Introduction:

Due to my curiosity and interests in physics, i would like to contribute many aspects in different area of physics. In this investigation, i would like to make experiment related to parabola. Parabola (according to dictionary.com) is a plane curve formed by the intersection of a right circular cone with a plane parallel to a generator of the cone. In simple word, a curve of an object that appears when throwing it into the air and dropped back down due to gravity. I would like to take a closer look in to the angle of particular object that can create the greatest distance from the same point. Which angle that the person throw will maximize the distance the most, and create the perfect and longest parabola. The entire lab will be based on the following research question:

In what angle of the Nerf gun does it lunch the dart furthest distance?

Nerf Gun

What is Nerf gun? Nerf is a toy brand that sells different types of toy of foam-based weaponry, the Nerf guns is one type of Nerf toys that shoot ammunition made from Nerf foam. It might be very strange to use a toy in an experiment, but i believe in this situation, Nerf gun is the best cannon for shooting objects. In this experiment, it required a person or thing to apply the same force for all of the tries. It is impossible for people to manage and control their strength precisely to make each tries in a fair state. Where the Nerf gun apply the same force to all darts each time, which makes the Nerf gun suitable for this experiment.

How Nerf Gun works

There is a piston inside the Nerf gun, the piston has been pulled back against the force of the spring and it locked with a latch that links to the trigger. At the tip of the spring connects a plunger. The Nerf gun now stored potential energy, and the chamber's value is now large. When the trigger is pulled, the piston has been released from the latch and the spring forced the plunger to move forward, causing the volume of the chamber to decrease and increase in air pressure. The air pressure applies force that cause the only move able object (dart) to blast off. Since the length of spring, volume of chamber, length of Nerf gun, and weight of dart does not change, it gives the perfect condition for fair experiment.

Apparatus:
- Meter ruler
- Pen, Marker and Paper
- Nerf Gun model: Nerf N-strike Elite strong-arm blaster slam fire.
- Nerf Gun Dart
- Table
- Tape and scissor
- Protractor

Photo of the Nerf gun: Nerf N-strike Elite strong-arm blaster slam fire

Instruction

Step 1: Place Meter ruler on the ground and put a table at the end of the Meter ruler.

Step 2: Create a giant protector by using paper and pen, and protractor. (Bigger size than the gun)

Step 3: Place the gun and created protractor on the table, mark the gun position and place the created protractor next to Nerf gun.

Step 4: Use the created protractor to determine the angle of recording experiment, and lunch the dart of Nerf gun.

Step 5: Wait until the dart stopped completely before measuring the distance from the table to the location where dart contact with surface of the floor.

Step 6: Record down the distance on piece of paper.

Step 7: Reload the Nerf gun dart.

Repeat step 4 to step 7 with different angles in the experiment.

* Location will be held in a large area of indoor, without any wind or disturbance.

* Location used: School Gym

Hypothesis

Due to my understanding of the physics, i believe that the 45 Degree is the angle that will lunch the dart furthest compare to the angles in 90 - 0. Because 0 degree is too flat and 90 degree is way too straight, 45 degree is where in the angle between two extremes, so i think it is the best angle that will make the dart fly the most distance. Furthermore, the distance will increase from 90 till 45 degree, and decrease till reaches 0 degree.

Data

Angles (Degree)	Distance (cm)			
	Tries 1	Tries 2	Tries 3	Average
90	119	49	-3	55
80	220	277	214	237
70	639	627	702	656
60	1270	1341	1280	1297
50	2020	1569	1697	1762
45	2265	2264	2290	2273
40	2110	2290	2377	2259
30	2135	2228	2318	2227
20	2105	2176	2164	2148
10	1602	1635	1657	1631
0	847	1023	505	792

Weight of Dart (g)	Height of Nerf gun placed (cm)
	64

Dimensions of Nerf gun in centimeter (cm)

Height (cm)	Length (cm)	Width (cm)

Dimensions of Nerf gun dart in centimeter (cm)

Radius (cm)	Length (cm)	Volume (cm^3)

Graph

Distance vs Angles graph
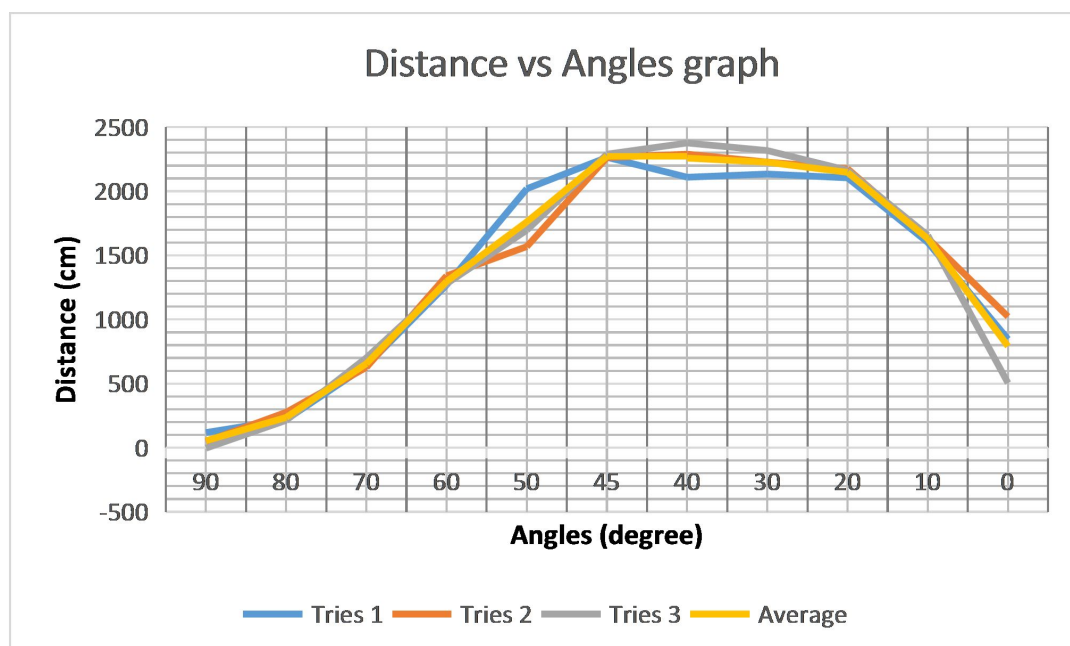
Analysis

The recordings of numbers are all calculated in average, in this way it is much easier to find the most accurate results.

(Try 1 + Try 2+ Try 3) / 3 = Average Tries

Based on the recording above, we can clearly sees the curve of the graph and the changes in the table number. The records had proofed that my hypothesis is correct. By the point of 45 degree, it is the maximum distance the Nerf gun can travel. The curve of the graph shows the change of the distance while changing in angles. In 90 degrees, the distance is the lowest.

Why 3 tries   Point of error is:

Counter difficulties
Hit The roof
Shoot too far

Error and Future Changes

There are many possible areas that contain errors can effect the result significantly, here are few things that I recognized and spotted during the experiment that needed to improved and edit.

- The dart bounces

- The dart is made by soft foam, so when it make contact with the ground, it won't stay in the same place, it bounces. The record will always be on the spot where it first hit the ground, so i have to record it by using visual to provide the values. For the future reference, it would be better to have two people in this experiment, one lunch the Nerf gun and other one stay next to the meter ruler and do the recording. It will minimized the error in recording of the dart position.

- The protractor is not accurate enough

- Although the protractor is very large that can put the Nerf gun next to it reading and placing the Nerf gun as stable and exact the angle as it can, the accuracy is not enough human reading and placing the Nerf gun cannot be very precise, it can shakes in between angles and cost the ending result significantly. However, imagining if there is a stand that can hold the gun in place and project the Nerf gun in different angle, the result will be far more accurate and reliable.

Conclusion:

Bibliography:

https://www.quora.com/How-do-Nerf-guns-work