Vishwa (Athlete) & Marwa (Coach)

# Javelin Throw
## Physics

**Data collected:**

| | | |
|---|---|---|
| **Release Angle** | 17.5 °<br><br>Refer to Pages 3 and 4 for the workings | Measured using Angulus (Angles On Images) app |
| **Initial Velocity** | 13.88 m/s<br>Refer to Page 5 and 6 for | Measured using formula for displacement in terms of |

| | | |
|---|---|---|
| | workings | initial velocity and acceleration<br><br>s=ut + ½ at^2 |
| **Wind speed** | +1.94 m/s | Measured using anemometer |
| **Wind direction** | Headwind (With the direction of javelin throw) | Measured using anemometer |
| **Distance travelled by the javelin** | First throw - 8m<br>Second throw - 9.4 m | Measured using measuring tape |
| **Time taken for the javelin to reach the ground** | 0.85 Seconds | Measured using a stopwatch |

## Concepts discussed to improve the javelin throw→

### Footwork

Worked on my footwork to ensure a consistent and powerful approach to the throw. The right footwork helped me generate more speed and power.

### Grip and Arm Position

Gripped the javelin correctly. Maintained a straight and relaxed arm position as I prepared to throw. I also held the javelin from between. As holding the javelin at its centre of gravity provides balance and stability. This is essential for maintaining control during the throw and ensuring that the javelin travels in a straight and predictable path.

### Maintain a Proper Launch Angle

The launch angle is the angle at which you release the javelin. To maximize distance, I aimed for an angle of around 30-45 degrees above the horizontal. This angle allows me to achieve the ideal balance between height and distance.

### Balance and Posture

I maintained good balance throughout my throw. My body was aligned properly during my approach and throw to maximize power and accuracy.

### Using my whole body

The javelin throw is not just about arm strength. I engaged my whole body, including my legs and core, to generate maximum force during the throw.

### Speed

I also considered taking a longer runup to increase the speed at which I throw the Javelin.

## Release Angle:

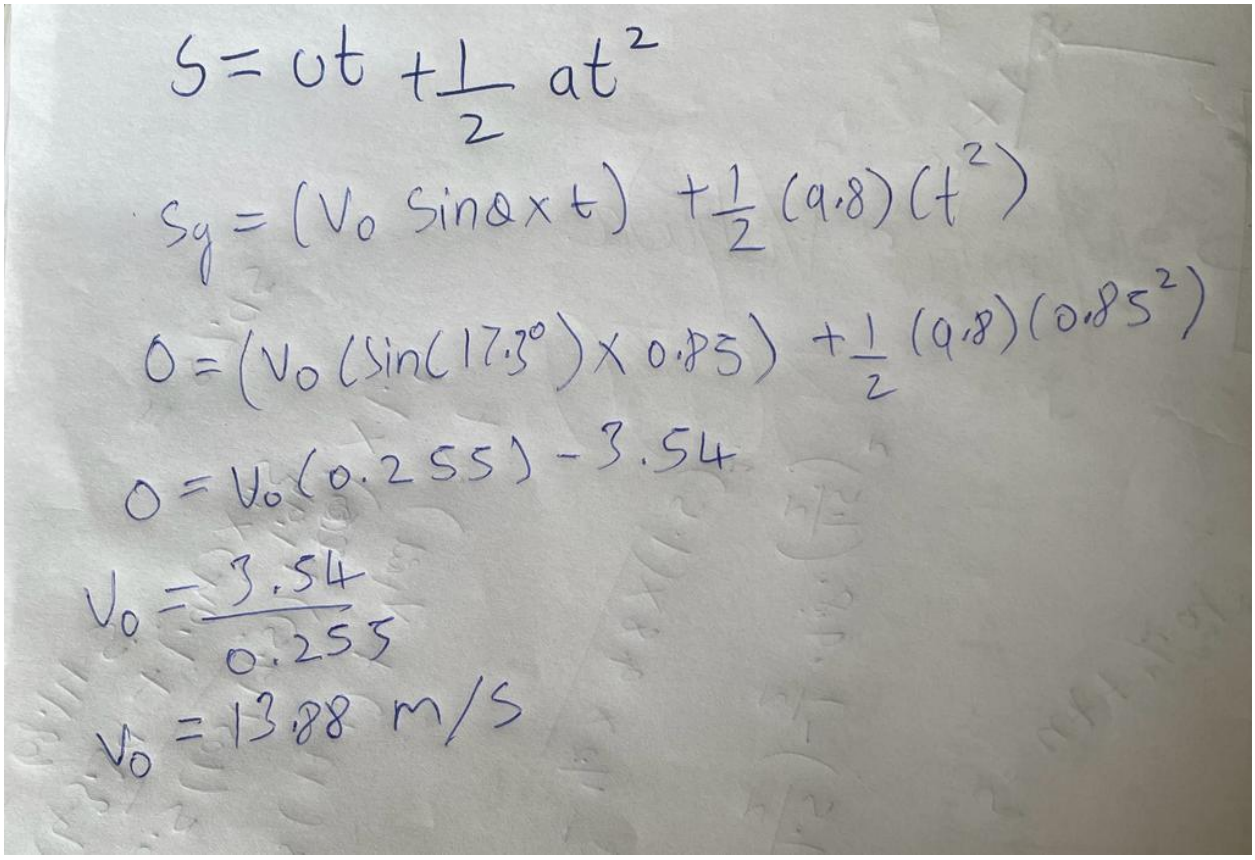
Using the profound app Angulus, we were able to find the release angle.

First, we set the red and blue line segments at 180 degrees each to make sure it was straight with respect to the center of the javelin/ hand grip:

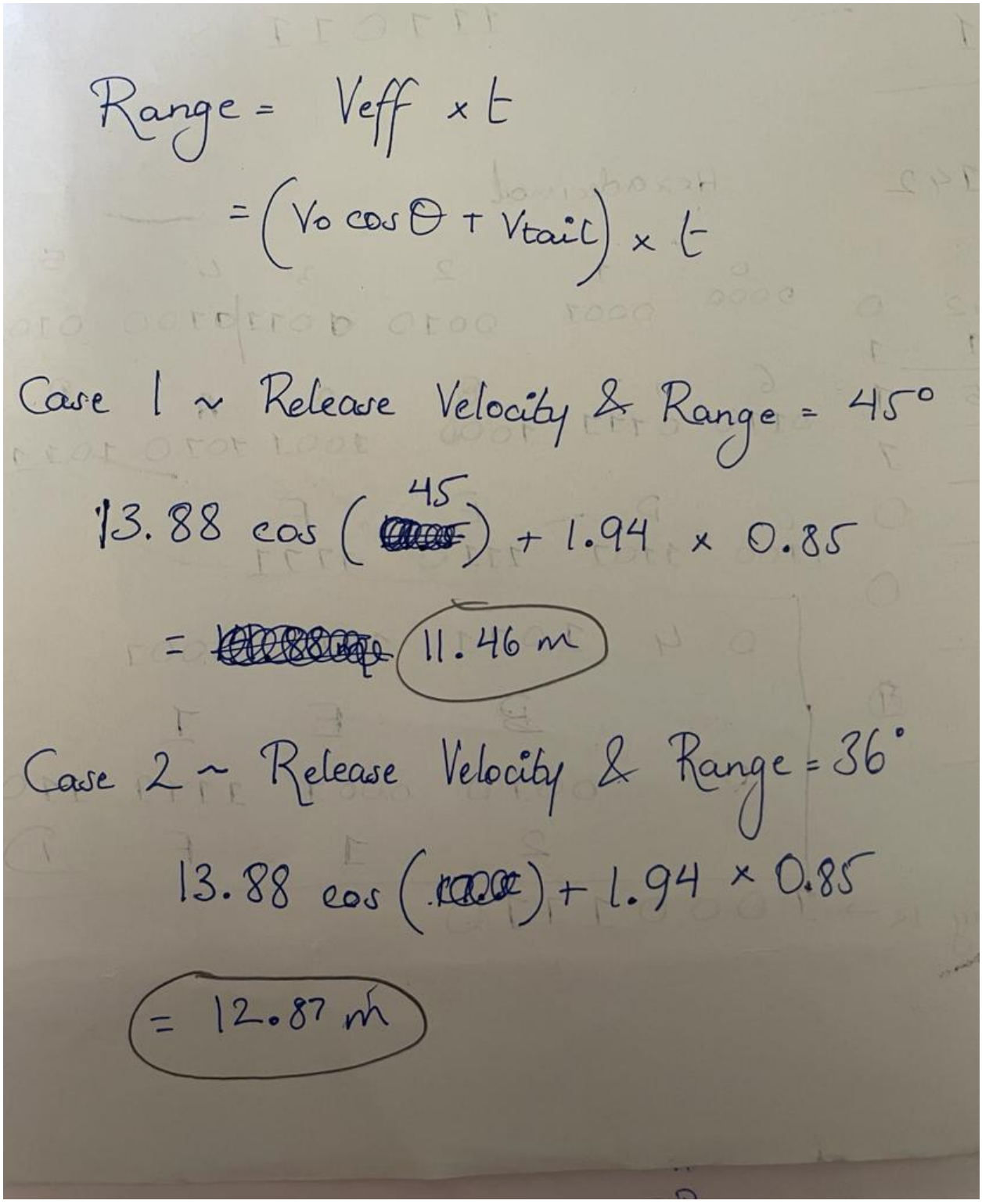

Now that we ensured that the line segment was horizontally straight, we moved the first quarter of the line directly on top of the javelin in the image:


Hence the release angle is 17.5 degrees

**Initial Velocity:**



**To understand the range for 45 and 36 angle→**



## Conclusion:

We all believe that 45 degrees is the optimum release angle, but here we have mathematically proven that Neeraj Chopra’s angle of 36 degrees causes the javelin to travel a further distance. From this we can say, that there are several factors to consider such as the thrower’s height and the arm distance that leads to a change in the optimum release angle, explaining why for Neeraj, 36 degrees is better than 45 degrees .

## Scientific Discussions After Initial Throw (Added):

Initial Velocity:

Initial velocity refers to the javelin's speed and direction at the moment it is launched. It plays a crucial role in determining how far the javelin will travel. The greater the initial velocity, the farther the javelin will go, assuming all other factors remain constant.

Athletes generate initial velocity through a combination of their strength, technique, and speed during the throwing motion.

Launch Angle:

The launch angle is the angle at which the javelin is released relative to the horizontal plane. The launch angle can significantly impact the flight path and distance of the javelin.

In general, a launch angle of around 35 to 40 degrees is often considered optimal for achieving maximum distance. This angle allows the javelin to achieve the right balance between horizontal and vertical motion.

Air Resistance (Drag):

Air resistance, or drag, is the force opposing the javelin's motion as it travels through the air. It acts in the opposite direction to the javelin's velocity and increases with the javelin's speed.

Air resistance has a substantial effect on the javelin's trajectory, especially at higher velocities. To minimize the impact of air resistance, javelin throwers often use techniques like reducing the javelin's cross-sectional area and maintaining a streamlined posture during the throw.

Gravity's Influence:

Gravity is a constant force that acts vertically downward. It affects the javelin's trajectory by pulling it downward, causing it to follow a parabolic path.

As the javelin ascends after release, gravity slows down its upward motion until it reaches its highest point (the apex) and starts descending. The angle at which the javelin is launched affects the time it spends ascending and descending.

Gravity's influence is essential to consider when determining the optimal launch angle and initial velocity to maximize the javelin's distance.