December 7, 1994 WOCOMAL VARSITY MEET

ROUND I: Arithmetic - percent, interest, discount, fractions, and decimals

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. If 300,000 people attended Woodstock II this summer, 37.5% of them loved the mud, half hated it, and the rest were indifferent, how many people there were indifferent about the mud?

2. Tom bought a $30 jacket at a 20% discount and a $20 shirt at a 30% discount. What is the single percentage discount that he received on his total purchase?

3. In a certain population, 1/2 of the men are married and 1/4 of the women are married. Assuming that all marriage partners come from this population and involve one man and one woman, what fraction of the population is not married?

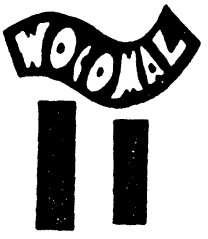
ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____%

(3 pts) 3. _____

Algonquin, Hudson, Tahanto



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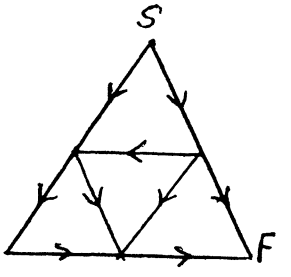
ROUND II: Set theory and logic

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Six hundred and ninety-seven days after Saturday is what day?

2. Using only the paths and directions shown, how many different routes can be taken from S to F?



3. On an airliner there are 9 boys, 5 American children, 9 men, 7 foreign boys, 14 Americans, 6 American males, and 7 foreign females. What is the number of people on the plane? (Assume that foreign means not American, children and boys are under 18, and men are 18 or over.)

ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____

Burncoat, St.John's, Southbridge

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ROUND III: Algebra 1 - open

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. If $a = c-b$, simplify $\frac{a+b}{c} + \frac{b-c}{a} + \frac{a-c}{b}$.

2. 36 students took a final exam. If the average of those passing was 78, the average of those failing was 60, and their overall average was 71, how many of these 36 students passed the final?

3. Jen made $17.62 in tips. All of the tips were in coins (25, 10, 5, 1 cent pieces). She had four times as many quarters as nickels and three times as many dimes as nickels. Altogether Jen had 111 coines. How many pennies did she have?

ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____

Auburn, Quaboag, Southbridge

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ROUND IV: Sequences and series

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Find the number of terms in the finite arithmetic sequence $-3, 1, 5, \ldots, 45$.

2. If $9x^2$, $6x^2+2$, and $4x^2+8$ are the first three terms of a geometric sequence, find the numerical value of the second term.

3. Consider the sequence 1, 5, 12, 22, 35, ... in which the successive differences between the terms increase by three each time. Find the 100th term.

ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____

Leicester, Quaboag, Shepherd Hill

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ROUND V: Matrix and determinant operations

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Find the product $\begin{bmatrix} 4 & 3 & 2 \\ 0 & 1 & 2 \end{bmatrix} \cdot \begin{bmatrix} 6 \\ 5 \\ 4 \end{bmatrix}$

2. Find matrix N such that $\begin{bmatrix} 1 & 3 \\ 5 & 7 \end{bmatrix} \cdot N = \begin{bmatrix} 10 & 6 \\ 34 & 30 \end{bmatrix}$

3. If $M = \begin{bmatrix} 1 & k \\ -k & 1 \end{bmatrix}$, find the sum of the elements in M^4 in terms of k.

ANSWERS

(1 pt) 1. $\begin{bmatrix} \quad \end{bmatrix}$

(2 pts) 2. $\begin{bmatrix} \quad \end{bmatrix}$

(3 pts) 3. _____

Leicester, Worcester Academy, QSC

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TEAM ROUND: Topics of previous rounds and open

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM
AND ON THE SEPARATE TEAM ANSWER SHEET 2 points each

1. A 400% increase is the same as a 100% increase followed by a ___?___ % increase.

2. Let n(S) = number of elements in set S and $\overline{S}$ denote the complement of set S. If n(A) = 9, n(B) = 46, and $n(\overline{A \cup B}) = 9$, find the difference between the largest and smallest possible values of $n(\overline{A \cap B})$.

3. Find two numbers such that their difference, sum, and product are in the ratio of 1 : 4 : 15 respectively.

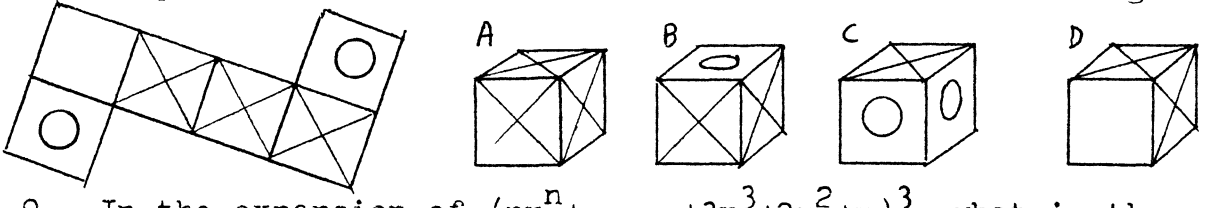
4. Consider the two arithmetic sequences 3, 14, 25, 36, ... and 2, 9, 16, 23, ... What are the first three numbers that appear in both sequences?

5. Find all values of x for which $\dfrac{\begin{vmatrix} x & 2 \\ 2 & x \end{vmatrix}}{\begin{vmatrix} x & x \\ x & 2 \end{vmatrix}} = \dfrac{-5}{3}$.

6. Solve: $|(2-|x|)| = 1$

7. I am thinking of a 3-digit number. If the product of its digits is 140 and the digits appear in increasing order from left to right, what is the number?

8. The pattern on the left will make which cube on the right?



9. In the expansion of $(nx^n + \ldots + 3x^3 + 2x^2 + x)^3$, what is the coefficient of x^5?

Bromfield, Hudson, Mass. Academy, South, Tahanto, West Boylston, Worcester Academy

December 7, 1994

I	1	37,500
	2	24%
	3	$\frac{2}{3}$
II	1	Wednesday
	2	6
	3	33
III	1	-1
	2	22
	3	7
IV	1	13
	2	$2\frac{1}{2}$ or...
	3	14,950
V	1	$\begin{bmatrix} 47 \\ 13 \end{bmatrix}$
	2	$\begin{bmatrix} 4 & 6 \\ 2 & 0 \end{bmatrix}$
	3	$2-12k^2+2k^4$

TEAM ROUND

1. 150 %
2. 18
3. 10 and 6
4. 58, 135, 212
5. $x = 3$ only
6. $x = -3, -1, 1, 3$ any order
7. 457
8. 8
9. 21