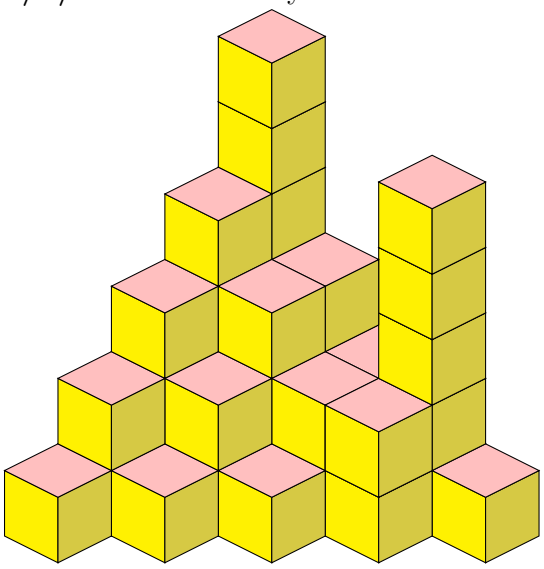
Selected MOEMS Problems of the Week, 2022–24

9/5/22 How many cubes are in the below structure? Some cubes are not visible.

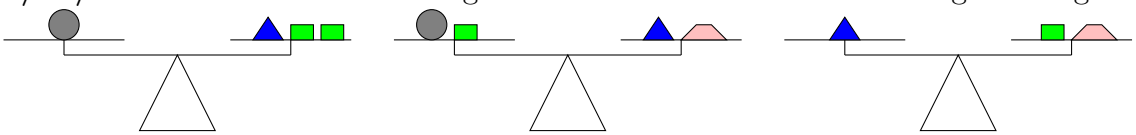


9/12/22 The complete outside (including the bottom) of a wooden 4-inch cube was painted purple. Then, it was cut into 1-inch cubes. How many of the 1-inch cubes do not have any purple paint on any face?

9/19/22 (modified) Suppose all the counting numbers are arranged in columns as show below. Under which column (letter) will 789 appear?

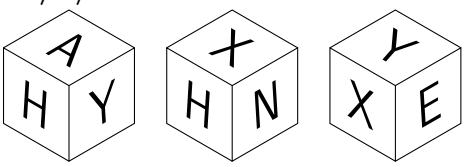
A	B	C	D	E	F	G
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	...	...

9/26/22 Each of the three diagrams below shows a balance of weights using different objects.



How many ▬ will balance a ●?

10/3/22 Below are three views of the same cube.



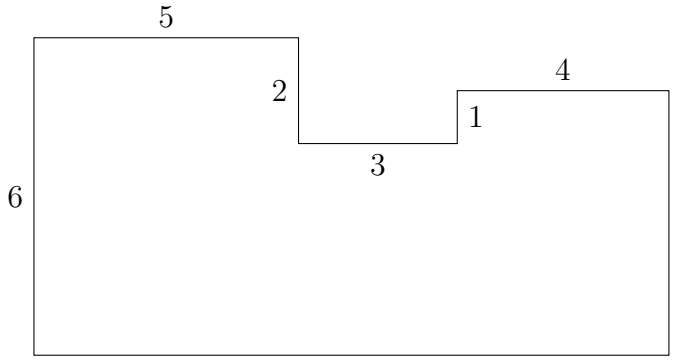
Which letter is on the face opposite H? Opposite X? Opposite Y?

10/17/22 The perimeter of a rectangle is 22 inches, and the inch measure of each side is a counting number (1, 2, etc.). How many different areas in square inches could the rectangle have?

10/31/22 When Frankenstein, Dracula, and a mummy compared the amount of candy that they got on Halloween, they discovered that Frankenstein and Dracula together had 12 pieces, Dracula and the mummy together had 18, and Frankenstein and the mummy together had 10. Who has the least amount of candy, and how much is it?

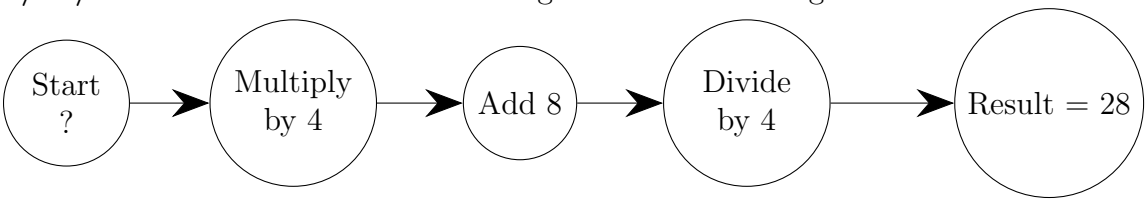
11/21/22 What is the simplest form of the fraction $\dfrac{1}{1+\dfrac{1}{2+\frac{1}{3}}}$?

12/5/22 In the figure below, all corners are right angles, and each number represents the unit length of the segment nearest to it. How many square units of area does the figure have?



12/19/22 "Consecutive numbers" are whole numbers that follow in order, like $7, 8, 9, 10, 11, 12$. Find three consecutive numbers such that the sum of the first and the third is 118.

1/23/23 What should be the starting number in the diagram?

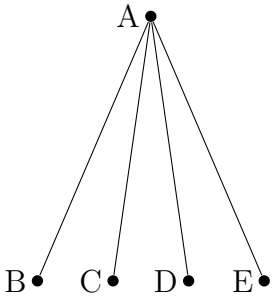


1/30/23 When certain numbers are placed in the empty boxes below, the sum is the same in each of the three rows, each of the three columns, and each of the two diagonals. What number should be in the center box? (Bonus: find all the missing numbers!)

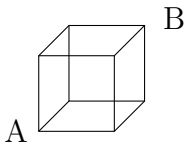
5		13
9	7	

2/13/23 Peter had a 12:00 noon appointment that was 60 miles from his home. He drove from his home at an average rate of 40 miles per hour and arrived 15 minutes late. At what time did Peter leave home for the appointment?

2/20/23 An acute angle is an angle whose measure is between 0 and 90 degrees (between 0 and $\pi/2$ radians). Using the line segments in the diagram, how many different acute angles can you find?

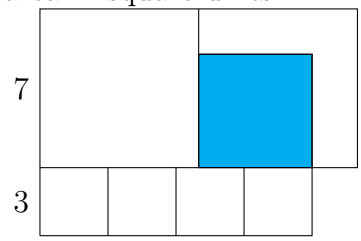


2/27/23 The length of the shortest trip from corner A to corner B along the edges of the cube is the length of three edges. How many different 3-edge routes are there from A to B?

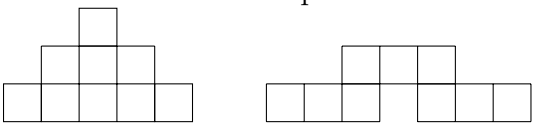


3/6/23 I have exactly ten coins whose total value is \$1. If three of the coins are quarters, then what are the remaining coins?

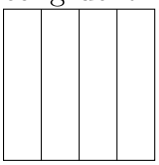
3/13/23 In the figure below, there are two large congruent squares with sides 7 units long, and four small congruent squares with sides of 3 units long. If the shaded figure is also a square, then what is its area in square units?



4/17/23 The small boxes in the two figures are all congruent squares. The perimeter of the first figure is 48cm. What is the perimeter of the second figure?

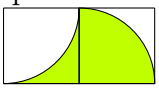


5/1/23 The square below is divided into four congruent rectangles. The perimeter of each of the four congruent rectangles is 25 units. How many units are there in the perimeter of the square?



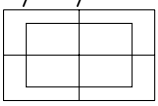
5/15/23 (modified) Note: 1^2 means 1×1, $2^2 = 2 \times 2$, $3^2 = 3 \times 3$, etc. Also, it may help to know that $1^2 + 2^2 + 3^2 + \cdots + 10^2 = 385$. Find the value of $N = 2^2 + 4^2 + 6^2 + \cdots + 20^2$.

5/29/23 ABCD and AFED are squares with a common side AD of length 10. Arc BD and arc DF are quarter-circles. What is the area of the shaded region?

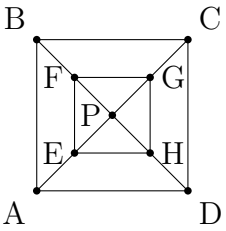


6/5/23 A square piece of paper is folded in half as shown and then cut into two rectangles along the fold. The perimeter of each of the two rectangles is 18cm. What is the perimeter of the original square?

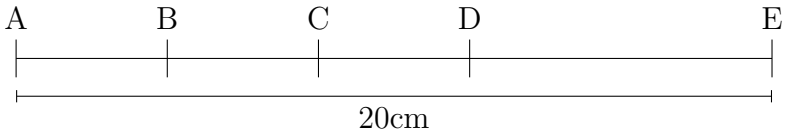
6/26/23 How many different rectangles can you find?



7/4/23 ABCD is a square; E, F, G, and H are midpoints of AP, BP, CP, and DP, respectively. What fractional part of the area of square ABCD is the area of square EFGH?



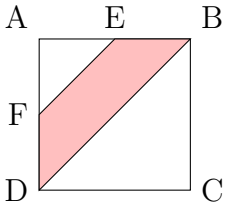
7/10/23 The length of AE is 20cm. B is the midpoint of AC, C is the midpoint of BD, and D is the midpoint of BE. What is the length of DE?



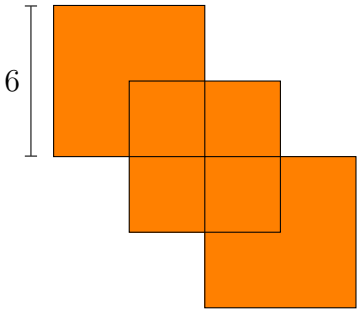
7/24/23 Consider the property that when a number is divided by either 5 or 7, the remainder is 1. What is the smallest odd counting number larger than 10 that has this property?

8/21/23 Six people participated in a checkers tournament. Each participant played exactly three games with each of the other participants. How many games were played in all?

9/11/23 ABCD is a square with area 16m^2. E and F are midpoints of sides AB and BC, respectively. What is the area of the trapezoid DFEB (shaded area)?



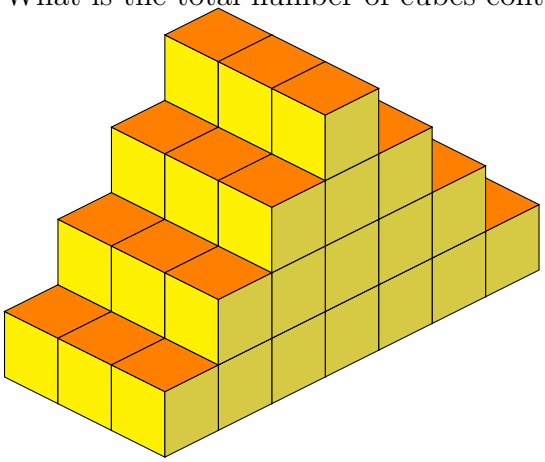
9/25/23 Three squares each have sides of length 6 units and overlap each other as shown. The points where the sides cross are midpoints. Find the area of the shaded figure.



10/2/23 Suppose all the counting numbers are arranged in columns as show below. Under which column (letter) will 300 appear?

A	B	C	D	E	F	G
1		2		3		4
	7		6		5	
8		9		10		11
	14		13		12	
15		16		...		...

11/6/23 The block stairs in the figure were constructed by placing layers of cubes on top of each other. What is the total number of cubes contained in the staircase?



11/13/23 Four numbers are arranged in order of size, and the difference between any two adjacent numbers is the same. Suppose 1/3 is the first and 1/2 is the fourth: 1/3, __, __, 1/2. What are the two numbers between 1/3 and 1/2?

11/20/23 13 plums weigh as much as two apples and one pear. Four plums and one apple have the same weight as one pear. How many plums have the weight of one pear?

1/1/24 When 24 is added to a number, the result is the same as when the number is multiplied by 3. What is the number?

1/8/24 The angles of a triangle are in a ratio of 4:3:2. What is the degree measure of the second-largest angle? (Note: the angles of any triangle sum to 180°.)

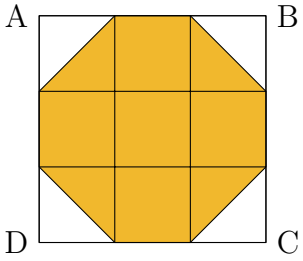
MOEMS PotW (selected)

Fairview Elementary Math Club

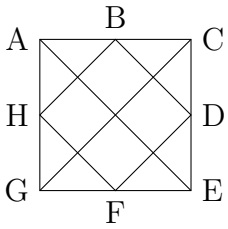
1/15/24 The "tribonacci" sequence starts with terms $T_0 = T_1 = 0$ and $T_2 = 1$ and follows a pattern where each term is found by adding the three that came before it. For example, $T_3 = T_2 + T_1 + T_0 = 1 + 0 + 0 = 1$, and then $T_4 = T_3 + T_2 + T_1 = 1 + 1 + 0 = 2$. What is T_8?

2/5/24 If you write out the first 20 odd counting numbers (1, 3, 5, ...), how many times does "3" appear as a digit?

3/11/24 Square ABCD is composed of nine congruent squares as shown. The area of the shaded region is 14cm^2. What is the area of square ABCD?



3/18/24 Square ACEG is drawn below. Points B, D, F, and H are midpoints of the sides of the square. How many squares can you find in this diagram?

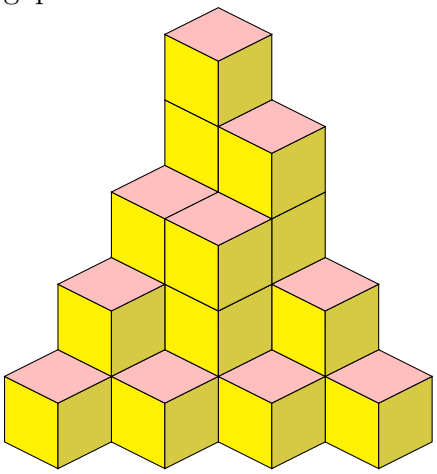


4/1/24 On a standard 12-hour clock, the numerals 12 and 6 are opposite each other. On the planet Bajor, they use a circular 10-hour clock with the numerals 1 to 10 equally spaced. What pair of opposite numerals on a Bajorian clock has a sum of 11?

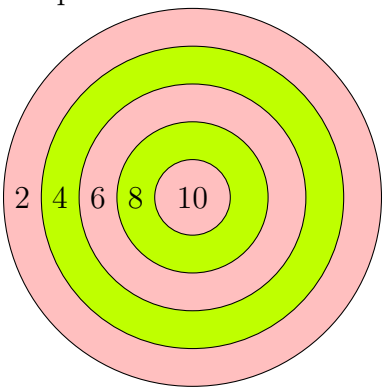
5/13/24 Leo has 6 more pogs than Wilson. After Leo gives 10 pogs to Wilson, how many more pogs will Wilson have than Leo?

6/17/24 Suppose a standard 12-hour clock now shows a time of 10:45. What time will the clock show 100 hours from now?

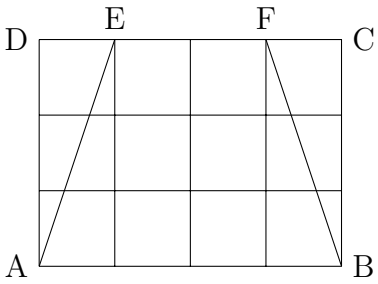
6/24/24 The block tower shown is made by placing congruent cubes on top of each other with no gaps. Not all cubes are visible. How many cubes does the tower contain?



9/9/24 Reuben throws 5 darts at the target shown. Each dart lands in a region of the target, scoring the points shown. Of the following total scores, list all that are *not* possible: 6, 14, 17, 38, 42, 58.



9/16/24 ABCD is a rectangle whose area is 12 square units. How many square units are contained in the area of trapezoid EFBA?



10/7/24 The area of a square is 36cm^2. A rectangle has the same perimeter as the square. The length of the rectangle is twice its width. What is the area of the rectangle?