

ROUND I: Evaluation of algebraic expressions and order of operations

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. If $a = \frac{5}{9}$ and $b = \frac{4}{9}$, find the exact value of $a^2 - 2ab + b^2$.

2. If $a * b = (a+1)(b-1)$ and $a \# b = ab^2$, evaluate $(3 * 2) \# (2 * 3)$.

3. Simplify:

$$3^2 \cdot 4 + 12 \cdot 4 \div 3 - 48 \div 12 \cdot 2 + 7^2 - (6 \cdot 12) \cdot 0 \div 2 + 96 \div 2 \div 2 \div 4 \cdot 2 + 10^3 - \frac{1}{2} \cdot 16 \div 8 + (3 \cdot 10)^2$$

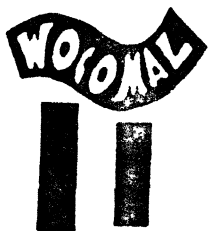
ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____

Auburn, Bromfield, Shepherd Hill



ROUND II: Solving linear equations

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Solve for x: $6x - (9-3x) = 6 - 3(x+2)$.

2. Solve for n: $\frac{n}{2} + \frac{n}{3} - \frac{n}{4} = 7$

3. Solve for t in terms of a and d: $d = \frac{a}{2}(2t - 1)$

ANSWERS

(1 pt) 1. $x =$ _____

(2 pts) 2. $n =$ _____

(3 pts) 3. $t =$ _____

Hudson, Notre Dame, Shrewsbury

ROUND III: Logic problems

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. For every two widgets I buy at the regular price, I get a third widget for \$1. I spent \$45 for 9 widgets. What is the regular price of one widget?

2. Miss White, Miss Black, and Miss Gray are out for a stroll together. One is dressed in white, one in black, and one in gray. "Isn't it odd," says Miss Gray, "that our dresses match our last names, but no one of us is wearing the color that matches her own name?" "So what?" responds the lady in black. Identify the color dress that each lady is wearing.

3. Each different letter represents a different digit and AC, BC, and CH represent two-digit numbers. A letter represents the same digit each time it appears. A times B = B, B times C = AC, C times D = BC, and D times E = CH. Find the digit that H represents.

ANSWERS

(1 pt) 1. $\$$ _____

(2 pts) 2. Miss White _____, Miss Black _____, Miss Gray _____

(3 pts) 3. _____

Hudson, South. Southbridge

ROUND IV: Ratio, proportion, variation

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM or AS SPECIFIED IN THE PROBLEM

1. Jose's forearm is $1\frac{1}{4}$ feet long. In a photograph, his forearm is 1 inch long. In simplest form, what is the ratio of the actual length of Jose's forearm to the length of the forearm in the photo?
2. Suppose that the Danger Index of an alien varies directly as the square of the number of tentacles it has. If an alien with 5 tentacles has a Danger Index of 75, find the Danger Index of an alien with 8 tentacles.
3. The radius of the earth is about 6170 kilometers. The highest point (Mt. Everest) is about 8850 meters above sea level and the lowest point (Marianas Trench) is about 11,000 meters below sea level. If these extremes were represented on a relief globe 30 centimeters in diameter, how high and low would they be? Answer in millimeters to three decimal places.

ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____

(3 pts) 3. high _____ mm, low _____ mm

South, unspecified

TEAM ROUND: Topics of previous rounds and open

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

1. If $y = x$ and $2x + 3y = 20$, then $x + y + x$ has what numerical value?
2. Solve for x : $\frac{1}{2}(3x + 2) - \frac{1}{4}(2x - 1) = \frac{1}{3}(4x + 7) + \frac{1}{6}x$
3. Three men and their wives were given \$5400. The wives together received \$2400. Sue got \$200 more than Jan and Lynn got \$200 more than Sue. Lou got half as much as his wife. Bob got the same as his wife. Matt got twice as much as his wife. Who is married to Sue?
4. Let B be the (positive) mean proportional between A and C . If A is the value of x that solves $3x - 9 = 15$ and C is the x -value that solves $-3x + 146 = 50$, then what is the value of B ?
5. List all the positive integers less than 40 that simultaneously satisfy all three conditions:
 - a) there is a remainder of 1 when the number is divided by 2
 - b) there is a remainder of 2 when the number is divided by 3
 - c) there is a remainder of 3 when the number is divided by 4.
- 6 Write $.0016\frac{1}{8}$ as a reduced fraction with positive integers as numerator and denominator.
7. After a sale of her stock of beans, a dealer found that she had $\frac{3}{8}$ of a bushel barrel of beans left. The next day she sold $\frac{1}{3}$ of the remaining beans. What part of the bushel barrel was then empty? Don't try to include the spaces between the beans.
8. Bob is b years old, Carol is c years old, and Alice is a years old. How many years from now will Bob be as old as Carol and Alice combined are then? Answer in terms of a , b , c .

Nov. 1, 2000

WOCOMAL Freshman Meet ANSWERS

- ROUND I
- 1 pt $\frac{1}{81}$
 - 2 pts 144
 - 3 pts 2004

- ROUND II
- 1 pt $x = \frac{3}{4}$ or .75
 - 2 pts $n = 12$
 - 3 pts $t = \frac{d}{a} + \frac{1}{2}$ or $\frac{2d+a}{2a}$

- ROUND III
- 1 pt \$7
 - 2 pts black, gray, white
in this order
 - 3 pts 6

- ROUND IV
- 1 pt 15:1 or $\frac{15}{1}$ or 15 to 1
 - 2 pts 192
 - 3 pts high .215 mm, low .267 mm

TEAM ROUND 3 pts each

- 5
- $x = \frac{-13}{6}$ or $-2\frac{1}{6}$
or $-2.\overline{16}$
- Low
- 16
- any order
11, 23, 35
- $\frac{129}{80,000}$
- $\frac{3}{4}$ or .75 or 75%
- b-a-c

ROUND I

1 $\frac{25}{81} - \frac{40}{81} + \frac{16}{81} = \frac{1}{81}$
 though it's neater to notice $(a-b)^2$

2 $3 \times 2 = (4)(1) = 4$
 $2 \times 3 = (3)(2) = 6$
 Then $4 \# 6 = (4)(36) = 144$

3 $94 + 48 \div 3 - 42 + 49 - 0 +$
 $48 \div 2 \div 4 \cdot 2 + 1000 - 8 \div 8 + 30^2$
 $= 36 + 16 - 8 + 49 + 24 \div 4 \cdot 2 + 1000 - 1 + 900$
 $= 93 + 6 \cdot 2 + 1899$
 $= 93 + 12 + 1899 = 2004$

ROUND II

1 $6x - 9 + 3x = 6 - 3x - 6$
 $12x = 9$
 $x = \frac{3}{4}$

2. Mult by 12 to get
 $6m + 4n - 3n = 84$
 $7n = 84$
 $n = 12$

3. $2d = a(2t - 1)$
 $2d = 2at - a$
 $2d + a = 2at$
 $\frac{2d+a}{2a} = t$

ROUND III

1 Think in groups of 3 \$45 for 9
 means \$15 for 3. \$1 for the third
 means \$14 for the first two and
 \$7 for one

ROUND III cont

2 The lady in black is neither Miss Black nor Miss Gray (who spoke first).
 \therefore Miss White wears black.
 Miss Gray doesn't wear gray, so she wears white and Miss Black is in gray

3 A times B = B makes A = 1
 B times C = 1C makes B = 3, C = 5, OK
 or B = 6, C = 2, making 2 * D = 62, not
 C * D = 5 * D = 35 makes D = 7
 D * E = 7 * E = 5H makes E = 8 and H = 6

ROUND IV

1. $1\frac{1}{4}$ ft = 12 + 3 = 15 inches
 Ratio is 15:1

2. $D = kt^2$
 $75 = k \cdot 5^2 \Rightarrow k = 3$
 Then $D = 3 \cdot 8^2 = 192$

3 Radius of globe = 15 cm = 150 mm
 For ht, h,

$$\frac{h}{150 \text{ mm}} = \frac{8850 \text{ m}}{6170 \text{ km} \cdot 1000 \frac{\text{m}}{\text{km}}}$$

$$h = \frac{8850 \cdot 150 \text{ mm}}{6170 \cdot 1000} = 0.215 \text{ mm}$$

For depth, x,

$$x = \frac{11000 \cdot 150}{6170 \cdot 1000} = 0.261 \text{ mm}$$

TEAM ROUND

1 2nd equation becomes $2x + 3x = 20$
 from which $x = 4$
 Then $4 + 4 \div 4 = 4 + 1 = 5$

2. Mult by 12 to get
 $6(3x+2) - 3(2x-1) = 4(4x+7) + 2x$
 $18x + 12 - 6x + 3 = 16x + 28 + 2x$
 $-6x = 13$
 $x = -\frac{13}{6}$

3 Money to wives
 $Jan + Sue + Lynn = 2400$
 $x + (x+200) + (x+400) = 2400$
 $3x + 600 = 2400$
 $x = 600$
 Then sum to husbands must total \$3000

		husband		Only one
Jan	600	600	Bob	of six
Sue	800	400	Lou	possible
Lynn	1000	2000	Matt	husband
		3000		amounts
				works

4 $3x - 9 - 15$ | $-3x + 146 = 56$
 $3x = 24$ | $46 = 3x$
 $x = 8 = A$ | $x = 32 = C$

$\frac{8}{B} = \frac{B}{32} \rightarrow B^2 = 256$ and $B = 16$

5. a) makes odd
 b) 2, 5, 8, 11, etc 3 apart $\left. \begin{array}{l} \\ \end{array} \right\} < 40$
 c) 3, 7, 11, 15, etc 4 apart $\left. \begin{array}{l} \\ \end{array} \right\}$

11, 23, 35 are the only ones on all three lists

6 $16 \frac{1}{8} = \frac{129}{8}$
 Then $.0016 \frac{1}{8} = \left(\frac{129}{8}\right) \left(\frac{1}{10,000}\right)$
 $= \frac{129}{80,000}$

7. $\frac{1}{3}$ of $\frac{3}{8} = \frac{1}{8}$ of barrel sold next day,
 $\frac{3}{8} - \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$ of barrel left, and
 $\frac{3}{4}$ of barrel empty.

8 Now b, c, a
 x yrs hence $b+x, c+x, a+x$
 Then $b+x = c+x + a+x$
 $b = c + a + x$
 $b - a - c = x$