

October 10, 2007

WOCOMAL Varsity Meet

Round 1: Arithmetic (NO CALCULATORS)

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Simplify:

$$\frac{\left(\frac{3}{2} \div \frac{9}{16}\right) + \left(\frac{1}{2} - \frac{1}{3} + 2\frac{5}{6}\right)}{\left(\frac{1}{3} + \frac{1}{4}\right) \div 7}$$

2. How many pens purchased at 3 for \$20 and sold for 4 for \$30 are required to make a profit of \$40 ?

3. Find the value of $\left(2\frac{1}{3} * \frac{7}{8}\right) - \left(\frac{5}{6} * 1\frac{2}{5}\right)$ if $x * y = \frac{(x+y)}{(x-y)}$.

ANSWERS

(1 pt.) 1. _____

(2 pts.) 2. _____

(3 pts.) 3. _____

Auburn, Douglas, and Wachusett

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Round 2: Algebra 1 (open)

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. In a stairway there are 36 steps of equal height. If each step were 1 inch higher, there would have been 32 steps. How high, in inches, is each step ?
2. An 8-foot length of canvas is to be cut into three pieces in the ratio 1:2:3. How long will the middle-sized piece be, if done accurately ? Answer in feet and inches.
3. It takes 15 workers to build 500 feet of fencing in 6 hours. At this rate, how many workers are needed to build 1000 feet of fencing in 9 hours ?

ANSWERS

(1 pt.) 1. _____ inches

(2 pts.) 2. _____ ft. _____ in.

(3 pts.) 3. _____

Burncoat, Quaboag, and West Boylston

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Round 3: Set Theory

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Set $U = \{1, 2, 3, 4, 5, 6, 7\}$ and is the universal set for this problem.
If $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{2, 3, 6\}$, and $C = \{3, 5, 7\}$, find the set $(A - B) \cup \bar{C}$, where \bar{C} is the complement of set C .
2. Set $A = \{1, 2, 3, 4\}$. How many subsets of set A contain less than 3 elements ?
3. Ninety students go to the zoo. 24 have a hot dog; 5 have a hot dog and a soda; 33 have a soda; 10 have a soda and a popsicle; 38 have a popsicle; 8 have a popsicle and a hot dog. 3 have a hot dog, a soda, and a popsicle. How many had none of these ?

ANSWERS

(1 pt.) 1. {_____}

(2 pts.) 2. _____

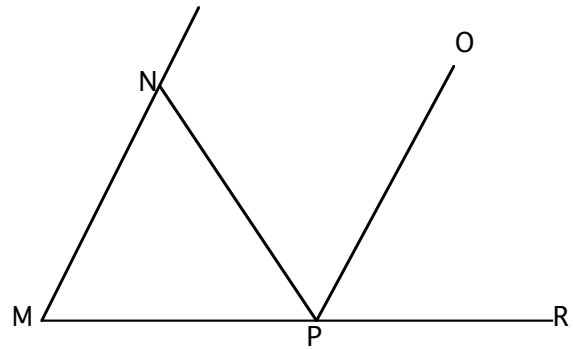
(3 pts.) 3. _____

Bartlett and Bromfield

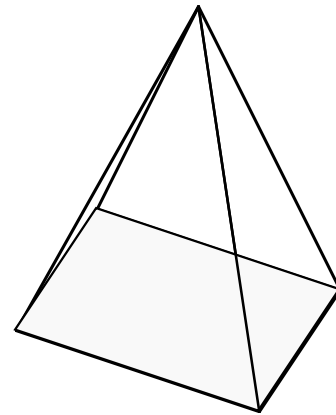
Round 4: Measurement

- The bases of a trapezoid are 12 feet and 26 feet long, and its area is 285 square feet. Find the distance, in feet, between the bases.

- Given: $\overline{MN} \parallel \overline{PO}$; \overline{PO} bisects $\angle NPR$; $MN = x + 5$;
 $MP = \frac{4x}{5} + 12$;
 $NP = 2x - 12$.
 Find the perimeter of $\triangle MNP$.



- In this right rectangular pyramid the pinnacle vertex hovers over the center of the base. In cubic centimeters, compute the pyramid's volume if the base edges measure 24 cm. and 18 cm., and the lateral edges measure 25 cm.



ANSWERS

(1 pt.) 1. _____ ft.

(2 pts.) 2. _____

(3 pts.) 3. _____ cm.³

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Round 5: Polynomial Equations (NO CALCULATORS)

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Find the value of k so that $2x^2 - 3x - 3k = 0$ has only one root for x .

2. Find the sum of the solutions of the equation

$$\left(3x - \frac{8}{x}\right)^2 - 7\left(3x - \frac{8}{x}\right) + 10 = 0 .$$

3. If $P(x+2) = x^3 + 9x^2 + 26x + 23$, find $P(x-2)$ as a polynomial in x .

ANSWERS

(1 pt.) 1. _____

(2 pts.) 2. _____

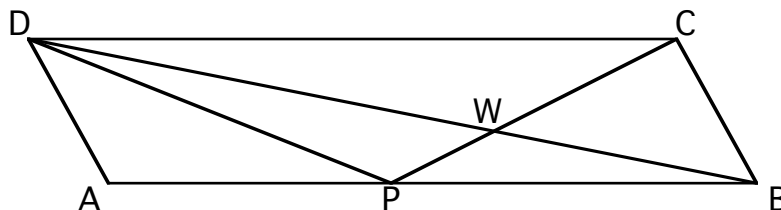
(3 pts.) 3. _____

St. John's, Shrewsbury, and Worcester Academy

ALL ANSWERS MUST BE IN SIMPLEST FORM AND
ON THE SEPARATE TEAM ANSWER SHEET

(2 points each)

1. If $a \# b = ab - a^2$ and $a \Delta b = \frac{a}{b - a}$, compute $(2137 \# 2136) \div (2137 \Delta 2136)$.
2. The ratio of females to males in class is 7 to 4. If 3 females and 12 males are absent tomorrow, the ratio of females to males becomes 5 to 2. If this occurs, how many students will be in class tomorrow?
3. If set A has 64 subsets, set B has 15 proper subsets, and the number of elements in $A \cap B$ is 2, then how many proper subsets are in $A \cup B$?
4. Find the volume, in cubic centimeters, of a cube whose diagonal is 4 centimeters longer than its edge.
5. Find the sum of a and b so that $2x^4 + x^2 + ax + b$ is divisible by both $x + 1$ and $x - 2$.
6. Find the value of the constant c , if the difference of the roots of $x^2 - 11x + c = 0$ is 3.
7. $ABCD$ is a parallelogram. Segment DP is a median of triangle ABD . The area of quadrilateral $APCD$ is 18. Find the area of triangle DPW .



8. Three babs cost the same as five baps, while ten babs cost the same as seven bops. If twenty-five baps cost \$ 16, find the cost of one-hundred and five bops.
9. Determine the value of k so that $x^2 - 3x - 4k$ divides $x^3 - 37x - 12k$.

Round 1: Arithmetic

(1 pt.) 68

(2 pts.) 48

(3 pts.) $\frac{522}{85}$ or $6\frac{12}{85}$
 or 6.14117647058823529

Round 2: Algebra

(1 pt.) 8 inches

(2 pts.) 2 feet, 8 inches

(3 pts.) 20

Round 3: Set Theory

(1 pt.) $\{1, 2, 4, 5, 6\}$

(2 pts.) 11

(3 pts.) 15

Round 4: Measurement

(1 pt.) 15 feet

(2 pts.) 81

(3 pts.) 2880 cm.^3

Round 5: Polynomial Equations

(1 pt.) $-\frac{3}{8}$ or -0.375

(2 pts.) $\frac{7}{3}$ or $2\frac{1}{3}$ or $2.\bar{3}$

(3 pts.) $x^3 - 3x^2 + 2x - 1$

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TEAM ROUND ANSWERS (2 points each)

1. 1

2. 84

3. 255

4. $80 + 48\sqrt{3}$ or $16(5 + 3\sqrt{3})$ or 163.138
or other factorings

5. -25

6. 28

7. 4

8. \$ 160

9. 7