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**upper primary Division**

**Grades 5 and 6**

**Contest Instructions and Information:**

**Part I: Individual Contest**

1. The IMOYA Contest has 3 Sections:

 Section A is composed of 5 calculations skills items.

 Section B is composed of 5 perk-ups problem items.

 Section C is composed of 5 challenging problem items.

2. Enter the letter of the correct answer on the space provided for each number.

3. Diagrams are NOT drawn to scale

4. No calculator, calculating device or protractor is allowed.

5. Time limit: 90 minutes

**SECTION A. Calculation Skill Problems**

*Compute each of the following using a simple method. Each correct answer worth 4 points. Total of 20 points*.

1. From among the following choices, three of them have equal sum. Which one whose sum is different from the others?

 A.  B.  C.  D. 

**Suggested Answer:**

 The answer is C.

2. Which fraction has a value that is exactly between and ?

 A.  B.  C.  D. 

**Suggested Answer:**

 The fraction in the middle is .

 The answer is A.

3. Which of the following choices given below must be the number to fill in the so that value of the fraction  is between 6 and 7?

 A. 36 B. 40 C. 45 D. 50

**Suggested Answer:**

 Since  and , so we must choose 50.

 The answer is D.

4. What is the simplified value of ?

 A. 2 B. 4 C. 8 D. 16

**Suggested Answer:**

 Analysis: .

 The answer is D.

5. Which among the choices has the largest value?

 A.  B.  C.  D. 

**Suggested Answer:**

 Since A: = 248,832

 B: = 131,072

 C:  = 65,536

 D: = 279,936

Therefore, the largest is D.

**SECTION B. Simple Problems**

*Select the correct answer in each problem. Each problem is worth 5 points, for a total of 30 points*.

1. The first two figures show two weighing scales that are balanced. How many *C*s are needed to balance the third weighing scale.

 A. 10 B. 12 C. 14 D. 16

 The Answer is D.

2. Fill in the six digits 1, 2, 3, 4, 5, and 6 in the 🗆s so that the product will be correct. If each digit can only be used once, what is the digit in the 🗆with the question mark?



A. 2 B. 3 C. 4 D. 5

**Suggested Solution:**



 Hence, ? = 3.

 The answer is B.

3. Three different classes in Grade Four planted a total of 230 trees. Among them, the number of trees planted by Class Jade is 5 more than twice the number of trees planted by Class Ruby and the number of trees planted by Class Diamond is 4 more than the total number of trees planted by the other two classes. How many trees were planted by the Class Jade?

 A. 77 B. 66 C. 46 D. 36

**Suggested Solution:**

 From the given information, we have the line segment diagram as follows:



 The number of trees planted by Class Ruby =  trees. The number of trees planted by Class Jade =36 × 2 + 5 = 77 trees.

 The answer is A.

4. There are 460 workers in a factory. If the number of male workers is 30% more than that of female workers, then how many male workers are there?

 A. 170 B. 200 C. 260 D. 290

**Suggested Solution:**

 Let *x* be the number of female workers.

 The number of male workers = 

 Then 

 Therefore, the number of male workers 

 The answer is C.

5. It is given that , where *a*, *b* and *c* are positive numbers. Which of the following is true?

 A.  B.  C.  D. 

**Suggested Solution:**

 

 Since 

 Hence,  b

 The answer is C.

**SECTION C. Challenging Problems**

*Solve each word problem. Simplified Solution of each problem is a must and it worth 10 points for a total of 50 points*.

1. As shown in the figure below, 4 circular holes were drilled on *a* cm long wooden strip to make a test tube rack. The diameter of each circular hole is 2 cm. What is the value of *x*?

 A.  B.  C.  D.

**Suggested Solution:**

 From the given figure, we setup an equation, .

 Answer is D.

2. The six non-zero positive integers from 1 to 6 are printed on the six faces of each cube and it is known that the sum of the two integers printed on any two opposite faces is 7. Arrange the six cubes one by one as shown in the figure on the right so that the sum of the integers on the two faces next to each other is 8. What number does the “\*” on the face of the cube represent?

A.4 B. 3 C. 2 D. 1

**Suggested Answer:**

 **1st Section Figure**

 From the first section figure,

 On the first cube:

 the opposite face of 4 is 3, then 3 and 5 are the integers or the faces next to each other.

 On the second cube:

 the opposite face of 5 is 2, then 2 and 6 are the integers on the faces next to each other.

 **2nd Section Figure**

 Take note the third cube is also on the 2nd section figure:

the opposite face of 6 is 1, it follows 3 and 4 are opposite faces, then the other two opposite must be 2 and 5.

 Let us assume 2 is on the left side face and 5 is on the right side face, so we have the opposite face of 2 is 5, then 5 and 3 are integers on the faces next to each other, followed by 4 is the opposite face of 3.

 **3rd Section Figure**

The answer is B.

3. Antonio, Benito and Carlito play marble game. The winner of each round of the game gets from each of the other players as many marbles as the winner had at the start of that round. After Round 3, Antonio has 12 marbles, Benito has 7 and Carlito has 8. How many marbles did Antonio have at the start of the game?

 A. 10 B. 13 C. 16 D. 19

**Suggested Solution:**

From the given information, the winner of a round receives as many marbles as he already has from each of the others. For example, if he has 6, he would get 12 more, 6 from each player, for a total of 18. ***These triples are what he has.*** That is, after each round, the winner’s total is a multiple of 3.

At the end of Round 3, the only multiple of 3 is Antonio’s total, so he won Round 3, Antonio must have started Round 3 with 4 marbles and received 4 more from each of the others. The table below shows how many marbles each had at the end of each round.

Similarly, at the end of Round 2, the only multiple of 3 is Carlito’s highlighted total, 12, so he won Round 2. Carlito had started Round 2 with 4 marbles and received 4 more from each of the others.

At the end of Round 1, the only multiple of 3 is Benito’s total, so he won Round 1 with 5 marbles and received 5 more marbles from each of the others. At the start of the game, Antonio had 8 + 5 = 13 marbles as grey highlighted in the table.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Antonio** | **Benito** | **Carlito** |
| End of Round 3 - Antonio won r marbles from each | **12** | 7 | 8 |
| End of Round 2 – Carlito won 4 marbles from each | 4 | 11 | **12** |
| End of Round 1– Benito won 5 marbles from each | 8 | **15** | 4 |
| Start | **13** | 5 | 9 |

 Thus, at the start of the game, Antonio had 13 marbles.

 The answer is B.

4. Among all three-digit numbers in the form of  how many are multiples of 22?

A. 1 B. 3 C. 4 D. 7

**Suggested Solution:**

From the given information, we know that is a multiple of 2 and 11, by divisibility property of 11, we have  it follows  must be an even number, then the possible three-digit numbers are 220, 924, 726 and 528; so there are four possible multiples of 22 in the form provided by the problem.

The answer is C.

5. A certain bus company with four bus stations namely operates from City *A* to City *B* as shown in the figure below. A gas station *M* is to be built on a convenient and reasonable site and that is on the operation routes between cities *A* and *B*. The sum of the distances from the four bus stations  to the gas station must be the smallest. Where must be the location of the gas station *M* in order to meet the condition?

 A. Stations *A* and *C* B. Stations C and *D* C. Stations *D* and *B* D. Stations *A* and *B*

**Suggested Solution:**

The mathematical model of this problem is to find a point *M* on the line segment *AB*, such that the sum of the distances from the point *M* to each of the four points *A*, *B*, *C*, *D* is the smallest; that is, is the minimum.

From the definition of absolute value, this model can be transformed into: there are four points *A*, *B*, *C*, *D* on the number line *AB* such that there is a point *O* is between point *A* and point *B*. We need to determine the location of point *O* so that the sum of the distances from *O* to each of the four points *A*, *B*, *C*, *D*;  is a minimum. Because  is a fixed value. Then it is obvious  is minimum when point *O* is locate at line segment *CD*. Hence, the minimum value is 

Therefore, to minimize the sum of the distances from each of the four bus stations *A*, *B*, *C*, and *D* to the gas station *M*, the gas station *M* must be constructed in the *CD* (including points *C* and *D*) for the best.

Mathematically, let be on the number line, their corresponding coordinates are  respectively with 

Since the problem required the sum of the distances from the four stations to the gas station to be the minimum, first we have Since and from the geometric interpretation of absolute value, when  the value of  is a minimum.

Similarly, when  then is also a minimum. But  so the best minimum value is 

 Thus, the minimum sum of the distances from each of the four bus stations *A*, *B*, *C*, and *D* to the gas station *M* is *CD* and the gas station *M* must be constructed in the *CD* (including points *C* and *D*) for the best.

The answer is B.