2011 Vestavia Hills High School
## Mathematics Tournament
Pre-Algebra Written Examination

1. The statement $x^2 - x - 6 < 0$ is equivalent to the statement:
   A. $-2 < x < 3$ B. $x > -2$ C. $x < 3$ D. $x > 3$ and $x < -2$ E. NOTA

2. How many unique ways are there to arrange the letters in the word "SONOROUS"?
   A. 6720   B. 40320   C. 336   D. 3360   E. NOTA

3. Find the equation of the line that is perpendicular to the line $5x + 3y = -8$ and passes through the point $(6,6)$.
   A. $3x + 5y = -12$ B. $5x + 3y = 12$ C. $-3x + 5y = 5$ D. $x - y = -12$ E. NOTA

4. Three fruitcakes are weighed two at a time in all possible ways. The weights of each pair are 12 lbs, 13 lbs, and 15 lbs. How much does the lightest fruitcake weigh, in pounds?
   A. 7   B. 4   C. 5   D. 8   E. NOTA

5. A rectangular $4 \times 3 \times 2$ block has all its surfaces painted red, and then it is cut into cubes with each edge 1 unit wide. How many cubes will have exactly one of its faces painted red?
   A. 0   B. 4   C. 8   D. 12   E. NOTA

6. Todd walks his dog one morning. He goes 5 miles north from his house until he reaches the gas station, where he rests for half an hour. Then, he walks his dog 8 miles east. Once he reaches the grocery store, he walks his dog 3 miles south, but goes back 1 mile north because he had dropped his four-function calculator. How far is he from his house, in miles?
   A. 73   B. $\sqrt{73}$ C. 68   D. $2\sqrt{17}$ E. NOTA

7. What is $403_8 + 254_8$ in base 2?
   A. 11011001_2 B. $101001000\,1_2$ C. $11000\,1011_2$ D. 100100111_2 E. NOTA

8. Allan and Wendy are best friends. They decide to play a game of soccer with 6 other friends. If Allan and Wendy are already on Team A, how many different combinations of players are there for the remaining two spots on Team A, given that Allan can pick any player he wants for his four-player team?
   A. 70   B. 35   C. 16   D. 15   E. NOTA

9. Simplify $\sqrt{\dfrac{8^8 + 4^8}{8^2 + 4^7}}$.
   A. 1028   B. 32   C. 64   D. 512   E. NOTA

10. A train leaves the station at 1:00 p.m. at a rate of 50 mph. Two hours later, a second train traveling at 65 mph leaves the same station going in the same direction on a parallel. At what time does the second train pass the first one?
    A. 9:30 p.m.   B. 8:40 p.m.   C. 9:40 p.m.   D. 8:30 p.m.   E. NOTA

11. Purple penguins pranced pleasantly on Pedestrian Street. At the same time, big babbling buffalos bumbled around. If there were 2011 heads and 6012 feet in all, how many buffalos were there?
    A. 995   B. 701   C. 117   D. 1016   E. NOTA

12. If a square's side lengths are integers, its perimeter cannot be:
    A. 104   B. 12   C. 8   D. 38   E. NOTA

13. There are 20 students in Honors Algebra II. The class average grade is a 33. (Mr. Taylor's tests are *really* hard.) When Soojung, Claire, and Kelly join the class, however, they all make a 100. What is the new class average?
    A. 48   B. 55   C. $\dfrac{141}{3}$ D. $\dfrac{960}{23}$ E. NOTA

14. Find the volume of a box with a height of 4 inches, a width of 3 inches, and a length of 5 inches, in ft³.
    A. 60 in³   B. $\dfrac{5}{144}$ ft³   C. 60 ft³   D. $\dfrac{5}{12}$ ft³   E. NOTA

15. If three lemons cost the same as four oranges, and three mangos cost the same as fourteen apples, how many apples cost the same as 1053 lemons, given that thirteen mangos cost the same as 676 oranges?
    A. 9   B. 126   C. 117   D. 378   E. NOTA

16. The Doctor was fixing the TARDIS's Chameleon circuit when suddenly, the TARDIS changed from a police call box of dimensions 3 ft x 10 ft x 12π ft into a beach ball of the same volume. What is the radius of the TARDIS beach ball?

    A. $3\sqrt[3]{10}$ ft   B. $4\sqrt[3]{4}$ ft   C. $4\sqrt[3]{10}$ ft   D. $3\sqrt[3]{6}$ ft   E. NOTA

17. Two sides of a triangle have lengths 14 and 16. Which of the following cannot be the length of the third side, if all three sides are measured in the same units?

    A. 2   B. 6   C. 7   D. 28   E. 29

18. Farhan the Fly is stuck inside of a cylindrical soda can with a radius of 3 inches and a height of 8 inches. In order to muster enough energy to fly, Farhan must take one warm-up lap along the bottom of the can, then fly the shortest distance from point A to point B without touching the vertical sides of the can. What is the distance that Farhan will travel?

    A. $6\pi + 6$ in   B. 12π in   C. $6\pi + 10$ in   D. $6\pi + 8$ in   E. NOTA

19. Eminem is playing with a square dartboard. There are two rings, and each ring has a width of 3 cm. If the area of the dartboard is 256 cm², what is the area of the smallest square?

    A. 100 cm²   B. $\dfrac{256}{3}$ cm²   C. 16 cm²   D. 36 cm²   E. NOTA

20. If there are 22 squirrels residing in Mr. Taylor's attic, as well as 17 raccoons and 19 bats, how long will it take them to fully ransack the attic if it takes one squirrel 132 days to ransack his attic, one raccoon 68 days, and one bat 228 days?

    A. $\dfrac{1}{2}$ B. 2   C. 8   D. 4   E. NOTA

21. Find $x+y+z$ if $\begin{cases} x+y-3z=-2 \\ x-3y+z=-6 \\ -3x+y+z=2 \end{cases}$ A. 20   B. 8   C. 9   D. 6   E. NOTA

22. Find the area of the figure, if the coordinates of its vertices are given in clockwise order: $(-1,1)$, $\left(0,\dfrac{3}{4}\right)$, $\left(\dfrac{1}{2},1\right)$, $\left(1,\dfrac{3}{4}\right)$, $\left(1,-\dfrac{35}{36}\right)$, $\left(0,-\dfrac{35}{36}\right)$, $\left(0,-\dfrac{5}{8}\right)$, $\left(-1,-\dfrac{35}{36}\right)$.

    A. 1   B. $\dfrac{659}{381}$ C. $\dfrac{169}{48}$ D. $\dfrac{497}{600}$ E. NOTA

23. If the amount of chocolates Emmy receives is directly proportional to how much it has rained that day, and on a day when it rained 20 cm Emmy received 5 bars of chocolate, how many full bars of chocolate does Emmy receive in a day where it rains 65 cm?

    A. 28   B. 12   C. 16   D. 8   E. NOTA

24. If today is Tuesday, March 15, what day of the week will January 1 be on next year?

    A. Saturday   B. Monday   C. Tuesday   D. Friday   E. NOTA

25. If $a=\dfrac{0.1}{0.5}$, $b=\dfrac{0.5}{1}$, and $c=\dfrac{1}{0.5}$, then:

    A. $a>b>c$ B. $b>a>c$ C. $c>a>b$ D. $a>c>b$ E. NOTA
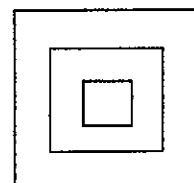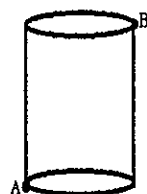
PLEASE WRITE YOUR NAME, COMPLETE SCHOOL NAME, AND TIE-BREAKER ANSWERS ON THE BACK OF THE SCANTRON FORM. DENOTE EACH TIE-BREAKER AS T1, T2, AND T3.

T1: You are given one hour to complete a contest exam. What fraction of the time remains after you have worked 25 minutes?

T2: How many digits are in 100000^{999}?

T3: What is the smallest positive value of k that makes $40k$ a perfect square?

YOU MAY KEEP THIS COPY OF THE EXAM.