

October 9, 1996

WOCOMAL VARSITY MEET

ROUND I: Arithmetic - Order of Operations and evaluation of algebraic expressions

ALL ANSWERS MUST BE EXPRESSED AS INTEGERS, REDUCED FRACTIONS, OR EXACT DECIMALS, NO DECIMAL APPROXIMATIONS

1. Evaluate $1 + 2 \div 3 \cdot 4 - 5$

2. Evaluate $0.94vt + \frac{gt^2}{2}$ when $v = 240$ feet per second, $t = 2.5$ seconds, and

$g = -32$ feet per second². Include units in your answer!

3. Consider these three operations and their definitions:

$$a \# b = 2a + b, \quad a * b = a^b \quad \text{and} \quad a ? b = \frac{b}{b+a}$$

Their order of operation is # before * before ?.

Evaluate $5 ? 2 \# 1 * 3$

ANSWERS

(1 pt.) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____

Bartlett, Mass. Academy, Southbridge



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ROUND II: Algebra I - Open

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. If $x + 2 = y$, evaluate $\left(\frac{|x - y|^2 + |y - x|^3}{x - y} \right)^3$

2. If $\frac{2}{x^3} - \frac{2}{x^2} - \frac{2}{x} - 2 = 0$, What is the value of $2x^3 + 2x^2 + 2x + 2$?

3. For what real value(s) of x is this expression undefined?

$$\frac{6}{5 + \frac{4}{3 + \frac{-2}{1+x}}}$$

ANSWERS

(1 pt.) 1. _____

(2 pts) 2. _____

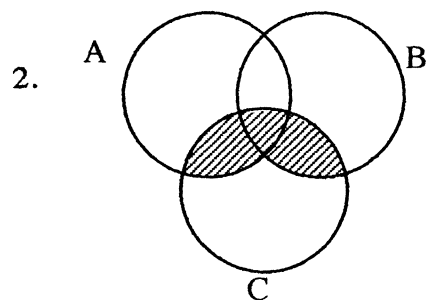
(3 pts) 3. _____

St. John's, Westboro, Worcester Academy

ROUND III: Set Theory

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. How many subsets of the set $\{ F, O, U, R \}$ contain exactly one vowel?



Describe the shaded region in terms of unions and intersections of sets A, B, and C. Do not use complements

3. Out of 60 families surveyed recently about family pets, 8 families had a dog, a cat, and a rabbit, 10 families had only a dog, 15 had only a rabbit, 5 had no pets, 3 had just a dog and cat, twice as many families had only a cat as had just a cat and a rabbit, and only 1 family had just a dog and a rabbit. How many families had only a cat?

ANSWERS

(1 pt.) 1. _____

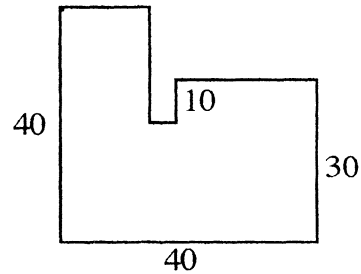
(2 pts) 2. _____

(3 pts) 3. _____

ROUND IV: Perimeters, areas, and volumes.

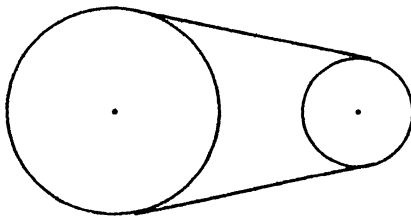
ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM OR AS DIRECTED IN THE PROBLEM

1. What is the perimeter of the octagon shown?
All angles are right angles.



2. A rectangular box has the same height as a cube. The width of its base is 2 units more than an edge of the cube and the length of its base is 3 units more than an edge of the cube. If the box has a volume 63 cubic units greater than that of the cube, find the volume of the cube.

- 3.



A belt wraps around two coplanar wheels with radii 2 and 7 and centers which are 10 units apart. Find the total length of the belt.

Give either an exact form answer or one number rounded to the nearest .001 obtained by using 3.1416 for π .

ANSWERS

(1 pt.) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____

TEAM ROUND: Topics of previous rounds and open.

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM EXCEPT PROBLEM 6 AND ON THE TEAM ANSWER SHEET 2 points each

1. For numbers x and y , operation θ is defined by: $x \theta y = \frac{x}{y^2 + y}$

Evaluate $[\sqrt{5} \theta (-\sqrt{6})] \cdot [(-\sqrt{5}) \theta \sqrt{6}]$

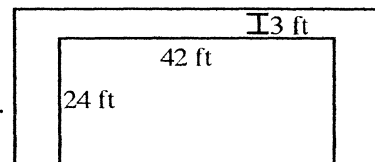
2. If the multiplicative inverse (reciprocal) of A is B and the additive inverse (opposite) of C is D , simplify the following expression to one involving only a specific number and the letter A or C or both.

$$BD + AC \div (-D) + BC + ABD \div C$$

3. Let $A = \{2,4,6,8,10\}$, $B = \{1,3,4,5,6,7\}$ and $C = \{2,3,5,6,8\}$. The universe is $A \cup B \cup C$. \bar{A} is the complement of set A .

Find $\overline{[(B \cap C) \cup (A \cap C)]} \cap (A \cap B)$.

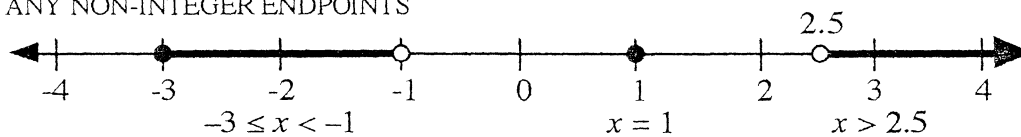
4. A paved sidewalk was built on 3 sides of a rectangular lot. The lot measures 24 feet by 42 feet. The longer walk is 3 feet wide. The price of paving was \$22 per square yard and the cost was \$902. If the width of the walk on the two shorter sides is the same, find the width. Include units!



5. Graph the solution of $\frac{x-5}{x} > 1$ on the number line provided.
6. If you roll a fair ordinary 6-faced die five times, what is the probability of getting at least two 2's? Give a decimal form answer with 4 decimal places.
7. The six-digit number $1k31k4$ has a factor of 12, but is not divisible by 9. Find the digit k .
8. If $y - x < x$ and $x + y < y$, list by letter all of the following statements which must be true.
 A) $y < x$, B) $x < y$, C) $x < y < 0$, D) $y < x < 0$,
 E) $x < 0$, F) $x > 0$, G) $y < 0$, H) $y > 0$.
9. Two numbers are such that their difference, their sum, and their product are to one another as $1 : 5 : 24$. Find their product.

ROUND V: Inequalities and Absolute value - answers on the number line

DRAW THE GRAPH FOR EACH INEQUALITY ON THE NUMBER LINE PROVIDED.
SPECIFY ANY NON-INTEGER ENDPOINTS

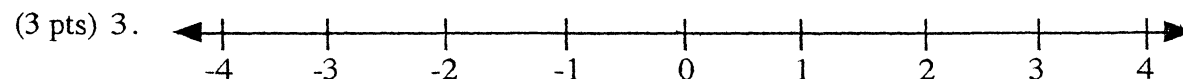
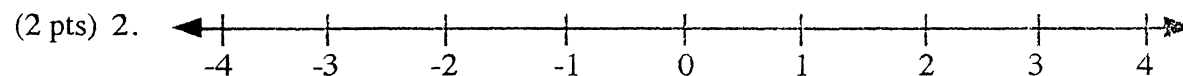
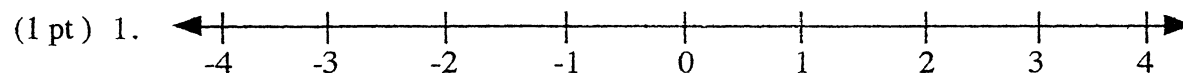


1. $|2x + 1| < 1$

2. $(x - 3)(x + 2)(x - 1) \leq 0$

3. $\left| \left| |2x| - 1 \right| - 1 \right| \leq \frac{1}{2}$

ANSWERS



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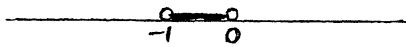
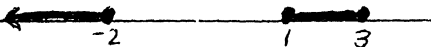
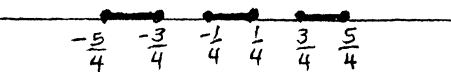
WOCOMAL VARSITY MEET ANSWERS

- ROUND I
- 1 pt $-\frac{4}{3}$ or $-1.\bar{3}$
- Arith
- 2 pts 464 feet
 - 3 pts $\frac{25}{26}$ ^{needed}

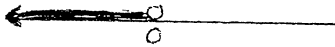
- ROUND II
- 1 pt -216
- Alg 1
- 2 pts 4
 - 3 pts $-1, -\frac{5}{3},$ and $-\frac{29}{19}$ ^{need all 3}

- ROUND III
- 1 pt 8
- Sets
- 2 pts $(A \cup B) \cap C$ or $(A \cap C) \cup (B \cap C)$ ^{order may vary, but () needed}
 - 3 pts 12

- ROUND IV
- 1 pt 180
- Perim
area
vol
- 2 pts 27
 - 3 pts $\frac{32\pi}{3} + 10\sqrt{3}$ or 50.831

- ROUND V
- 1 pt 
 - 2 pts 
 - 3 pts 

TEAM ROUND 2 pts each

- $-\frac{1}{6}$ or $-.1\bar{6}$
- A-1
- { 4 }
- 4.5 feet or 1.5 yards
Need units!
- 
- 0.1962
- 6
- A, D, E, G ^{any order}
- 96