Essex County Math League
May 22, 2019
Algebra 2

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 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 $x^2 + bx + c = 0$ and one root is $x = -1 + i$, where $i = \sqrt{-1}$, find the value of b + c.

A) 2 B) 3 C) 4 D) 5 E) NG

2) In a cage at the zoo live six friendly parrots. Each morning they greet each other individually with a "hello." How many greetings might be heard each morning?
A) 30 B) 15 C) 12 D) 6 E) NG

3) Given $f(x) = |x - 1|$ *and* $g(x) = x - 1$. If $h(x) = f(g(x)) + g(f(x))$, what is the minimum value of h(x)?

A) -1 B) 1 C) 2 D) 0 E) NG

4) If the domain of f(x) is restricted by $x^2 < 4$, then the range of $f(x) = x^2 - 2x - 3$ is:

A) $0 < f(x) < 5$ B) $-4 < f(x) < 5$ C) $-3 < f(x) < 5$

D) $-4 < f(x) < 4$ E) NG

5) Solve for x: $4^{2x^2-3} = 8$

A) 3/2 B) -3/2 C) $\pm 3/2$ D) no solution E) NG

6) Factor completely: $(2a-1)^6 - (1-2a)^6$

A) $2(1-2a)^3(1-a)(4a^2-2a+1)$ B) $-1(2a-1)^3(a-1)(4a^2-2a+1)$

C) $(2a-1)^3+1$ D) $(2a+1)(2a^2-a-1)$ E) NG

7) Which circle best describes: $x^2+y^2-4x+8y-64=0$

A) center (2, 4) and radius 8 B) center (2, -4) and radius 8

C) center (-2, 4) and radius $2\sqrt{21}$ D) center (2, -4) and radius $2\sqrt{21}$ E) NG

8) Given the system of equations: $2x + y - z = 8$, $3x + 2y - z = 10$ and $x + 3y - 4z = 12$, find the value of $x + y - z$,

A) 5 B) $5\frac{1}{3}$ C) 30 D) $30\frac{1}{3}$ E) NG

9) Given $f(x) = x^2 + 2$ *with* $x \geq 0$ then $f^{-1}(x) =$

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

10) The length that a spring stretches, from its normal length, is directly proportional to the mass attached to the spring. If a mass of "a" kg stretches the spring "b" cm, then a mass of "c" kg will stretch the spring how far?

A) "abc" cm B) $\frac{ab}{c}$ cm C) $\frac{bc}{a}$ cm D) $\frac{ac}{b}$ cm E) NG

11) If $f(x) = 3x - 2$ and $g(f(x)) = \sqrt{3x}$, then g(x) =

A) $\sqrt{x}$ B) $\sqrt{x+2}$ C) $\sqrt{3x+2}$ D) $\sqrt{3x-2}$ E) NG

12) Solve for x: $\ln(x) + \ln(4) - \ln(2) = 8$

A) 16 B) e^8 C) $2e^8$ D) $\frac{e^8}{2}$ E) NG

13) Given $f(x) = ax^4 + bx^2 + cx + 1$ and $g(x) = 8ax^2 - 2bx + c$ and f(2)=5, find g(-1)=

A) -2 B) 2 C) 4 D) 5 E) NG

14) the solution set of $\frac{|2x+1|}{x-1} < 3$, is :

A) x<0 or x>4 B) x<1 C) x<1 or x>4 D) x>4 E) NG

15) The graph of $|y + 2| = |x - 3|$ forms 2 intersecting lines. The point of intersection of these lines lie in

A) quadrant I B) quadrant II C) quadrant III D) quadrant IV E) NG

16) Given $x^2 + y^2 = 68$ *and* $xy = 16$, then $|x - y|$=

A) 4 B) 8 C) 16 D) 36 E) NG

17) Given $\sqrt{x+3} = x + 1$, then x=

A) -2 B) -2 or 1 C) 1 D) 1 or -1 E) NG

18) A train traveling at 30 mph requires 21 minutes longer to go a certain distance than a train traveling 36 mph. What is the distance traveled?

A) 31 mi. B) 42 mi. C) 63 mi. D) 64 mi. E) NG

19) Given $x^3 - 27 = 0$, find the sum of all 3 roots.

A) 0 B) 3 C) $3\sqrt{3}$ D) -3 E) NG

20) Find the quotient of $x^3 - 3x^2 - 4x + 12$ *and* $x - 2$.

A) $x^2 - x - 6$ B) $x^2 + 5x + 6$ C) $x^2 - x + 6$ D) $x^2 - 5x + 6$ E) NG

Tie breaker: This question will be scored only if there is a tie amongst the highest scorers. Please write your answer in the area described by the proctors.

Find the exact length between the lines y = x and y = x + 2.

Answers to 2019 ECML Contests

Algebra 1		Algebra 2		Advanced Math	
1)	C	1)	C	1)	E
2)	B	2)	A	2)	C
3)	C	3)	D	3)	A
4)	D	4)	C	4)	B
5)	A	5)	C	5)	D
6)	B	6)	E	6)	D
7)	E	7)	D	7)	C
8)	C	8)	A	8)	A
9)	D	9)	C	9)	A
10)	C	10)	C	10)	A
11)	C	11)	B	11)	B
12)	B	12)	D	12)	B
13)	C	13)	B	13)	D
14)	D	14)	C	14)	B
15)	B	15)	D	15)	A
16)	D	16)	E		
17)	A	17)	C		
18)	B	18)	C		
19)	C	19)	A		
20)	B	20)	A		
TB	5/12	TB	$\frac{\sqrt{2}}{2}$	TB	$y = \pm 2$