Practice Round

1. Given the determinant $\begin{vmatrix} 2x & 1 \\ x & x \end{vmatrix} = 3$, solve for x.

Answer _____

2. Consider the following pattern:

1 is happy.

10 is happy because $1^2 + 0^2 = 1$, which is happy.

13 is happy because $1^2 + 3^2 = 10$, which is happy.

19 is happy since $1^2 + 9^2 = 82$, $8^2 + 2^2 = 68$, $6^2 + 8^2 = 100$ and $1^2 + 0^2 + 0^2 = 1$, which is happy.

On the other hand, 2, 3, 4, 5, 6, 7, 8 and 9 are unhappy.

11 is unhappy because $1^2 + 1^2 = 2$, which is unhappy.

12 is unhappy because $1^2 + 2^2 = 5$, which is unhappy.

Find an additional happy number, besides 1, 10, 13, 19, 68, 82 and 100.

Answer _____

3. If $10^{2y} = 25$, then what is the value of 10^{-y}?
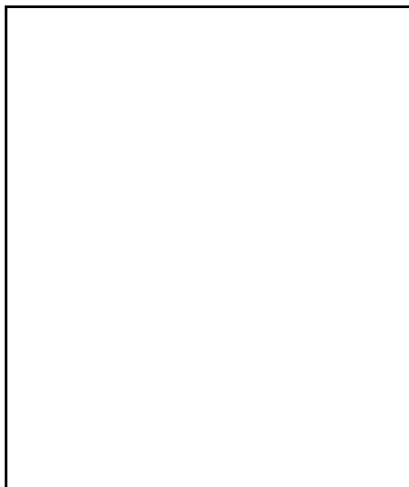
Answer _____

Round One

1. A bicycle went up a hill at a speed of 10 miles an hour and down the same distance at a speed of 20 miles per hour. What was the average speed, in miles per hour, for the round trip?

    Answer _____

2. Give the pair(s) of values of x and y that are the common solutions of the equations $y = (x+1)^2$ and $xy + y = 1$.

    Answer _____

3. A balloon **B** (see figure) is anchored to the ground at a point **E** by a wire making an angle of 48° with the ground. The point **D** on the ground directly under the balloon is 260 ft. from **E.** How long is the wire, assuming it to be straight, to the nearest foot?

    Answer _____

Round Two

1. The Lakers lead the Magic 3 games to 2 in the best of seven-game NBA finals. Assuming the probability that the Lakers win any particular game against the Magic is 3/5, what is the probability that the Magic will win the championship?

                                             Answer _____
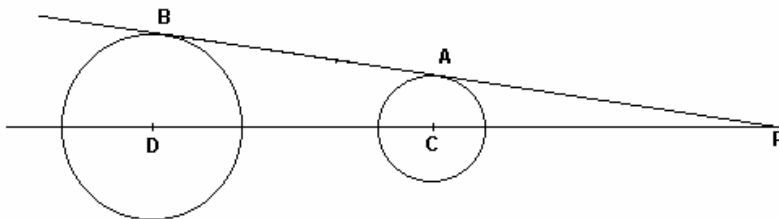
2. A man born in the first half of the nineteenth century was x years old in the year x^2. What year was he born in?

                                             Answer _____

3. Given: PCD is a line through the centers of circles C and D.
              PAB is the common external tangent to points A and B.

    Find the ratio of the area of Circle C to the area of Circle D in terms of any given line segments.

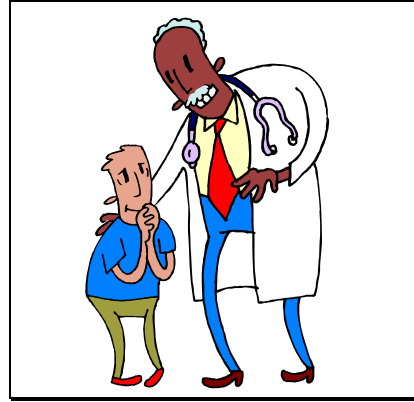

                                             Answer _____

Round Three

1. The number y of doctor visits per year by a patient of age x is given by the model
$$y = 6.95 - 0.3\,x + 0.0083\,x^2 - 0.00002\,x^3$$

At what age are doctor visits minimized (round to the nearest year)?
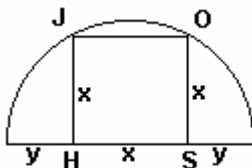
Answer _____

2. Albert can do a piece of work alone in 8 days. After working alone for 2 days, Beatrice joins him and together they finish the work in 2 more days. How many days would it take Beatrice alone to do the job?

Answer _____

3. Given: JOSH is a square inscribed in a semicircle. What is the ratio of x to y expressed as a fraction?

Answer _____

Round Four

1. Simplify the following statement and express the result with positive exponents.

$$(x + y)^{-1} (x^{-1} + y^{-1}).$$

Answer _____

2. Determine all real solutions of the equation

$$\frac{4^x}{9^{1/x}} + \frac{9^x}{4^{1/x}} = \frac{275}{6}$$

Answer _____

3. Given an air speed of 380 mph, a plotted course of 90 degrees, a wind speed of 50 mph from the North, find the directional track (to the nearest tenth of a degree) and ground speed (to the nearest mile per hour) of the airplane.

Answer _____

Round Five

1. If the base of a rectangle is increased by 10% and the area is unchanged, then the altitude is decreased by what percentage (rounded to the nearest tenth of a percent)?

    Answer _____

2. Simplify completely the product $(\log_a b)(\log_b a)$.

    Answer _____

3. One day in a foreign country I met three politicians. Now, all of the politicians of this country belonged to one of two political parties. The first was the Veracious Party, consisting of persons who could tell only the truth. The other party, called the Deceit Party, consisted of persons who were chronic liars and could only lie. I asked these politicians to which party they belonged. The first said something that I did not hear. The second remarked, "He said he belonged to the Veracious Party." The third said, "You're a liar!" For each politician identify the party affiliation. Note: All three responses must be correct for you to receive credit for this question.

    Politician Number One: Veracious   Deceit   Not Enough Information to Tell

    Politician Number Two: Veracious   Deceit   Not Enough Information to Tell

    Politician Number Three: Veracious   Deceit   Not Enough Information to Tell

Round Six

1. Judy Zahrndt wants to name her new baby so that the babies monogram (first, middle and last initials) will be distinct (different) letters in alphabetical order. How many different monograms could she create? (Assume Judy's child will have the same last name as her.)

    GRZ?   *TUZ?*
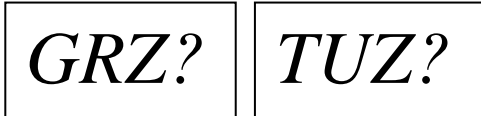
    Answer _____

2. A square based container with no top is being designed to hold 2500 cubic centimeters. What should the dimensions of the box be if it is to have a surface area of 900 square centimeters and the height should be less than one-half the width?

    Answer _____

3. Imagine that you have written down the numbers from 1 to 1,000,000. How many times would you have written the digit zero down?

    Answer _____

Group Round

Some friends of your group have asked for your assistance. It is nearing the end of 1998 and they are considering getting married in the near future. A mutual acquaintance has suggested to them that they should get married before the end of the year so they can take advantage of the higher standard deduction for married couples on their 1998 income tax. Someone else seems to think that they heard it was actually detrimental to your tax situation to be married. The information that your friends have collected about their tax situations is presented below. If the information is not presented it is assumed that they have no records of that type of transaction and it should not be considered in the problem. They are currently surviving only on their own incomes. Using the information, the tax form and work-booklet provided calculate:

a.) The couples total tax liability if they file as two single individuals.

b.) The couples total tax liability if they file jointly as a married couple.

c.) The couples total tax liability if they file as married - filing separately.

Which of the three results in the lowest tax burden?

Your group will be awarded one point for each of the total tax liabilities, if it is within $500 and an additional point if it is within $50.

Your group will be awarded three points if you correctly identify which of the three results in the lowest tax burden.

Additionally, if you have at least six points above, you may score one additional point for each 10 minutes of time that is remaining when you turn in your solution.

Brandon - 27 year old male		Alika - 23 year old female	
No Dependents		One dependent qualifying child - Crissy	
Wages and Salaries total	$36,800	Wages and Salaries total	$40,130
Taxable Interest Income totals	$ 1,250	Taxable Interest Income total	$ 97
Real Estate Taxes paid:	$ 1,130		
Mortgage Interest paid:	$ 6,720		
Charitable Donations:	$ 3,700	Charitable Donations	$ 1,130
Medical Expenses:	$ 3,400	Medical Expenses	$ 1,200

Answers:

Filing Singly: $_____   Filing Jointly: $_____

Filing married but separate: $_____   Best Method: _____