1. What is the ones digit of the value of the below expression?

   下面表达式计算结果的个位数字是几?

   $$222,222 - 22,222 - 2,222 - 222 - 22 - 2$$

   (A) 0 **(B)** 2 **(C)** 4 **(D)** 6 **(E)** 8

2. What is the value of the below expression in decimal form?

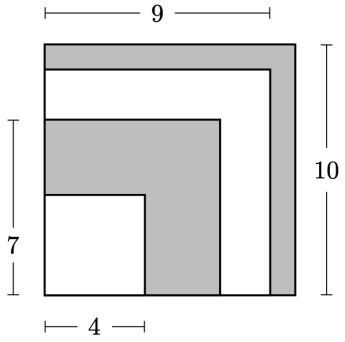
   下面表达式计算结果的小数表示是什么?

   $$\frac{44}{11} + \frac{110}{44} + \frac{44}{1100}$$

   (A) 6.4 **(B)** 6.504 **(C)** 6.54 **(D)** 6.9 **(E)** 6.94

3. Four squares of side length 4, 7, 9, and 10 units are arranged in increasing size order so that their left edges and bottom edges align. The squares alternate in color white-gray-white-gray, respectively, as shown in the figure. What is the area of the visible gray region in square units?

   四个边长为 4, 7, 9, 10 个单位的正方形按尺寸递增的顺序排列, 使得它们的左边缘和底边缘对齐. 如图所示, 正方形的颜色交替分别为白-灰-白-灰. 问可见的灰色区域的面积是多少个平方单位?

   (A) 42 **(B)** 45 **(C)** 49 **(D)** 50 **(E)** 52

4. When Yunji added all the integers from 1 through 9, she mistakenly left out a number. Her incorrect sum turned out to be a square number. Which number did Yunji leave out?

   当 Yunji 将从 1 到 9 的所有整数相加时，她不小心遗漏了一个数．她所得的错误总和是一个平方数．问 Yunji 遗漏了哪个数?

   (A) 5 **(B)** 6 **(C)** 7 **(D)** 8 **(E)** 9

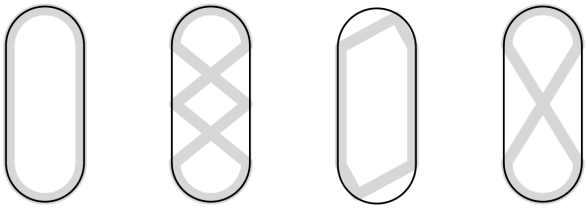
5. Aaliyah rolls two standard 6-sided dice. She notices that the product of the two numbers rolled is a multiple of 6. Which of the following integers *cannot* be the sum of the two numbers?

   Aaliyah 抛掷两个标准的 6 面骰子．她注意到掷出的两个数的乘积是 6 的倍数．问以下哪个整数 不可能 是这两个数的和?

   (A) 5 **(B)** 6 **(C)** 7 **(D)** 8 **(E)** 9

6. Sergei skated around an ice rink, gliding along different paths. The gray lines in the figures below show four of the paths labeled P, Q, R, and S. What is the sorted order of the four paths from shortest to longest?

   Sergei 在溜冰场上沿着不同的路径滑冰．下图中的灰色线条显示了四条路径，分别标记为 P，Q，R，S．问这四条路径按从短到长的顺序排列是怎样的?



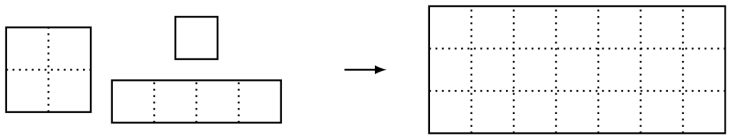
Path ｜路径

   (A) P, Q, R, S **(B)** P, R, S, Q **(C)** Q, S, P, R

   (D) R, P, S, Q **(E)** R, S, P, Q

7. A 3×7 rectangle is covered without overlap by 3 shapes of tiles: 2×2, 1×4, and 1×1, shown below. What is the minimum possible number of 1×1 tiles used?

   如下图所示，一个 3×7 的长方形被 2×2，1×4，1×1 这 3 种形状的瓷砖没有重叠的覆盖．问最少要用多少个 1×1 的瓷砖?



   (A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

8. On Monday Taye has \$2. Every day, he either gains \$3 or doubles the amount of money he had on the previous day. How many different dollar amounts could Taye have on Thursday, 3 days later?

   星期一，Taye 有 2 美元．之后的每一天，他要么赚 3 美元，要么将前一天的金额翻倍．问在 3 天后的星期四，Taye 手上的钱数有多少种不同的可能金额?

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

9. All of the marbles in Maria's collection are red, green, or blue. Maria has half as many red marbles as green marbles and twice as many blue marbles as green marbles. Which of the following could be the total number of marbles in Maria's collection?

   Maria 收藏的所有弹珠是红色、绿色或蓝色的．Maria 拥有的红色弹珠数量是绿色弹珠数量的一半，而蓝色弹珠数量是绿色弹珠数量的两倍．问以下哪个选项可能是 Maria 收藏的弹珠总数?

   (A) 24 **(B)** 25 **(C)** 26 **(D)** 27 **(E)** 28

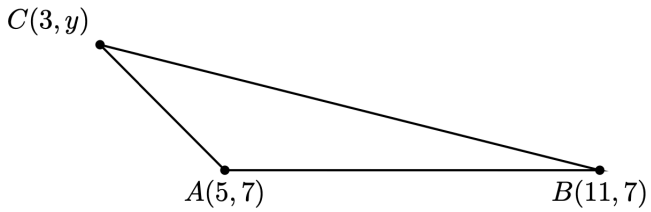
10. In January 1980 the Mauna Loa Observatory recorded carbon dioxide (CO_2) levels of 338 ppm (parts per million). Over the years the average CO_2 reading has increased by about 1.515 ppm each year. What is the expected CO_2 level in ppm in January 2030? Round your answer to the nearest integer.

1980 年 1 月，莫纳洛亚观测站记录的二氧化碳（CO_2）水平是 338ppm．这些年来，CO_2 的读数平均每年增加约 1.515ppm．问预计 2030 年 1 月的 CO_2 水平将是多少 ppm？将答案四舍五入到最接近的整数．

(A) 399 **(B)** 414 **(C)** 420 **(D)** 444 **(E)** 459

11. The coordinates of $\triangle ABC$ are $A(5,7), B(11,7)$ and $C(3,y)$, with $y > 7$. The area of $\triangle ABC$ is 12. What is the value of y ?

$\triangle ABC$ 的顶点坐标为 $A(5,7)$，$B(11,7)$，$C(3,y)$，其中 $y > 7$．$\triangle ABC$ 的面积是 12．问 y 的值是多少？



(A) 8 **(B)** 9 **(C)** 10 **(D)** 11 **(E)** 12

12. Rohan keeps a total of 90 guppies in 4 fish tanks.

    - There is 1 more guppy in the 2nd tank than in the 1st tank.
    - There are 2 more guppies in the 3rd tank than in the 2nd tank.
    - There are 3 more guppies in the 4th tank than in the 3rd tank.

    How many guppies are in the 4th tank?

    Rohan 在 4 个鱼缸里一共养了 90 条孔雀鱼.

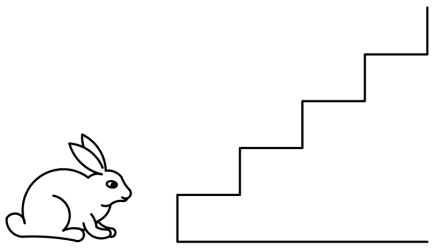
    - 第 2 个鱼缸里的孔雀鱼比第 1 个鱼缸多 1 条.
    - 第 3 个鱼缸里的孔雀鱼比第 2 个鱼缸多 2 条.
    - 第 4 个鱼缸里的孔雀鱼比第 3 个鱼缸多 3 条.

    问第 4 个鱼缸里有多少条孔雀鱼?

    (A) 20 **(B)** 21 **(C)** 23 **(D)** 24 **(E)** 26

13. Buzz Bunny is hopping up and down a set of stairs, one step at a time. In how many ways can Buzz start on the ground, make a sequence of 6 hops, and end up back on the ground? (For example, one sequence of hops is up-up-down-down-up-down.)

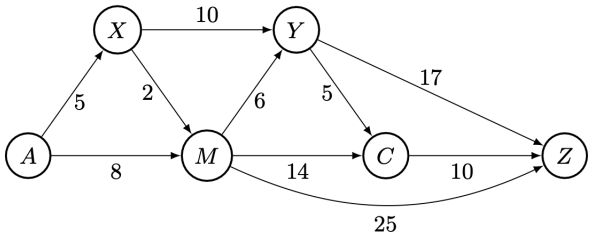
    小兔 Buzz 沿着楼梯跳上跳下，一次跳一级台阶. Buzz 从地面开始，做 6 次跳跃后又回到地面的方式有多少种?（例如，一种跳跃方式是上-上-下-下-上-下.）

    (A) 4 **(B)** 5 **(C)** 6 **(D)** 8 **(E)** 12

14. The one-way routes connecting towns A, M, C, X, Y, and Z are shown in the figure below (not drawn to scale). The distances in kilometers along each route are marked. Traveling along these routes, what is the shortest distance from A to Z in kilometers?

下图显示了连接城镇 A，M，C，X，Y，Z 的单行道路（非按比例绘制）. 每条道路的长度以千米为单位标明. 问沿着这些道路行驶，从 A 到 Z 的最短距离是多少千米?



(A) 28 **(B)** 29 **(C)** 30 **(D)** 31 **(E)** 32

15. Let the letters F, L, Y, B, U, G represent distinct digits. Suppose $\underline{F}\,\underline{L}\,\underline{Y}\,\underline{F}\,\underline{L}\,\underline{Y}$ is the greatest number that satisfies the equation

$$8 \cdot \underline{F}\,\underline{L}\,\underline{Y}\,\underline{F}\,\underline{L}\,\underline{Y} = \underline{B}\,\underline{U}\,\underline{G}\,\underline{B}\,\underline{U}\,\underline{G}.$$

What is the value of $\underline{F}\,\underline{L}\,\underline{Y} + \underline{B}\,\underline{U}\,\underline{G}$?

字母 F，L，Y，B，U，G 代表不同的数字. 假设 $\underline{F}\,\underline{L}\,\underline{Y}\,\underline{F}\,\underline{L}\,\underline{Y}$ 是满足下述方程的最大数.

$$8 \cdot \underline{F}\,\underline{L}\,\underline{Y}\,\underline{F}\,\underline{L}\,\underline{Y} = \underline{B}\,\underline{U}\,\underline{G}\,\underline{B}\,\underline{U}\,\underline{G}$$

问 $\underline{F}\,\underline{L}\,\underline{Y} + \underline{B}\,\underline{U}\,\underline{G}$ 的值是多少?

(A) 1089 **(B)** 1098 **(C)** 1107 **(D)** 1116 **(E)** 1125

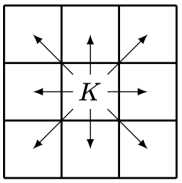
16. Minh enters the numbers 1 through 81 into the cells of a 9×9 grid in some order. She calculates the product of the numbers in each row and column. What is the least number of rows and columns that could have a product divisible by 3?

Minh 将从 1 到 81 的数按照某种顺序填入 9×9 方格表的方格中．她计算每行和每列中各个数的乘积．问乘积能被 3 整除的行和列最少有多少个?

(A) 8 **(B)** 9 **(C)** 10 **(D)** 11 **(E)** 12

17. A chess king is said to *attack* all the squares one step away from it, horizontally, vertically, or diagonally. For instance, a king on the center square of a 3×3 grid attacks all 8 other squares, as shown below. Suppose a white king and a black king are placed on different squares of a 3×3 grid so that they do not attack each other. In how many ways can this be done?

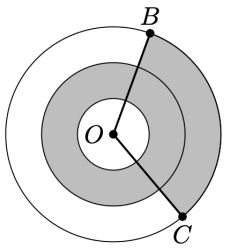
国际象棋中的国王可以沿水平、垂直或对角线方向攻击与它一步之遥的所有方格．例如，如下图所示，3×3 方格表的中心方格内的国王可以攻击到其他 8 个方格．假设一个白色国王和一个黑色国王被放置在 3×3 方格表的不同方格上，使得它们互相不攻击．问满足这样要求的放置方式有多少种?



(A) 20 **(B)** 24 **(C)** 27 **(D)** 28 **(E)** 32

18. Three concentric circles centered at O have radii of 1, 2, and 3. Points B and C lie on the largest circle. The region between the two smaller circles is shaded, as is the portion of the region between the two larger circles bounded by central angle BOC, as shown in the figure below. Suppose the shaded and unshaded regions are equal in area. What is the measure of $\angle BOC$ in degrees?

三个同心圆以 O 为圆心，半径分别为 1，2，3．点 B 和 C 在最大的圆上．如下图所示，两个较小的圆之间的区域涂为阴影，两个较大的圆之间以圆心角 BOC 为界的区域部分也涂为阴影．假设阴影区域和非阴影区域的面积相等．问 $\angle BOC$ 的度数是多少？



(A) 108 **(B)** 120 **(C)** 135 **(D)** 144 **(E)** 150

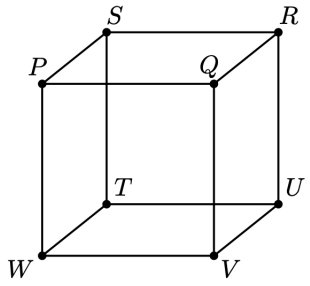
19. Jordan owns 15 pairs of sneakers. Three fifths of the pairs are red and the rest are white. Two thirds of the pairs are high-top and the rest are low-top. The red high-top sneakers make up a fraction of the collection. What is the least possible value of this fraction?

Jordan 拥有 15 双运动鞋．在这些鞋中，五分之三是红色的，其余的是白色的．在这些鞋中，三分之二的鞋是高帮，其余的是低帮．将红色高帮运动鞋在其中所占的比例用分数表示．问这个分数的最小可能值是多少？

(A) 0 **(B)** $\frac{1}{5}$ **(C)** $\frac{4}{15}$ **(D)** $\frac{1}{3}$ **(E)** $\frac{2}{5}$

20. Any three vertices of the cube $PQRSTUVW$, shown in the figure below, can be connected to form a triangle. (For example, vertices P, Q, and R can be connected to form isosceles $\triangle PQR$.) How many of these triangles are equilateral and contain P as a vertex?

如下图所示，立方体 $PQRSTUVW$ 的任意三个顶点可以连接形成三角形．（例如，顶点 P，Q，R 可以连接形成等腰 $\triangle PQR$．）问这些三角形中，以 P 为一个顶点的等边三角形有多少个?



(A) 0 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 6

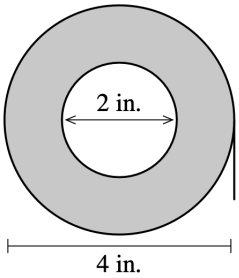
21. A group of frogs (called an *army*) is living in a tree. A frog turns green when in the shade and turns yellow when in the sun. Initially the ratio of green to yellow frogs was 3 : 1. Then 3 green frogs moved to the sunny side and 5 yellow frogs moved to the shady side. Now the ratio is 4 : 1. What is the difference between the number of green frogs and yellow frogs now?

一群青蛙生活在一棵树上．在阴凉处，青蛙会变成绿色；在阳光下，青蛙会变成黄色．最初，绿色青蛙与黄色青蛙的比例是 3 : 1．然后，有 3 只绿色青蛙移动到了阳光下，有 5 只黄色青蛙移动到了阴凉处．现在的比例变为 4 : 1．问现在绿色青蛙和黄色青蛙的数量之差是多少?

(A) 10 **(B)** 12 **(C)** 16 **(D)** 20 **(E)** 24

22. A roll of tape is 4 inches in diameter and is wrapped around a ring that is 2 inches in diameter. A cross section of the tape is shown in the figure below. The tape is 0.015 inches thick. If the tape is completely unrolled, approximately how long would it be? Round your answer to the nearest 100 inches.

一卷直径为 4 英寸的胶带缠绕在直径为 2 英寸的环上. 胶带的横截面如下图所示. 胶带的厚度为 0.015 英寸. 如果胶带完全展开, 大约有多长? 请将答案四舍五入到最接近的 100 英寸.

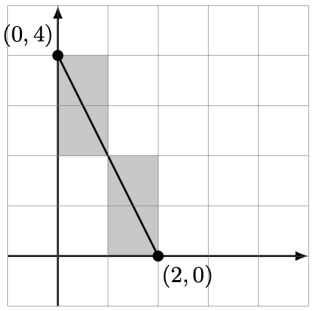


in. | 英寸 | 英寸

(A) 300 **(B)** 600 **(C)** 1200 **(D)** 1500 **(E)** 1800

23. Rodrigo has a very large piece of graph paper. First he draws a line segment connecting point $(0,4)$ to point $(2,0)$ and colors the 4 cells whose interiors intersect the segment, as shown below. Next Rodrigo draws a line segment connecting point $(2000,3000)$ to point $(5000,8000)$. Again he colors the cells whose interiors intersect the segment. How many cells will he color this time?

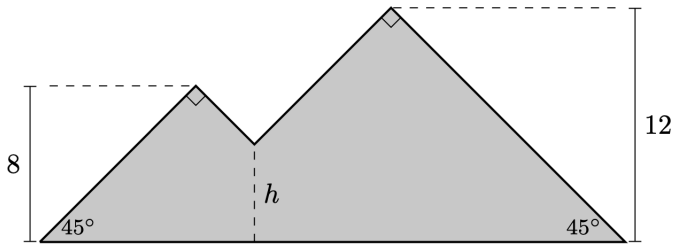
Rodrigo 有一张很大的方格纸．首先，如下图所示，他绘制一条连接点 $(0,4)$ 和点 $(2,0)$ 的线段，并把内部与线段相交的 4 个单元格染色．接下来，Rodrigo 绘制一条连接点 $(2000,3000)$ 和点 $(5000,8000)$ 的线段．他再次对内部与这条线段相交的单元格染色．问这次他会给多少个单元格染色？



(A) 6000 **(B)** 6500 **(C)** 7000 **(D)** 7500 **(E)** 8000

24. Jean made a piece of stained glass art in the shape of two mountains, as shown in the figure below. One mountain peak is 8 feet high and the other peak is 12 feet high. Each peak forms a 90° angle, and the straight sides of the mountains form 45° angles with the ground. The artwork has an area of 183 square feet. The sides of the mountains meet at an intersection point near the center of the artwork, h feet above the ground. What is the value of h ?

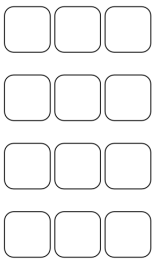
如下图所示，Jean 制作了一件呈两座山形状的彩色玻璃艺术品．一座山峰的高度是 8 英尺，另一座山峰的高度是 12 英尺．每个山峰都成 90° 角，山的直边与地面成 45°．该艺术品的面积为 183 平方英尺．山的两侧相交在艺术品中心附近的一点，距地面 h 英尺．问 h 的值是多少?



(A) 4 **(B)** 5 **(C)** $4\sqrt{2}$ **(D)** 6 **(E)** $5\sqrt{2}$

25. A small airplane has 4 rows of seats with 3 seats in each row. Eight passengers have boarded the plane and are distributed randomly among the seats. A married couple is next to board. What is the probability there will be 2 adjacent seats in the same row for the couple?

一架小飞机有 4 排座位，每排有 3 个座位．已经有八名乘客登机，他们在这些座位中随机就坐．接下来要登机的是一对夫妻．问这对夫妻能够坐在同一排的 2 个相邻座位上的概率是多少?



(A) $\frac{8}{15}$ **(B)** $\frac{32}{55}$ **(C)** $\frac{20}{33}$ **(D)** $\frac{34}{55}$ **(E)** $\frac{8}{11}$

Answers.

BCEEB DEDEB DEBAC DEACD EBCBC