

SUN 日

MON 一

TUE 二

WED 三

THU 四

FRI 五

SAT 六

SEPTEMBER

九月 2009

A student bought two story books at \$30 and \$70 respectively. He sold the first book at a profit of 20% and the second book at a loss of 10%. Find the percentage of the overall loss.

1

十三

Given that n is a positive integer, if $x + x^{-1} = 2$, find the value of $x^n + x^{-n}$.

2

十四

Given that m is a constant, find x if $\begin{cases} mx - m = 26 \\ x^2 + x + 1 = m \end{cases}$.

3

十五

Find the maximum value of A if $A = 1 + n + n^2 + n^3 + \dots$, for $0.25 \leq n \leq 0.75$.

4

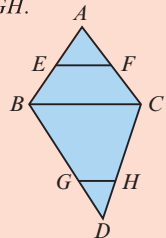
十六

Find the unit digit of $2008^{2008} + 2009^{2009}$.

5

十七

E and F are the mid-points of AB and AC respectively. G and H divide DB and DC respectively in the ratio 1 : 3. Suppose $EF = 12$, find GH .



6

十八

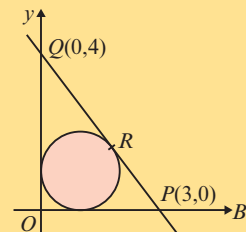
Given $(2^3 + 1)(2^6 + 1)(2^{12} + 1)(2^{24} + 1) = \frac{2^n - 1}{k}$ where n is a positive integer, find k .

7

白露

In the diagram, the inscribed circle of $\triangle OPQ$ touches PQ at R .

R is $(\frac{9}{5}, \frac{k}{5})$, $k = ?$



8

二十

$ABCD$ is a line segment in which $AB : BC : CD = 3 : 2 : 1$. $A = (4, 5)$, $D = (10, 11)$, $C = (p, 10)$, find p .

9

廿一

Ten litres of a mixture contain 60% of alcohol and 40% of water by volume. How many litres of water should be added so that the resulting mixture contains 30% of alcohol by volume?

10

廿二

If an equilateral triangle of side length k cm consists of exactly 121 equilateral triangles of side lengths 1 cm, find k .

11

廿三

If A , B and C finish running the same distance in 3, 4 and 5 minutes respectively, then A 's speed : B 's speed : C 's speed = 20 : 15 : s , find s ?

12

廿四

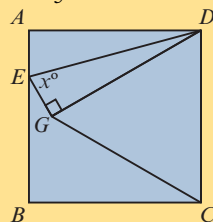
If $\overline{ABC} + \overline{ABC} + \overline{ABC} = \overline{BBB}$, where A , B and C are distinct positive integers, find $A + B + C$.

13

廿五

$ABCD$ is a square and GCD is an equilateral triangle. E is a point on AB such that $\angle EGD = 90^\circ$.

Find $\frac{x}{5} - 1$.



14

廿六

Given $f(x) = 4x^2 + bx - 49$ and $f(x) = f(-x)$, find $f(4)$.

15

廿七

Given a sequence 0, -1, 4, -9, x , -25, find x .

16

廿八

Find the maximum value of $2\sin^2\theta - 8\sin\theta + 7$.

17

廿九

Find the coefficient of x in the expansion of $(1 + 2x)^3(1 + 3x)^4$.

18

三十

Use 4 distinct nonzero digits to form 24 4-digit numbers. Arranging in ascending order, the 2nd is a multiple of 5, the 23rd is even but not divisible by 4 and the difference of the 5th and 20th is between 3000 and 4000. Find the sum of the digits of the 24th.

19

八月

Given that $y \propto \frac{1}{x}$. If x is increased by 25%, find the percentage decrease in y .

20

初二

The length and width of a cuboid are both increased by 10% and the height remains unchanged, find the percentage increase in volume.

21

初三

If $\tan A = -\frac{5}{4}$, then $\frac{2\sin A - 3\cos A}{3\sin A - 2\cos A} = \frac{k}{23}$. Find k .

22

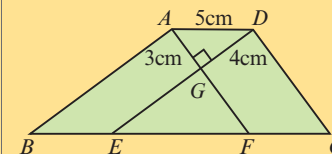
初四

轉錄自雞兔同籠《古算題》
今有雞兔同籠，上有三十五頭，
下有九十四足，問雞幾何？

23

秋分

In the diagram, $ABED$ and $AFCD$ are parallelograms and the area of $ABED$ is 36. Find the area of $\triangle GEF$.



24

初六

Find the remainder of $(x + 1)(x^2 - 3) + 1$ when it is divided by $x - 3$.

25

初七

If $0.\dot{7}2 + 0.\dot{5}3 = 1.x$, find x .

26

初八

If $a : c = 2 : 3$, $b : c = 5 : 4$, $(a + c) : (b + c) = 20 : x$, find x .

27

初九

轉錄自《九章算術》勾股
今有戶高於廣六尺八寸，兩隅相去適一丈，問戶廣幾何？

28

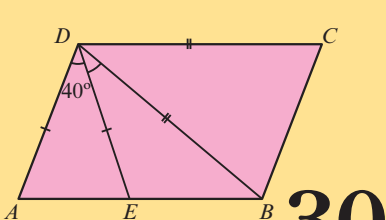
初十

Find the real part of $(5 + 2i)(5 - 2i)$.

29

十一

Given $ABCD$ is a parallelogram, find $\angle BDE$.



30

十二

電腦圖形學 (Computer Graphics)

電腦圖形學(Computer Graphics, 簡稱CG)是一種使用數學演算法將二維或三維圖形轉化為電腦顯示器的柵格形式的科學。主要研究如何在電腦中表示圖形、以及利用電腦進行圖形的計算、處理和顯示的相關原理與演算法。圖形通常由點、線、面、體等幾何元素和灰度、色彩、線型、線寬等非幾何屬性組成。一類是基於線條資訊表示的,如工程圖、等高線地圖、曲面的線框圖等;另一類是明暗圖,也就是通常所說的真實感圖形。



Produced by:

Mathematics Education Section
EDUCATION BUREAU

Contents from Maths Calendar 2009. Department of Applied Mathematics, The Hong Kong Polytechnic University

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