ b) $3\sqrt{2}/4$ c) $\sqrt{2}/4$ d) $-5\sqrt{2}/6$

17. Find the radius of the circle whose center is $C(-2, 1)$ and is tangent to the line $2x - y = -1$.

- a) $4\sqrt{5}$ b) $\frac{\sqrt{2}}{2}$ c) 8 d) $\frac{4\sqrt{5}}{5}$

18. A man can rent all 40 of his apartments for \$500 each month. However, for each \$100 increase in rent he rents 5 less. How much should he charge per month to guarantee the best return?

- a) 550 b) 600 c) 650 d) 700

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19. Find all real values of x that satisfies: $\frac{x^4 + x^3 + x + 1}{x^4 - x^3 + x - 1} = 0$

- a) -1 b) 0 c) 1 d) \emptyset

20. Find the y - value in the solution of: $\log(3x + 5) - \log y = 1$ and $5x - 2y = 6$.

- a) $\frac{35}{22}$ b) $\frac{17}{11}$ c) $\frac{25}{44}$ d) $\frac{43}{44}$

21. Let k, l, m, n , be zeros of $x^4 - 10x^3 + 35x^2 + 25 = 0$. Evaluate $k^2 + l^2 + m^2 + n^2$.

- a) 15 b) 25 c) 30 d) 35

22. The graphs of $x^2 + y = 10$ and $x + y = 8$ intersect in 2 points. Find the distance between these points.

- a) 3 b) $3\sqrt{2}$ c) 5 d) 9

23. The solution set to $\frac{3}{x} + \frac{5}{y} = 10$ and $\frac{2}{x} + \frac{3}{y} = 9$ is (x, y) find $30x - 21y$.

- a) 597 b) 303 c) 1 d) 5

24. If $\frac{S}{x-2} + \frac{T}{x+3} = \frac{8x-1}{x^2+x-6}$, find the sum of S + T.

- a) 9 b) 2 c) 4 d) 7

25. If $z = 3 + 2i$, simplify: $z\bar{z} + 2z - 3\bar{z}$; (note: \bar{z} is the complex conjugate of z).

- a) $10 - 2i$ b) $11 - 2i$ c) $10 + 10i$ d) $25 - 6i$

26. Let $P = \frac{x+1}{x}$, $\frac{1}{100} \leq x \leq 100$. For what value of x does P have its smallest value?

- a) 100 b) 50 c) 10 d) .1

27. Which of the following is a solution to: $6\left(x + \frac{1}{x}\right)^2 - 35\left(x + \frac{1}{x}\right) + 50 = 0$

- a) 1 b) $\frac{1}{3}$ c) 4 d) 6

28. If $\begin{vmatrix} x & -1 & 2 \\ 2 & x & 4 \\ 0 & 3 & 1 \end{vmatrix} = 2$. find the product of the real solutions.

- a) 2 b) 6 c) -12 d) 12

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29. Find the number of positive integer pairs that are in the solution of $5x + 11y = 97$

- a) 0 b) 1 c) 2 d) 3

30. Find the sum of the solution(s) to: $8(\log_3 x)^2 = 14\log_3 x + 3$

- a) $\sqrt{3} - \sqrt[4]{3}$ b) $4\sqrt{3}$ c) $3\sqrt{3} + \sqrt[4]{3}$ d) $2\sqrt{3} - \sqrt{6}$

Tie-Breakers:

1. Find the solution set for $1 \leq |2x - 1| \leq 5$.

2. Find \mathbf{A} in $\mathbf{AX} = \mathbf{C}$ where $\mathbf{X} = \begin{bmatrix} 1 & 2 & -1 \\ 0 & 3 & 1 \end{bmatrix}$; $\mathbf{C} = \begin{bmatrix} 2 & -5 & -5 \\ 4 & 23 & 1 \end{bmatrix}$ and \mathbf{A} is a 2×2 matrix.

3. Find the area of the region between $y = |x + 1| - |x - 2|$ and $y = 7$.