Mathlete Training Centre
Round 1 RIPMWC open

2011 RIPMWC open round 1

1. The 4-digit number 2011 can be partitioned (20|11) into two 2-digit numbers, 20 and 11, whose product is 220. How many other 4-digit numbers can be partitioned in the same way into two 2-digit numbers to give a product of 220 or 440?

2. 2011 people each have exactly one secret which is different from that of the rest of the people. When one of them calls another, the caller tells every secret he knows, but learns nothing from the person he calls. How many phone calls will be needed in order for each person to know all the 2011 secrets?

3.

Albert ordered 4 pairs of black socks and some additional pairs of blue socks. The price of each pair of black socks was twice that of the blue. When the order was filled, it was found that the number of pairs of the two colours had been interchanged. This increased the bill by 50%. The ratio of the number of pairs of black socks to the number of pairs of blue socks in the original order was:

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4.

Which of the following five fractions is largest?

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5.

The sum $\frac{1}{86} + \frac{8989}{8686} + \frac{90909}{868686} + \frac{13131313}{86868686} + \frac{1717171717}{8686868686}$ is equal to

6.

Figure A shows a structure which is made up of 4 smaller cubes. If we put 2 identical such structures together, we will be able to get a larger cube.

Figure B shows another structure which is made up of 5 smaller cubes. What is the minimum number of such identical structures required to form a larger cube?

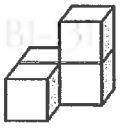

Figure A

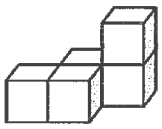

Figure B

7.

There are more than 10 but less than 100 children sitting in a circle. They count clockwise around the circle starting from 1. If the same child has counted 22 and 2011, what is the sum of the smallest and largest possible number of children in the circle?

8.

John is standing on a rectangular grid as shown above. He is allowed to move one step south, north, east or west. After 4 moves, he is supposed to get back to the starting point. How many possibilities are there for the sequence of 4 moves?

9.

How many zeros are there at the end of the value of the expression?

$$\left(\underbrace{99..99}_{2011\ 9s} \times \underbrace{99..99}_{2011\ 9s} + \underbrace{199..99}_{2011\ 9s}\right) \times 0.20112011$$

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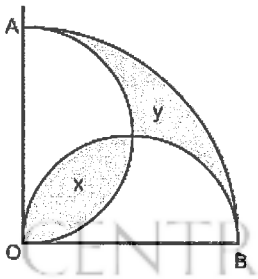
10.

OAB is a quadrant of a circle with OA (= OB) as its radius of length 4 cm. OA and OB are also diameters of two semi-circles as shown in the diagram below which is not drawn to scale. Shaded areas x and y are as shown in the diagram. Find the value of $\frac{x}{y}$.



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11. There are 10 identical chocolate bars in a box. Andy can only eat 1 or 2 of these chocolate bars at a time. He does this until there is no more left. In how many different ways can he do this?

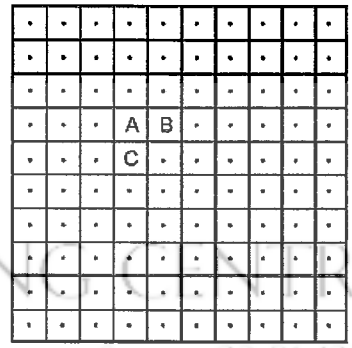
12. In the number arrangement

1
2 3
4 5 6
7 8 9 10
11 12 13 14 15
.....
.....

What is the number that will appear directly below the number 2011?

13.

3 points A, B and C are selected from 100 points, all equally spaced apart, in the following 10 × 10 grid. A fourth point D is to be selected from the remaining 97 points such that 4 triangles are formed by joining the 4 points and the ratio of their areas is 1 : 2 : 3 : 6. How many possible selections are there for point D?



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14.

If the number $26\underbrace{2011201120112011...2011}_{n\ \ 2011s}7$ is divisible by 33, what is the minimum value of n?

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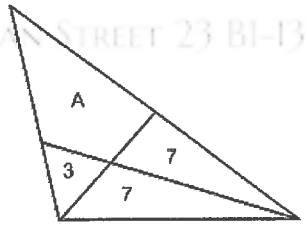
15.

Find the value of the expression $4-\frac{6}{1\times(1+2)}-\frac{9}{(1+2)\times(1+2+3)}-$

$$\frac{12}{(1+2+3)\times(1+2+3+4)}-\ldots-\frac{60}{(1+2+\ldots+19)\times(1+2+\ldots+20)}.$$

16.

As shown in the diagram, a triangle is divided into four regions by two line segments. The areas of the three triangles are indicated in the diagram. Determine the area of region A.



17.

How many pairs of positive integers (m, n) satisfy the equation $\frac{1}{m} - \frac{1}{n} = \frac{1}{2011}$?

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18.

In a certain sequence of positive integers, one adds the sum of digits of each term to the term itself to obtain the next term. The first few terms of the sequence are given below:

1, 2, 4, 8, 16, 23, 28, ...

What is the 151st term in the sequence?

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19.

Suppose you write positive square numbers 1, 4, 9, 16, 25, ... in a row, without blank spaces, as shown below

14916253649648110012 1... .

What will be the 2011th digit?

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20.

Ali, Bala and Charles started out 100 km journey. Ali and Charles went on a car at a speed of 25 km/h, while Bala walked at a speed of 5 km/h. After a certain distance, Charles got off the car and walked on at a speed of 5 km/h, while Ali went back for Bala and got him to the destination at the same time that Charles arrived. The total time in hours that has elapsed from the start and the end of the journey was _____.

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