

ROUND I: Evaluation of algebraic expressions and order of operations

NO CALCULATOR USE

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Find the value of $(a+b)^c$ if $a = \frac{1}{2}$, $b = 2$, and $c = 3$.

2. Evaluate for $a = -2$, $b = 3$, $c = 5$
$$\frac{-a^4 - \{(b-a) + (c-a)\} - (a+b)}{-b}$$

3. Let $x \oplus y = \frac{2y-x}{x+y}$ and $x * y = \frac{xy}{5}$. Evaluate $[3 \oplus 4] * [3 \oplus -4]$.

ANSWERS

1. (1 pt) _____

2. (2 pts) _____

3. (3 pts) _____

Holy Name. St. John's, South



ROUND II: Solving linear equations

NO CALCULATOR USE

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. If $16 \cdot 16 \cdot 16 = 8 \cdot 8 \cdot 8 \cdot p$, then $p = ?$

2. Solve for x: $\frac{2}{3}(2x - 5) - \frac{5}{3}(4 - x) = 2$

3. Solve for x: $\frac{1}{2}(x - .01) + \frac{1}{3} = 0.1x + \frac{1}{4}$

ANSWERS

1. (1 pt) _____

2. (2 pts) _____

3. (3 pts) _____

Algonquin, Doherty, South

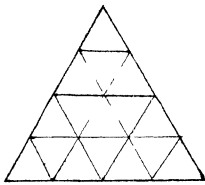
ROUND III: Logic problems

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. The nine squares are to be filled such that each row and column contains each of the numbers 1, 2, and 3
Which number would go in location B?

2		
	1	B

2.



How many triangles are in this diagram?
(Note several sizes)

3. There are fewer than 15 houses on one side of a street that are numbered 2, 4, 6, etc. Mrs. M. lives in one of these houses. The numbers of all the houses numbered below hers on that side have the same sum as all those numbered above hers on that side. How many houses are there on her side of the street?

ANSWERS

1. (1 pt) _____

2. (2 pts) _____

3. (3 pts) _____

TEAM ROUND: Topics of previous rounds and open

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM and ON THE SEPARATE
TEAM ROUND ANSWER SHEET 3 points each

1. Evaluate $\left(\frac{1}{2} * \frac{-1}{2}\right) - \left(\frac{-1}{2} * \frac{1}{2}\right)$ if $a * b = \frac{ab - b}{2}$.
2. Solve for n: $n - \{3 - [n - (3 - [n - 3])]\} = -10$
3. Three people each start a game with a pile of money. In each round one person loses and gives to each of the other two an amount of money, from the loser's own pile, that doubles the amount of money in the winner's piles. After three such rounds, each has lost just once and each has \$48. What are the three amounts of money with which the players began?
4. In a game preserve, 239 deer are caught, marked, and then released. Later, out of 198 deer caught, 42 are marked. Using x for the total deer population in the preserve, write a proportion using the given numbers which would reasonably estimate the value of x .
5. If Mr. Zip runs a mile in 3 minutes and 45 seconds, what is his average speed in miles per hour?
6. There is a pair of whole numbers strictly between 1 and 10, a and b , such that $a^b = b^a + 1$. Find the value of $(a + b)^2$.
7. A six-pointed star is formed by taking equilateral triangle ABC and flipping it along line YZ to form triangle DEF so that all sides intersect at trisection points. Express in simplest form the ratio of the area of the entire star to the area of triangle ABC.

$$a + b = 13$$

8. $b + c = 15$ List a, b, and c in increasing order.

$$c + a = 18$$

Algonquin, Auburn, Bromfield, Hudson, Quaboag, Shrewsbury, Worcester Academy

November 7, 2001

ANSWERS

WOCOMAL FRESHMAN MEET

- ROUND I
- eval
- 1 pt $\frac{125}{8}$ or $15\frac{5}{8}$ or 15.625
 - 2 pts 9
 - 3 pts $\frac{11}{7}$ or $1\frac{4}{7}$ or $1.\overline{571428}$

- ROUND II
- linear eq
- 1 pt 8
 - 2 pts 4
 - 3 pts $\frac{-47}{240}$

- ROUND III
- logic
- 1 pt 2
 - 2 pts 27
 - 3 pts 8

- ROUND IV
- ratio prop var
- 1 pt 75
 - 2 pts $6\frac{2}{3}$ hrs or 6 hr, 40 min
need units
 - 3 pts 100 $\frac{20}{3}$ hrs OK

TEAM ROUND 3 pts each

1. $\frac{1}{2}$ or .5

2. $-\frac{1}{3}$ or $-.3\bar{3}$

3. $^{\circ}24$ $^{\circ}42$ $^{\circ}78$ any order

4. $\frac{x}{239} = \frac{198}{42}$ any equivalent proportion

5. 16 mi/hr

6. 25

7. $\frac{4}{3}$ or 4:3 or 4 to 3

8. b, a, c in this order

ROUND I

$$1. \left(\frac{1}{2} + 2\right)^3 = \left(\frac{5}{2}\right)^3 = \frac{125}{8} = 15\frac{5}{8}$$

$$2. \frac{-(-2)^4 - \{[(3+2) + (5+2)] - (-2+3)\}}{-3}$$

$$= \frac{-16 - \{5+7-1\}}{-3} = \frac{-16-11}{-3} = \frac{-27}{-3} = 9$$

$$3. 3\oplus 4 = \frac{8-3}{7} = \frac{5}{7}$$

$$3\oplus -4 = \frac{-8-3}{-1} = 11$$

$$\text{Then } \frac{5}{7} * 11 = \frac{5 \cdot 11}{7} = \frac{11}{7} = 1\frac{4}{7}$$

ROUND II

$$1. \frac{16 \cdot 16 \cdot 16}{8 \cdot 8 \cdot 8} = p, \quad p = 8$$

2. Mult by 3 to get

$$2(2x-5) - 5(4-x) = 6$$

$$4x - 10 - 20 + 5x = 6$$

$$9x = 36 \quad \text{or } x = 4$$

3. Mult by 12 to get

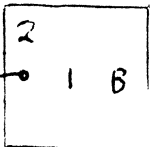
$$6(x-0.01) + 4 = 1.2x + 3$$

$$6x - .06 + 4 = 1.2x$$

$$4.8x = -.94$$

$$x = \frac{-.94}{4.8} = \frac{-.94}{480} = \frac{-.47}{240}$$

ROUND III

1. Must be 3  Then B must be 2

side length	#Δ's
1	16
2	7
3	3
4	1
	<u>27</u>

← 6 Δ and 1 ▽

ROUND III cont.

- 3 Try: $2+4 \neq 8$ not 4 houses
 $2+4+6 \neq 10$ or 22 no
 $2+4+6+8 \neq 12$ or 26 no
 $2+4+6+8+10 = 14+16$ yes, 8 houses
 Trying up to #28 finds no more

ROUND IV

$$1. \frac{x_1}{y_1} = \frac{x_2}{y_2} \quad \text{so } \frac{12}{5} = \frac{60}{y} \Rightarrow 4y = 300$$

$$y = 75$$

2. Total work requires $8.5 = 6 \cdot t$ machine hours

$$\frac{40}{6} = t = 6\frac{2}{3} \text{ hrs}$$

$$3. \frac{Sr}{Jr} = \frac{6}{5} = \frac{24}{20} \quad \text{and} \quad \frac{Jr}{Soph} = \frac{4}{3} = \frac{20}{15}$$

$$\therefore Sr : Jr : Soph = 24 : 20 : 15$$

$$24x + 20x + 15x = 295$$

$$59x = 295 \Rightarrow x = 5$$

$$\text{and } 5 \cdot 20 = 100 \text{ Jr}$$

TEAM ROUND

$$1. \frac{1}{2} * -\frac{1}{2} = \frac{-\frac{1}{4} + \frac{1}{2}}{2} = \frac{\frac{1}{4}}{2} = \frac{1}{8}$$

$$-\frac{1}{2} * \frac{1}{2} = \frac{-\frac{1}{4} - \frac{1}{2}}{2} = \frac{-\frac{3}{4}}{2} = -\frac{3}{8}$$

$$\text{Then } \frac{1}{8} - \left(-\frac{3}{8}\right) = \frac{4}{8} = \frac{1}{2}$$

$$2. n - \{3 - [n - (3 - n + 3)]\} = -10$$

$$n - \{3 - [n - 6 + n]\} = -10$$

$$n - \{3 - 2n + 6\} = -10$$

$$n - 9 + 2n = -10$$

$$3n = -1$$

$$n = -\frac{1}{3}$$

3. Work backwards, loser circled

End of Round	A	B	C	loser gives
3	48	48	48	
2	(96)	24	24	48
1	48	(84)	12	60
At start	24	42	(78)	66

$$4. \frac{\text{total pop}}{\# \text{ marked}} = \frac{\# \text{ caught}}{\# \text{ of them marked}}$$

$$\frac{x}{239} = \frac{198}{42} \quad \text{or any equivalent proportion}$$

$$5. \frac{1 \text{ mile}}{3\frac{3}{4} \text{ min}} = \frac{x \text{ mi}}{60 \text{ min}}$$

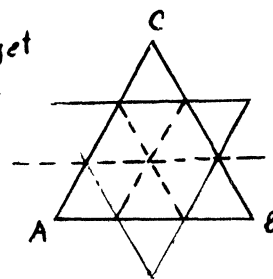
$$\frac{15}{4}x = 60 \Rightarrow x = 60 \frac{4}{15} = 16 \text{ mph}$$

6. Trial and error, experiment to find

$$a = 3, b = 2$$

$$\text{Then } (3+2)^2 = 25$$

7. Add more lines; get 12 congruent equilat. triangles making the entire star and 9 of them making $\triangle ABC$.



$$\therefore \frac{12}{9} = \frac{4}{3}$$

8. Since $13 < 15$, $a+b < b+c$ and $a < c$.

Since $15 < 18$, $b+c < c+a$ and $b < a$.

\therefore increasing order is b, a, c

(Solving a system finds $b=5, a=8, c=10$)