2025

AUSTRALIAN MATHEMATICS COMPETITION

AMC.

AUSTRALIAN MATHS TRUST

Senior
Years 11–12

DATE
5 August

TIME ALLOWED
75 minutes

Information 考試說明

- There are 30 questions: 25 multiple-choice and 5 integer.
  本次考試共 30 題，包含 25 題單選題和 5 題答案爲整數 000~999 的選填題。
- You are allowed 75 minutes to do the questions.
  考試時長爲 **75 分鐘**。
- There are no penalties for incorrect answers.
  答錯不扣分。
- The questions have been checked thoroughly. Each question is clearly written and no further explanation will be given.
  本次考試的所有試題已仔細檢查。每題均清楚陳述，不會提供更多解釋。
- Diagrams are not drawn to scale. They are intended only as aids.
  圖形並非按比例繪製，僅供參考。

Competition rules 考試規則

- Do not open the paper until told to do so.
  收到監考老師指示前，請勿翻開試卷。
- Mobile phones and smart watches are not allowed.
  禁止使用手機和智慧型手錶。
- You may not use calculators.
  不允許使用計算機。

No student may sit the competition more than once or sit more than one division of the competition. AMT conducts integrity checks on competition results and reserves the right to withhold results or disqualify students if plagiarism or duplicate sittings are suspected.

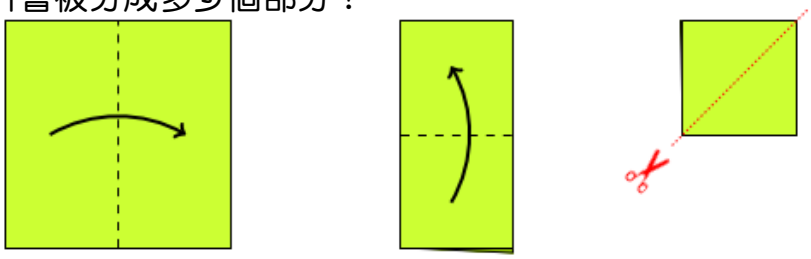
IMPORTANT

All papers must be immediately returned to a supervisor at the end of the competition.
This paper is not for circulation or distribution until Monday 29 September 2025.

TURN THE BOOKLET OVER AND READ THE INSTRUCTIONS ON THE BACK COVER.

Senior Division
Questions 1 to 10, 3 marks each
1-10 題，每題 3 分

1. A paper square is to be folded twice and then cut along the dotted line as shown.
After this, how many pieces of paper are there?
如圖所示，將一張正方形紙片對折兩次後沿虛線剪開。完成上述步驟後，請問這張紙片會被分成多少個部分？



(A) 2 (B) 4 (C) 8 (D) 12 (E) 16

2. Allendale Square is a 132-metre tall building in Perth. A stairwell runs from the ground floor to the roof.
If the height of each step is 20 cm, approximately how many steps are in the stairwell?
位於珀斯(Perth)的艾倫代爾廣場(Allendale Square)是一座高132公尺的大樓。大樓內有一座樓梯，從地面層直通頂層。如果每級臺階的高度是20公分，請問該座樓梯大約有多少級臺階？

(A) 66 (B) 132 (C) 660 (D) 730 (E) 1320

3. $(4^3)^2 - (2^3)^4 =$
請問 $(4^3)^2 - (2^3)^4$ 的值是多少？
(A) 0 (B) 12 (C) 24 (D) 128 (E) 896

4. $\sqrt{2+3\sqrt{4}} =$
請問 $\sqrt{2+3\sqrt{4}}$ 的值是多少？
(A) $2\sqrt{2}$ (B) 3 (C) $\sqrt{10}$ (D) $2\sqrt{3}$ (E) 4

5. Apple scost $3 each. One apple and two bananas cost $7. Two apples, three bananas and four lemons cost $16. What is the cost of one lemon?
蘋果每個售價為3美元。一個蘋果和兩根香蕉的售價是7美元。兩個蘋果、三根香蕉和四個檸檬的總價是16美元。請問一個檸檬的價格是多少？
(A) 25*c* 25美分 (B) 50*c* 50美分
(C) $1 1美元 (D) $2 2美元 (E) $4 4美元

6. If $(1,\ 4)$ is the mid-point of the line joining $(-1,\ p)$ and $(q, 6)$, then $pq =$

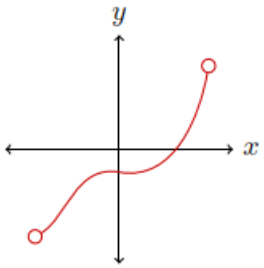
如果點$(1,4)$是連接點$(-1,\ p)$與點$(q,6)$線段的中點，請問 pq 的值是多少？

(A) 0 (B) 4 (C) 6 (D) 12 (E) 16

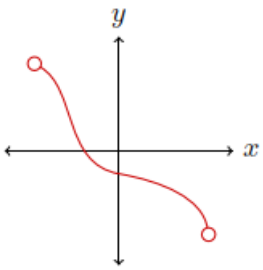
7. Which of the following graphs has positive gradient at all points between the endpoints?

請問以下哪一個圖形在其兩個端點之間的所有點的切線均具有正斜率？

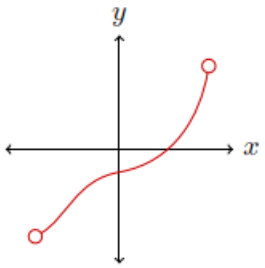
(A)



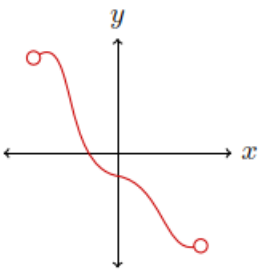
(B)



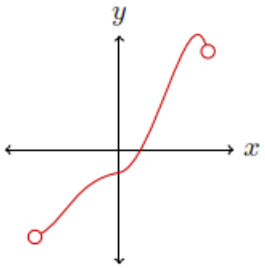
(C)



(D)



(E)



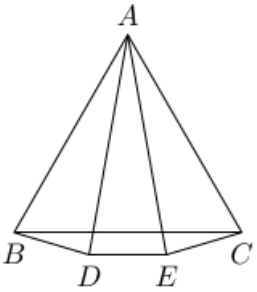
8. What is the value of $\dfrac{0.20}{0.25}+\dfrac{0.25}{0.20}$?

請問$\dfrac{0.20}{0.25}+\dfrac{0.25}{0.20}$的值是多少？

(A) 2.05 (B) 2.25 (C) 2.025 (D) 20.25 (E) 2.5

9. In the diagram , ABC is an equilateral triangle and triangles ABD and AEC are both isosceles with $AB = AD$ and $AE = AC$. Also , $BD = DE = EC$. What is the value, in degrees , of $\angle ADE$?

如圖所示，ABC 是一個正三角形，且三角形 ABD 和 AEC 均為等腰三角形，其中 $\overline{AB} = \overline{AD}$ ，$\overline{AE} = \overline{AC}$ 。且，$\overline{BD} = \overline{DE} = \overline{EC}$ 。請問 $\angle ADE$ 的度數是多少？



(A) 60 (B) 65 (C) 70 (D) 75 (E) 80

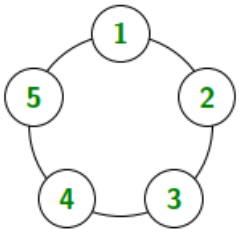
10. Which one of these numbers is the smallest?

請問以下哪一個數最小？

(A) $(-10)^{1000}$ (B) 10^{-1000} (C) 1000^{-10} (D) $\sqrt[10]{1000}$ (E) $\sqrt[1000]{10}$

Questions 11 to 20, 4 marks each
11-20 題，每題 4 分

11. Starting at one of these digits, then moving all the way around the circle in either direction, a 5-digit number can be read off.
For instance 34512 and 43215 are 2 of the 10 possibilities.
When all 10 of these numbers are added, the result is a six-digit number. What is the largest digit of this number?



如圖所示，從圖中任意一個數字出發，按順時針或逆時針方向繞一圈，可以讀出一個5位數。這樣的5位數一共有10個，例如，34512和43215就是其中的2個。當將這10個所有可能的5位數相加時，結果是一個六位數。請問這個六位數中最大的數字是多少？

(A)1　(B)3　(C)5　(D)7　(E)9

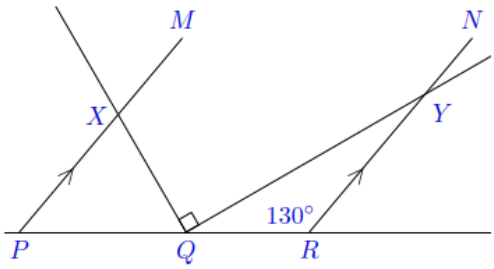
12. If $2.025 = 1 + \dfrac{1}{1 - \dfrac{1}{n}}$ then the value of n is

如果 $2.025 = 1 + \dfrac{1}{1 - \dfrac{1}{n}}$，請問 n 的值是多少?

(A) -41　(B) -40　(C) 5　(D) 40　(E) 41

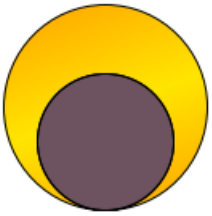
13. In the diagram, PM is parallel to RN, $\angle XQY = 90°$ and $\angle QRY = 130°$.
What is the value of $\angle MXQ + \angle QYN$?

如圖所示，$\overline{PM}$ 平行於 $\overline{RN}$，$\angle XQY = 90°$, $\angle QRY = 130°$。請問 $\angle MXQ + \angle QYN$ 是多少度？



(A)180°　(B)210°　(C)260°　(D)270°　(E)350°

14. A sportswear brand designed this new logo. The smaller circle has regular paint and the crescent between the two circles has metallic paint.
The radius of the larger circle is 1.5 times the radius of the smaller circle.
What is the ratio of regular paint to metallic paint in their logo?



某運動服裝品牌設計了一款新標誌。較小的圓使用普通塗料，兩圓之間的月牙形區域使用金屬塗料。大圓半徑是小圓半徑的1.5倍。請問在這款標誌中，普通塗料與金屬塗料的比例是多少？

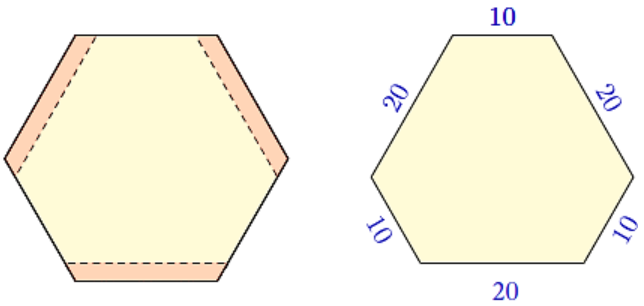
(A)1：1　(B)1：2　(C)1：3　(D)4：5　(E)5：8

15. My local hardware shop has screws in packs of 500, 200 and 50 screws. I manage to buy the number of screws I need for no more than $100. What is the most screws I could have bought?
本地五金店出售螺絲，包裝規格分別為每包500個、每包200個以及每包50個，每包價格如表所示。我計劃以不超過100美元的價格買到所需數量的螺絲。請問下列哪個答案符合**不超過**100美元而能買到最多數量的螺絲？

Screws in pack 螺絲包裝規格	*Price* 價格(美元)
500	$36
200	$16
50	$10

(A)1000 (B)1100 (C)1200 (D)1300 (E)1350

16. Identical strips are trimmed parallel to three sides of a regular hexagon as shown. The resulting hexagon has sides of length 10 cm and 20 cm.
What was the perimeter of the original hexagon?
如圖所示，從正六邊形的三條邊上平行地修剪掉相同的條帶，得到的新六邊形邊長分別為10公分和20公分。請問原六邊形的周長是多少？



(A) less than 90 cm 小於90公分
(B) exactly 90 cm 等於90公分
(C) between 90 cm and 100 cm 90公分至100公分之間
(D) exactly 100 cm 等於100公分
(E) more than 100 cm 大於100公分

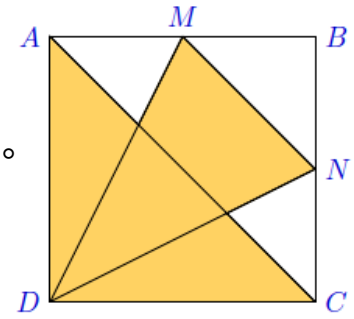
17. In this cross number puzzle, each variable p through x represents a different integer from 1 to 9.
Each row is read left to right and the answer is in the last square. Similarly, each column is read top to bottom, with the answer in the last square. For example, in the second column, $q \times t + w = 65$.
What is the value of $p + t + x$?

p	+	q	+	r	18
×		×		÷	
s	+	t	+	u	20
−		+		+	
v	+	w	−	x	5
36		65		3	

如圖所示的縱橫數字謎題中，變數 p 到 x 分別代表1到9中的不同整數。每一列從左到右讀取，最後一個方格顯示運算結果。同樣地，每一列行上到下讀取，最後一個方格顯示運算結果。例如，在第二行中，$q \times t + w = 65$。請問 $p + t + x$ 的值是多少？

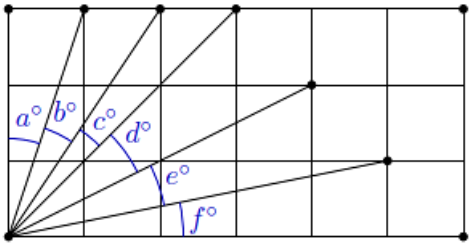
(A)13 (B)15 (C)16 (D)18 (E)20

18. $ABCD$ is a square. The midpoint of AB is M and the midpoint of BC is N.
What fraction of the square is shaded?
$ABCD$ 是一個正方形。$\overline{AB}$ 的中點是 M，$\overline{BC}$ 的中點是 N。
請問圖中陰影區域面積占正方形面積的幾分之幾？



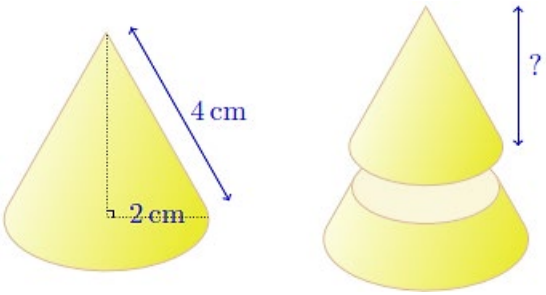
(A) $\frac{9}{16}$ (B) $\frac{5}{8}$ (C) $\frac{17}{24}$ (D) $\frac{3}{4}$ (E) $\frac{5}{6}$

19. Some segments are drawn, joining points on this grid of squares. Six angles are identified, but some of them may be equal.
Which of the six angles are equal?
如圖所示，在由正方形組成的網格中，
繪製了若干條連接點的線段。圖中標出了六個角，
其中一些角可能相等。請問這六個角中哪些是相等的？



(A) $a=d$, $b=e$, $c=f$
(B) $a=f$ *only* 只有 $a=f$
(C) $a=f$, $b=e$, $c=d$
(D) $a=b=c$, $d=e=f$
(E) $a=d$ *only* 只有 $a=d$

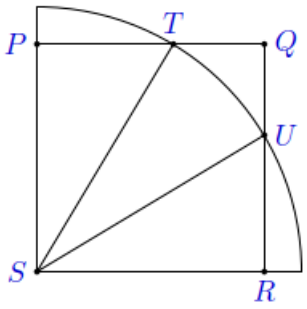
20. A solid cone has base radius 2 cm and slant height 4 cm. A cut is made parallel to the base, forming two pieces that have the same total surface area.
In centimetres, how far below the apex was the cut made?
一個實心圓錐的底面半徑為 2 公分，斜高為 4 公分。現平行於其底面將該圓錐體切割成總表面積相等的兩部分。請問切割面距離圓錐頂點多遠（單位：公分）？



(A) $\sqrt{3}$ (B) 2 (C) $1+\sqrt{3}$ (D) $2\sqrt{2}$ (E) 3

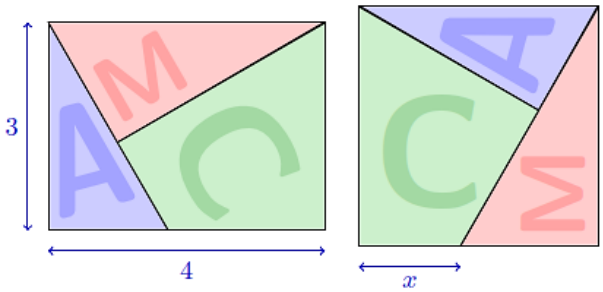
Questions 21 to 25, 5 marks each
21-25 題，每題 5 分

21. A quadrant of a circle of radius 13 units intersects the square $PQRS$ at T and U. Triangles PTS and SUR are each one-third of the area of the square.
What is the area of the square, in square units?
一個半徑為13個單位的四分之一圓與正方形$PQRS$相交於點T和點U。三角形PTS和三角形SUR的面積各占正方形面積的三分之一。請問這個正方形的面積是多少平方單位？
(A)100 (B)117 (C)125 (D)144 (E)169



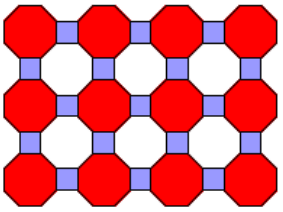
22. Bob's computer has listed all possible binary strings of length 9. Each string has 9 symbols, where each symbol is either 0 or 1.
How many of these strings include a 0 directly followed by a 1?
鮑伯的電腦列出了所有可能長度為9的二進制數串。每個數串由9個數字組成，每個數字是0或1。請問其中有多少個數串中有出現一個0後緊接一個1的組合？
(A)256 (B)384 (C)460 (D)484 (E)502

23. A rectangle is cut into a 3-piece jigsaw puzzle that can be rearranged to form a square, as shown.
What is the length marked x?
如圖所示，一個矩形被分成三塊拼圖，這三塊拼圖可以重新排列組成一個正方形。請問標記為x的長度是多少？
(A)$3(\sqrt{2}-1)$ (B)$\frac{4}{3}$ (C)$\sqrt{2}$ (D)$\sqrt{3}$ (E)$2(\sqrt{3}-1)$



24. Kerri can walk the 9 km around the block at a steady rate in 1 hour and 45 minutes. She can run around the same block in 35minutes.
If it takes Kerri an hour to get around the block by a mix of walking and running, for what fraction of the hour is she walking?
凱莉以固定的速度走完一圈9公里的街區，用時1小時45分鐘。她跑步繞行同一個街區，用時35分鐘。如果凱莉以步行和跑步的組合方式繞該街區一圈用時1小時，請問她步行的時間占這1小時的幾分之幾？
(A)$\frac{5}{9}$ (B)$\frac{3}{5}$ (C)$\frac{5}{8}$ (D)$\frac{2}{3}$ (E)$\frac{7}{10}$

25. A *tessellation* is a covering of the plane with polygons that extends forever.
The diagram shows part of a tessellation of the plane using regular octagons and squares.
What proportion of the plane is coloured white?



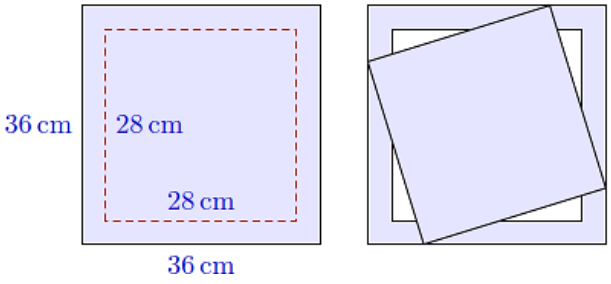
棋盤式鋪設(*tessellation*)是一種多邊形在平面上無限延伸的鋪設方式。
圖中展示了使用正八邊形和正方形鋪設平面的部分棋盤樣式。
請問白色部分占整個平面的比例是多少？

(A) $\sqrt{2}-1$ (B) $\frac{1}{3}$ (C) $\frac{\sqrt{2}}{4}$ (D) $\frac{3}{8}$ (E) $\frac{2\sqrt{2}}{5}$

For questions 26 to 30, shade the answer as an integer from 0 to 999 in the space provided on the answer sheet.
第 26-30 的答案為 0-999 之間的整數，請將答案填塗在答題卡對應區域。
Questions 26 to 30 are worth 6, 7, 8, 9 and 10 marks, respectively.
第 26-30 題分別為 6, 7, 8, 9, 10 分。

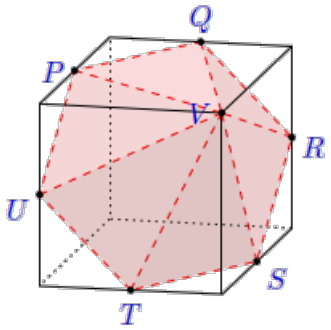
26. In the polynomial $P(x) = ax^5 + bx^4 + cx^3 + dx^2 + ex + f$, the coefficients a, b, c, d, e and f are either 1 or -1. It is known that $P(2) = 11$. What is $P(4)$ equalt to?
在多項式 $P(x) = ax^5 + bx^4 + cx^3 + dx^2 + ex + f$ 中，係數 a, b, c, d, e 和 f 的取值均為 1 或 -1。已知 $P(2) = 11$。請問 $P(4)$ 等於多少？

27. A 28 cm × 28 cm square is cut out from the centre of a 36 cm × 36 cm square piece of paper, as shown on the left.
The smaller square is rotated so that its corners are on the edges of the original square, as shown on the right.

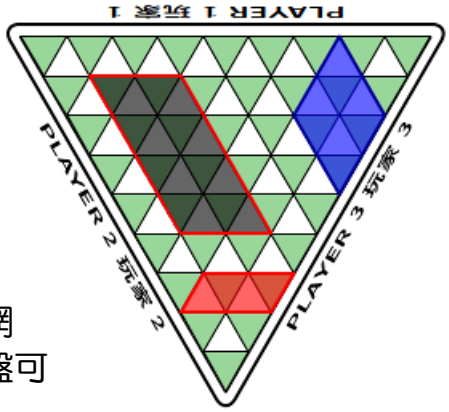


In square centimetres, what is the combined area of the four white triangles not covered by the rotated square?
如左圖所示，從一張 $36cm \times 36cm$ 的正方形紙片的中心裁出一個 $28cm \times 28cm$ 的正方形。接著，如右圖所示，將裁出的小正方形旋轉，使其四個頂點落在原始正方形的四條邊上。請問，四個未被旋轉小正方形覆蓋的白色三角形的總面積是多少平方公分 (cm)？

28. A cube of side length 10 has volume 1000. Points P, Q, R, S, T, and U are midpoints of six of the sides, as shown, and are all in a common plane. The vertex V of the cube is equidistant from these six midpoints.
What is the volume of the hexagonal pyramid $PQRSTUV$?
一個邊長為10的立方體，其體積為1000。如圖所示，點P,Q,R,S,T和U是立方體六條邊的中點，且它們均在同一個平面上。立方體的一個頂點V到這六個中點的距離都相等。請問六棱錐$PQRSTUV$的體積是多少？



29. In the game of *Parallelogram Blockade*, players place parallelograms of any size within this triangular board so that their edges line up with the triangular grid.
The diagram shows a possible board after three parallelograms have been placed.
在"平行四邊形迷陣"遊戲中，玩家需將任意大小的平行四邊形放置在三角形棋盤內，使其邊與三角形網格的邊對齊。圖中展示了放置三個平行四邊形後棋盤可能出現的一種佈局。
How many possible ways are there for placing the first parallelogram?
請問，放一個平行四邊形有多少種可能的放置方式？



30. A quartic polynomial $p(x)$ has integer coefficients and $p(n) \geq n$ for all integers n. Also $p(1) = 1$, $p(10) = 10$ and $p(-3) = 2025$. What is $p(3)$?
一個四次多項式 $p(x)$ 的係數均為整數，且對於所有整數 n，滿足 $p(n) \geq n$。已知 $p(1) = 1$，$p(10) = 10$ 且 $p(-3) = 2025$。請問 $p(3)$ 的值是多少？