Mathematics Short Answer Problems

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

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**Instructions:**

* Write down your name and country on the answer sheet.

* Write your answer on the answer sheet.

* You have 60 minutes to work on this test.

* 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**

# SHORT ANSWER PROBLEMS

(1)  The radius of a circle is increased by 100%. Find the percentage increase in the area?

(2)  Three committees meet today. Of these three committees, one meets every 11 days, a second meets every 15 days, and the third meets every 21 days. What is the number of days before they all meet on the same day again?

(3)  A nonzero number is halved and the result is squared. This yields a number which is twice the original number. What is the original number?

(4)  The hypotenuse of a right triangle has length 10 cm, and the other two sides have lengths $y$ and $3y$ respectively. Find the area of the triangle, in cm$^2$.

(5)  In the diagram below, $ABC$ is an equilateral triangle of side length 7 cm. The arcs $AB$, $BC$ and $CA$ are drawn with centres $C$, $A$ and $B$ respectively. Find the total length, in cm, of the three arcs. (Using $\pi = \dfrac{22}{7}$)
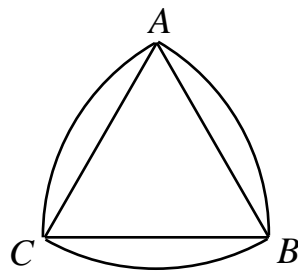


(6)  Carmen selects four different numbers from the set {1, 2, 3, 4, 5, 6, 7} whose sum is 11. If $l$ is the *largest* of these four numbers, what is the value of $l$?

(7)  When my age is divided by 2, 3, 4 or 6 there is always a remainder of 1, but when divided by 7 there is no remainder. How old am I if my age is under 100?

(8)  If 7 is subtracted from a three-digit number $x$, the result is a multiple of 7. If 8 is subtracted from $x$, the result is a multiple of 8. If 9 is subtracted from $x$, the result is a multiple of 9. When $x$ is divided by 10, what is the remainder?

(9)  In a class of 25 children, 12 wear glasses and 11 wear braces. If 7 wear both glasses and braces, what is the number of those who wear neither?

(10)  *IMSO*, *MOSI* and *SMIO* are some arrangements of the letters *I*, *M*, *S* and *O*. How many different arrangements are there such that the letter *I* is not next to the letter *O*?

(11)  A boy saved 1 dollar in the first week, 4 dollars in the second week, he saved 3 dollars more than he did the previous week. What was the total number of dollars that the boy had in the first ten weeks?

(12) A two-digit odd number is a multiple of 9. The product of its digits is also a multiple of 9. What is this number?

(13) The product of two positive integers is 1 000 000. Neither of the two numbers contains the digit 0. What is their sum?

(14) In triangle $\triangle ABC$, $\angle A = 50°$ and the external bisector of $\angle B$ and $\angle C$ meet in $O$. find the measure of $\angle BOC$, in degrees?
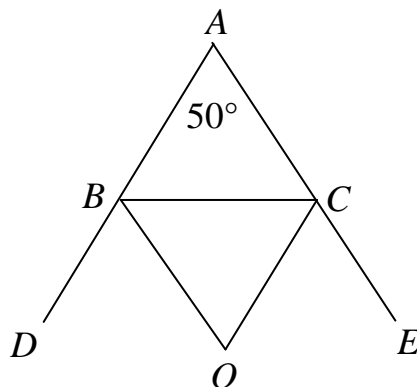


(15) In the diagram below, each of the small squares in the 4×4 grid measures 1 cm by 1 cm. Find the area of the 11-sided polygon, in cm$^2$.
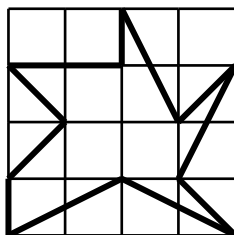


(16) The teacher gave ten tests during the year, each carrying the same weight. If Mary had got 10 more marks on the last test, her average would have become 92. What was her actual average?

(17) The faces of a cube contain the numbers 1, 2, 3, 4, 5, 6 such that the sum of the numbers on each pair of opposite faces is 7. For each of the cube's eight corners, we multiply the three numbers on the faces incident to that corner, and write down its value. (In the diagram, the value of the indicated corner is $1 \times 2 \times 3 = 6$.) What is the sum of the eight values assigned to the cube's corners?
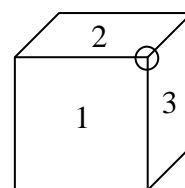


(18) In a certain province, there are twelve highways, each joining a pair of cities. Each city is situated at the termination of three highways. What is the number of cities in this province?

(19) A positive integer $n$ is divisible by four of 2, 3, 4, 5, 6 and 7, but not by the other two. If the two numbers that do not divide $n$ are consecutive, what is the smallest value of $n$?

(20) The positive integers $a$ and $b$ are such that $\dfrac{5}{7} < \dfrac{a}{b} < \dfrac{9}{11}$.

Find the value of $a + b$ when $b$ takes the smallest possible value.

(21) In the diagram below, *ABCD* is a square, *E* is a point on *AD* and *F* a point on *AB* such that *DE=2AE* and *AF=2BF*. What is the ratio of the area of triangle *CEF* to that of square *ABCD*?
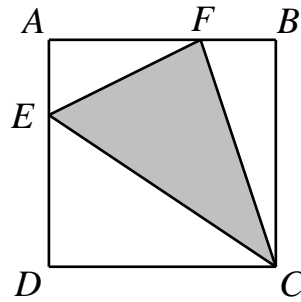


(22) Consider the following pattern:



$$Y_1 = 6 \qquad Y_2 = 15 \qquad Y_3 = 28$$
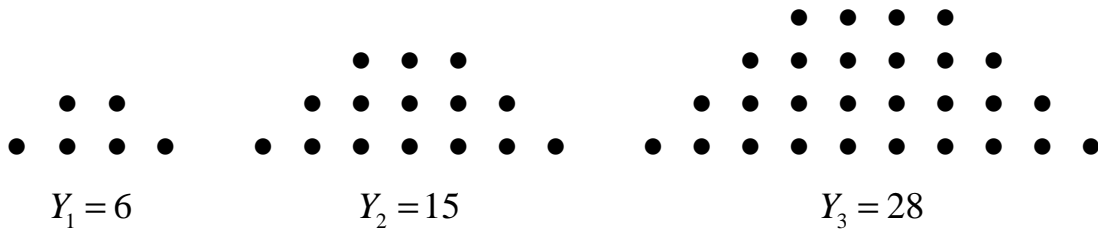
Find $Y_{199}$.

(23) The first four digits of an eight-digit perfect square are 2012. Find its square root.

(24) Peter arranges 5 poker cards on the table as shown in Figure 1. Then he rotates one of them 180°. Now the five cards are as shown in Figure 2. Which card, A, B, C, D or E, has been rotated?
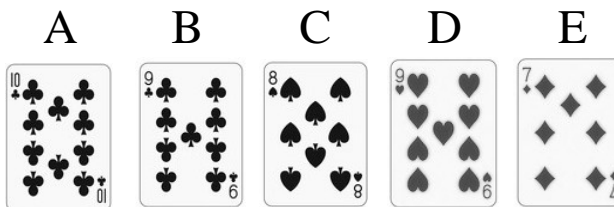


Fig. 1

A    B    C    D    E



Fig. 2

(25) When a two-digit number is divided by the sum of its digits, what is the largest possible remainder?