

**Algebra I Test**  
**VHHS Math Tournament**  
**2007**

1. Find the number of terminating zeroes are at the end of  $98!$ .

- A. 19              B. 20              C. 21              D. 22              E. NOTA

2. A man is now six times as old as his son. In two years, the man will be five times as old as his son. Find the difference between the present ages of the man and his son.

- A. 9              B. 28              C. 32              D. 40              E. NOTA

3. Jimmy rolls a pair of dice. What is the probability that the numbers that show on the two dice add up to a prime number?

- A.  $\frac{7}{18}$               B.  $\frac{5}{12}$               C.  $\frac{13}{36}$               D.  $\frac{1}{3}$               E. NOTA

4. Of the following digits, which one CANNOT be the units digit of  $n^2$  if  $n$  is an integer?

- A. 1              B. 2              C. 6              D. 9              E. NOTA

5. A master plumber can complete a job in 6 working days. After he has worked for 2 days, he was called away for a new job, and another plumber completed the job in 10 additional days. How long would it take the second plumber to do the job if he worked alone?

- A. 10              B. 14              C. 15              D. 16              E. NOTA

6. Find the number of distinct arrangements of the letters in the word BASSOON.

- A. 210              B. 1260              C. 2520              D. 5040              E. NOTA

7. Convert  $1337_9$  into base 16.

- A. 3EE              B. 1006              C. 3DF              D. 1005              E. NOTA

8. Simplify:  $\frac{x+5}{x^2+6} \cdot \frac{x^4+2x^2-24}{x-2} \div \frac{x^2+5x+6}{x^2+7x+12}$

- A.  $x^2+19x+20$               B.  $\frac{x+5}{x+4}$               C.  $\frac{x+4}{x+5}$               D.  $x^2+6x+8$               E. NOTA

9. If  $xy = 3$  and  $x + y = -7$ , what is the value of  $x^3 + y^3$ ?

- A. -343              B. -280              C. 280              D. 343              E. NOTA

10. Find the value of:  $\sqrt{6+\sqrt{6+\sqrt{6+\sqrt{6+\dots}}}}$

- A. 2              B. 3              C. 4              D. 5              E. NOTA

11. Richard and Gerald are walking toward each other on a straight road 10 km long. Richard travels at a rate of 3.3 km/hr, and Gerald travels at 4.2 km/hr. When they start walking, Richard's dog Checkers runs toward Gerald at 9 km/hr, and runs back toward Richard as soon as he reaches Gerald. If Checkers continues to run back and forth between Richard and Gerald, what is the total distance in km that Checkers travels before Richard and Gerald meet each other, assuming that Checkers wastes no time turning around?

- A. 12      B.  $\frac{450}{41}$       C. 11      D. 24      E. NOTA

12. Which of the following points satisfy the system of inequalities?

$$\begin{cases} 2x - 5y \geq -7 \\ -x + 3y \leq 4 \end{cases}$$

I. (-1, 1)      II. (19, 5)      III. (-7, -1)

- A. I only      B. II only      C. III only      D. I and II      E. NOTA

13. The amount of charge stored on a capacitor varies jointly as the voltage and area of the plates and inversely as the distance between the two plates of the capacitor. If a capacitor whose plates have area 16 and whose distance is  $\frac{1}{3}$  apart and whose voltage is 25 stores 300 units of charge, how much charge does another capacitor hold if its plates have area 12 and distance  $\frac{1}{7}$  apart and if its voltage is 28?

- A. 108      B.  $\frac{7500}{49}$       C.  $\frac{1875}{4}$       D. 588      E. NOTA

14. Let  $x$  be the units of greebes sold by a certain manufacturer of greebes. The manufacturer has determined that the cost function for producing  $x$  number of greebes is  $C = 10x + 675$  and that the quantity of greebes sold is given by  $x = 2500 - 100p$ , where  $p$  is the unit price. If profit is defined as total revenue minus cost, and total revenue is defined as unit price times quantity sold, what is the maximum profit that this manufacturer can make?

- A. \$750      B. \$1500      C. \$4950      D. \$5000      E. NOTA

15. A man invests a portion of \$9,000 at 3% and the rest at 4%. If his total return from the two investments is \$295, how much income did he receive from the money invested at 4%?

- A. \$100      B. \$142.86      C. \$195      D. \$250      E. NOTA

16. Find the sum of the coefficients in the product  $(2x + 3)(x - 1)(40 - x^2)$  after simplification.

- A. -84      B. 0      C. 156      D. 195      E. NOTA

17. Solve:  $|5x - 4| \geq |3x + 5|$

- A.  $\left(-\infty, -\frac{1}{8}\right] \cup \left[\frac{9}{2}, \infty\right)$       B.  $\left(-\infty, -\frac{9}{2}\right] \cup \left[\frac{1}{8}, \infty\right)$       C.  $\left[-\frac{1}{8}, \frac{9}{2}\right]$       D.  $(-\infty, \infty)$       E. NOTA

18. Abe is rowing a boat upstream such that his boat is traveling at 25 km/hr. The river flows downstream at 3 km/hr. At 10 AM, he accidentally drops his hat into the river, at which time the hat floats downstream, carried by the current of the river. At 11:30 AM, he realizes that he has lost his hat, and turns around to chase his hat rowing at the same speed. At what time will he catch up to his hat, to the nearest minute?

- A. 12:51 PM      B. 12:54 PM      C. 1:00 PM      D. 1:11 PM      E. NOTA

19. Find the sum of the first 30 terms of an arithmetic sequence whose fourth term is 7 and whose nineteenth term is 52.

- A. 85            B. 88            C. 91            D. 94            E. NOTA

20. In the following sequence, each term is the sum of the previous two terms. What is the sum  $a + d + e$  if  $a, b, c, d$ , and  $e$  all represent integers?

9,  $a, b, c, 27, d, 69, e$

- A. 55            B. 103            C. 148            D. 177            E. NOTA

21. Billy has 3 quarters, 1 nickel, and 4 pennies. How many different sums of money can he make (\$0.00 does not count as a sum of money)?

- A. 38            B. 39            C. 40            D. 41            E. NOTA

22. Which of the following is a solution of the system of equations:

$$\begin{cases} 3y = x^2 \\ x^2 + y^2 - 30y = 0 \end{cases}$$

- A. (3, 3)            B. (3, -3)            C. (-3, 3)            D. (0, 0)            E. NOTA

23. How many three digit numbers exist such that the digits are in strictly decreasing order from left to right (e.g., 753 and 410 satisfy this condition, while 544 and 472 do not)?

- A. 120            B. 336            C. 504            D. 720            E. NOTA

24. In base  $x$ , the base 10 integer 125 can be written as 175. What is  $x$ ?

- A. 7            B. 8            C. 9            D. 15            E. NOTA

25. The number  $x$  is such that when it is divided by 2, its remainder is 1; when divided by 3, the remainder is 2; when divided by 4, the remainder is 3; when divided by 5, the remainder is 4. What is the smallest possible value of  $x$ ?

- A. 29            B. 89            C. 119            D. 239            E. NOTA

TB1. Set  $S$  contains elements with the following properties:

- I. 2 is in  $S$
- II. If  $x$  is in  $S$ , then  $x+7$  and  $3x$  are in  $S$
- III. No numbers other than those that satisfy conditions I and II are in  $S$

What is the smallest integer greater than 2007 that is NOT in  $S$ ?

TB2. Find the units digit of  $2007^{2007} + 2006^{2006} + 2005^{2005} + 2004^{2004}$ .

TB3. What are all the real solutions of  $x^3 + x^2 - 5x + 3$ ?