Essex County Math League

Wednesday, May 25, 2022

Algebra 1

Essex County Math League

May 25, 2022

Algebra 1

Directions: You may write on this test. Be sure that your name, subject, and school (including town name) are on the answer sheet. Mark the answer sheet with dark, careful marks using a #2 pencil. Your score will be determined by your number of correct answers; incorrect answers will NOT lower your score. You may ONLY use a calculator on this test that is approved for use on the SAT's. The answer to the tie-breaker should be placed on the answer sheet in the place indicated by the proctors. The tie-breaker will be scored only in the case of a tie between the top scorers, and will not county as part of the team score. The fifth choice for each question is NG which means "Not Given" and is a valid answer that indicates that the correct answer is not among the answers given.

1. Find the solution to the system of equations:
   Line 1: $2x + 3y = 6$
   Line 2: $(-1, 14)$ and $(4,39)$

A.) $(3, 33)$ B.) $(-3, 4)$ C.) $(6, 0)$ D.) $(0, 19)$ E.) $(3, 8)$

2. For what positive value of k will $x^2 + 5kx + 225$ be a perfect square?

A.) 3 B.) 5 C.) 6 D.) 15 E.) *all positive numbers*

3. Let $f(x) = 3x - 8$ and $g(x) = 4x + 1$. If $g(f(a)) = 5$, what is the value of a?

A.) 1 B.) 3 C.) 5 D.) 28 E.) 29

4. Find the distance between the x and y intercept of: $4x - 3y = 12$.

A.) 5 B.) 7 C.) 144 D.) $2\sqrt{3}$ E.) $\sqrt{5}$

5. The average of 3 consecutive odd integers is 45. What is the largest value?

A.) 21 B.) 25 C.) 43 D.) 45 E.) 47

6. Solve for x: $\frac{\sqrt{45}}{x} = 6$.

A.) $18\sqrt{5}$ B.) $\frac{\sqrt{15}}{2}$ C.) $\frac{\sqrt{15}}{3}$ D.) $\frac{3\sqrt{5}}{2}$ E.) $\frac{\sqrt{5}}{2}$

7. If $a = -2, b = 5$, and $c = \frac{1}{2}$, evaluate $\frac{a^2c}{b} + \frac{b}{a}$.

A.) -1 B.) $\frac{-21}{10}$ C.) $\frac{-29}{10}$ D.) $\frac{21}{10}$ E.) $\frac{29}{10}$

8. The sum of the solutions of $x^2 - 5x - 6 = 0$ is:

A.) --4 B.) 4 C.) −5 D.) 5 E.) 7

9. Factor Completely: $3x^3 + 2x^2y - 3xy^2 - 2y^3$

A.) $(3x + 2y)^2(x - y)^2$ B.) $(3x + 2y)^2(x - y)(x + y)$ C.) $(3x + 2y)(x - y)^2$

D.) $(3x - 2y)(x - y)(x + y)$ E.) $(3x + 2y)(x - y)(x + y)$

10. If the ratio of $a: b$ is 3 and $3a - 2b = 14$, solve for b.

B.) 1 B.) 2 C.) 3 D.) 5 E.) 6

11. Solve for x where $x > 0$: $25^x = 5^{x^2-3x}$

A.) 1 B.) 2 C.) 3 D.) 5 E.) 6

12. Simplify $\frac{4x^5(x^{-2})}{(2x^5)^4}$.

A.) $\frac{2}{x^7}$ B.) $2x^{17}$ C.) $\frac{12}{x^{17}}$ D.) $\frac{4}{x^{17}}$ E.) $\frac{1}{4x^{17}}$

13. Simplify $[(x-2)^2+(x+3)^2+(x+5)^2]-[(x^2+4)+(x^2+9)+(x^2+25)]$

A.) $12x$ B.) $20x$ C.) $12x-8$ D.) $20x-8$ E.) $6x^2$

14. Simplify: $\frac{\frac{x}{y}+\frac{y}{x}}{\frac{x}{y}}$

A.) $1+\frac{y^2}{x^2}$ B.) $\frac{1}{x}$ C.) $\frac{1}{y}$ D.) $1+\frac{x^2}{y^2}$ E.) x^2+y^2

15. In which quadrant does the vertex of $y=-2x^2+8x-1$ lie?

A.) *I* B.) II C.) *III* D.) *IV* E.) *the vertex is on the* $y-axis$

16. If the point (-6, -8) is on the line $y = mx - 4$, which of the following points is also on the line?

A.) $(-4, 0)$ B.) $(2, 3)$ C.) $(6, 0)$ D.) $(-4, -11)$ E.) $(6, 8)$

17. Kat has n pizzas with 6 slices each. If everyone at her party has exactly 2 slices, how many people are at her party?

A.) $2n$ B.) $2 + n$ C.) $3n$ D.) $3 + n$ E.) $6n$

18. Let n be a prime number greater than 5. What is the least common multiple between $6n^4$ and $10n^7$?

A.) $2n^7$ B.) $2n^4$ C.) $60n^{11}$ D.) $30n^4$ E.) $30n^7$

19. A rectangle has an area of $3x^2 + 8x + 5$ and a perimeter of 44, what is the value of x?

B.) 1 B.) 2 C.) 3 D.) 4 E.) 5

20. Rationalize the denominator: $\frac{2+\sqrt{3}}{4-\sqrt{3}}$.

A.) 11 B.) $-\frac{1}{2}$ C.) $11+6\sqrt{3}$ D.) $6+6\sqrt{3}$ E.) $5-2\sqrt{3}$

Tie Breaker.

Two cubes have side lengths that are equal to $2x$ and $3x$. How many times greater is the surface area the large cube to the surface area of the small cube?

ALGEBRA 1

Answer Key:

1.) B
2.) C
3.) B
4.) A
5.) E
6.) E
7.) B
8.) D
9.) E
10.)B
11.)D
12.)E
13.)A
14.)A
15.)A
16.)C
17.)C
18.)E
19.)D
20.)C

Tie Breaker: 1.25 bigger