

ECML

2013

Algebra 2

# ESSEX COUNTY MATH LEAGUE

May 22, 2013

## 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 the number of correct answers. Incorrect or blank answers will **NOT** lower your score. You **MAY** use only a SAT I approved calculator on this test. 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 answer to part e) will always be **NG** for “Not Given”. This is a viable answer and means that the correct answer is **not** one of the first four listed.

1) Evaluate the expression:  $y^2 - 3y + 4$  when  $y = 1 - \sqrt{2}$ .

- A)  $4 - \sqrt{2}$       B)  $4 + \sqrt{2}$       C)  $4 - 3\sqrt{2}$       D)  $4 + 3\sqrt{2}$       E) NG

2) What is the average of the expressions:  $(2x-3)$ ,  $(-5x+6)$ , and  $(6x+12)$ ?

- A)  $3x+15$       B)  $2x+10$       C)  $x+15$       D)  $x+5$       E) NG

3) Factor, completely:  $x^6 - \frac{1}{8}$

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

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

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

5) Find the value(s) of k such that  $3x^2 + 8 = 4kx$  has no real roots.

- A)  $k = \pm\sqrt{6}$       B)  $k \leq \sqrt{6}$       C)  $k > \sqrt{6}$  or  $k < -\sqrt{6}$       D)  $|k| < \sqrt{6}$       E) NG

6) Simplify:  $\frac{4+2i}{1+i}$

- A)  $3+i$  B)  $3-i$  C)  $1+i$  D)  $1-i$  E) NG

7) Given:  $f(x) = 2x + 5$  and  $g(x) = 3x - k$ , find  $k$  such that  $f(g(x)) = g(f(x))$ .

- A)  $5x+5$  B)  $x-5$  C)  $-10$  D)  $20$  E) NG

8) Solve the system of equations:  $\frac{x}{3} - \frac{y}{5} = 1$   
 $2x = y + 7$

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

9) Simplify the following expression:  $3\log(n) - 2\log\left(\frac{3}{n^2}\right) + \log(\sqrt{n^3}) + \log\left(\frac{9}{\sqrt{n}}\right)$

- A)  $8\log(n)$  B)  $\log(8n)$  C)  $8$  D)  $0$  E) NG

10) Find the value of  $k$ , such that the point  $(-5, k)$  is collinear with  $(4, -3)$  and  $(-2, 5)$ .

- A)  $-2$  B)  $-8$  C)  $7.25$  D)  $16$  E) NG

11) Given:  $f(x) = 2^{-x}$ , find the value of  $F(-3) - f(3)$ .

- A)  $0$  B)  $1$  C)  $7\frac{7}{8}$  D)  $-7\frac{7}{8}$  E) NG

12) The value of a diamond varies directly as the square of its weight. If a diamond weighing 2 carats is valued at \$400, what would be the value of a diamond weighing 3.5 carats?

- A) \$700 B) \$1000 C) \$1225 D) \$1375 E) NG

13) Solve for  $x$ :  $|6x - 5| > 2x + 7$

- A)  $-\frac{1}{4} < x < 3$  B)  $-3 < x < \frac{1}{4}$  C)  $x < -\frac{1}{4}$  or  $x > 3$  D)  $x < -3$  or  $x > \frac{1}{4}$  E) NG

14) Simplify:  $\sqrt[7]{27}$

- A)  $81$  B)  $-81$  C)  $9$  D) empty set E) NG

15) If the graphs of  $3x + y = 9$  and  $2x - y = k$  intersect each other on the  $x$ -axis, then  $k = \underline{\hspace{1cm}}$

- A)  $9$  B)  $6$  C)  $3$  D)  $-3$  E) NG

16) Find the equation of the parabola having vertex at the origin and passing through the points  $(-2, 1)$  and  $(-2, -1)$ .

- A)  $y = 2x^2$       B)  $y = -2x^2$       C)  $x = -2y^2$       D)  $x = -\frac{1}{2}y^2$       E) NG

17) If  $x - y > 0$ , which of the following statements MUST be true?

- I       $y > 0$   
II       $x^2 > y^2$   
III       $x + y > 0$

- A) I, II, III      B) II and III only      C) II only      D) None      E) NG

18) A contractor agreed to do a certain job for \$9000. Because of good weather, he was able to complete the job in 4 days less than the time he planned, thus earning \$75 more per day than he had expected. How many days did it take him to finish the job?

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

19) Which of the following equations has roots  $p$  and  $q$  such that

$$p^2 + q^2 = 31 \text{ and } p + q = -6 ?$$

- A)  $2x^2 - 12x + 5 = 0$       B)  $x^2 - 6x - 11 = 0$       C)  $2x^2 + 12x + 5 = 0$       D)  $x^2 + 6x - 11 = 0$       E) NG

20) If  $f(x) = ax^2 + bx + c$ ,  $f(2) = -1$ ,  $f(3) = 2$ , and  $f(x) = 0$  has a root of 1, find the value of  $abc =$

- A) -70      B) -35      C) -14      D) -10      E) NG

Tie Breaker. This question will only be scored to break a tie amongst the high scorers on this contest. It will not count as part of the team score.

What is the exact product of the slopes of the asymptotes of the hyperbola:

$$9x^2 - 16y^2 + 54x + 64y + 161 = 0$$