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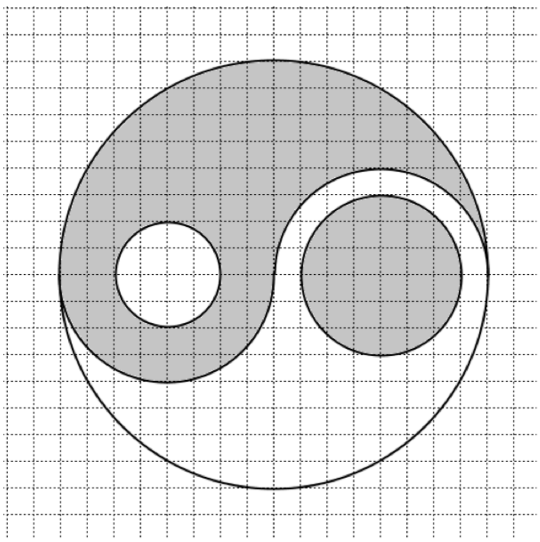
15th Primary Mathematics World Contest
Team Contest 2012

1. Calculate：$\frac{1}{3}+\frac{1}{5}+\frac{1}{7}+\frac{1}{9}+\frac{1}{11}+\frac{1}{33}+\frac{1}{35}+\frac{1}{45}+\frac{1}{55}+\frac{1}{77}+\frac{1}{105}$.

2. If $4n+1$ and $6n+1$ are both perfect squares, what is the minimum value of the positive integer n?

3. In the figure on the square grid below, the large circle has both shaded and unshaded areas. Find the ratio of the shaded areas to the unshaded areas.



4. Let $A=x+\frac{1}{y+\frac{1}{z}}$, $B=y+\frac{1}{z+\frac{1}{x}}$, $C=z+\frac{1}{x+\frac{1}{y}}$, where x, y and z are positive integers. If $A=\frac{37}{16}$, calculate the value of $A\times B\times C$.

5. Given:

$A=1^2-2^2+3^2-4^2+\cdots+11^2$,

$B=1^2-2^2+3^2-4^2+\cdots+11^2-12^2$,

$C=1^2-2^2+3^2-4^2+\cdots+11^2-12^2+13^2$,

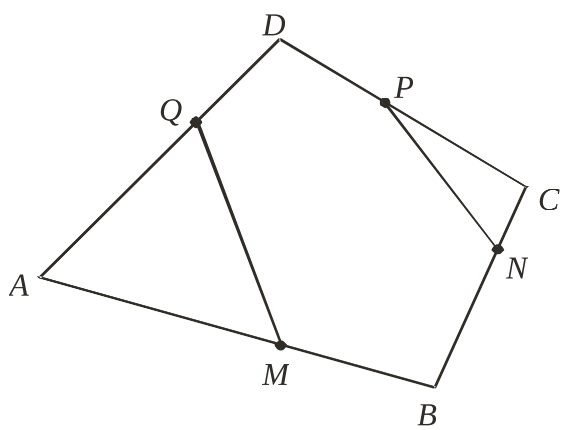
$D=1^2-2^2+3^2-4^2+\cdots+11^2-12^2+13^2-14^2$.

Find the value of $A+B+C+D$.

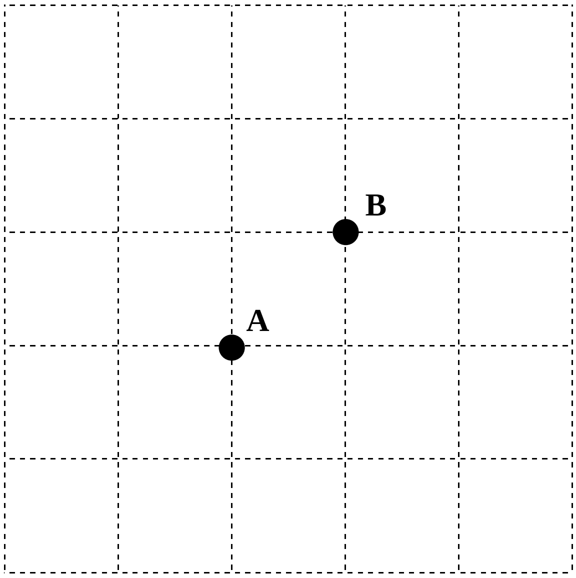
6. There are two piles of balls. The number of balls in pile A is between 240 and 300.
Step 1: From pile A, take the same number of balls as there are in pile B and give them to pile B.
Step 2: From pile B, take the same number of balls as in the current pile A and give them to pile A.
Step 3: From pile A, take the same number of balls as in the current pile B and give them to pile B.
Step 4: From pile B, take the same number of balls as in the current pile A and give them to pile A.
Step 5: From pile A, take the same number of balls as in the current pile B and give them to pile B.
The two piles now have the same number of balls. How many balls were originally in pile A?

7. There are six three-digit numbers $\overline{abc}$, $\overline{acb}$, $\overline{bac}$, $\overline{bca}$, $\overline{cab}$, $\overline{cba}$. One of these numbers is removed and the sum of the remaining five numbers is 1990. What is the numerical value of the number that was removed?

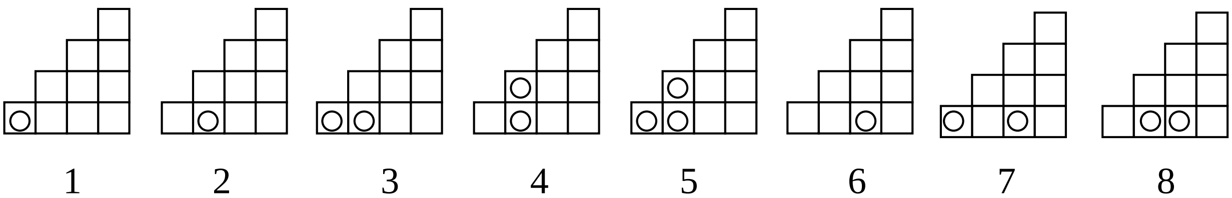
8. In the figure below:
The point M divides side AB such that $AM : MB = 3 : 2$.
The point P divides side CD such that $CP : PD = 4 : 3$.
The point Q divides side DA such that $DQ : QA = 1 : 2$.
The point N divides side BC such that $BN : NC = a : b$.
If the area of $MBNPDQ$ is $\frac{3}{5}$ of the area of $ABCD$, find the ratio $a : b$.



9. A curious tourist wants to drive around the streets of an ancient town. In the figure below, each side of a small square represents 1 km. The lines represent the streets and points of intersection of the lines represent the places to visit. The tourist wants his route to be as long as possible but he does not want to visit the same place twice. He starts at point A and drives along the streets to point B. Draw a longest possible route on the figure below and write down the length of this route.



10. There is a secret code where every integer has a unique icon and every icon represents only one integer. The eight icons below represent the first eight positive integers (1 to 8) according to a specific rule.



Draw circles into the figure below to create the icon for 60.