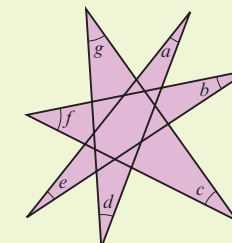| SUN 日	MON 一	TUE 二	WED 三	THU 四	FRI 五	SAT 六

拋物線天花板

聲音從一個拋物線反射物的焦點，平行傳送至對面的拋物線反射物，再經反射聚在另一焦點上。以美國國會山莊圓頂大廳南面的雕像廳為例，在廳一邊的某個定點，人們能夠清楚聽到另一邊廳的人的說話，就算發出任何噪音也並不會使傳送於大廳間的談話聲變得模糊，而站在兩者之間的人卻甚麼也聽不到。

焦點 focus　　焦點 focus

THU 四 — 1 十七
Given that $x^2 + ax + b$ is a common factor of $x^3 + 4x^2 + 5x + 6$ and $2x^3 + 7x^2 + 9x + 10$. Find a.

FRI 五 — 2 耶穌受難節 / 十八
If $a + b + c + d + e + f + g = 90n°$, find n.

SAT 六 — 3 耶穌受難節翌日 / 十九
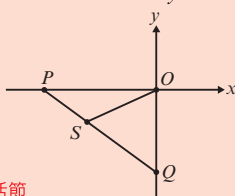Find $\int_0^1 (4y - y^2 + 4y^3 + 1)^{-\frac{2}{3}}(12y^2 - 2y + 4)\,dy$.

SUN 日 — 4 復活節 / 二十
In the figure, $P(-8, 0)$ and $Q(0, -6)$ are two points and O is origin. S is a point on PQ such that the area of $\triangle OQS$ equals one third of area of $\triangle OPQ$. Find the absolute value of y-coordinate of S.

MON 一 — 5 復活節星期一 / 清明
There are 9 cards, numbered from 1 to 9, in a bag. If 3 cards are drawn at random, the probability that all are odd is $\dfrac{k}{42}$, find k.

TUE 二 — 6 清明節翌日 / 廿一
The code of an item starts with 2 English letters followed by digits. What is the minimum length of the item code for taking care of a million items?
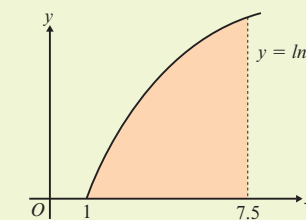
WED 三 — 7 廿二
$x + \dfrac{1}{x} = 3$, find $x^2 + \dfrac{1}{x^2}$.

THU 四 — 8 廿三
If $\begin{pmatrix} \cos 45° & -\sin 45° \\ \sin 45° & \cos 45° \end{pmatrix}^n = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, find the least value of n.

FRI 五 — 9 廿四
Find the area of shaded region (Correct to the nearest integer).
$y = \ln x$

SAT 六 — 10 廿五
Using digits 0, 1, 2, and 5, how many 3-digit numbers can be formed, which are divisible by 5? (If no digit may be repeated).

SUN 日 — 11 廿七
3 balls are chosen without replacement from an urn containing 3 red, 4 white and 5 blue balls. The probability that all the 3 chosen balls are of different colors is $\dfrac{3}{b}$. Find b.

MON 一 — 12 廿八
When $x + y = 4$, find the minimum value of $3x^2 + y^2$.

TUE 二 — 13 廿九
Given that $f\left(x + \dfrac{1}{x}\right) = x^3 + \dfrac{1}{x^3}$ and $f(4) = 4b$, find b without solving x.

WED 三 — 14 三月
$f(x)$ is a polynomial with real coefficients of degree 17. What is the maximum number of unreal roots of $f(x) = 0$ given that there is a double real root?

THU 四 — 15 初二
Birthday of **Leonhard Euler**. The most prolific mathematician of all times. Euler became totally blind in 1771 but produced almost half of his phenomenal output in St. Petersburg after 1766, with the help of several assistants.

FRI 五 — 16 初三
Find the sum of the last 4 digits of 11^{12} without finding the exact value of 11^{12}.

SAT 六 — 17 初四
A man has $4.55 in change composed entirely of dimes (10 cents) and quarters (25 cents). How many quarters does the man have so that he has the minimum number of coins?

SUN 日 — 18 初五
The cross-section of a hemisphere is the region bounded by the curve $y = \sqrt{9 - x^2}$ and the x-axis. If the volume of the hemisphere is $k\pi$, find k.

MON 一 — 19 初六
Find the longest distance from the origin to the locus: $x = -5 + 6\cos\theta$ and $y = 12 + 6\sin\theta$.

TUE 二 — 20 穀雨
Find $|k|$ ($k \neq 0$) such that the circles $x^2 + y^2 + 4x - 2y - 5 = 0$ and $x^2 + y^2 + x - 3y - k = 0$ touch each other.

WED 三 — 21 初八
4 numbers are chosen from $\{1, 2, 3, …, 9\}$ without replacement. The probability that the sum of the 4 numbers is odd is $\dfrac{10}{c}$. Find c.

THU 四 — 22 初九
Given that $f(n) = \dfrac{\sin n\pi}{4}$, where n is an integer. If $c = f(1) + f(2) + … + f(2003)$, find $9c$ (Correct to the nearest integer).

FRI 五 — 23 初十
Given $f\left(x + \dfrac{1}{x}\right) = x^2 + \dfrac{1}{x^2}$, find $f(5)$.

SAT 六 — 24 十一
The chance of getting a head to that of getting a tail for tossing a loaded coin is of the ratio of $2:3$. What is the expected number of tails obtained if the coin is tossed 40 times?

SUN 日 — 25 十二
Find the number of ways of selecting 3 letters without replacement from the word BIOLOGY.

MON 一 — 26 十三
Given that the sum of two prime numbers is 15. If product of these prime numbers is s, find s.

TUE 二 — 27 十四
Let $f_0(x) = \dfrac{1}{1-x}$ and $f_n(x) = f_0(f_{n-1}(x))$, $n = 1, 2, 3, …$. Find $f_{2000}(27)$.

WED 三 — 28 十五
Let α and β be the roots of the equation $x^2 - 8x + (R + 1) = 0$. If $\dfrac{1}{\alpha^2}$ and $\dfrac{1}{\beta^2}$ are the roots of the equation $324x^2 - rx + 1 = 0$, find r.

THU 四 — 29 十六
Birthday of **Jules Henri Poincaré**. Poincaré was the last universal genius and quintessential absent-minded professor (cf. Savant Cosinus comic strip). Poincaré conceived Special Relativity before Einstein did. His mathematical legacy includes chaos theory and topology.

FRI 五 — 30 十七
Birthday of **Johann Carl Friedrich Gauss**. At the age of 7, the Prince of Mathematics found instantly the sum (5050) of all integers from 1 to 100 (as the sum of 50 pairs, each adding up to 101). At age 19, his breakthrough about constructible polygons helped him choose a mathematical career.

APRIL 四月 2010