



MathConceptition

2024

S2

Question Booklet

問題簿

Time: 1 hour

Calculators are NOT permitted.

Instructions:

- 1. DO NOT OPEN THIS QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.**
- 2. If the information printed on your answer sheet is not correct, please inform the invigilator immediately.**
- 3. Please use a pencil and write your answers neatly ONLY on the answer sheet provided. DO NOT write or draw in the circle next to each answer box. No mark will be given if you failed to follow this instruction.**
- 4. Unless otherwise specified, all answers must be in exact value and in its simplest form. Writing the units for the answers is NOT necessary.**
- 5. Rough-work sheets provided will be collected at the end of the contest but they will not be marked.**
- 6. Diagrams in this question booklet are not necessarily drawn to scale.**

限時：1 小時

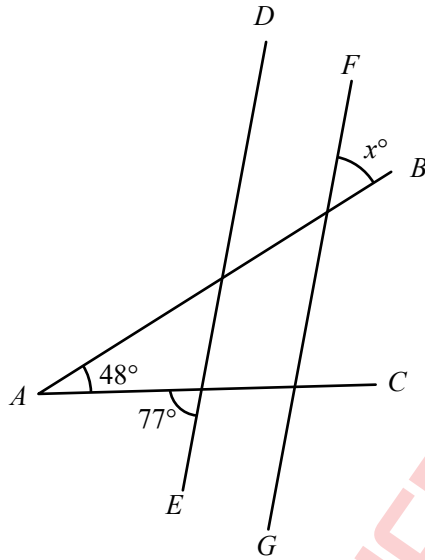
不允許使用計算機。

比賽須知：

- 1. 未宣布開始前，切勿翻閱此問題簿。**
- 2. 請核對答題紙上列出的資料是否與你相符。如有問題，請舉手。**
- 3. 所有答案必須寫在答題紙內，並須用鉛筆作答。請勿填寫或畫花題號後方的圓圈，否則該題答案將會作廢。**
- 4. 除非題目特別表明，所有答案均不需填寫單位，但必須以準確數值及最簡方式表示。**
- 5. 比賽完結時監考員會收回桌上的草稿紙，但草稿紙上所書寫的任何文字或圖表將不獲評閱。**
- 6. 此問題簿的附圖不一定依比例繪成。**

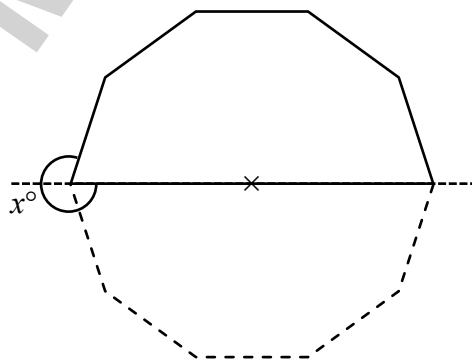
- 1) The following figure is formed with four straight lines AB , AC , DE and FG . [3%]
 Given that $DE \parallel FG$, find x .

下圖以四條直線 AB 、 AC 、 DE 和 FG 組成。已知 $DE \parallel FG$ ，求 x 。



- 2) The figure below shows a hexagon that is formed by cutting away half of a regular decagon with a horizontal line. Find x . [3.1%]

下圖所示的六邊形是由一個正十邊形沿水平線切去一半所形成的。
 求 x 。



- 3) If $\sqrt{sv} = 13$, $\sqrt{ts} = 7$ and $\sqrt{vt} = 2$, where s , t and v are all positive, then the value of stv is ____? [3.2%]

若 $\sqrt{sv} = 13$ 、 $\sqrt{ts} = 7$ 及 $\sqrt{vt} = 2$ ，其中 s 、 t 和 v 都是正數，則 stv 的值是 ____?。

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- 4) 10 workers can demolish a house in 5 whole days. However, 6 of them were transferred to another site at the beginning of the 5th day. Assuming each worker does the exact same amount of work, how many hours will it take for the remaining workers to complete the remaining demolition? [3.3%]

10 名工人能在 5 整天拆卸一間屋。然而，其中 6 名工人在第 5 天開始時被調往另一個工地。假設每位工人都做一樣份量的工作，剩下的工人還需要多少小時才能完成拆卸？

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- 5) Alan and Ben are comparing their balances in their bank accounts. If Ben gives Alan \$48.2 thousands, then they will have the same balance. If Alan gives Ben \$34 thousands, then Ben's balance will be three times as much as Alan's balance. They have \$ ___?___ altogether in their bank accounts. [3.4%]

雅文和達明在比較他們的銀行帳戶餘額。若達明給了雅文 \$4.82 萬，則二人的餘額相同。若雅文給了 \$3.4 萬達明，則達明的餘額是雅文的三倍。他們二人帳戶餘額合共有 \$ ___?___。

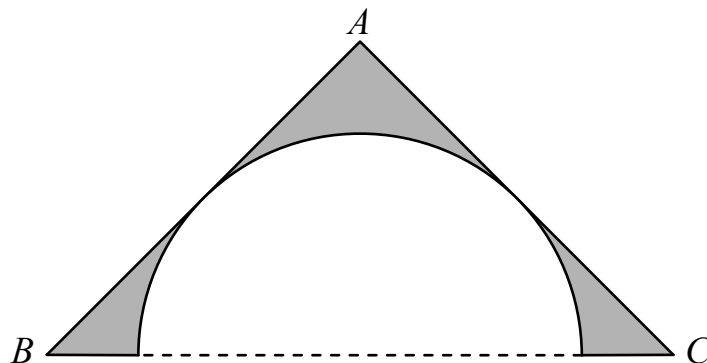
- 6) The figure shows the remaining part of a right-angled isosceles triangle ABC after cutting out the largest semi-circle from it. [3.5%]

If $BC = \sqrt{980}$ cm, then the area of the shaded region is ___?___ cm^2 .

(Take π as $\frac{22}{7}$)

圖中所示為一個被剪下最大的半圓的直角等腰三角形 ABC 的餘下部分。若 $BC = \sqrt{980}$ cm，則陰影部分面積為 ___?___ cm^2 。

(取 π 為 $\frac{22}{7}$)

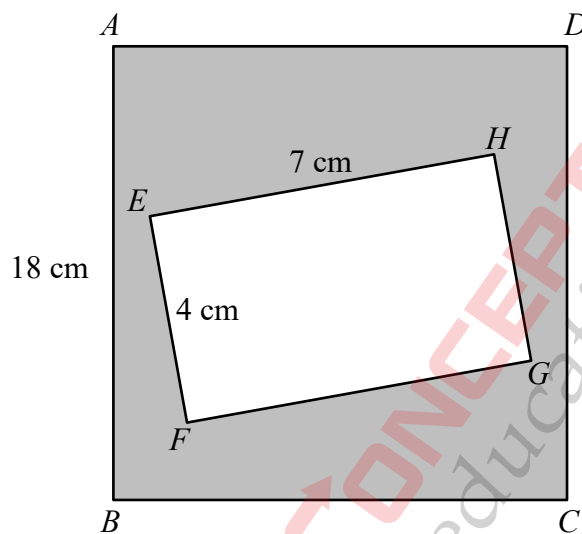


- 7) In the figure, the lengths are measured correct to the nearest cm. $ABCD$ is a square and $EFGH$ is a rectangle. [3.6%]

The lower limit of the area of the shaded region is ___?___ cm^2 .

在圖中，所有長度量度值都是準確至最接近的 cm 。 $ABCD$ 是一個正方形和 $EFGH$ 是一個長方形。

陰影部分面積的下限是 ___?___ cm^2 。



- 8) Factorise $y^{p+6} + xy^{p+4} - xy^{p+3} - x^2y^{p+1}$, where p is a positive integer. [3.7%]

因式分解 $y^{p+6} + xy^{p+4} - xy^{p+3} - x^2y^{p+1}$ ，其中 p 是一個正整數。

- 9) Find the sum of the coefficient of x and the constant term of the following expression. [4.8%]

求下列數式中 x 的係數和常數項之和。

$$\frac{\frac{2}{1+2x} - \frac{1}{2x+1}}{\frac{2}{5x+1}}$$

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- 10) What is the number of possible isosceles triangles that can be formed by choosing any 3 vertices from a cube? [4.9%]

以正方體其中 3 個頂點作三角形的頂點，可以製作多少個等腰三角形？

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- 11) Given that $(Ax + 5)(Bx - 3) \equiv 91x^2 + Cx - 15$, where A and B are positive integers. Find the sum of all the possible values of C . [5.1%]

已知 $(Ax + 5)(Bx - 3) \equiv 91x^2 + Cx - 15$ ，其中 A 和 B 都是正整數。求 C 的所有可能值之和。

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- 12) Given that 1 006 011 006 001 has an odd number of factors, find the factor that is in the middle when the factors are ordered from the smallest to the largest. [5.2%]

已知 1 006 011 006 001 的因數數目為奇數，求當其因數由小至大排列時，排在中間的因數。

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- 13) Find the number of triangles that satisfy all of the following criteria. [6.3%]
(Congruent triangles are considered to be the same triangle.)

- (i) The perimeter is 38 cm.
- (ii) The length (in cm) of each side is an integer.
- (iii) The shortest side is not shorter than 8 cm.

求能滿足下列所有條件的三角形的數目。

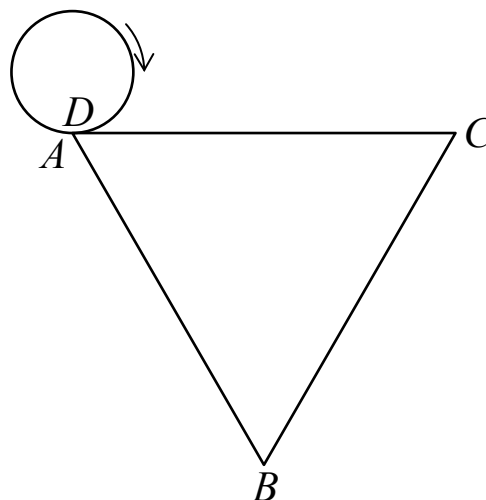
(全等三角形均視為同一個三角形。)

- (i) 周界為 38 cm。
- (ii) 每一條邊的長度都是整數。(以 cm 為單位)
- (iii) 最短的一邊不短於 8 cm。

- 14) In the figure, ABC is an equilateral triangle. Point D on the circle is currently at the bottom of the circle, and it is overlapping point A on the triangle. The circle rolls along the perimeter of the triangle until point D overlaps with point A once more. Given that the ratio of the circumference of the circle to the perimeter of the triangle is $1 : 3$, how many revolutions does the circle make? [6.4%]

在圖中， ABC 是一個等邊三角形。 D 是圓上的一點。點 D 目前在圓的最低點，並與點 A 重疊。該圓沿三角形的周界滾動，直至點 D 再次與點 A 重疊。若圓的圓周和三角形的周界之比為 $1 : 3$ ，則圖中的圓自轉了多少次？

For example, 1 revolution:
例如，自轉 1 次：



- 15) Find the number that becomes a square number when either 134 or 187 is added to it. [6.5%]

求與 134 或 187 分別相加後都會變成正方形數的數字。

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- 16) Let n be a positive even number less than 60. Find the number of n such that there exists only one pair of positive integers x and y satisfying the equation $x^2 - y^2 = n$. [6.6%]

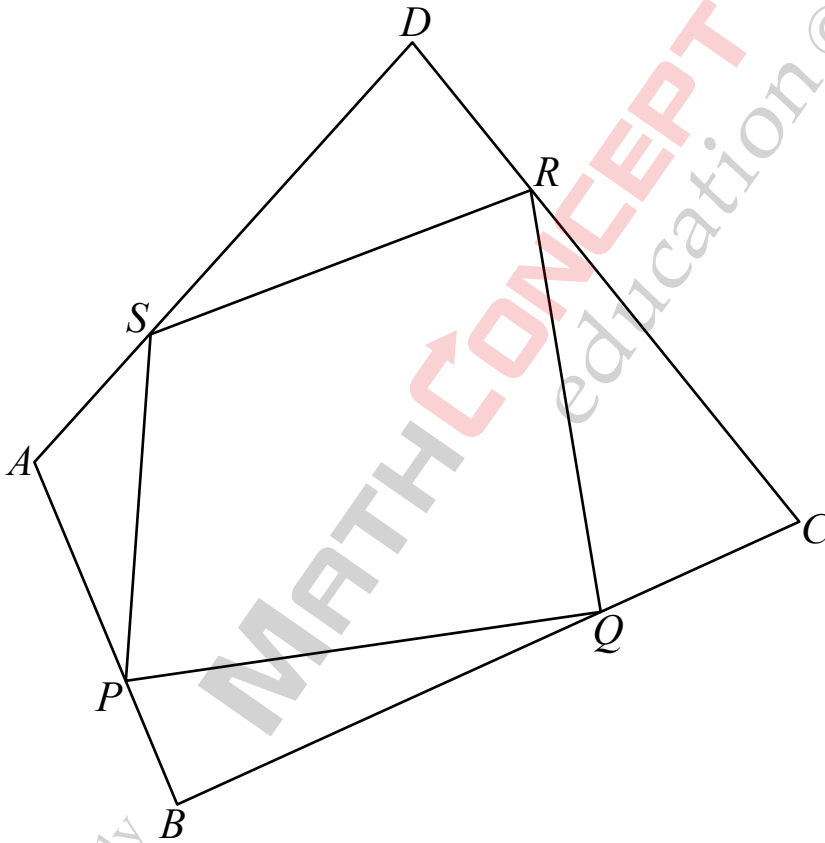
設 n 為小於 60 的正偶數，求使得只有一組正整數 x 和 y 能滿足方程 $x^2 - y^2 = n$ 的 n 的數目。

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- 17) P, Q, R and S are points on AB, BC, CD and AD of an irregular convex quadrilateral $ABCD$ respectively. If the area of $ABCD$ is 2025 square units and $\frac{AP}{PB} = \frac{BQ}{QC} = \frac{CR}{RD} = \frac{DS}{SA} = 4$, then the area of $PQRS$ is _____ square units. [6.7%]

P, Q, R 和 S 分別為不規則凸四邊形 $ABCD$ 的 AB, BC, CD 和 AD 上的點。若四邊形 $ABCD$ 的面積為 2025 平方單位，

且 $\frac{AP}{PB} = \frac{BQ}{QC} = \frac{CR}{RD} = \frac{DS}{SA} = 4$ ，則 $PQRS$ 的面積是 _____ 平方單位。



- 18) There are 17 perfect squares between N to $N + 2024$ exclusively for some positive integer N . The lowest possible value of N is denoted as L . For $N = L$, when the 17 perfect squares are arranged in ascending order, the negative square root of the value of the 7th perfect square is denoted as R . Find $L + R$. [6.8%]

對於某正整數 N ，在 N 與 $N + 2024$ 之間（不包括 N 和 $N + 2024$ ）有 17 個完全平方。 N 的最小值記為 L 。對於 $N = L$ ，當那 17 個完全平方由小至大排列時，第七個完全平方的值的負平方根記為 R 。求 $L + R$ 。

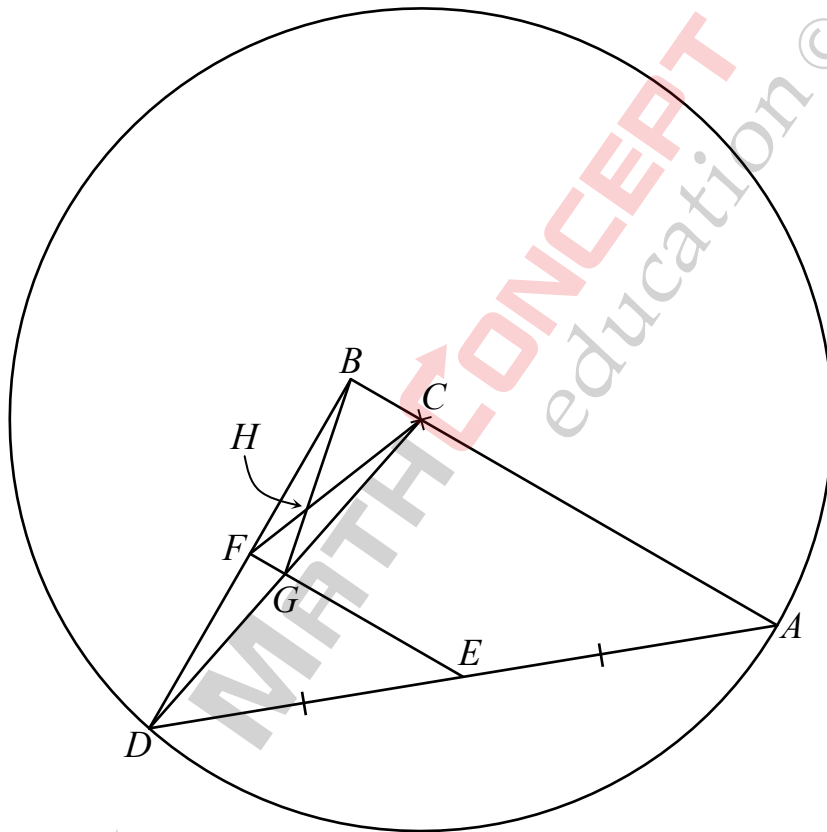
- 19) It is known that the value of $\frac{12^{10} - 1}{13^2 - 26}$ has only 4 factors, find the greatest prime factor of the value. [6.9%]

已知 $\frac{12^{10} - 1}{13^2 - 26}$ 的值只有 4 個因數，求該數值的最大質因數。

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- 20) In the figure, C is the centre of the circle. E is a point on AD such that $AE = ED$. F is a point on BD such that $EF \parallel AB$. H is the intersection of BG and CF . ACB , DGC and EGF are straight lines. If $AD = 10$ cm, $AB = 8$ cm and $AB \perp DB$, find the height of $\triangle GCH$ in cm with respect to the base GC . [7%]

在圖中， C 是圓的圓心。 E 是 AD 上的一點，使得 $AE = ED$ 。 F 是 BD 上的一點，使得 $EF \parallel AB$ 。 H 是 BG 與 CF 的交點。 ACB 、 DGC 和 EGF 都是直線。若 $AD = 10$ cm， $AB = 8$ cm， $AB \perp DB$ ， $\triangle GCH$ 的高（以 GC 作為底）是多少厘米？



End of paper
全卷完



REG NO			S2
NAME			
GRADE			
SEAT			

ANSWER SHEET

IDCHECK

ABSENT

ANSWER		ANSWER	
1	29	11	224
2	288	12	1 003 001
3	182	13	18
4	60	14	$3\frac{2}{3}$ or $\frac{11}{3}$ or in words e.g. three and two thirds, etc.
5	328 800	15	542
6	52.5 or $52\frac{1}{2}$ or $\frac{105}{2}$	16	8
7	272.5 or $272\frac{1}{2}$ or $\frac{545}{2}$	17	1377
8	$y^{p+1}(x + y^2)(y^3 - x)$	18	2249
9	3.4 or $3\frac{2}{5}$ or $\frac{17}{5}$	19	22 621
10	32	20	$\frac{14}{25}$ or 0.56

