

IMAS Sample Question Lower Level (G6 and lower) Round 1

1. (Geometry) In the following figures, how many of them are not symmetric?



- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6

Ans : D.

2. (Number Theory) How many prime number are there among 2, 19, 197, 2009 and 2011?

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4

Ans : E.

$2009 = 7^2 \times 41$; 2, 19, 197 and 2011 are prime, Hence E.

3. (Number Theory) The ancient Chinese use special binary symbols to represent everything, using “—” to represent “1”, “--” represents “0”. They also use “≡” to represent “1” which is the binary system “001”. And “≡” to represent “6”, which is the binary representation of “110”. What is the sum of the number in base 10 which are represented by “≡”, “≡”, “≡”, “≡” and “≡”?

- (A) 12 (B) 14 (C) 14 (D) 30 (E) 35

Ans : C.

“ ≡ ”, “ ≡ ”, “ ≡ ”, “ ≡ ” and “ ≡ ” are 3, 0, 7, 2, and 5. The sum is 17.

4. (Arithmetic) There are two pools, each with a equal number of fishes. Leong and Hung are competing to collect as much as fish as they could. When all the fishes in the first pool were collected by them, the ratio of the number of fish that Leong and Hung collected is 3:4. And after all the fish in the second pool were collected, Leong get 33 fishes more than his first catch and the ratio of the number of fishes they collected in the second pool is 5:3. How many fishes originally are in each pool?

- (A) 24 (B) 112 (C) 168 (D) 224 (E) 336

Ans 1 : C.

The number of fishes in each pool is

$$33 \div \left(\frac{5}{5+3} - \frac{3}{4+3} \right) = 168$$

Ans 2 : C.

This could be solved by using ratio, Assume that Leong’s first catch is $3n$, then

Hung's is $4n$. Accordingly, we have $\frac{3n+33}{4n-33} = \frac{5}{3}$, and get $n = 24$. Hence each pool has $7n = 168$ (fishes).

Ans 3 : C.

Let the number of fishes in each pool equal to $56x$. The first catch of Leong is $24x$, and his second catch is $35x$. Accordingly, $35x - 24x = 33$ and $x = 3$. Hence the number of fishes in each pool equal to $56x = 168$.

5. (Arithmetic) Two of the fractions are removed from $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{6}$, so that the sum of the remaining three fractions is closest to $\frac{6}{7}$. Which two fractions were removed?

- (A) $\frac{1}{2}$, $\frac{1}{5}$ (B) $\frac{1}{2}$, $\frac{1}{6}$ (C) $\frac{1}{3}$, $\frac{1}{5}$ (D) $\frac{1}{3}$, $\frac{1}{4}$ (E) $\frac{1}{4}$, $\frac{1}{5}$

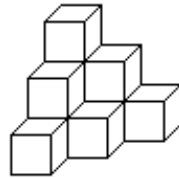
Ans : D.

The fractions are put into equal denominator

$$\frac{1}{2} = \frac{210}{420}, \quad \frac{1}{3} = \frac{140}{420}, \quad \frac{1}{4} = \frac{105}{420}, \quad \frac{1}{5} = \frac{84}{420}, \quad \frac{1}{6} = \frac{70}{420}, \quad \frac{6}{7} = \frac{360}{420}.$$

The sum of the numerator is 609, which is 249 more than 360, and $140+105=245$ is closest to 249. So the two fractions removed are $\frac{1}{3}$, $\frac{1}{4}$.

6. (Geometry) As shown in the figure, the three-dimensional figure is composed by 10 cubes, each with side 1 cm. What is the total surface area of the figure?



- (A) 24 cm^2 (B) 27 cm^2 (C) 36 cm^2 (D) 48 cm^2 (E) 54 cm^2

Ans : C.

Viewing from top, bottom, front, back, left and right, the surface area are both 6 cm^2 , hence the total surface area is 36 cm^2 .

7. (combinatoric) 1234 is a 4-digit number. The digits of the number are rearrange from the largest to the smallest and from the smallest to the largest to form two numbers. Subtracting the smaller number from the larger number gives 3087 ($4321 - 1234 = 3087$). Then the 4-digit number 3087 is used to rearrange into a largest and smallest numbers, and subtracting the smaller number from the larger number gives 8352 ($8730 - 0378 = 8352$), working continuously, we have a

sequence of numbers:

$$1234 \rightarrow 3087 \rightarrow 8352 \rightarrow \dots$$

After 12 such operations, what is the sum of the 13 numbers?

Answer : _____

Ans : 74413.

$$1234 \rightarrow 3087 \rightarrow 8352 \rightarrow 6174 \rightarrow \mathbf{6174} \dots$$

The sum of the 13 numbers is

$$\begin{aligned} 1234 + 3087 + 8352 + 10 \times 6174 &= 12673 + 61740 \\ &= 74413 \end{aligned}$$

Note: The operation is called a Kaprekar operation (after D. R. Kaprekar)

8. (Combinatoric) There are twelve books on the classroom bookshelf. Given that every members of the mathematics groups have borrowed two of the books, and each book on the bookshelf has been borrowed three times. How many members are there in the mathematics group?

Answer : _____

Ans : 18

As there are 12 books on the shelf, and each one of them were borrowed by 3 members of teh mathematics group, Hence it has been borrowed $12 \times 3 = 36$ (times) . Assume there are x members in the mathematics group, each of them borrowed two of the books, hence the total number was $2x$.

$$2x = 36$$

$$x = 18$$

(By construction, divide 18 people into 6 groups, each group consist of 3 persons. The 12 books is distributed to these 6 groups, and there are 2 books for each person)