Intermediate Division

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

1. Of the following, which is closest to 14?
請問下列哪個數字最接近 14?

(A) 14.4   (B) 13.84   (C) 14.14   (D) 13.68   (E) 14.21
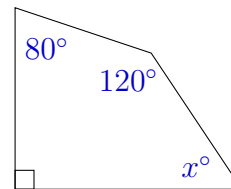
2. What is the value of $(57 \times 346) + (43 \times 346)$?
請問 $(57 \times 346) + (43 \times 346)$ 的值是多少?

(A) 14 878   (B) 19 722   (C) 31 500   (D) 34 600   (E) 46 300

3. What is the value of x in the diagram?
請問圖中 x 的值是多少?

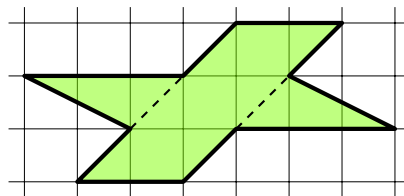(A) 40   (B) 50   (C) 60   (D) 70   (E) 80

4. The average of 2024 and an unknown number is $2\frac{1}{2}$. What is the unknown number?
2024 與一個未知數的平均數為 $2\frac{1}{2}$。請問這個未知數是多少?

(A) 2019   (B) −2019   (C) 2029   (D) −2029   (E) −2024

5. What is the area of the shape drawn in the grid?
請問網格中圖形的面積是多少?

(A) 7   (B) 8   (C) 9   (D) 10   (E) 11

6. Let p be 12% of 300 and q be 6% of 600. What is the difference between p and q?
設 p 為 300 的 12%，q 為 600 的 6%。請問 p 和 q 之間的差值是多少?

(A) 0   (B) 2   (C) 6   (D) 12   (E) 30
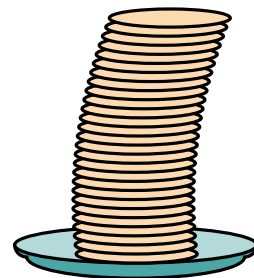
7. The largest integer n for which $0.6n$ is less than 17 is

若 $0.6n$ 小於 17，請問整數 n 的最大值是多少？

(A) 9   (B) 10   (C) 11   (D) 26   (E) 28

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8. Pat has 12 eggs, 2 kg of flour, and 2 L of milk. His pancake recipe calls for 2 eggs, 250 g of flour and 400 mL of milk. He makes as many pancakes as he can while using the ingredients in the proportions given in the recipe. How much flour will he have left?

Pat 有 12 個雞蛋、 2 kg 麵粉和 2 L 牛奶。他的煎餅菜譜上標明製作一個煎餅需要 2 個雞蛋、 250 g 麵粉和 400 mL 牛奶。如果他按照菜譜上的原材料比例製作盡可能多的煎餅，請問他會剩下多少麵粉？

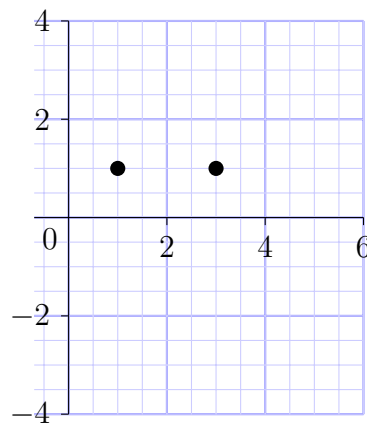(A) None 沒有剩餘   (B) 250 g   (C) 500 g   (D) 625 g   (E) 750 g

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9. Theo's collection of toy dinosaurs is stored in two containers. He noticed that one of the containers had 4 times as many dinosaurs in it as the other. He moved 18 to the other container so that the two containers had the same number. How many dinosaurs are in Theo's collection?

Theo 將恐龍玩具收納在兩個箱子中。他注意到其中一個箱子的恐龍玩具數量是另一個箱子的 4 倍，因此他從裝有更多玩具的箱子中拿出 18 個玩具放到另一個箱子中，使得兩個箱子中的恐龍玩具數量相同。請問 Theo 有多少個恐龍玩具？

(A) 40   (B) 45   (C) 50   (D) 55   (E) 60

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10. Eiliyah is drawing an isosceles triangle on the number plane. It has an area of 6 square units. She has already plotted two vertices of the triangle, at $(1,1)$ and $(3,1)$. Which of the following could be the coordinates of the third vertex of the triangle?

Eiliyah 正在座標平面上繪製一個面積為 6 個平方單位的等腰三角形。她已經標記出這個等腰三角形的兩個頂點 $(1,1)$ 和 $(3,1)$。請問下列哪一項可能是這個等腰三角形的第三個頂點座標？

(A) $(2,3)$ (B) $(2,4)$ (C) $(2,6)$ (D) $(2,-3)$ (E) $(2,-5)$

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

11. Yalis has to take a tablet every 9 hours. The course of medication is 15 tablets. He takes his first tablet at 11 am on Tuesday. When will he take his last tablet?

Yalis 需要每 9 個小時服用 1 片藥，整個療程一共需要服用 15 片藥。他在週二上午 11 點服用了第 1 片藥。請問他將在什麼時候服用最後 1 片藥？

(A) 2 pm Wednesday 週三下午 2 點

(B) 5 am Friday 週五凌晨 5 點

(C) 5 pm Sunday 週日下午 5 點

(D) 4 am Monday 週一凌晨 4 點

(E) 8 pm Tuesday 週二下午 8 點
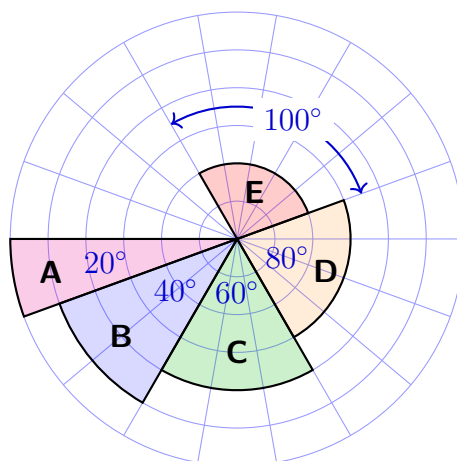
12. How many digits are in the number 202^4?

請問 202^4 中有多少位數字？

(A) 7   (B) 10   (C) 12   (D) 18   (E) 81

13. In the diagram, the concentric circles are equally spaced, with radii from 1 to 6, and the lines from the origin are equally spaced 20° apart. Which of these five areas is largest?

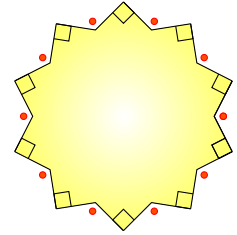如圖所示，所有同心圓等距排列，各圓半徑從裏到外依次從 1 遞增到 6。從圓心引出的各線段之間的夾角均為 20°。請問以下 5 個區域中，哪個區域最大？

(A) A   (B) B   (C) C   (D) D   (E) E

14. Kate and Jim exercise at their local beach, going from one end to the other and back. Starting together, Kate jogs at a steady pace of 10 km per hour, while Jim walks at 6 km per hour. They first meet again after 30 minutes. How long, in kilometres, is the beach?

Kate 和 Jim 在沙灘上鍛煉身體，從一端到另一端再返回。兩人同時出發，Kate 按照 10 km/h 的速度勻速慢跑，而 Jim 按照 6 km/h 的速度行走，出發 30 分鐘後兩人第一次相遇。請問這個沙灘長多少 km？

(A) 3   (B) 4   (C) 5   (D) 6   (E) 7

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15. This star has order-10 rotational symmetry, with 10 internal right angles as shown. What is the size of each of the obtuse angles marked with a dot?
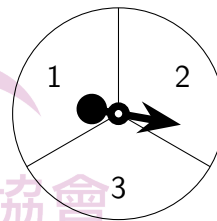
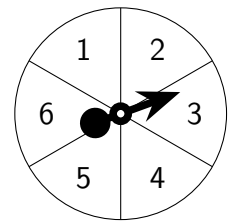如圖所示，此星形是 10 階旋轉對稱圖形，有 10 個內直角。請問圖中每個用圓點標記的鈍角為多少度？

(A) $120°$ (B) $126°$ (C) $132°$ (D) $138°$ (E) $142°$

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16. A game uses the two spinners shown. The player who spins the higher number wins. Equal spins are a draw. What is the probability that player one wins?

遊戲採用如圖所示兩個轉盤，轉到較大數字的玩家獲勝。如果兩位玩家轉出的結果相同則為平局，請問 1 號玩家獲勝的概率是多少？

Player one
1 號玩家

Player two
2 號玩家

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{6}$ (D) $\frac{2}{3}$ (E) $\frac{5}{6}$

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17. When the number 9045 is split into two 2-digit numbers, the first number is twice the second number: $90 = 2 \times 45$. Many other 4-digit numbers can be split into two 2-digit numbers where the first number is twice the second. There is a unique 2-digit number that divides into all such 4-digit numbers. What is this number?
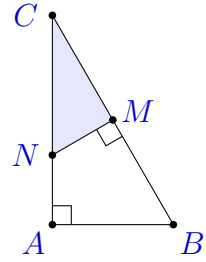
將數字 9045 分成兩個 2 位數後，第一個數字是第二個數字的兩倍，即 $90 = 2 \times 45$。還有很多類似的 4 位數可以分為兩個 2 位數，且第一個 2 位數是第二個 2 位數的兩倍。存在唯一一個 2 位數，能整除所有類似的 4 位數。請問這個 2 位數是多少？

(A) 18   (B) 35   (C) 45   (D) 52   (E) 67

18. Triangle ABC has a right angle at A, and side AC is twice as long as AB. Also MN is the perpendicular bisector of BC, as shown. In area, what fraction of $\triangle ABC$ is $\triangle CMN$?
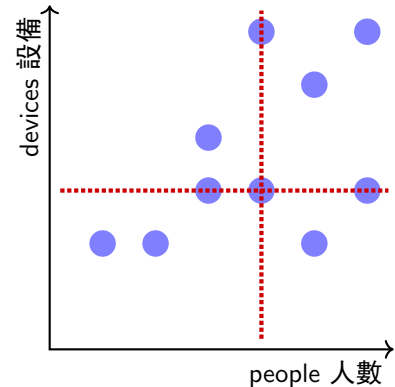
三角形 ABC 在點 A 處存在一個直角。AC 邊長度是 AB 邊長度的兩倍。MN 是 BC 邊的垂直平分線，如圖所示。請問 $\triangle CMN$ 的面積占 $\triangle ABC$ 面積的幾分之幾？

(A) $\dfrac{1}{3}$ (B) $\dfrac{1}{\sqrt{5}}$ (C) $\dfrac{2}{5}$ (D) $\dfrac{\sqrt{5}}{8}$ (E) $\dfrac{5}{16}$

19. A researcher surveys 10 households and creates this scatterplot showing how many people and how many internet-connected devices are in each house.

一位研究人員對 10 個家庭進行了調研，並根據其調研結果繪製了如圖所示的散點圖，表示每個家庭中的人數與聯網設備數量之間的關係。

To help categorise her data, she adds a vertical line representing the median number of people and a horizontal line representing the median number of devices.

為了將數據分類，她在圖中加入一條垂線表示人數的中位數，又加入一條水平線表示設備數量的中位數。

One extra household is surveyed and the results are added to the scatterplot. What will happen to the median lines?

現在對另一個家庭進行調研，調研結果最終會表示在這個散點圖中。請問圖中兩條中位線將會有何變化？

(A) Both lines move. 兩條線都會移動。

(B) Neither line moves. 兩條線都不會移動。

(C) Only the vertical line moves. 只有垂線會移動。

(D) Only the horizontal line moves. 只有水平線會移動。

(E) It depends on the location of the new point. 取決於新加入點的位置。

20. I make up all the 5-digit numbers that use each of the digits from 1 to 5 once. I then arrange these 120 numbers in increasing order from 12 345 to 54 321. Which number is the 42nd in this order?
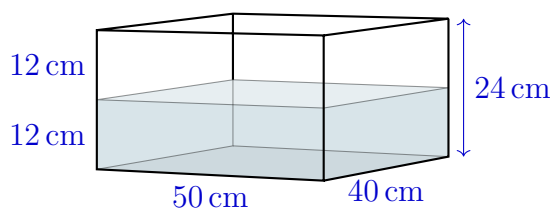
數字 1 到 5 可以組成 120 個不同的 5 位數，其中每位數字只使用一次。然後將這些數字從 12345 到 54321 進行升序排列。請問按此順序，第 42 個數是什麼？

(A) 15 234   (B) 21 354   (C) 23 154   (D) 24 531   (E) 24 513

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

21. A tank in the shape of a rectangular prism has dimensions as shown. It contains water to a depth of 12 cm. A solid cube of side 20 cm is placed into the tank, with one face flat on the bottom of the tank. By how much will the water level in the tank increase?

一個長方體水缸的尺寸如圖所示。水缸中的水深為 12 cm。將一個邊長為 20 cm 的實心立方體平放在缸底，請問此時水缸中的水位會上漲多少 cm？

(A) 3 cm   (B) 4 cm   (C) 5 cm   (D) 8 cm   (E) 12 cm

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22. February 2024 had 5 Thursdays. When will February next have 5 Thursdays?

2024 年 2 月有 5 個週四。請問接下來哪一年的 2 月再次出現 5 個週四？

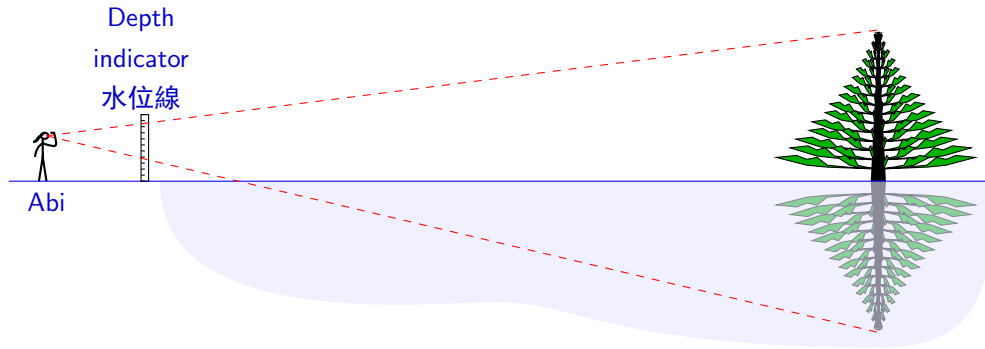(A) 2028   (B) 2044   (C) 2048   (D) 2052   (E) 2080

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23. A group of tourists stayed in two rooms when visiting a museum. The average age of the tourists in the first room was 45 and the average age of the tourists in the second room was 20. When one tourist walked from the first room to the second, the average ages in each room increased by 1. If the second group had 7 more tourists at the beginning, what was the age of the tourist who moved rooms?

參觀博物館時，一群遊客分別在兩個房間裏。第一個房間裏遊客的平均年齡是 45 歲；第二個房間裏遊客的平均年齡是 20 歲。如果某位遊客從第一個房間走到第二個房間，那麼每個房間裏遊客的平均年齡都會增加 1。如果剛開始時，第二個房間比第一個房間多 7 位遊客，請問從第一個房間走到第二個房間的遊客的年齡是多少？

(A) 36   (B) 37   (C) 38   (D) 39   (E) 40

24. Abi is walking beside a lake. In the distance she can see a tree and its reflection on the surface of the lake. There is a depth indicator 5 metres away from her with its 0-metre mark at the lake surface level.

Abi 在湖邊散步。在某個距離，她剛好能看到一棵樹和樹在湖面的倒影。在距離她 5 m 處有一個水位線，湖面高度剛好達到 0 m 刻度處。

From Abi's point of view, the top of the tree is in line with the 1.8-metre mark on the depth indicator, while the reflection of the top of the tree is in line with the 1.1-metre mark. Abi's eyes are level with the 1.5-metre mark. How tall is the tree in metres?

從 Abi 的視角看，樹的頂部剛好與水位線 1.8 m 刻度處齊平，而樹的倒影的頂部與水位線 1.1 m 刻度處齊平。Abi 的眼睛與水位線 1.5 m 刻度處齊平。請問這棵樹高多少米？

(A) 9   (B) 9.5   (C) 10   (D) 10.5   (E) 11

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25. Six maths students, Amy, Bao, Cecil, Daria, Emilia and Felipe are given 60 problems to complete over the weekend. Although none of them completes all 60, each completes at least 52 of the problems, and each one completes a different number of problems. Also the order from least to most problems is the same as the alphabetical order of their names.

Amy, Bao, Cecil, Daria, Emilia, Felipe 6 位學生需要在本週末完成 60 道題。雖然她們 6 個人都沒有將這 60 道題全部完成，但是每個人都至少完成了其中 52 道題且每個人完成的題目數量不同。同時，如果將這 6 位同學的題目完成數量從最少到最多進行排序，那麼所得順序剛好與這 6 位同學的名字按字母表順序進行排序的結果相同。

Finally, each of them completes k times as many problems on Saturday as they do on Sunday, where k is a different whole number from 1 to 6 for each of them. Which of them completed 3 times as many problems on Saturday as on Sunday?

最終，每個學生週六完成的題目數量都是其週日完成的題目數量的 k 倍。對於每個人來說，k 是 1 到 6 之間的一個不同整數。請問哪一位學生在週六完成的題目數量是其週日完成的題目數量的 3 倍？

(A) Amy   (B) Bao   (C) Cecil   (D) Daria   (E) Emilia

26. In the multiplication puzzle shown, a, b and c represent different digits.
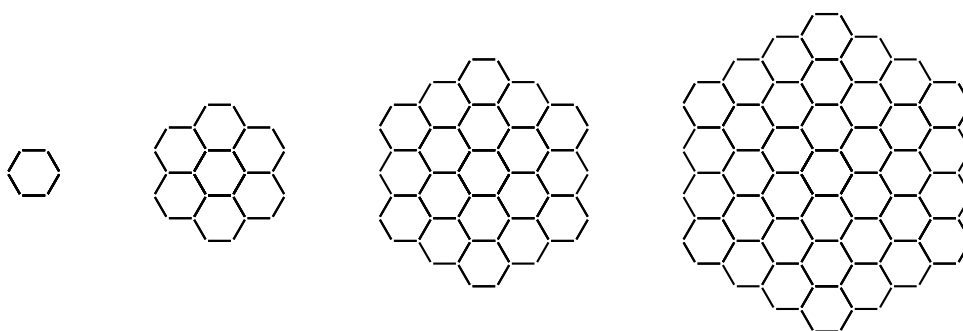下方所示乘法運算中 a, b, c 代表不同數字。

$$
\begin{array}{r}
a\ a\ b\ b \\
\times \qquad c \\
\hline
c\ b\ b\ c
\end{array}
$$

There is more than one way to solve this puzzle. What is the sum of all possible
three-digit numbers of the form abc?
解決這道題的方法不止一種。請問所有可能的三位數 abc 之和是多少？

27. Rodney builds increasingly large shapes out of unit rods. The smallest uses six rods and
each larger shape adds a layer of hexagons around the previous shape.
Rodney 使用單位長度的棍子構建圖形，且這些圖形逐漸增大。最小的圖形使用六根棍
子，之後的每個圖形都是通過在前一個圖形周圍加一層六邊形構建而成的。

Starting with 2024 rods, Rodney builds a single shape like this, as large as possible. How
many rods will he have left over?
Rodney 使用 2024 根棍子構建一個盡可能大的圖形。請問他最後還能剩下多少根棍子？

28. Let x, y and z be positive integers satisfying the following three equations:

設 x, y, z 為滿足下列 3 個方程的正整數：
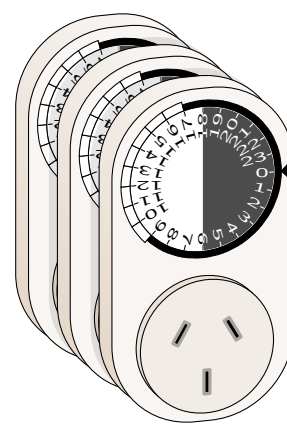
$$xy + x + y = 2024$$
$$yz + y + z = 2024$$
$$zx + z + x = 728.$$

What is the value of $x + y + z$?

請問 $x + y + z$ 的值是多少？

29. Tim uses plug-in timers to automate his indoor plant lighting. Each timer has a plug on the back, a socket on the front, and a motorised dial that rotates once for every 24 hours that the plug has power.

Tim 用插電式定時器來實現室內植物補光燈的自動化。每個定時器的背面都有插頭，正面有插座，附帶一個電動錶盤。定時器插電後，電動錶盤每 24 小時轉一圈。

When the time on the dial is between 9:00 and 17:00, the timer switch is on, so that any power on the plug is switched through to the socket.

當錶盤上的時間介於 9:00 到 17:00 之間時，定時器開啟，插電後為前方插座供電。

For fun, he plugs together three of his timers, all set to time 0:00, with a lamp plugged into the front socket. How many hours until the lamp turns on?

Tim 做了一個有趣的實驗。他將 3 個時間設置為 0:00 的定時器串聯起來，並將一盞台燈插入定時器前方插座。請問需要幾小時才能點亮這盞台燈？

30. A triangle, $\triangle ABC$, has sides $AB = 18$, $AC = 24$, and $BC = 30$. Point P is on side AB and a line is drawn through P so that half of the perimeter of $\triangle ABC$ lies on each side of the line and half of the area of $\triangle ABC$ lies on each side of the line. What is the square of the distance CP?

在三角形 $\triangle ABC$ 中，$AB = 18$，$AC = 24$，$BC = 30$。點 P 位於 AB 邊上，過點 P 作一條直線。這條直線將 $\triangle ABC$ 的周長和面積平分。請問 CP 長度的平方是多少？