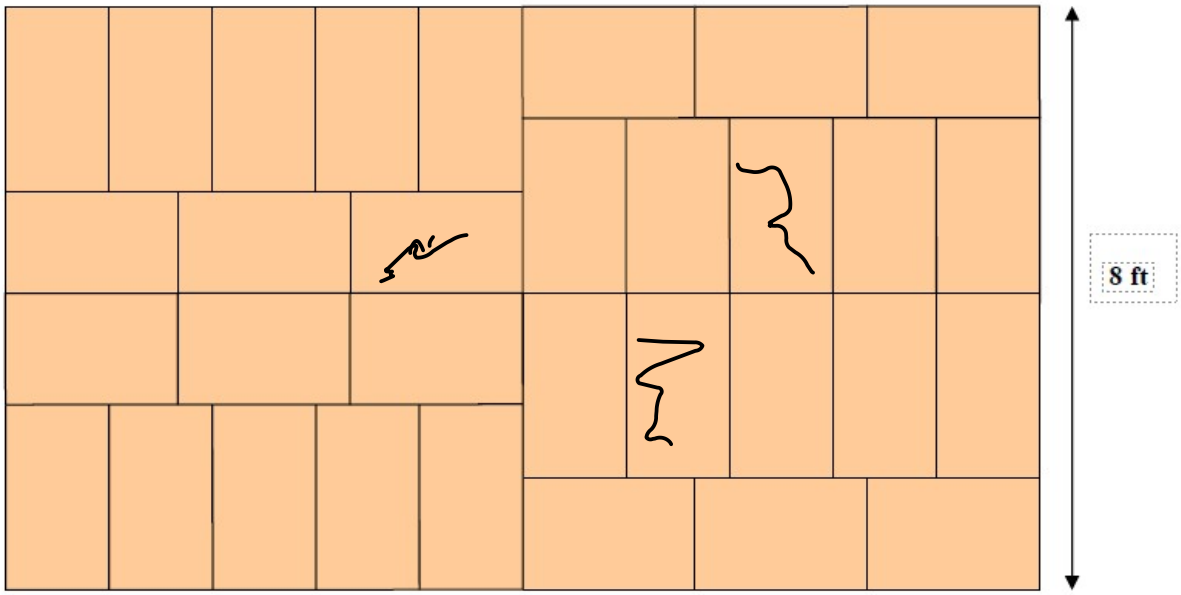
Mystery Patio Pavers

You work for a company that makes custom paver tiles. A customer sent you this picture of his patio. He said the patio is made up of identical tiles, positioned either vertically or horizontally. He wants to replace three tiles that are cracked. He didn't give you the dimensions of the tiles but did tell you that the width of the patio is 8 feet.



- What are the dimensions of a replacement tile for the patio? **(2 points)**
- What is the area of the patio? **(1 point)**

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1014 to present your solution to the Master Teacher.

Digital Equation

Using the digits 1 – 9 at most one time, fill in the boxes below to form the largest possible integer value for the sum of the values of *x* and *y*. Use the number tiles in your box to help you.

A team may return to present this problem to receive the most points possible. The maximum integer solution is 3 points. An integer solution is worth 1 point.

$$2x - \square = \square$$

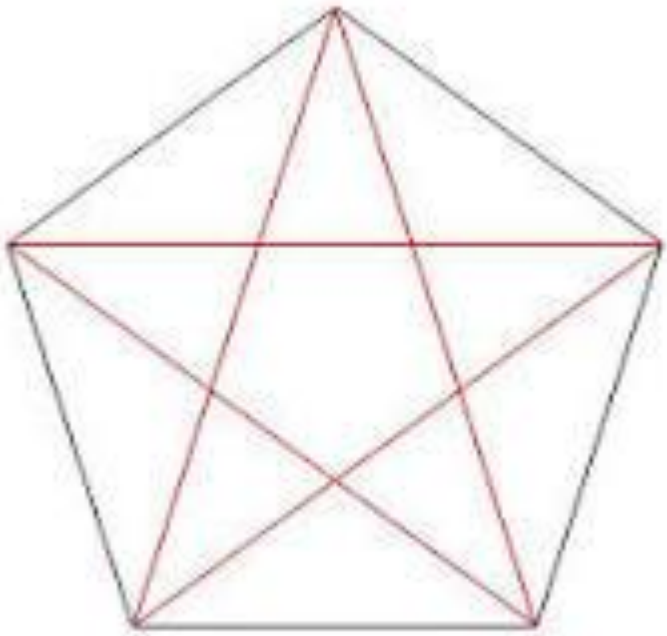
$$\square y + \square = \square$$

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1016 to present your solution to the Master Teacher.

Number of Triangles
(2 points)

How many triangles of all sizes are shown in the diagram?



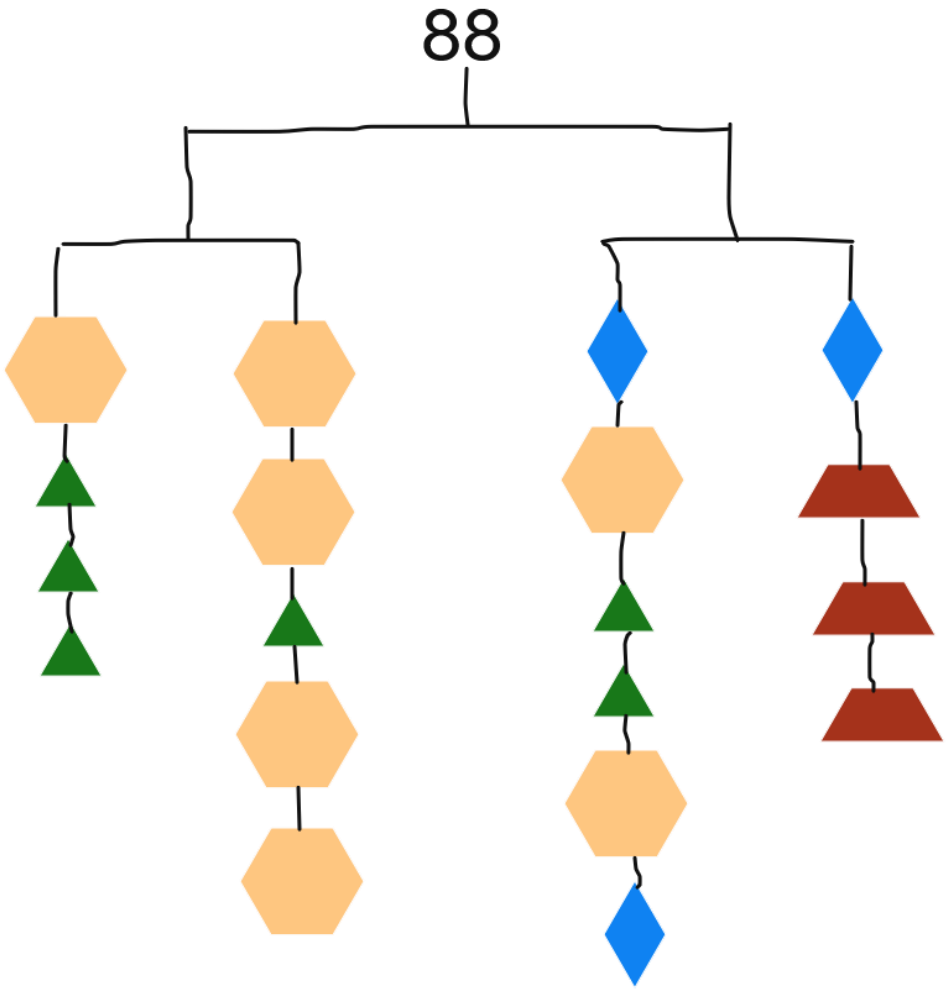
Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1066 to present your solution to the Master Teacher.

Pattern Block Mobile

3 points

The total value of all of the pieces in this mobile is 88. The Mobile is balanced as shown. What is the value of each piece? (You have a set of pattern blocks that you can use to help solve the problem.)

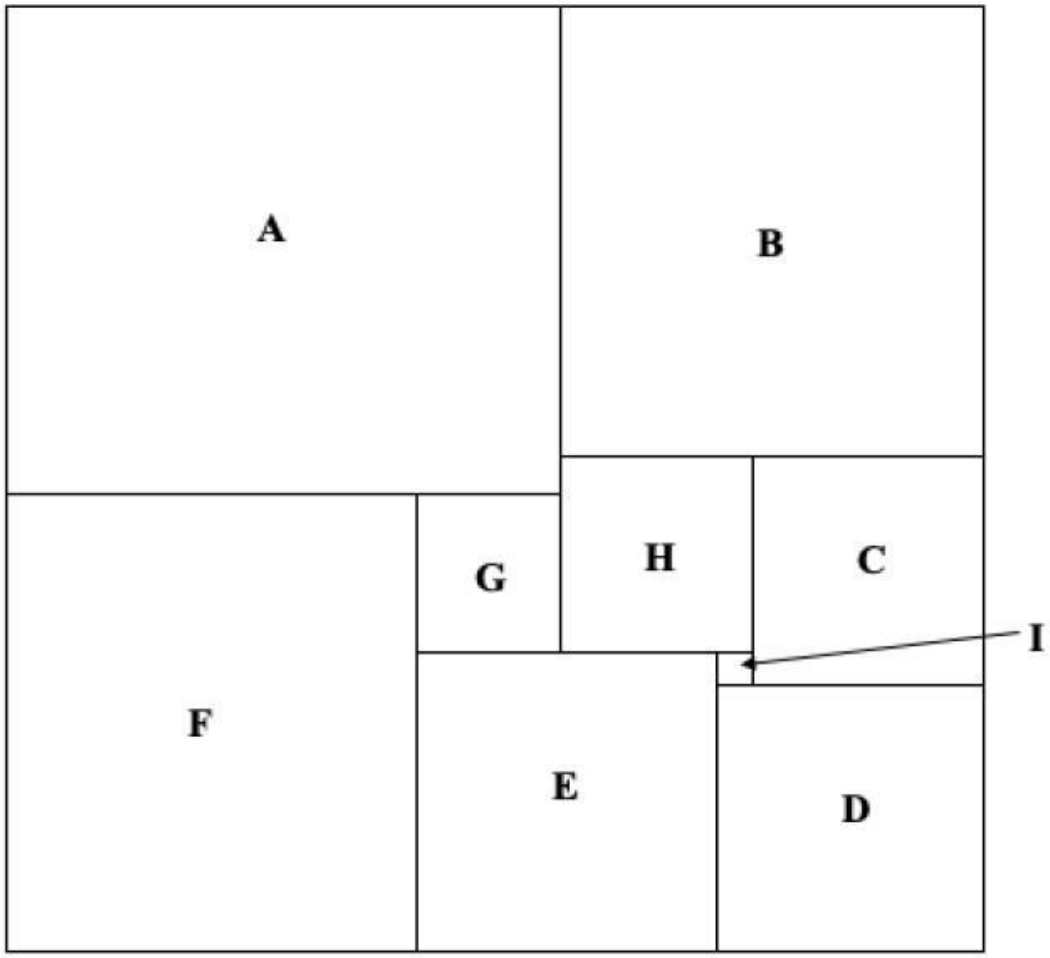


Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1015 to present your solution to the Master Teacher.

Squares, Squares, and More Squares

In November 1958, the magazine *Scientific American* showed this diagram on its cover.



Each of the interior rectangles is a square.

- If square D is 81 square units and square C is 64 square units, what is the area of the entire figure? **(1 point)**
- What is the perimeter of the outer figure? **(1 point)**

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1056 to present your solution to the Master Teacher.

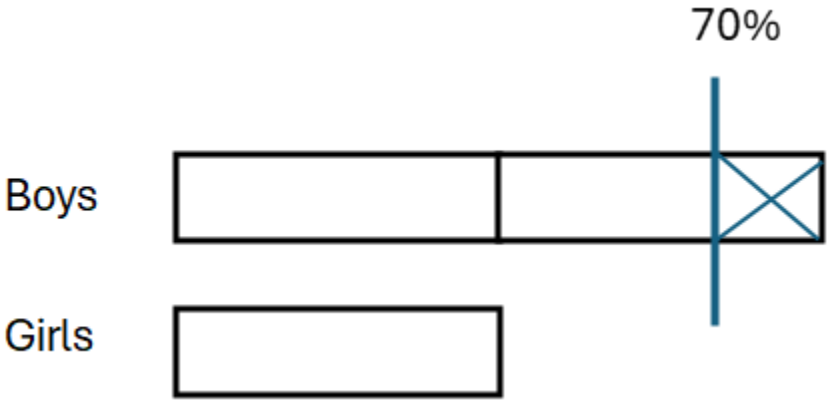
Finding Mathematical Harmony

A.

Boys

Girls

B.



C.

Boys

Girls

Finding Mathematical Harmony

There are twice as many boys as girls in the school choir. The number of boys has decreased by 30%. By what percentage must the number of girls increase so that an equal number of boys and girls are in the choir?

1. Describe what is happening in drawings A, B, and C. Relate these drawings to the choir problem above.

2. By what percent did the girls increase?

3. What is a possible number of boys in the original choir for this scenario to happen?

POINT VALUE: 1 point per question for a total of 3 points

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1063 to present your solution to the Master Teacher.

Famous Mathematicians

(3 points)

Although not all of the mathematicians listed below actually worked together, the equation below makes you think they did.

Each unique letter represents a unique digit 0 through 9. If a letter is repeated, it will have the same value.

Your task is to determine the value of each mathematician.

EUCLID + GAUSS = PASCAL

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1060 to present your solution to the Master Teacher.

Part I- Maximizing Cost Savings

I averaged about 12.3 miles per gallon on ethanol (E85) and 13.6 miles per gallon on regular unleaded. To the right is a dotplot, boxplot, and a vertical line representing the means of my driving fuel efficiency.

Someone asked me about the size of my gas tank; I looked this up and it is 35 gallons in a 2015 Ford F250.

If I were to pull up at the following gas station with regular fuel costing $3.35 and ethanol (E85) fuel costing $2.35, which fuel would save me the most money when driving given that my truck gets about 1.3 more miles per gallon using regular unleaded? Why? **(1 point)**

Which fuel should I purchase at this gas station to save the most money on fuel with the current difference in fuel economy? Why? **(1 point)**

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1064 to present your solution to the Master Teacher.

Part II - Maximizing Cost Savings

(3 points)

If I pull up at any gas station, how can I determine which gas to pick to give the most savings if the cost of E85 is x and the cost of regular unleaded gasoline is y.

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1064 to present your solution to the Master Teacher.

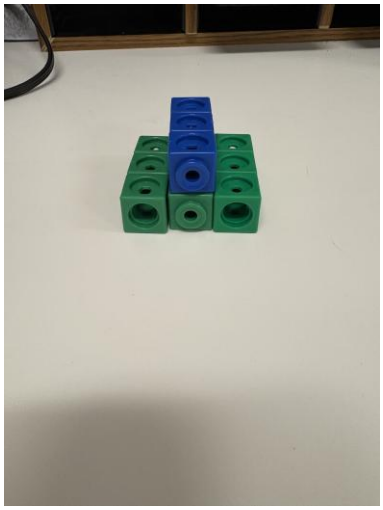
Staircase Problem

(3 points)

How many blocks do you need to make a a staircase that is 100 blocks high?

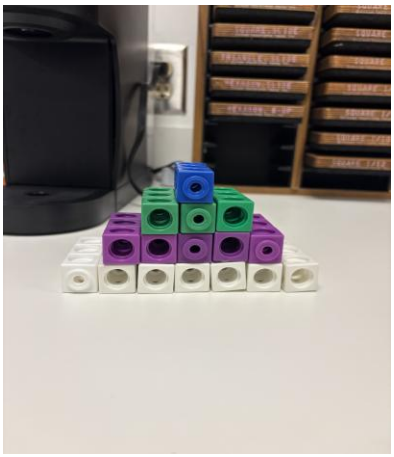
1 block high

2 blocks high



3 blocks high

4 blocks high

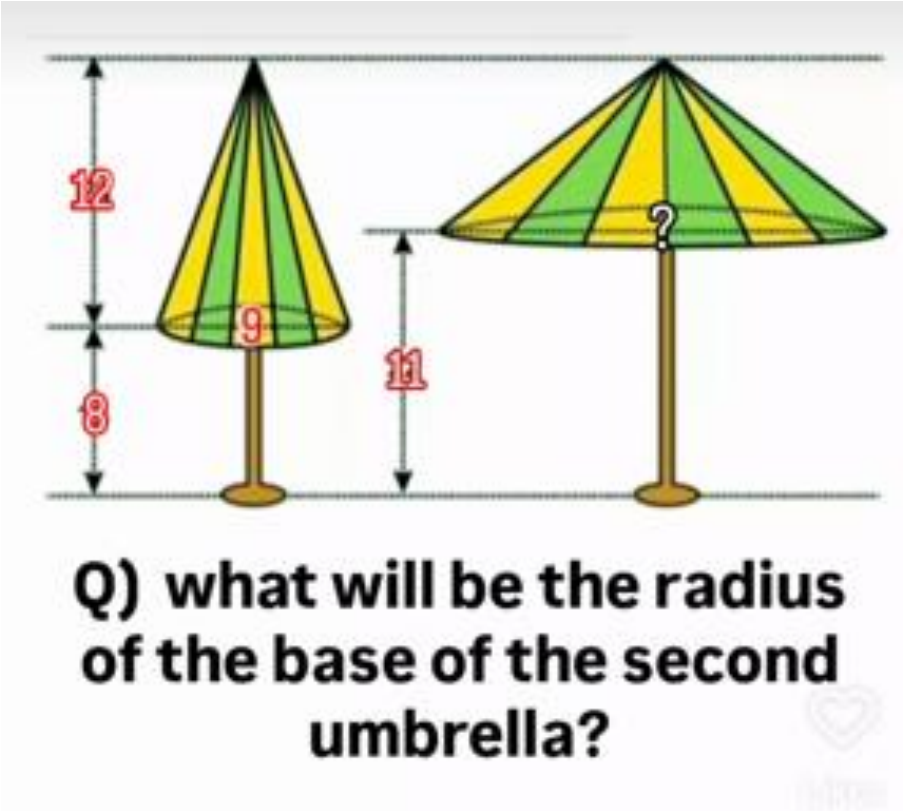


Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1065 to present your solution to the Master Teacher.

Umbrella Radius

(2 points)



Q) what will be the radius of the base of the second umbrella?

the closed umbrella diameter is 9

Be prepared to justify your descriptions.

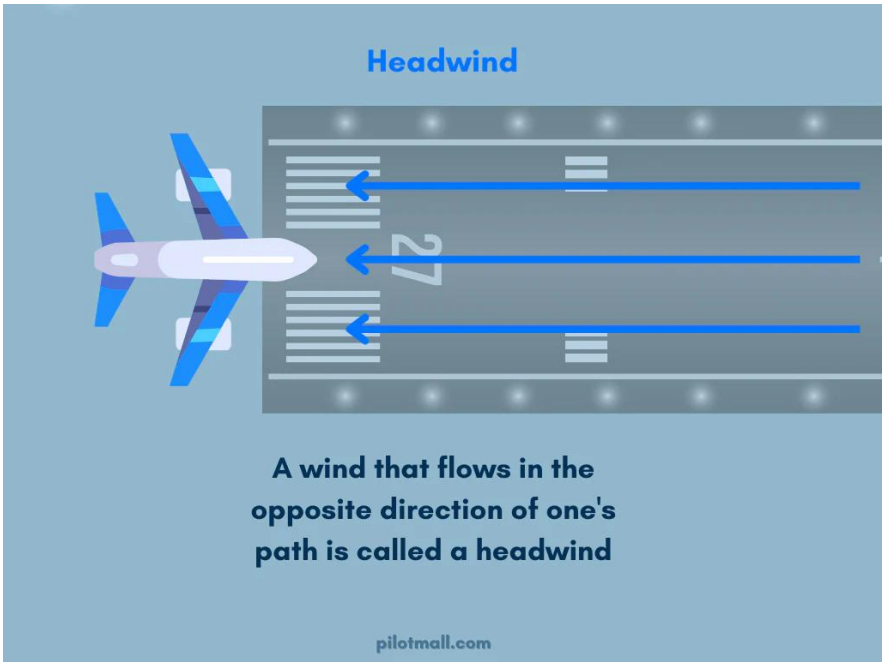
When you have solved the problem, go to Historic Room 1059 to present your solution to the Master Teacher.

Average Speed

(2 points)

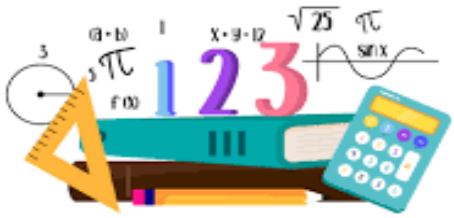
A plane leaves airport A and travels at an average ground speed of 100 miles per hour to airport B. The plane refuels and travels back from airport B to airport A at an average ground speed of 80 miles per hour because of a strong head wind. What was the average ground speed for the round trip?

You may be given a hint by the Master Teacher and receive only 1 point for the problem.



Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1067 to present your solution to the Master Teacher.



Factorial Problem

(2 points)

A factorial is defined as a!=(a)(a-1)(a-2)(a-3)...1 for any positive integer.

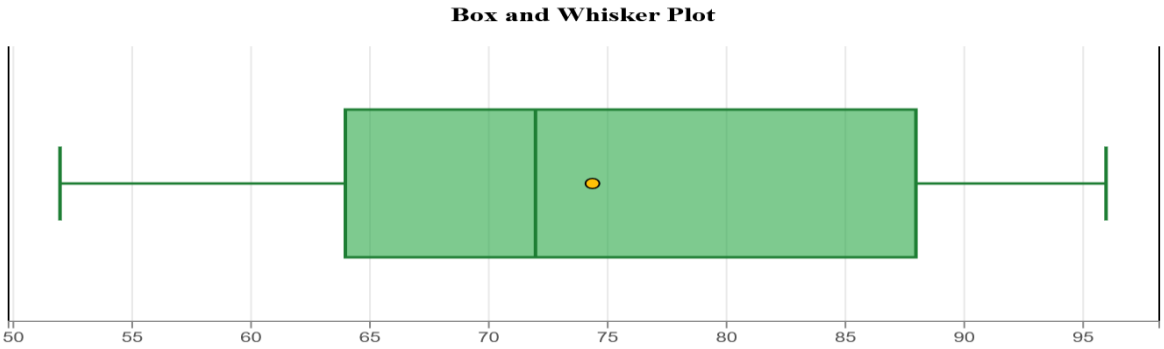
For example, 4!=4x3x2x1=24

Find n in the following equation: (6!)(7!)=n!

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1069 to present your solution to the Master Teacher.

Probability Challenge



At a Math Masters practice, 24 teams' scores are summarized below:

- Minimum: 52
- Q_1: 64
- Median: 72
- Q_3: 88
- Maximum: 96

A team is selected at random:

1. What is the probability the team scored between 64 and 88? **(1 point)**
2. If no two teams scored the same amount, what is the probability a randomly selected team scored more than 88? **(1 point)**

Be prepared to justify your descriptions.

When you have solved the problem, go to Historic Room 1013 to present your solution to the Master Teacher.

Math Masters problem(s) from Pilot Peppers

*Students are not required to solve all three problems. However, the more problems that are solved, the more points their team earns. This Master Teacher allows one penalty-free question to be asked. If your team does not use their penalty-free question, you will be awarded 0.5 points.

There are two types of miles: statute miles (SM) and nautical miles (NM). Statute miles are used when driving vehicles on the ground, while nautical miles are used when flying in an airplane or riding in a boat. (Airplanes are cooler though.) Based on the fact that there are two different types of miles, each of those types has its own rate or speed designation. The rate for statute miles is miles per hour or mph, which most people are familiar with. The rate for nautical miles is knots or kts. No, this doesn't mean you tied a knot in a rope (but there might be a little history behind that to research later); knots is nautical miles per hour. Both statute miles and nautical miles are used in aviation, but in different ways. Often times pilots have to use both of them in one flight, just for different reasons.

Flight Level 1 problem:

A statute mile is 5,280 feet, whereas a nautical mile is approximately 6,076 feet.

- Question: Why is a nautical mile is longer?
- Two part question: Part 1: Determine the ratio to use to convert statute miles to nautical miles. Part 2: Determine the ratio to use to convert nautical miles to statute miles.
- Convert 54 statute miles to nautical miles.
- Convert 109 nautical miles to statute miles.

Flight Level 2 problem:

Pilot Peppers loves to fly her airplane as much as she can. Since she used to teach math, she's all about the numbers. She recently recorded that it took her 54 mins to fly to one of her favorite grass airstrips, Moontown near Huntsville, AL. However, it only took 40 minutes to get back home. During the two flights, the climb out and landing phases were the same and her indicated cruising airspeed was roughly the same, 95 kts.
Question: Why did it take longer to get to Moontown than it did to return?
Question: Based on your answer to the first question, provide calculations and a convincing argument to explain why it took longer to get to Moontown than it did to return.

Flight Level 3 problem:

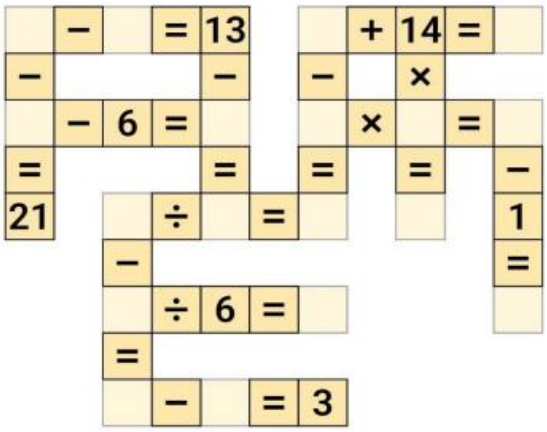
Recently, Pilot Peppers was soaring through the skies, enjoying the amazing views, and remembering trips she had previously made. She remembered one of the most special trips thus far which was her first trip after becoming a pilot. Pilot Peppers and her husband flew to a grass airstrip south of Atlanta called PeachState Aerodrome to eat lunch at Barnstormers, a restaurant located at the airstrip. The trip was 77 NM one way from the grass airstrip she lives on (where she keeps her plane and flies from). During that trip, she had a 10-kt headwind; so, it felt like it took forever to get there. As she continued her musings, she noted that another trip she made took the same amount of time even though the trip was to a different place. On that particular trip, Pilot Peppers flew 93 NM to Auburn University Regional Airport, in (you guessed it) Auburn, AL. Luckily she had a 10-kt tailwind this time. (Side note: Pilot Peppers is also known as Dr. Peppers since she earned a doctorate in math education at Auburn University).

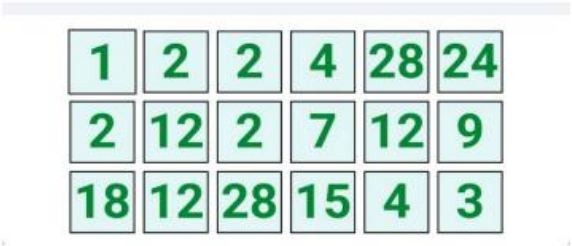
Question: What was Dr. Pilot Peppers's average cruising speed on these trips?
Be prepared to provide calculations and evidence to support your solution.
Note: A one-chance bonus credit is available for this problem for providing a very thorough solution during your first visit to the Master Teacher's room.

TIE BREAKER!

11:30-11:45

When finished, return to envelope and have **pair of students** submit to CRMC staff/volunteers at Printing Press in Breezeway.





Complete the ***Cross Math*** grid by placing the green number tiles in the blank spaces to create a correct number fact. Each green tile will be used once, and all the tiles will be used to complete the grid.