ROUND I: Algebraic word problems

EACH ANSWER MUST BE IN SIMPLEST EXACT FORM

1. If the sum of two numbers is $5x + 3$ and one of the numbers is 7, write an expression in simplest form for the sum of twice the other number and 8.

2. Peggy rode out of town on her bicycle at a rate of 24 km/hr. When her bicycle broke down, she walked it back to town along the same route at a rate of 6 km/hr. If she was gone a total of 5 hours,
   a) how far from town did she get
   and
   b) how long did it take her to walk back to town?

3. The I.M. Hipp Tire Company produces tires for motor cycles and cars. One week the company produced a total of 269 tires for 70 vehicles. This included a spare tire for each car. How many motor cycle tires did the company produce that week?

ANSWERS

(1 pt) 1._____

(2 pts) 2a_____ km   b._____ hours

(3 pts) 3. _____

A   rn, Burncoat, Quaboag

ROUND II: Operations on polynomials

Simplify each expression to a polynomial with terms in decreasing order of exponents.

1. $3a(-a)^2 + 2a(-a^2)$

2. $N^{V-3}(N^3 + 4N) - 2N^{V-5}(3N^3)$

where V is an integer greater than 5.

3. $(x-3)(x^2 + 7x + 6) + (2x+5)(x^2 - x - 1) - 7x(x-3)$

ANSWERS

(1 pt) 1._____

(2 pts) 2._____
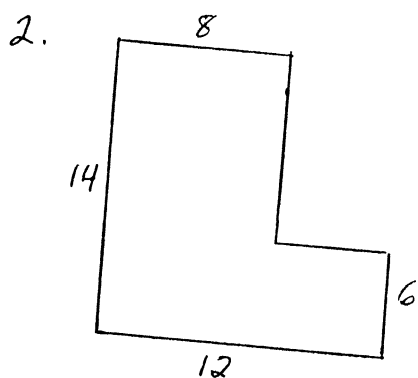
(3 pts) 3._____

outhbridge, Tahanto, Worcester Academy

ROUND III: Perimeter and area of plane figures, volume of
        rectangular solids, circumference and area of circles

EACH ANSWER MUST BE EXPRESSED IN SIMPLEST EXACT FORM.   KEEP π AS π.

1. A rectangle of length 20 and width 12 has its length decreased by 20% and its width increased by 50%. By what percent does the area change?

2.

How many 8 inch by 8 inch square tiles are needed to exactly cover the floor shown in the diagram? All dimensions are in <u>feet</u> and all angles are right angles.

3 Square ABCD has sides of length 6. Quarter circles of radius 6 are drawn inside the square, one centered at A, the other at C. The quarter circles bound a football shaped region. Find its area.

ANSWERS

(1 pt) 1. _____ %

(2 pts) 2. _____

(3 pts) 3. _____

tlett, Shrewsbury, Worcester Academy

ROUND IV: Factoring

Factor each expression as completely as possible over the integers
and simplify each factor when possible.

1. $18 x^2 - 9 xy - 27 y^2$

2. $42 x^2 - x - 18$

3. $(x^2 + 2x - 3)^2 - (x^2 - 5x + 4)^2$

ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____
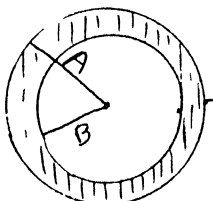
Hudson, St.John's, Southbridge

EACH ANSWER MUST BE IN SIMPLEST EXACT FORM AND ON THE SEPARATE
TEAM ANSWER SHEET
                                           3 points each

1. Elaine averaged 20 mph going in one direction on a trip and 30 mph on the return trip by the same route in reverse. What was her average speed for the entire round trip?

2. Multiply $(x-2y-4)$ by $(x-2y+4)$.

3. A picture is twice as long as it is wide. It is mounted so that a border 2 cm wide completely surrounds the picture. Find the dimensions of the picture alone if the area of the border is 136 cm^2.

4. Factor completely: $2x^3 + 6x^2y - 4x^2z - 12xyz$

5. Three girls bought melons and shared them equally with a fourth girl, who paid them 48¢ for her share. If the first girl brought 3 melons, the second girl brought 4 melons, and the third girl brought 5 melons, how much of the 48¢ should the second girl get?

6. Change 342_{five} into a number expressed in base three.

7. If these are concentric circles with radii A and B, find the area of the shaded region in factored form. Keep π as π.

8. Letters have replaced digits in this coded addition problem. What 5-digit number is represented by PEACE?

$$\begin{array}{r} USSR \\ + USA \\ \hline PEACE \end{array}$$

ROUND I   Word prob

1 pt   1. $10x$

2 pts   2.   24 km   4 hr

3 pts   3.   54

ROUND II   Opns on polys

1 pt   1. a^3

2 pts   2. $N^V - 2N^{V-2}$

3 pts   3. $3x^3 - x - 23$

ROUND III   area, etc

1 pt   1.   20 %

2 pts   2.   306

3 pts   3. $18\pi - 36$ or $18(\pi - 2)$

ROUND IV   Factoring

1 pt   1. $4(2x - 3y)(x + y)$

2 pts   2. $(14x + 9)(3x - 2)$

3 pts   3. $7(x - 1)^2(2x - 1)$

TEAM ROUND   3 pts each

1.   24 mph

2. $x^2 - 4xy + 4y^2 - 16$.
      (any order)

3.   10 by 20 cm
      (either order)

4. $2x(x + 3y)(x - 2z)$

5.   16 ¢

6. 10121_{three}

7. $\pi (A + B)(A - B)$

8.   10 270