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Po Leung Kuk
20th Primary Mathematics World Contest
Individual Contest 2017

Item 1

The average of six numbers is 12. If one of the numbers is changed to 3, then the average of the new set of six numbers is 11. What is the value of the number that was changed?

Item 2

There are 11 sticks, one of each length 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11 cm. Choose three of them to form a triangle. One side of the triangle must be 11 cm. What is the maximum number of non-congruent (different) triangles that can be formed?

Item 3

Find the minimum positive difference between two 5-digit numbers that use all the digits from 0 to 9. For example, 71483 and 20956 are two 5-digit numbers that use all the digits from 0 to 9 and their difference is 50527.

Item 4

Four students A, B, C and D stand facing each other in a circle and each student puts on a colored hat. These hats have been randomly chosen from 2 reds, 2 yellows and 2 greens. Each student can only see the other three students' hats, and they cannot hear each other.

A says : "Neither B nor C is wearing a red hat."

B says : "I see three different color hats."

C says : "I do not see a green hat."

D says : "I see two students wearing the same color hats."

What color hat is each student wearing?

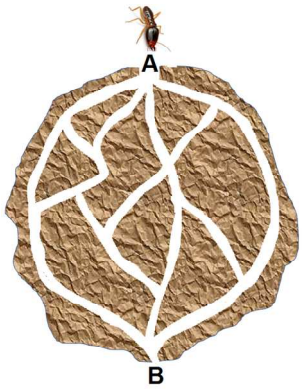
Item 5

How many positive factors of 15^{90} are multiples of 15^{39}?

Item 6

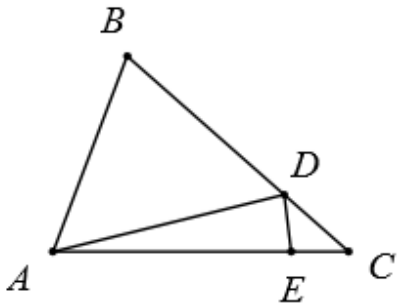
The diagram below shows the pathways inside an ant nest. An ant will travel from point A to point B, and can only move in a downwards direction.

Find the number of different ways the ant can reach point B.



Item 7

In $\triangle ABC$, point D is on BC and point E is on AC. AD and DE are drawn as shown in the figure. If $AC = BC$, $AB = BD$, $AD = AE$ and $DE = CE$, find the measure (size) of angle C, in degrees.



Item 8

A 12 cm × 8 cm rectangular piece of paper is to be folded as in the figures A, B and C below. The folds must be made on the dotted lines. Find the area, in cm^2, of the shaded part in figure C.

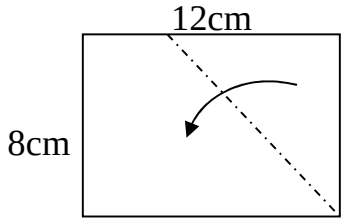


Figure A

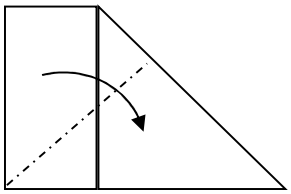


Figure B

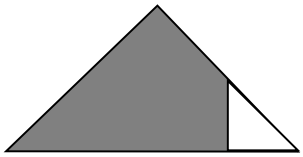
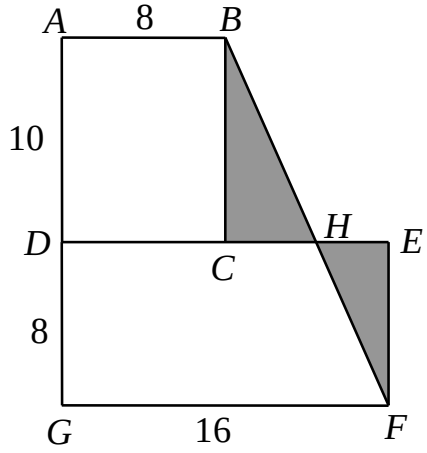


Figure C

Item 9

ABCD is a 10 cm × 8 cm rectangle and *DEFG* is an 8 cm × 16 cm rectangle, as shown in the figure. Find the positive difference between the areas of triangles *BCH* and *HEF*, in cm^2.



Item 10

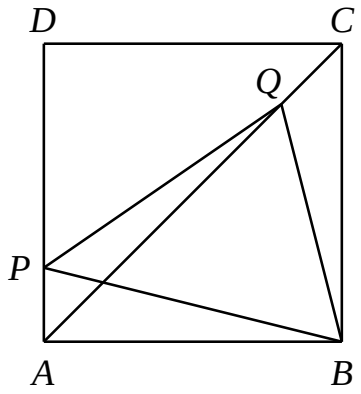
A girl and a boy played the game Rock, Scissors and Paper ten times, where Rock beats Scissors, Scissors beats Paper and Paper beats Rock. The boy used Rock three times, Scissors six times and Paper once. The girl used Rock twice, Scissors four times and Paper four times. None of the ten games was a tie. What is the number of games the boy lost?

Item 11

We define $S(n)$ as the sum of the digits of a positive integer *n*, for example $S(7) = 7$, $S(19) = 1 + 9 = 10$ and $S(1099) = 1 + 0 + 9 + 9 = 19$.
Find the value of $S(1) - S(2) + S(3) - S(4) + \ldots - S(2016) + S(2017)$.

Item 12

ABCD is a square, point *P* is on *AD*, point *Q* is on *AC*. Also, *AP* : *PD* = 1 : 3 and *AQ* : *QC* = 4 : 1 as shown in the figure. If the area of triangle *PQB* is 24 cm², what is the area of square *ABCD*, in cm²?



Item 13

In the fraction $\frac{a}{b}$, a and b are positive integers. Amanda multiplied the numerator of this fraction by 340. Which positive integer closest to 2017 should Amanda add to the denominator to obtain the fraction $\frac{2a}{3b}$?

Item 14

What is the largest value of positive integer *n* such that $\frac{n}{666} = 0.2y17y17y17\cdots$, where *y* is a single digit and $y17$ is repeating?

Item 15

Select n numbers from the consecutive positive integers 1, 2, 3, 4, … , 2017 so that no selected number is 6 times another selected number.

What is the maximum value of n?