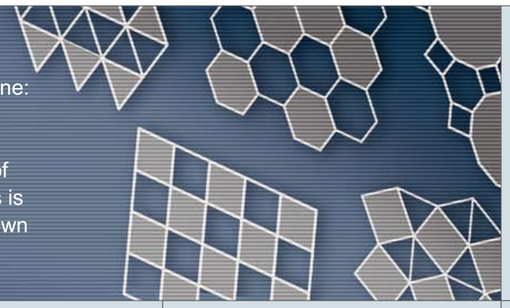
SUN 日	MON 一	TUE 二	WED 三	THU 四	FRI 五	SAT 六

Tessellation

There are three monohedral regular tilings of the plane: equilateral triangles (six of them meeting at each vertex), squares (four around each vertex) and hexagons (three around each vertex). The number of regular tilings with one or more than one type of tiles is eleven. These eleven types of regular tilings are known by the name of Archimedean Tilings.



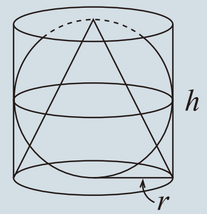
Let α, β be the roots of $x^2 + bx - 2 = 0$. Find the largest value m such that for all b in the interval $(-m, m)$ we have $\alpha > 1$ and $\beta < -1$.

1 廿六

Find the smallest natural number k such that $\sum_{n=1}^{\infty} \frac{1}{n^2} \le k$.

2 廿七

If volume of cone : volume of sphere : volume of cylinder = 1 : 2 : x, find x.



3 廿八

If a number N is chosen randomly from the set of positive integers, the probability of the unit digit of N^4 being unity is $\frac{P}{10}$, find P.

4 廿九

Simplify $\sqrt{5 \cdot \sqrt{5 \cdot \sqrt{5 \cdot \ldots}}}$.

5 三十

Given that $48^x = 2$ and $48^y = 3$.
If $8^{\frac{x+y}{1-x-y}} = b$, find b without using a calculator.

6 十一月

There are 2003 bags arranged from left to right. It is given that the leftmost bag contains 7 balls and every 7 consecutive bags contain 19 balls altogether. If the rightmost bag contains s balls, find the value of s.

7 大雪

What is the maximum number of times that a circle and a square intersect?

8 初三

設 x, y 是實數，且滿足 $x^2 + xy + y^2 = 3$。求 $u = x^2 - xy + y^2$ 的最大值。

9 初四

Suppose that n people are seated in a random manner in a row of n seats. If the probability that two particular people will be seated next to each other is 0.2, find n.

10 初五

Let $f(x)$ be a real-valued function defined on the set of real numbers such that $f(f(x + y)) = f(x + y) + f(x)f(y) - xy$. Find $f(11)$. [Hint: Find the unique function that satisfies the given condition.]

11 初六

If $P(A) = \frac{1}{6}$ and $P(B) = \frac{5}{12}$ and $P(A \mid B) + P(B \mid A) = \frac{7}{10}$, find $\frac{1}{P(A \cap B)}$.

12 初七

Given that the letters in the following long division problem represent digits from 0 to 9. Find the quotient PI.

$$\begin{array}{rcccccc} & & & & P & I & \\ \hline B & A & R & K & C & A & B & I & N \\ & & & & B & A & R & K & \\ & & & & R & S & I & N & N \\ & & & & R & S & P & C & A \\ & & & & & & P & G & A \end{array}$$

13 初八

某大樓共20層。有19人在第一層上了電梯，他們分別要去第 2 至第 20 層，每層 1 人，電梯只允許停一次，只可使 1 人滿意，其餘 18 人都要步行上樓或下樓。假設乘客每向下走 1 層的不滿意度為 1，每向上走 1 層的不滿意度為 2，所有人的不滿意度之和為 S。為使 S 最小，電梯應當停在第幾層？

14 初九

If $x + y + z = 10$ and $x^2 + y^2 + z^2 = 10$, find $\frac{xy + yz + zx}{3}$.

15 初十

Given that $0° < \theta < 90°$ and $1 + \sin\theta + \sin^2\theta + \ldots = \frac{3}{2}$. Find $18\cos^2\theta$.

16 十一

Given that p, q and r are distinct roots of the equation $x^3 - \sqrt{19}\,x^2 + x - 2 = 0$. Find $p^2 + q^2 + r^2$.

17 十二

咖啡 A 與咖啡 B 以 $x : y$ 之重量比例混合。A 的原價為 50元/千克，B 的原價為 40元/千克。若 A 的價格增加 10%，B 的價格減少 15%，則混合咖啡每千克的價格不變。問 33 千克的混合咖啡中有多少千克的咖啡 A？

18 十三

If $\overline{BY} \times \overline{BY} = \overline{RIB}$, find the number $\overline{BY}$.

19 十四

一種新型的電子產品投產，計劃兩年後使成本降低 36%，問平均每年應降低成本百份之幾？

20 十五

If 7, 1, 4, 16, x, 3, 12, 48, 53 is a sequence, find x.

21 十六

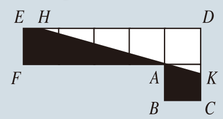
Birthday of **Srinivasa Ramanujan**. He lacked a formal mathematical education but, in 1913, a few of his early results managed to startle G. H. Hardy (1877 - 1947) who invited him to Cambridge in 1914. Ramanujan has left an unusual legacy of brilliant unconventional results.

22 冬至

在由 1, 2, 3, 4 四個數字組成的沒有重複數字的四位數中比 1234 大的數共有多少？

23 十八

$ABCDEF$ is a "L-shaped" figure formed by six squares. HAK is a straight line and the area of the shaded region is equal to $\frac{1}{2}$ of the area of $ABCDEF$. If the side length of each small square is 1 cm and the length of HK is k cm, find k^2.



24 十九

Given that the sum of k consecutive positive integers, starting from n, is 2006. Find n^2 such that k is maximal.

25 聖誕節

馬路上有編號為 1, 2, 3, ... , 9 的九盞路燈。為節省用電，可以把其中的 2 盞或以上的路燈關掉，但不能同時關掉相鄰的路燈，也不能關掉兩端的路燈。則滿足條件的關燈方法有多少種？

26 廿一

If 17, 6, 3, 9, x, 16, 8, 24, 72 is a sequence, find x.

27 聖誕節後第一個周日

How many different orders for six hot dogs are possible if there are three varieties of hot dog?

28 廿三

Birthday of **Thomas Stieltjes**. He was a pioneer in the field of moment problems and contributed to the study of continued fractions. The Thomas Stieltjes Institute for Mathematics at the University of Leiden is named after him, as is the Riemann-Stieltjes integral.

29 廿四

How many people do you need in a group to ensure at least a 70 percent probability that 2 people in the group share a birthday?

30 廿五

大小不同的兩個角相加之後為 30 度。其中一個角用度表示，為 x 度，另一個角用分表示，為 x 分。如果 x 是帶分數，求出 x 分數部份中的分子。〔註：1 度為 60 分〕

31 廿六

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