

Mu Alpha Theta - 2012
Equations & Inequalities

Choose the correct answer for each problem. If the correct answer is not present, choose "NOTA" (none of the above).

1. If $x - 2y = 1$ and $x + y = 16$, then which of the following is *false*?
A. $x - y = 6$ B. $x + 2y = 21$ C. $3x - y = 28$ D. $5x - 11y = 30$ E. NOTA

2. Solve the equation for x: $\frac{3x}{x-3} + \frac{-3}{x+3} = \frac{54}{x^2-9}$
A. -5, 3 B. -7 C. -5 D. -7, 3 E. NOTA

3. If the following system has no solution, then find the value of a.
$$3x + 6y = 11$$
$$ax - 122 + 72y = 0$$

A. 111 B. 66 C. -66 D. 36 E. NOTA

4. If $x^2 - y^2 = 24$ and $y = 4 - x$, then find the value of $2x + y$.
A. 5 B. 7 C. 9 D. 11 E. NOTA

5. Completely simplify: $\frac{3}{x} + \frac{1}{2x-8} + \frac{-x}{x^2-16}$
A. $\frac{5x-24}{2x(x+4)}$ B. $\frac{5x+24}{2x(x+4)}$ C. $\frac{5x+24}{x(x-4)}$ D. $\frac{5x-24}{x(x-4)}$ E. NOTA

6. How many of the following inequalities is/are equivalent to $x^2 - 6x + 5 > 0$?
I. $-|x-3| < -2$
II. $-x^2 + 6x + 5 < 0$
III. $1 < x < 5$
IV. $\frac{1}{10}|(3x-9) + (4x-12)i| > 1$
A. 1 B. 2 C. 3 D. 4 E. NOTA

7. Given: $x + 2y = 9$
 $2x - 3y + 4z = -8$ Find the value of $x + y + z$.
 $x + y - 6z = 25$
 A. 1 B. 2 C. 3 D. 4 E. NOTA
8. If $\sqrt{x} + 2\sqrt{y} = 7$ and $\sqrt{x} - \sqrt{y} = 5$, then find the value of y^2 .
 A. $\frac{289}{9}$ B. $\frac{17}{3}$ C. $\frac{2}{3}$ D. $\frac{4}{9}$ E. NOTA
9. Farmer Fred has on his farm 4-legged frogs and 2-legged flamingos. Farmer Fred has 15 animals. There are 50 legs on Fred's farm, not including Fred's legs. Find the number of flamingos on the farm.
 A. 2 B. 5 C. 10 D. 15 E. NOTA
10. Solve the equation for x: $\sqrt{2x+87} + x = 6$
 A. -3 B. -3, 17 C. 15, 17 D. 15 E. NOTA
11. Solve the equation for x: $2x^4 - 7x^2 + 2 = 0$
 A. $\frac{7 \pm \sqrt{33}}{4}$ B. $\frac{7 \pm \sqrt{65}}{4}$ C. $\frac{\pm \sqrt{7 \pm \sqrt{33}}}{2}$ D. $\frac{\pm \sqrt{7 \pm \sqrt{65}}}{2}$ E. NOTA
12. Solve the inequality for x: $8 \leq -3x + 7 \leq 16$
 A. $-3 \leq x \leq \frac{-1}{3}$ B. $\frac{-23}{3} \leq x \leq -5$ C. $x \leq -3$ or $x \geq \frac{-1}{3}$ D. $x \geq \frac{-1}{3}$ and $x \leq -3$
 E. NOTA
13. Solve for a, if the equation $x^2 + 2ax = 3a$ has two imaginary solutions.
 A. $-3 < a < 0$ B. $a < -3$ or $a > 0$ C. $0 < a < 3$ D. $a < 0$ or $a > 3$ E. NOTA
14. Solve the following system of equations:
 $2x - 3y - 3z = 19$
 $x - 3y + z = 1$
 $-x + 3y + 3z = -17$
 A. (2, -4, -1) B. (-4, 2, -1) C. (2, -1, -4) D. (-1, 2, -4) E. NOTA
15. Solve the equation for x: $(x - 4)(x + 2) = 6$
 A. $-1 \pm \sqrt{3}$ B. $1 \pm \sqrt{3}$ C. $1 \pm \sqrt{15}$ D. $-1 \pm \sqrt{15}$ E. NOTA

16. Solve the equation for x : $3x^2 = 5 + 4x$
 A. $\frac{2 \pm \sqrt{5}}{3}$ B. $\frac{2 \pm \sqrt{19}}{3}$ C. $\frac{-2 \pm \sqrt{19}}{3}$ D. $\frac{-2 \pm \sqrt{19}}{3}$ E. NOTA
17. Suppose $0 < a < c$. Solve for x : $ax + b < cx + d$
 A. $\left(-\infty, \frac{b-d}{a-c}\right)$ B. $\left(-\infty, \frac{d-b}{a-c}\right)$ C. $\left(\frac{b-d}{a-c}, \infty\right)$ D. $\left(\frac{d-b}{a-c}, \infty\right)$ E. NOTA
18. If $\frac{1}{x} + \frac{3}{y} = \frac{1}{5}$, find $\frac{y}{x}$.
 $\frac{2}{x} + \frac{2}{y} = \frac{1}{7}$
 A. $\frac{1}{9}$ B. $\frac{1}{7}$ C. $\frac{1}{5}$ D. $\frac{1}{3}$ E. NOTA
19. When writing the questions for this test, I worked and procrastinated for a total of 20 hours spent on the task. When I wrote my term paper, I spent only half as much time working as I did when writing this test. I spent 3 times as much procrastinating when writing my term paper as I did when writing this test. I spent 27.5 hours on my term paper. How much time did I procrastinate in total while doing these two tasks?
 A. 28 hours B. 19.5 hours C. 13 hours D. 7 hours E. NOTA
20. Simplify: $\frac{\frac{x+3}{x^2-4}}{\frac{x^2-x-12}{x^3-8}}$
 A. $\frac{(x+2)(x-4)}{x^2+2x+4}$ B. $\frac{x^2+2x+4}{(x+2)(x-4)}$ C. $\frac{x^2-2x+4}{(x-2)(x+4)}$ D. $\frac{x^2+4x+6}{(x+2)(x-4)}$ E. NOTA
21. Simplify: $\frac{\frac{1}{2} + \frac{3}{x}}{\frac{x+3}{4}}$
 A. $\frac{2(x-6)}{x(x-3)}$ B. $\frac{x(x+6)}{2(x+3)}$ C. $\frac{2(x+6)}{x(x+3)}$ D. $\frac{2x(x+6)}{x+3}$ E. NOTA

22. If $\frac{a}{6} - \frac{a}{9} = \frac{2}{3}$, then $a = ?$
A. 8 B. 10 C. 11 D. 13 E. NOTA
23. If y is a real number, what is the smallest possible value of x in the equation
$$y = \sqrt{4 - x^2}$$

A. -5 B. -4 C. -3 D. -2 E. NOTA
24. For which of the following values of z is $\frac{5z - 5}{2z^2 + 7z - 15}$ undefined?
A. -5 B. $-\frac{3}{2}$ C. $-\frac{2}{3}$ D. 5 E. NOTA
25. Which quadratic inequality has the solution set $-3 \leq x \leq 8$?
A. $x^2 - 5x - 24 \geq 0$ B. $x^2 - 5x + 24 \leq 0$ C. $x^2 + 5x - 24 \leq 0$
D. $x^2 - 5x - 24 \leq 0$ E. NOTA

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Answer Key

1. D
2. C
3. D
4. C
5. B
6. B
7. D
8. E
9. B
- 10.A
- 11.C
- 12.A
- 13.A
- 14.C
- 15.C
- 16.B
- 17.D
- 18.A
- 19.A
- 20.B
- 21.C
- 22.E
- 23.D
- 24.A
- 25.D