

Mathematical literacy (數學能力) is an individual's capacity to identify, to understand, and to engage in mathematics and make well-founded judgements about the role that mathematics plays, as needed for an individual's current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen.

Three dimensions of mathematical literacy:

- ✧ Processes
- ✧ Content
- ✧ Context

Mathematical Processes

1. mathematical thinking and reasoning
2. mathematical argumentation
3. mathematical communication
4. modelling
5. problem posing and solving
6. representation
7. using symbolic, formal and technical language and operations
8. use of aids and tools

Levels of Mathematical Competency

Class 1: reproduction, definitions, and computations

Class 2: connections and integration for problem solving

Class 3: mathematisation, mathematical thinking,
generalisation and insight

Mathematical Content

in terms of “overarching concepts”

(1) Change and relationships

(2) Space and shape

(3) Quantity and uncertainty *

* NOT to be assessed in the current test

Mathematical Situations and Contexts

(culturally relevant)

For a student (in order of relevance or distance):

Private life (daily life), school life, work and sports, the local community and society as encountered in daily life, and scientific contexts

Tasks based on “*authentic*” contexts which are likely to occur in real-world setting

Scores in the Test on Mathematical Literacy

(all expressed in percentages)

	English version	Chinese version	Pooled together
Total math score			
Boys	66.16	57.83	59.34
Girls	59.34	53.60	54.99
All	62.20	55.76	57.12
Score on "Change" items			
Boys	61.65	53.87	55.28
Girls	55.56	49.90	51.27
All	58.11	51.93	53.24
Score on "Space" items			
Boys	64.36	55.65	57.22
Girls	56.07	50.51	51.85
All	59.55	53.13	54.49

Gender difference:

Boys scored significantly higher than girls in “Total math score,” “Score on Change items,” and “Score on Space items” in both language versions (and therefore in the pooled results).

Difference in performance in the two content areas:

- (1) Boys scored significantly higher in items of “Space and shape” than in items of “Change and relationships” in both language versions (and therefore in the pooled results).
- (2) This is NOT found for girls.
- (3) Students (boys and girls together) scored significantly higher in items of “Space and shape” than in items of “Change and relationships” in both language versions (and therefore in the pooled results).

Space and shape

Easiest item: M144Q03 (mean score: 0.91)

(no. of painted surfaces on a block)

Hardest item: M266Q01 (mean score: 0.18)

(perimeter of some irregular polygons)

Change and relationships

Easiest item: M155Q04 (mean score: 0.93)

(considering change in some statistics)

Hardest item: M192Q01 (mean score: 0.28)

(rise of water level in containers of various shapes)

三角形

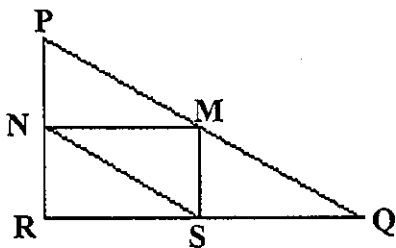
問題 64： 三角形

M161Q01

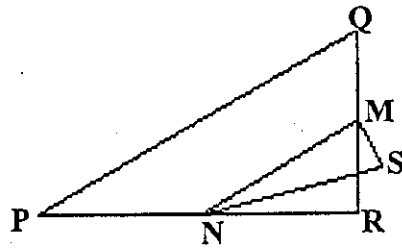
圈出一個符合以下描述的圖形。

三角形 PQR 是直角三角形，R 是直角。RQ 線較 PR 線短，M 是 PQ 線的中點，而 N 則是 QR 線的中點，S 是三角形內的一點，MN 線較 MS 線長。

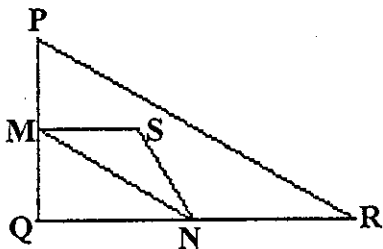
A



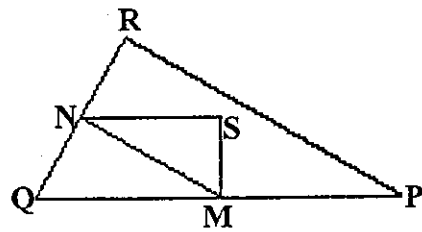
B



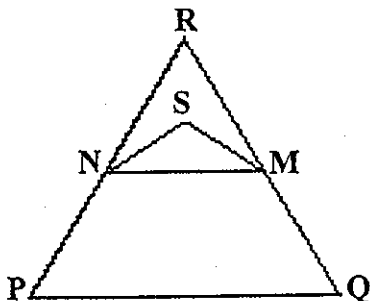
C



D



E



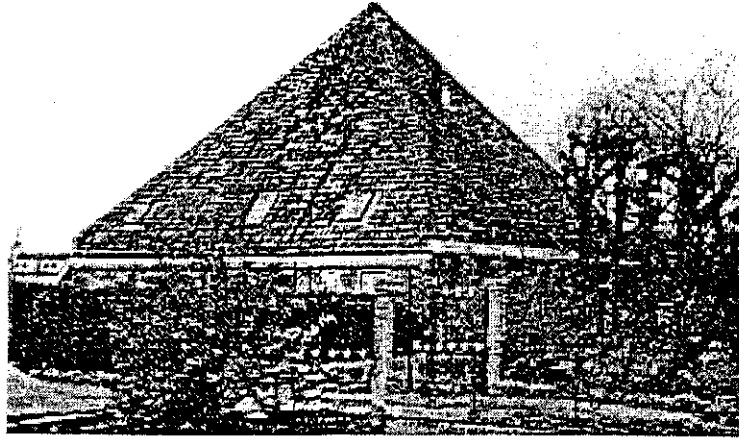
M161Q01 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.78	0.68
Girls	0.70	0.64
All	0.73	0.66

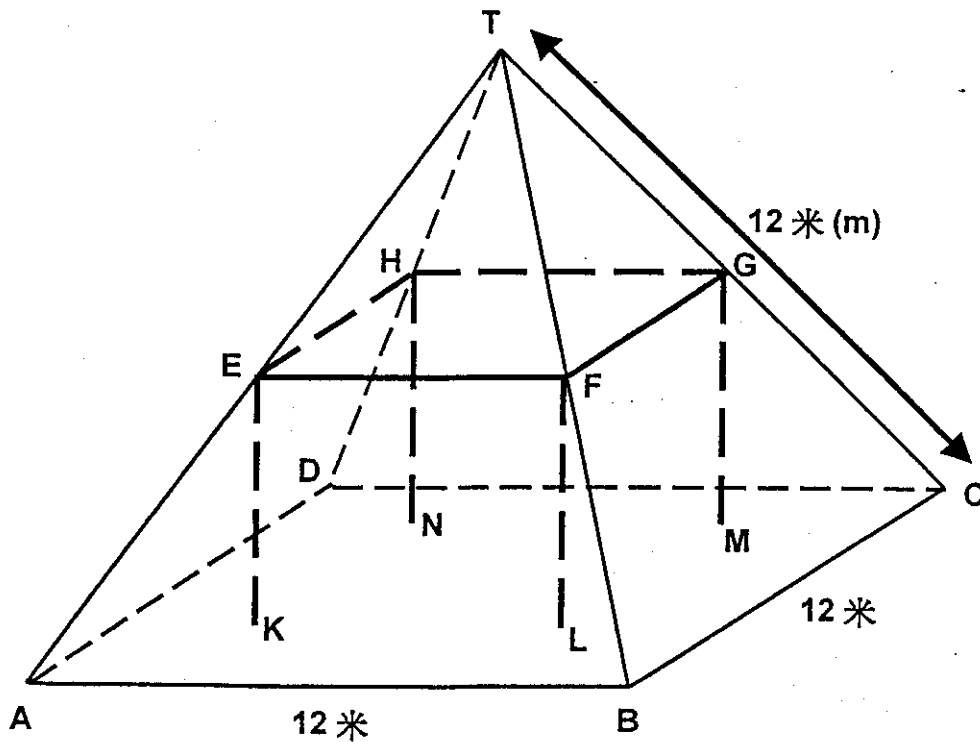
Process: Competency Class 1
 Content: Space and Shape
 Situation: Scientific

農場

下面這幀相片是一間屋頂呈金字塔形的農舍。



以下是一名學生所繪製的農舍屋頂的數學模型，並已列出不同的長度。



模型中，閣樓地板 ABCD 是個正方形。支撐屋頂的橫樑是方木架（直棱柱）EFGHKLMN 的邊緣。E 是 AT 的中點，F 是 BT 的中點，G 是 CT 的中點，H 是 DT 的中點。金字塔頂的所有邊長都是 12 米。

問題 45：農場

M037Q01

請計算出閣樓地板 ABCD 的面積。

閣樓地板 ABCD 的面積是 = 144 平方米

Process: Competency Class 1
Content: Space and Shape
Situation: Occupational

問題 46：農場

M037Q02

請計算出 EF 的長度。EF 是方木架的其中一條水平橫樑。

EF 的長度是 = 6 米

Process: Competency Class 2
Content: Space and Shape
Situation: Occupational

M037Q01 Mean Scores (max: 1)

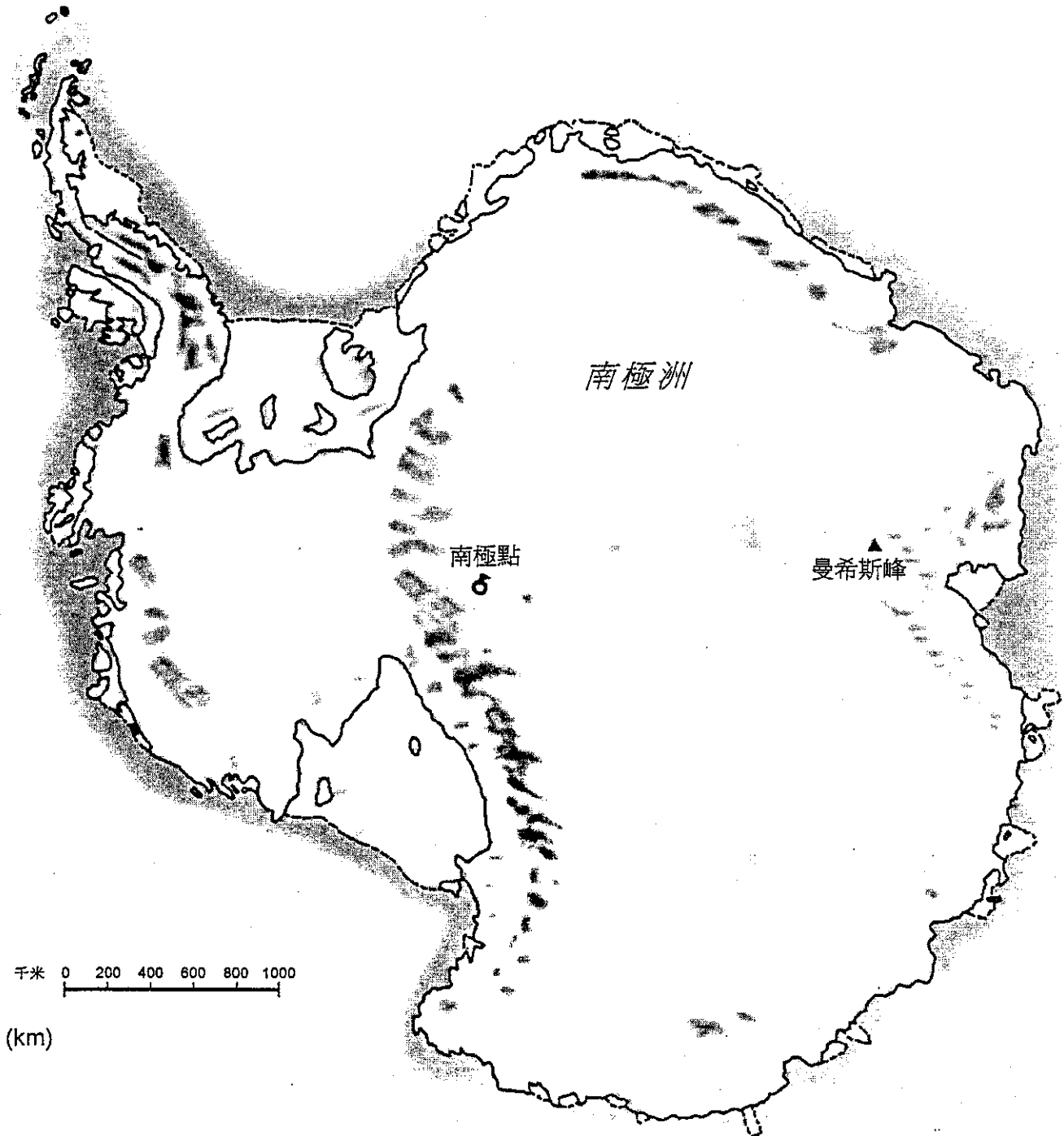
	English Version	Chinese Version
Boys	0.96	0.89
Girls	0.94	0.87
All	0.95	0.88

M037Q02 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.91	0.86
Girls	0.87	0.83
All	0.88	0.85

陸地的面積

南極洲地圖



問題 53： 陸地的面積

M148Q02- 01 02 11 12 13 14 21 22 23 24 25 99

運用地圖的比例尺，估計出南極洲的面積。

列出和說明估計方法（若有需要，可以在地圖上表示出你的估計方法）。

Process: Competency Class 2
Content: Space and Shape
Situation: Personal

12 000 000 km²
- 18 000 000 km²

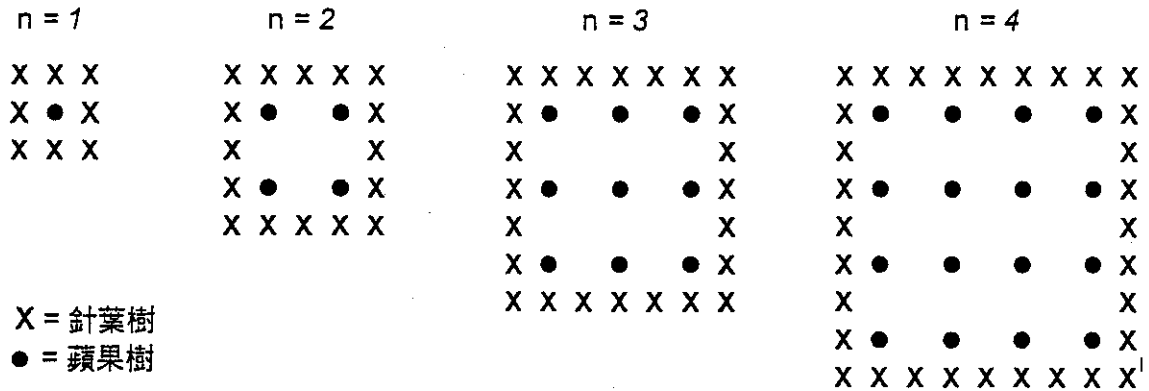
M148Q02 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.57	0.515
Girls	0.55	0.49
All	0.56	0.50

蘋果

一個農夫按照正方形的規律種植蘋果樹。為了保護果樹免受強風侵襲，他在果園的周圍栽種了針葉樹。

下面是栽種情況的示意圖，根據蘋果樹的行數 (n)，你可以看到蘋果樹和針葉樹的種植規律。



問題 49：蘋果

M136Q01- 01 02 11 12 21 99

請完成下表：

n	蘋果樹棵數	針葉樹棵數
1	1	8
2	4	
3		
4		
5		

Process: Competency Class 2
Content: Change and Relationships
Situation: Educational

M136Q01 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.905	0.825
Girls	0.88	0.825
All	0.89	0.825

問題 50：蘋果

M136Q02- 00 11 12 13 14 15 9 9

你可以用以下兩條公式，計算出上述方式所種植的蘋果樹和針葉樹的棵數：

蘋果樹的棵數 = n^2

針葉樹的棵數 = $8n$

n 是蘋果樹的行數。

Process: Competency Class 2
Content: Change and Relationships
Situation: Educational

若 n 等於某個數值時，蘋果樹的棵數與針葉樹的棵數便會相等。現試求出這個 n 的數值，並說明計算的方法。

M136Q02 Mean Scores (max: 1)

.....
 $n=8$

	English Version	Chinese Version
Boys	0.90	0.79
Girls	0.80	0.76
All	0.84	0.77

問題 51：蘋果

M136Q03- 01 02 11 21 99

假設這個農夫要建一個更大、可以種植更多果樹的果園。當他擴建果園時，哪一種樹的棵數會增加得較快？是蘋果樹還是針葉樹？請解釋你是如何找到答案的。

.....

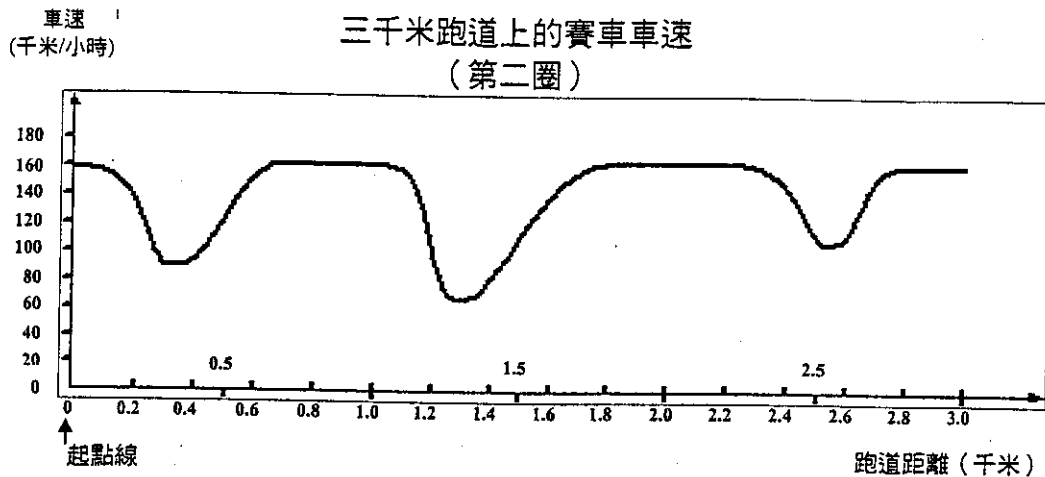
Process: Competency Class 3
Content: Change and Relationships
Situation: Educational

M136Q03 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.48	0.335
Girls	0.38	0.27
All	0.42	0.30

賽車速度

下圖顯示一架賽車沿著一條 3 千米(km)的平跑道，跑第二圈時的速度變化情形。



問題 57：賽車速度

M159Q01

從起點線到跑道上最長直線路段的起始大概距離多少？

- A 0.5 千米
- ⓑ 1.5 千米
- C 2.3 千米
- D 2.6 千米

Process: Competency Class 1
Content: Change and Relationships
Situation: Scientific

M159Q01 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.59	0.44
Girls	0.51	0.31
All	0.55	0.38

問題 58：賽車速度

根據記錄，第二圈的最低車速是在哪個地方？

- A 起點線
- B 大約 0.8 千米
- Ⓒ 大約 1.3 千米
- D 在跑道的半路

Process: Competency Class 1
Content: Change and Relationships
Situation: Scientific

M159Q02 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.89	0.91
Girls	0.87	0.88
All	0.88	0.90

Process: Competency Class 2

問題 59: 賽車速度

Content: Change and Relationships ^{M159Q03}
Situation: Scientific

你如何形容賽車在 2.6 千米和 2.8 千米之間的速度情況?

- A 賽車維持均速。
- B 賽車在加速。
- C 賽車在減速。
- D 不能夠從圖中看出賽車的速度。

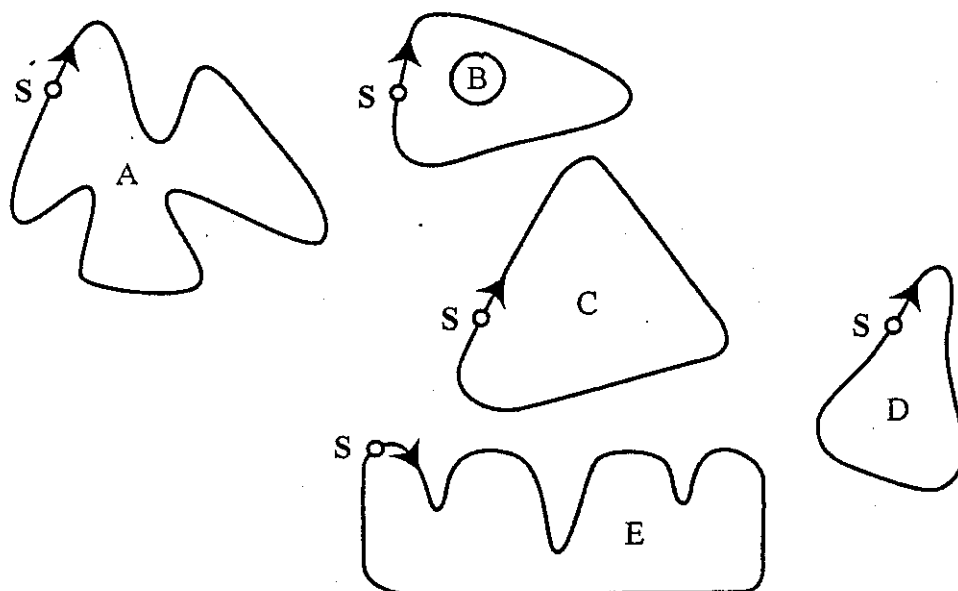
M159Q03 Mean Scores (max: 1)

	English Version	Chinese Version
Boys	0.94	0.85
Girls	0.95	0.81
All	0.95	0.83

問題 60: 賽車速度

下面有 5 張不同的跑道圖。

哪幅圖是該輛賽車行駛的賽道?



S: 起點

M159Q05 Mean Scores (max: 1)

Process: Competency Class 2
Content: Change and Relationships
Situation: Scientific

	English Version	Chinese Version
Boys	0.57	0.48
Girls	0.34	0.25
All	0.44	0.37