



Mathalone 2010

Practice Questions

Round 2

Brief Instructions for Round 2

10 questions, 6 minutes/question

- You will be asked 10 mathematical Exact Answer questions.
- You will be given ONLY SIX minutes to answer each question for a total of 60 minutes.
- Hand written exact answers must be written with fractions reduced, radicals simplified, and denominators rationalized. Do not make an approximation for π or any other irrational numbers. Answers must be exact.
- The answer sheet will be collected at the end of this round.
- ONLY the top 3 teams will be awarded.
- Good Luck 😊

Question 1

x men work x hours a day for x days to dig a tunnel of length x yards.

If y men work y hours a day for y days, **what length (in yards) of the continuation of the tunnel would you expect them to dig?**

Question 2

Some tarts had been eaten without Dr. Watfa's permission, by one or more of his five children. When questioned, they gave the following answers:

- Ace: One of us ate the tarts.
- Bea: Two of us ate the tarts.
- Cec: Three of us ate the tarts.
- Dee: Four of us ate the tarts.
- Eve: All of us ate the tarts.

Dr. Watfa knew from the past behavior of her children that the guilty ones lied while the others told the truth.

What was the number of children who ate the tarts?

Question 3

The table shows the distance (in km) between five towns in southern France. Five friends live in these five towns and want to meet.

Bergerac				
87	Bordeaux			
79	47	Langon		
61	31	54	Libourne	
58	84	37	65	Marmande

In which town should they meet to keep the total travelling distance as small as possible?

Question 4

Suppose a manufacturer makes two types of skis: a trick ski and a slalom ski. Suppose each trick ski requires 8 hours of design work and 4 hours of finishing. Each slalom ski requires 8 hours of design and 12 hours of finishing. Furthermore, the total number of hours allocated for design work is 160, and the total available hours for finishing work is 180 hours. Finally, the number of trick skis produced must be less than or equal to 15.

Suppose the profit on each trick ski is \$5 and the profit for each slalom ski is \$10.

How many each of each type of ski should the manufacturer produce to earn the greatest profit?

Question 5

Let $a > 1$ and $b > 1$ be real numbers such that:

$$\log_{10}(a + b) = \log_{10} a + \log_{10} b$$

What is the value of:

$$x = \log_{10}(a - 1) + \log_{10}(b - 1)$$

Question 6

On a certain island there are two varieties of people: the truth tellers, who always tell the truth and the liars, who always lie. You meet a group of three people there. Some of the three are liars and some are truth tellers, but you don't know who is who.

You ask the first of them "What variety are you?" The first person answers, but you can't hear the answer. The second of the three then says: "The first one said he is a truth teller." Then the third one says: "The second one is lying."

Determine what the second and the third are.

Question 7

Cucumbers are assumed, for present purposes, to be a substance that is 99% water by weight. If 500 pounds of cucumbers are allowed to stand overnight, and if the partially evaporated substance that remains in the morning is 98% water, **how much is the morning weight?**

Question 8

$$\text{If } x = \sqrt{3\sqrt{2\sqrt{3\sqrt{2\dots}}}}$$

Find the value of x^3 ?

Question 9

Recall that $n! = n \times (n - 1) \times (n - 2) \times \cdots \times 2 \times 1$.

What is the maximum value of the integer x such that 3^x divides $30!$?

Question 10

Given that a and b are digits from 1 to 9, **what is the number of fractions of the form a/b** , expressed in lowest terms, which are less than 1?

End of Round 2

- **Please remain seated** and put your pens down Immediately.
- Any violators will be **PENALIZED (-2 points)**
- Answer sheets will be collected by the organizers.
- The top 3 teams will be announced after a Short break in the closing ceremony.
- Good luck 😊