2010 **World Mathematics Team Championship**
Primary School Level
Team Round

1. In a repeating decimal $1.0\dot{5}011\dot{7}$, the 2010^{th} digit behind the decimal is __________. If we keep 2010 significant digits for this number, then this new number will have __________ number of 1's.

2. Place cubes with edge length of 1 cm to form a sequence of solids as shown in Fig. 1. The 20^{th} solid has a surface area of __________ sq. cm.

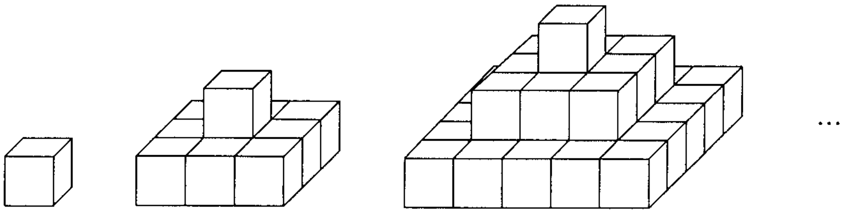


Fig. 1

3. The number resulting from $1 \times 2 \times 3 \times 4 \times \cdots \times 2009 \times 2010$ ends in __________ zeros.

4. Evaluate: $12\frac{1}{6} + 20\frac{1}{10} + 30\frac{1}{15} + 42\frac{1}{21} + 56\frac{1}{28} + 72\frac{1}{36} + 90\frac{1}{45} =$ __________.

5. Suppose that bag A has 50 more marbles than bag B. If $\frac{1}{5}$ of bag A's marbles are taken out and placed in bag B, then bag B will have 10 more marbles than A. What is the total number of marbles in both bags originally?

6. When m and n are natural numbers greater than 1, which of the following four expressions cannot be prime numbers?

(A) $n(n+1)+m$. (B) $n(n+1)+m^2$. (C) $n(n+1)+2^m$. (D) $n(n+1)+3^m$.

7. The proportion of boys to girls in School A is 8 : 7 and the proportion of boys to girls in School B is 30 : 31. If these two schools are merged into one school, the proportion of boys to girls in this new school is 27 : 26. Find the proportion of students of School A to School B before the merger. Use 1- digit numbers to do the closest estimate of this proportion.

8. Some prime numbers such as m can be written as $m = k(k+1)+p$ where k is a positive natural number, and p is a prime number. Write down 3 prime numbers that are in this form and greater than 100.

9. How many 3- digit numbers that are multiples of 6, in which the sum of hundreds digit and units digit is twice tens digit?

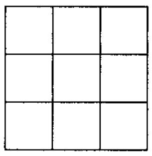


Fig. 2

10. Place 9 natural numbers from 1 to 9 into the nine squares shown in Fig. 2. Use each of these 9 numbers once and only once and place the numbers so that the sum of the numbers from each row, each column, and each diagonal would add up to n. Which of these 5 numbers 15, 16, 17, 18, 19 can be used for n?

11. How many distinct odd numbers we have to take out from the list of 1896 numbers in 117, 118, 119, ⋯, 2011, 2012 so to guarantee this new set has at least two odd numbers with the sum of 2010?

12. Place natural numbers from 2 to 10 into the nine circles in the Fig. 3 so that the sums of the three numbers on each line are equal. Each number must be used once and only once. What is the number placed in the center circle and what is that common sum of three numbers on each line?

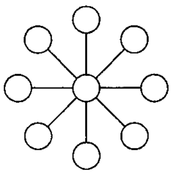


Fig. 3

13. If we divide a cube with edge length 6 into 157 cubes with integer edge length, how many cubes with edge length 1 are among these 157 cubes?

14. Place natural numbers from 1 to 2010 according to the below configuration:

	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
···	···	···	···	···	···	···
2002	2003	2004	2005	2006	2007	2008
2009	2010					

Fig. 4

As in Fig. 4, use a rectangular frame to block off 9 numbers (3 rows and 3 columns). If the sum of these 9 numbers is 17991, then what is the smallest number among these 9 numbers?

15. Plant flowers of 4 different colors in the 7 areas as in the Fig. 5 so that each area has flowers of the same color. How many ways can we plant the flowers so that neighboring regions have flowers of different colors?

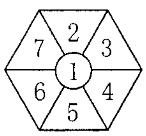


Fig. 5

16. Suppose there are four kinds of weights, 5 grams, 25 grams, 30 grams, and 50 grams. We take at least one from each kind and no more than six 50- gram weights. If we are to take n of these weights so to make the total weight of 1000 grams, then what is the minimum value for n?

17. As in Fig. 6, the figures are all assembled using sticks of the same length. The first figure requires 7 sticks, the second figure requires 13 sticks, and so on. Following this pattern, how many sticks are required to assemble the 11^{th} figure?

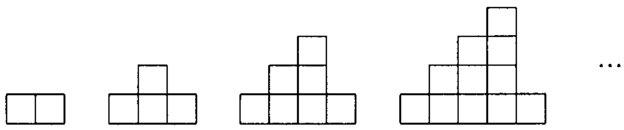


Fig. 6

18. A pool has two incoming pipes A and B and one outgoing pipe C. A and B can separately fill an empty pool in 12 and 10 hours, respectively. Suppose there is some water in the pool now. If pipe A is filling the pool alone, and at the same time, C is draining water from the pool, then it would take 1 hour to empty the pool. However, if both pipes A and B are filling the pool and C is draining the pool, then it would take 7 hours to empty the pool. How many minutes would it take to empty the pool if we turn off A and B and only use C to drain the pool?

19. Let rectangle $ABCD$ have a size as indicated in the Fig. 7 and its side DC is on the straight line l. If the rectangle $ABCD$ rotates clockwise for $90°$ about Point C, then find the area swept by rectangle $ABCD$ during the rotation. (Use $\pi = 3$.)

20. How many 4- digit numbers can satisfy the following three conditions?

(1) All four digits are different;

(2) The digits are in descending orders (the unit digit is the smallest digit);

(3) The sum of two of the four digits is equal to the sum of the other two digits.

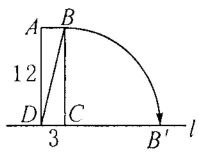


Fig. 7

2010 **World Mathematics Team Championship**
Primary School Level
Relays Round

Round 1 • A

How many 3- digit prime numbers such that the sum of digits is 5?

2010 **World Mathematics Team Championship**
Primary School Level
Relays Round

Round 1 • B

Let T be the answer passed from your teammate. What is the largest 3- digit number so that it has a remainder of 2 when being divided by T and it has a remainder of T when being divided by 6 and it has a remainder of 2 when being divided by 7?

2010 **World Mathematics Team Championship**
Primary School Level
Relays Round

Round 2 • A

If one places the same natural number N into □ in $\frac{8\times\square}{\square-13}$ and the result is still a natural number, then how many different natural numbers N can be placed in □?

2010 **World Mathematics Team Championship**
Primary School Level
Relays Round

Round 2 • B

Let T be the answer passed from your teammate. Find a natural number n so that

$n^3+(n+1)^3+\cdots+(n+T)^3=3024$, where $x^3=x\times x\times x$.

2010 World Mathematics Team Championship
Primary School Level
Relays Round

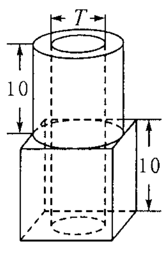
Round 3 • A

Find a number n so that $\dfrac{1}{3+\dfrac{2}{5+\dfrac{4}{7+\dfrac{6}{n}}}}=\dfrac{11}{37}$.

2010 World Mathematics Team Championship
Primary School Level
Relays Round

Round 3 • B

Let T be the answer passed from your teammate. As in the figure, a cylinder with both height and diameter equal to 10 cm is placed on a cube with edges also equal to 10 cm. If we dig a cylinder of diameter T cm from the top to the bottom. Find the surface area of the resulting geometric figure. (Use 3 for π.)



2010 **World Mathematics Team Championship**
Primary School Level
Individual Round

Round 1

1. If 2 cows can be exchanged for 63 sheep and 2 rabbits can be exchanged for 3 chickens and 3 sheep can be exchanged for 32 rabbits, then 3 cows can be exchanged for how many chickens?

2. Following some pattern with the first 8 numbers as 1, 3, 6, 10, 15, 21, 28, 36, what is the 50^{th} number in the number series?

3. In a group of 12 classmates, 5 persons can play ping-pong, 3 can play ping-pong and chess, 4 cannot play ping-pong and chess. How many of these classmates can play chess?

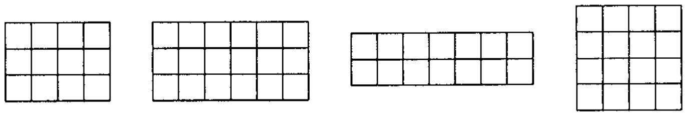
4. If n is a natural number from 1 to 20, then how many possible values for n so that $a = 13 \times 13 + n$ is a prime number?

2010 **World Mathematics Team Championship**
Primary School Level
Individual Round

Round 2

1. How many natural numbers greater than 10 but less than 40 has the property that if we interchange its tens and units digits, the new and the original numbers are relatively prime to each other?

2. Which of the four figures below can be totally covered (without overlapping) by the 4-square L shape  pieces ?



3×4 (A) 3×6 (B) 2×7 (C) 4×4 (D)

3. One worker had made 5000 parts. If each part passed inspection, it can be sold for \$5. If it is rejected, then it will cost him \$3. If this worker had received \$22,000 for these parts, then how many of this worker's parts had passed inspection?

4. A bag contains 70 socks which are identical except for color: 10 White, 15 Magenta, 20 Tan, and 25 Charcoal. If you reach into the bag without looking, how many socks do we have to take out to ensure we have 4 pairs of socks?(Regard the two socks of the same color as a pair.)

2010 **World Mathematics Team Championship**
Primary School Level
Individual Round

Round 3

1. There are 4 small circles of equal area inside a large circle as shown in Fig. 1. Suppose that each small circle's radius is 5 cm and that the radius of the large circle has the same length as the diameter of the small circle. Then what is the perimeter of the shaded region and what is the area of the non-shaded region? (Use $\pi = 3$.)

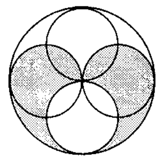


Fig. 1

2. How many 3-digit numbers are not multiples of 50 but divisible by 2, 3, and 5?

3. Cards A and B has 4 numbers each. The number on the lower left hand corner of Card B is the same number on the lower right hand corner of Card A in Fig. 2. Use parentheses and the four operations $+$, $-$, $\times$, $\div$ on the four numbers on each card (each number used once and only once) to get a result of 36. Write these two expressions.

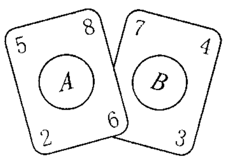


Fig. 2

4. A and B are running around an oval shaped track of 1200 meters long. A's speed is 3 m/s (meters per second) and B's speed is 4 m/s. If they start from the same spot on the track but running opposite directions, then how far have they run when they meet in the starting point for the second time?

2010 **World Mathematics Team Championship**
Primary School Level
Individual Round

Round 4

1. In Fig. 1, each square's vertices are on the midpoints of the sides of the larger square. If we order the areas of all the squares from small to large and the smallest square has an area of 1, then what is the perimeter of the 2011^{st} square ? (Use a^n to represent multiply a n times like $3 \times 3 \times 3 \times 3 = 3^4$.)

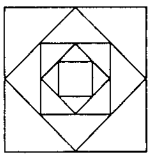


Fig. 1

2. As in Fig. 2, the proportions of length to width are the same for rectangles $ABCD$, $ABEF$ and $AGHF$. Also, the area proportion of rectangles $ABCD$ to rectangle $AGHF$ is $\frac{81}{16}$ and the perimeter of rectangle $BEHG$ is 22. What is the area of rectangle $ECDF$?

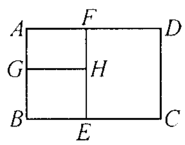


Fig. 2

2010 **World Mathematics Team Championship**

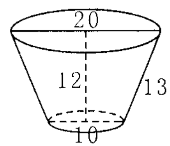
Primary School Level

Individual Round

Round 5

1. There is a tunnel between Locations A and B. A car left B for A at 8:16. A truck left A for B at 9:00. Suppose both the car and the truck arrived at the tunnel at the same time and that the truck left the tunnel 2 minutes later than the car. If the car arrived A at 10:56 and the truck arrived B at 12:20, then what time was it when they both arrived at the tunnel at the same time?

2. Suppose we have a cylinder with radius 20 cm and height 35 cm that contains full of juice. Suppose we pour the juice from the cylinder to cups that look like the one shown in the figure If the top of the cup has a diameter of 20 cm and the base has a diameter of 10 cm and the cup is 12 cm tall with the side 13 cm long, then the juice in the cylinder can fill how many of these cups?



WMTC Primary School answers

一、 Team round

1	1；804	**11**	504
2	4642	**12**	2 or 6 or 10；15 or 18 or 21
3	501	**13**	154
4	$322\frac{7}{15}$	**14**	1991
5	250	**15**	264
6	C	**16**	31
7	$\frac{3}{4}$	**17**	157
8	$m=k(k+1)+p$ ($k\in N_+$, p is prime number)， example: $m=101,103,107$，109， 113,127,131,137,139 and so on	**18**	35
9	20	**19**	186.75
10	15	**20**	50

二、 Relay round

Round 1	982
Round 2	2
Round 3	1206

三、 Individual round

Round 1	**1**	1512	**3**	6
	2	4642	**4**	3

Round 2	**1**	14	**3**	4625
	2	D	**4**	11

Round 3	**1**	90;150	**3**	$5\times8-6+2=36;(7-4+3)\times6=36$
	2	24	**4**	16800

Round 4	**1**	2^{1007}	**2**	67.5

Round 5	**1**	10 点	**2**	20