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Mathematics Essay Problems

9th International Mathematics and Science Olympiad (IMSO) for Primary School 2012

Instructions:

* Write down your name and country on every page.
* You have 90 minutes to work on this test.
* Write down your detail solutions or working process in English in the space below the question.
* Use pen or pencil to write your answer.

“Smart, Skilled, and Creative In a Joyful Competition for Excellence”

City Montessori Inter College,
RDSO Campus, Manak Nagar, Lucknow, India
27 Oct. – 2 Nov 2012

NAME ___________________________ COUNTRY ________________________
ESSAY PROBLEMS

NAME ___________________________ COUNTRY ___________________________

1. The sum of the numbers $A$, $B$ and $C$ is 390. Given that $A$ is 3 times of $B$ and $A$ is one third of $C$, find the value of $C$.

   ANSWER: ______________

2. A palindrome is a number which reads the same backwards as forwards. A car odometer read 26962 km. After two hours driving the odometer showed the next palindrome. What was the average speed of the car, in km per hour?

   ANSWER: ______________ km per hour
3. Class A has 10 students and class B has 15 students. In a test, the average grade for class A is 60, and the average grade for class B is 66. A new student writes the test in the office. If he is put in class A, its average will become 62. If he is put in class B, what will its average become?

**Answer:**

4. Helen has a string of black beads and white beads which follows a certain pattern. She put a portion of the string beads inside the box as shown in the diagram on the right. How many black beads are there in the portion of the string inside the box?

**Answer:** black beads
ESSAY PROBLEMS

NAME ___________________________  COUNTRY ___________________________

5. Two years ago, Steve was three times as old as Bill, and in three years he will be twice as old as Bill. Find the sum of their ages.

6. Dad walks at 6 km per hour when alone and mom walks at 4 km per hour when alone. When they walk together, they compromise at 5 km per hour. They leave home to go to the store 1 km away. Six minutes after leaving home, dad has to return for the shopping list while mom goes on. How long does mom have to wait in the store, in minutes, before dad arrives with the shopping list?

ANSWER:  

6. Dad walks at 6 km per hour when alone and mom walks at 4 km per hour when alone. When they walk together, they compromise at 5 km per hour. They leave home to go to the store 1 km away. Six minutes after leaving home, dad has to return for the shopping list while mom goes on. How long does mom have to wait in the store, in minutes, before dad arrives with the shopping list?

ANSWER:  _____________ minutes
7. A says, ``I ate it."
   B says, ``The one who ate it was either C or D."
   C says, ``Exactly one of A and B is lying."
   D says, ``C did not eat it."
   If exactly two of them are lying, who ate it?

8. In the right diagram, $\angle ABC = \angle BDC = 90^\circ$.
   If $\frac{AD}{DC} = \frac{9}{4}$, then what is the value of $\frac{BD}{AC}$?
9. A three-digit number is multiplied by a two-digit number whose tens’ digit is 9. The product is a four-digit number whose hundreds digit is 2. How many three-digit numbers satisfy this condition?

**ANSWER:**

10. $ABC$ is a triangle with a right angle at $C$. $E$ is a point on $AC$ and $D$ is a point on the extension of $CB$ such that triangle $DEC$ is similar to triangle $ABC$. $AB$ cuts $DE$ at $F$, and $AE=EF$. Calculate $\angle ABC$, in degrees.

**ANSWER:**
11. P and Q are the points on the sides AB and BC of a triangle ABC respectively such that BP=3PA and QC=2BQ. K is the midpoint of the segment PQ. If the area of the triangle ABC is 120 cm², find the areas of the triangle AKC, in cm².

\[ \text{ANSWER: } \]

12. A triangle is divided into seven triangles. The areas of four of them are 420 cm², 80 cm², 60 cm² and 30 cm² as shown in the diagram on the right. Find the area of triangle AEF, in cm².

\[ \text{ANSWER: } \]
13. The diagram below shows six distinct positive integers in a ring and the sum of any two neighboring numbers is a perfect square.

![Diagram]

The below diagram is to be filled with six different positive integers such that it has the same property. If $X \leq 20$, find all possible values of $X$.

![Diagram with variable $X$]

**ANSWER:**