Essex County Math League

May 24, 2023

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 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 count 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) If –2 is a solution of $3x^2 + k = 5x$, then $k =$ _____.

A) –22
B) –20
C) 2
D) 46
E) NG

2) Simplify completely.

$$(3a^4)(2a^3)^2 - (-2a^2)^3(3a^2)^2$$

A) $-6a^{10}$
B) 0
C) $60a^{10}$
D) $84a^{10}$
E) NG

3) A number increased by one-fourth of its additive inverse is equal to 18. Find the number.

A) 16
B) 20
C) 24
D) 28
E) NG

4) If $a = 3$, $b = -4$, and $c = -6$, evaluate $\frac{ab^2}{a} - \frac{a^3b^2}{c^2}$

A) –16
B) –4
C) 4
D) 16
E) NG

5) Subtract the sum of $(a + 2b)$ and $(2a - b)$ from their difference.

A) –4a – 2b
B) –4a – 4b
C) 2a – 4b
D) 4a + 2b
E) NG

6) Find the smaller of two consecutive positive odd integers whose sum is “2a”.

A) $\frac{1}{2}a$
B) $\frac{1}{2}a - 1$
C) a – 1
D) a + 1
E) NG

7) Solve the following equation for x: $|x + 2| = |x - 2|$

A) –1
B) 0
C) 0, 1
D) –1, 0, 1
E) NG

8) Simplify completely: $1 + \left(x - \frac{2}{x}\right)^{-1}$

A) $\frac{(x+2)(x-1)}{x^2-2}$
B) $\frac{x^2-3}{x^2-2}$
C) x
D) $\frac{x^2-1}{x^2-2}$
E) NG

9) Find the ratio of a:b if $\frac{3a-2b}{a+2b} = 2$

A) $-\frac{6}{5}$
B) $-\frac{5}{6}$
C) 1
D) $\frac{5}{6}$
E) NG

10) Solve for x: $(x^2 - 4)^2 - (x^2 - 4) = 20$

A) $\emptyset$
B) 0.3
C) $0, \pm 3$
D) $\pm 3, \pm 2\sqrt{2}$
E) NG

11) If the following points are collinear, find the value of y: (–2, 3), (1, 7), (–6, y)

A) –2
B) $-\frac{4}{3}$
C) $-\frac{7}{3}$
D) $\frac{4}{3}$
E) NG

12) Solve for k: $\frac{2}{k-1} > \frac{k+1}{4}$

A) $k < -3$
B) $-3 < k < 3$
C) $k > 3$
D) $k \neq 1$
E) NG

13) Solve for x, given x is an integer: $-4 < 5 - 3x < 8$

A) $-3 < x < 1$
B) $\{2, 1, 0\}$
C) $\emptyset$
D) $-1 < x < 3$
E) NG

14) Which of the following is a multiple of (x – 2)?

A) $x^2 + 8x + 12$
B) $x^2 - 8x + 12$
C) $x^2 - 4x - 12$
D) $2x^2 - 32$
E) NG

15) Find the midpoint between the x and y intercepts of: $8x - 4y = 32$

A) $(-2, 4)$
B) $(2, -4)$
C) $(-2, -4)$
D) $(4, -8)$
E) NG

16) The intersection of the two given lines is: $y = \frac{2}{5}x + 2$ and $y = \frac{5}{2}x - 19$

A) $(-2, 5)$
B) $(-10, 6)$
C) $(5, -2)$
D) $(10, 6)$
E) NG

17) What is the product of: $(3\sqrt{a} - 2)(2\sqrt{a} + 3)$

A) $6a - 6$
B) $6a^2 - 6$
C) $6a + 5\sqrt{a} - 6$
D) $6a - 5\sqrt{a} + 6$
E) NG

18) What is the remainder when $x^3 + 3x^2 - 4x - 12$ is divided by $x - 2$?

A) -12
B) 0
C) 16
D) 24
E) NG

19) Express $x^2y^{-4}z^{-\frac{1}{2}}$ with only positive exponents:

A) $\frac{x^2z^{\frac{1}{2}}}{y^4z}$
B) $(xy^2z)^2$
C) $\frac{-x^2}{y^4z}$
D) $\frac{2x^2}{y^4z^{\frac{1}{2}}}$
E) NG

20) Given the parabola $y - 4 = \frac{1}{4}(x + 3)^2$, what are the coordinates of the focus?

A) (–3, 4)
B) (–3, 5)
C) (3, –4)
D) (4, –3)
E) NG

Tie Breaker: *This question must be written on the scantron sheet in the area indicated by the proctors. This question will only be scored to break a tie between the highest scorers on the contest.*

A rectangular photo is surrounded by a 2-inch wide border on all sides. The area of the border is 32 inches square. What is the perimeter of the photo?

ANSWER KEY

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

TB. 8 inches