International Mathematics Competition (TIMC 2016)

Chiang Mai, Thailand 14 - 20 August 2016

Invitational World Youth Mathematics Intercity Competition

TEAM CONTEST

Time：60 minutes

Instructions:

- Do not turn to the first page until you are told to do so.
- Remember to write down your team name in the space indicated on every page.
- There are 10 problems in the Team Contest, arranged in increasing order of difficulty. Each question is printed on a separate sheet of paper. Each problem is worth 40 points. For Problems 1, 3, 5, 7 and 9, only answers are required. Partial credits will not be given. For Problems 2, 4, 6, 8 and 10, full solutions are required. Partial credits may be given.
- The four team members are allowed 10 minutes to discuss and distribute the first 8 problems among themselves. Each student must attempt at least one problem. Each will then have 35 minutes to write the solutions of their allotted problem independently with no further discussion or exchange of problems. The four team members are allowed 25 minutes to solve the last 2 problems together.
- No calculator, calculating device, electronic devices or protractor are allowed.
- Answer must be in pencil or in blue or black ball point pen.
- All papers shall be collected at the end of this test.

English Version

For Juries Use Only

No.	1	2	3	4	5	6	7	8	9	10	Total	Sign by Jury
Score												
Score												

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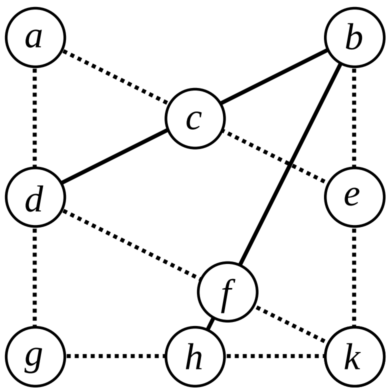
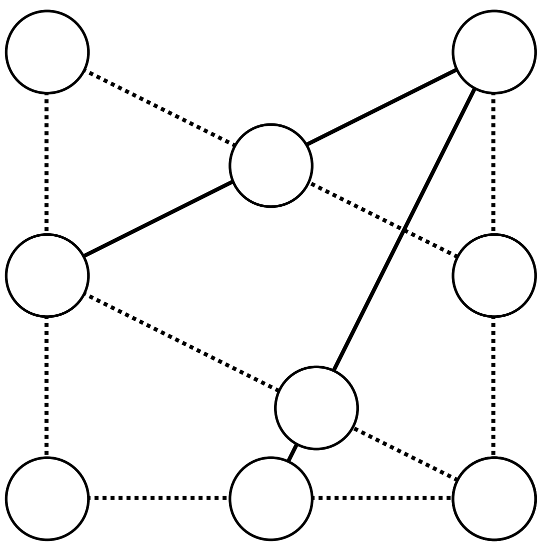
17th August, 2016, Chiang Mai, Thailand

Team : ______________________ Score : ______________

1. The diagram below shows nine circles joined by seven lines, with three circles on each line. Replace each of a, b, c, d, e, f, g, h and k by a different one of 1, 2, 3, 4, 5, 6, 7, 8 and 9, such that the number in the middle circle of a solid line is equal to the sum of the numbers in the other two circles, and the number in the middle circle of a dotted line is equal to the difference of the numbers in the other two circles.





Answer: ______________________

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2. When the digits of a three-digit number x are written in reverse order, we obtain a number y such that $x+2y=2016$. Determine the sum of all possible values of x.

Answer: ____________________

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3. How many of the first 2016 positive integers can be expressed in the form $1+2+\cdots+(k-1)+mk$, where k and m are positive integer? For example, we have $6=1+2+3\times1$ and $11=1+2\times5$.

Answer: ______________________________

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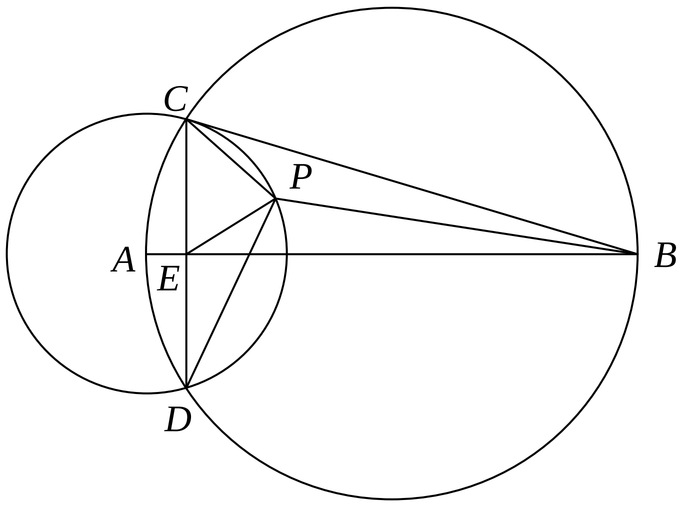
4. A circle with diameter *AB* intersects a circle with centre *A* at *C* and *D*. *E* is the point of intersection of *AB* and *CD*. *P* is a point on the second circle such that *PC* = 16 cm, *PD* = 28 cm and *PE* = 14 cm. Find the length, in cm, of *PB*.



Answer: ______________________ cm

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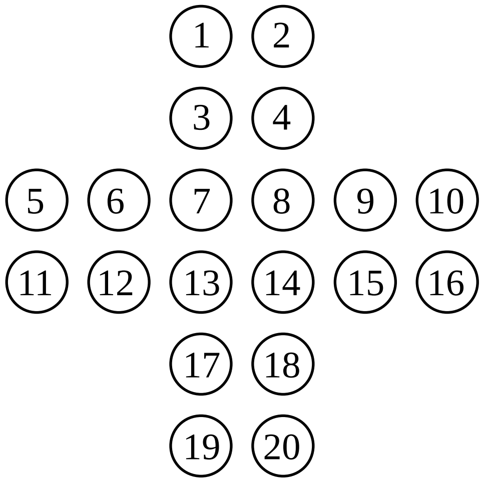
5. The diagram below shows an arrangement of 20 numbered circles. Note that circles 3, 9, 12 and 18 determine a square. What is the minimum number of circles we have to remove so that no four remaining circles determine a square?



Answer: ______________________ circles

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6. A Mathematics test consists of 3 problems, each worth an integral number of marks between 1 and 10 inclusive. Each student scores more than 15 marks, and for any two students, they obtain different numbers of marks for at least one problem. Find the maximum number of students.

Answer: ________________________ students

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7. Let x, y and z be positive real numbers such that
$\sqrt{16-x^2}+\sqrt{25-y^2}+\sqrt{36-z^2}=12$.
If the sum of x, y and z is 9, find their product.

Answer: ______________________________

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8. What is the largest number of integers that may be selected from 1 to 2016 inclusive such that the least common multiple of any number of integers selected is also selected?

Answer: ______________________________

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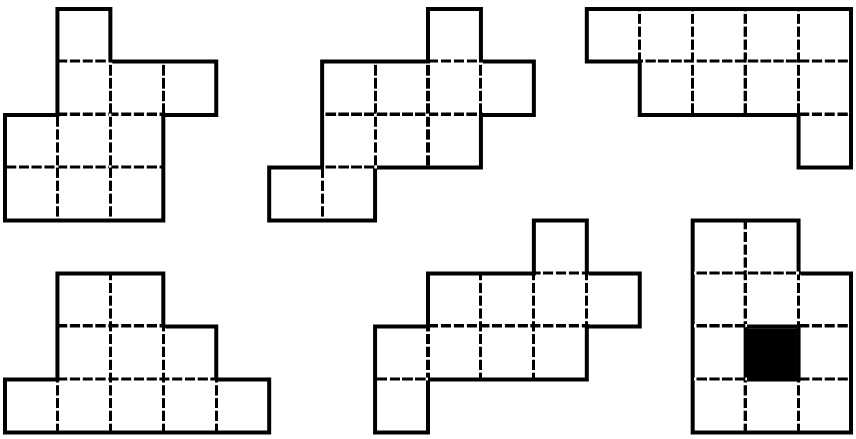
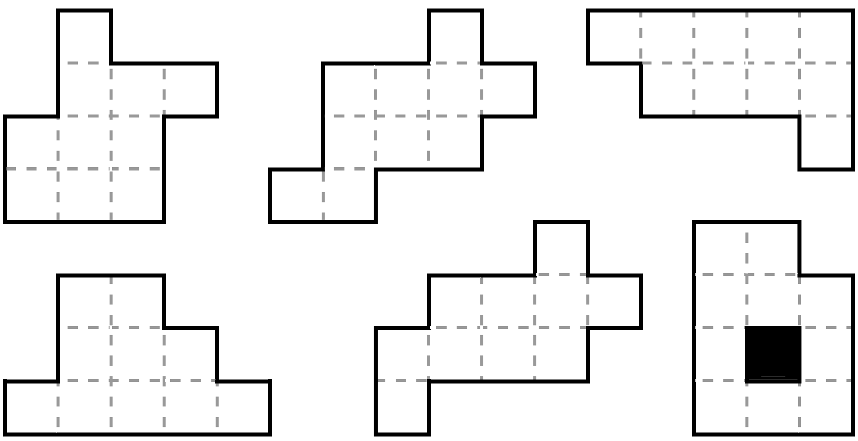
9. Dissect the six figures in the diagram below into twelve pieces, each consisting of five squares, such that no two of the twelve pieces are identical up to rotation and reflection.



Answer:



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10. Let $T(n)$ be the numbers of positive divisors of a positive integer n. How many positive integers n satisfy $T(n)=T(39n)-39=T(55n)-55$?

Answer: ______________________________