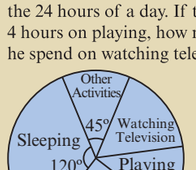
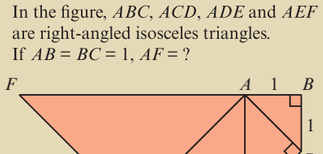
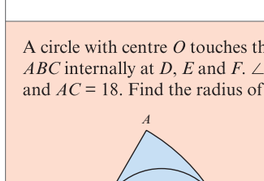
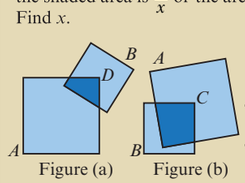
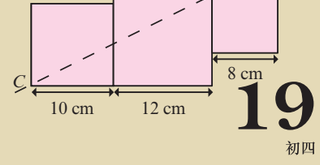
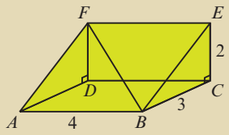
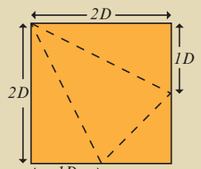
# DECEMBER
# 十二月 2009

| SUN 日 | MON 一 | TUE 二 | WED 三 | THU 四 | FRI 五 | SAT 六 |
|---|---|---|---|---|---|---|
| | | If $r = \sqrt[3]{h^3 - 7r^3}$, then the ratio $r : h$ is $a : 2$, $a = ?$<br>**1** 十五 | If $x^5 \times 9^x = 2592$, find $x$.<br>**2** 十六 | The pie chart shows how a boy spends the 24 hours of a day. If the boy spends 4 hours on playing, how much time does he spend on watching television?<br>  <br>**3** 十七 | In the figure, $ABC$, $ACD$, $ADE$ and $AEF$ are right-angled isosceles triangles. If $AB = BC = 1$, $AF = ?$<br>  <br>**4** 十八 | If $4^x + 5^x + 6^x + 7^x + 9^x + 11^x = 12^x$, find $x$.<br>**5** 十九 |
| A circle with centre $O$ touches the sector $ABC$ internally at $D$, $E$ and $F$. $\angle C = 60°$ and $AC = 18$. Find the radius of the circle.<br>  <br>**6** 二十 | If $2x = 3y = 4z$, then $\frac{x+y-z}{x-y+z} = \frac{k}{5}$. $k = ?$<br>**7** 大雪 | Find the maximum value of $2\sin^2\theta - 4\cos\theta + 4$.<br>**8** 廿二 | Find the real part of $(3 - i)(2 + i)(1 - 2i)$.<br>**9** 廿三 | Find the maximum value of $K$ if $K = 1 + n + n^2 + n^3 + \ldots$, for $0.10 \le n \le 0.90$.<br>**10** 廿四 | 修改自牧童分瓜《古算題》<br>昨日獨看瓜，因事來家，牧童盜去眼昏花，信步廟東牆外過，聽得爭嘩：十三俱分咱，十五增加；每人十六少十八，借問人有幾？會先答。<br>**11** 廿五 | If $f(x) = x^2 - 2x + p$ is divisible by $(x + 1)$, find the remainder of $f(x)$ when it is divided by $(x + 3)$.<br>**12** 廿六 |
| How many ways are there to go from $A$ to $B$ in the figure such that one can only go forward at each junction?<br>  <br>**13** 廿七 | Find the value of $n$ if $28\, e^{i\theta}\cos\theta - 14\, e^{2i\theta} = n$.<br>**14** 廿八 | Given $\left(1^2 - \frac{1}{2^2}\right) \times \left(1^2 - \frac{1}{3^2}\right) \times \left(1^2 - \frac{1}{4^2}\right) \times \ldots \times \left(1^2 - \frac{1}{15^2}\right) = \frac{8}{y}$, find $y$.<br>**15** 廿九 | $A$ and $B$ are squares with centres $C$ and $D$, respectively. In Figure (a), the shaded area is $\frac{1}{9}$ of the area of $A$. In Figure (b), the shaded area is $\frac{9}{x}$ of the area of $B$. Find $x$.<br>  <br>**16** 十一月 | If 123456789 × $M$ + $N$ = 987654321 where $M$, $N$ are one digit numbers, find $M + N$.<br>**17** 初二 | Find the product of roots of $x^3 - 8x^2 + 21x - 18 = 0$.<br>**18** 初三 | In the figure there are 3 squares and the line through $C$ bisects the 3 squares into 2 portions of equal area. Find $y$.<br>  <br>**19** 初四 |
| Given $133^n + 110^n + 84^n + 27^n = 144^n$, find $4n$.<br>**20** 初五 | Given $1^3 + 2^3 + \ldots + 6^3 = y^2$, find $y$.<br>**21** 初六 | The diagram shows a right prism with a right-angled triangle $BCE$. Find the angle between line $BF$ and the plane $ABCD$, correct to the nearest degree.<br>  <br>**22** 冬至 | A tetrahedron is formed by folding along the dotted lines in the figure. If its height is $\frac{A}{B}$ where $A$ and $B$ are positive integers, find the minimum value of $A + B$.<br>  <br>**23** 初八 | Given a sequence 6, $k$, 60, 120, 210 …, find $k$.<br>**24** 初九 | 《九章算術》盈不足<br>今有米在十斗桶中，不知其數。滿中添粟而舂之，得米七斗。問故米幾何？<br>（提示：5 升粟即 3 升米。）<br>聖誕節<br>**25** 初十 | Given $20 < R < 30$, find $R$ for $R^5 = 11\,881\,376$ without using calculators.<br>聖誕節後第一個週日<br>**26** 十一 |
| Given a sequence 0, 2, 5, 9, 14, 20, $n$, find $n$.<br>**27** 十二 | Given $1^3 + 2^3 + \ldots + 7^3 = R^2$, find $R$.<br>**28** 十三 | Given a sequence 8, 11, 17, $n$, 53, 101, find $n$.<br>**29** 十四 | Given $\cos^{-1}\{\sin[\cos^{-1}(\sin 30°)]\} = p°$, find $p$.<br>**30** 十五 | The day before yesterday I was 25 years old and on a day of the next year I will be 28 years old. Which day was I born?<br>**31** 十六 | **概率論（Probability）**<br>機率論或概率論是研究隨機性或不確定性等現象的數學。更精確地說，機率論是用來模擬實驗在同一環境下會產生不同結果的情況。典型的隨機實驗有擲骰子、扔硬幣、抽撲克牌等。<br>  | |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