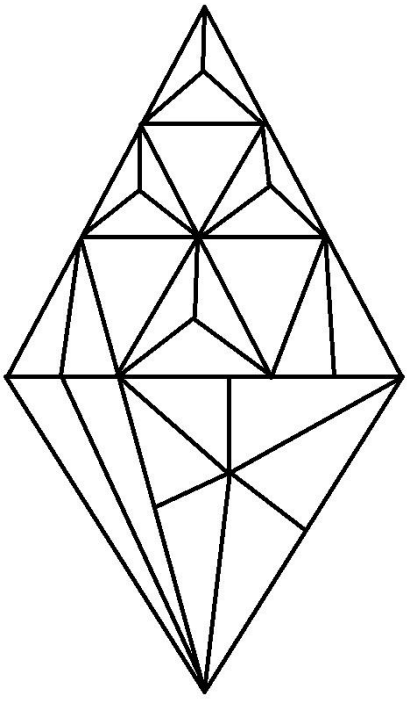
Week #1 Winter 2023

Problem of the Week Solution



How many triangles are in the image above?

Solution: 46

Week #2 Winter 2023

Problem of the Week Solution

On Monday morning there wasn't a flake of snow on the ground. Later that day, it snowed at a constant rate of 1 inch per hour from 12:00pm until 8:00pm and then stopped leaving 8 inches of snow on the ground. On Monday night, the snow melted at a rate of .125 inches per hour from 8:00pm Monday night until 12:00pm Tuesday. On Tuesday it snowed at a constant rate of 1 inch per hour from 12:00pm until 8:00pm and then stopped leaving 8 more inches of snow on the ground. On Tuesday night, the snow melted at a rate of .125 inches per hour from 8:00pm Tuesday night until 12:00pm Wednesday. This pattern continues for a very long time (snowing during the day and melting at night). For example, on Monday at noon there should be 0 inches of snow, on Tuesday at noon there should be 6 inches,... This went on for so long that Gerald, who was in his 97th year of life declared "I will shovel the snow as soon as it reaches 97 inches!" At what time, and what day of the week should we see Gerald outside shoveling snow?

Solution: Tuesday (three Tuesdays later) at 7:00 pm

Week #3 Winter 2023

Problem of the Week Solution

6	1	8
7	5	3
2	9	4

Is it possible to fill the squares with different numbers (no two numbers can be the same) so that the sum of each row and the sum of each column and the sum of each diagonal gives the same value?

Solution: A possible solution is filled in above.

Week #4 Winter 2023

Problem of the Week Solution

This week we will play a little game. You get to go first. There are 54 "beans" on my desk. During your first turn you may as little as 1 bean and as many as 53 beans. From then on, when it is my turn I may take as little as 1 bean and as many as double the amount of beans you just took. When it is your turn, you may do the same: take as little as 1 bean and as many as double the amount of beans I just took. The person that takes the last bean wins. For the problem of the week, you must beat me. The catch is that the problem of the week points will be awarded to the student(s) who take the highest number of beans on their first turn and still win the game.

Solution: If I am able to get you down to the following number of beans and make it so that you are unable to take all of them, I will win: 3, 5, 8, 13, 21, 34. To see that I can win in any scenario where you take more than 1 bean to begin, I need to tell you my plays. To describe how I would play (if I am unable to take them all at once), I will list my plays in ordered pairs (x,y) where x tells you the number of beans on the table at the start of my turn and y tells you the number of beans that I will take.
(52,5) (51,1) (50,3) (49,2) (48,1) (47,13) (46,1) (45,3) (44,2) (43,1) (42,8) (41,2) (40,1) (39,5) (38,1) (37,3) (36,2) (35,1) (33,1) (32, 3) (31,2) (30,1) (29,8) (28,2) (27,1) (26,5) (25, 1) (24,3) (23,2) (22,1) (20,2) (19,1) (18,5) (17,1) (16,3) (15,2) (14,1) (12,1) (11,3) (10,2) (9,1) (7,2) (6,1) (4,1) (2,2)

Since I have a play for every possible value that I am faced with except 3, 5, 8, 13, 21, 32 I will always be able to beat you if I am not left with this many beans. If you take 1 bean, I will be unable to win (you would play according to the plan above). If you take anything less than 11 beans I have a plan that will avoid being left with 3, 5, 8, 13 or 21 beans, but if you take 12 beans or more I am able to take the remaining beans and win. **The answer is that you must take 1 bean.** For more information, look up Fibonacci Nim.

Week #5 Winter 2023

Problem of the Week Solution

There are four boxes of caramel apples. Each of the boxes contains 100 caramel apples. In three of the boxes, each caramel apple weighs exactly 12 ounces. In the fourth box, each of the caramel apples weighs exactly 12.1 ounces. The cardboard material for each of the four boxes weighs the same. None of the boxes are labeled and you cannot tell by looking which box is the "fourth" box. In front of you, there is a digital scale. It is low on battery and can only be used once. It is also faulty: any amount of goods that weighs at most 120.3 ounces will register the correct weight, but any amount of goods that weighs more than 120.3 ounces will produce an error message. How can you determine which box has the 12.1 ounce apples by using the scale exactly once?

Solution: If you take one apple from the first box, 2 from the second box, 3 from the third box and 4 from the fourth box and weigh it, the number after the decimal will be the box that the apples that weigh 12.1 ounces will be in. If there is an error,