

## Anatomy of a Homer--#756



One of the most exciting things in baseball is the home run. Seeing the ball sail majestically in the air out of the park is a wondrous thing. It is not easy to do. Hitting a round ball with a round bat 350 to 400 feet is one of the most difficult things in all of sports. For this reason, few players have impacted the game more than Babe Ruth. His ability to hit runs was unprecedented. He hit more home runs in a single season than many entire teams. His prodigious abilities were not limited to the ballpark. The Babe had a great appetite and his ability to consume prodigious numbers of hot dogs and soda pop matched his ability to hit home runs. Although raised in an orphanage and reformatory by Catholic priests, the Babe was no angel. He had a bad temper on and off the field, and sometime this got him in trouble. Despite his bad-boy tendencies, he genuinely loved children and would always go out of his way to nice things for them—possibly because his childhood was such a difficult one. Babe Ruth hit 714 homers in his career, but if he had played under modern rules he would have been credited with many more. Although he will always be famous for his ability to hit “Ruthian” home runs, he broke into the major leagues as an outstanding pitcher. Some of his pitching records still stand today.

Hank Aaron, also known as Hammerin’ Hank, also possessed an incredible ability to hit home runs. Aaron's consistency helped him to establish a number of important hitting records during his 23-year career. Aaron holds the records for the most career runs batted in (2,297) and the most career extra base hits (1,477). Hank Aaron is also in the top five for career hits with 3,771 (third) and runs with 2,174, which is tied for fourth with Babe Ruth. He also is in second place in at-bats (12,364), and in third place in games played (3,298). Unfortunately, his record-breaking homer (#715) that surpassed Babe Ruth was marred by hate mail and multiple death threats because he was black. Some people did not want to see a black man break a record set by a white person. Interestingly, former manager Dusty Baker was on deck when Aaron hit the now famous #715. Although the stadium is now gone and is a parking lot for Turner Field, the section of the wall over which Aaron hit the home run remains in tact.

Barry Bonds grew up in San Carlos and went to high school at Serra High School in San Mateo. The son of Giants star outfielder Bobby Bonds, he grew up in a world filled with baseball. His god-father was Hall of Famer Willie Mays. Bonds turned down a contract to the Giants, ironically because Willie counseled him the contract wasn’t high enough. He

went on to Arizona State where he set records, not only as a hitter but also as a base stealer. He debuted for the Pittsburgh Pirates in 1986, the same year as Giants first baseman Will Clark. Bonds' accomplishments during his baseball career place him among the greatest baseball players of all-time. He has a record-setting seven Most Valuable Player awards, including a record-setting four consecutive MVPs. He is a 14-time All-Star and 8-time Gold Glove-winner. He holds numerous Major League Baseball records, including the all-time Major League Baseball home run record with 762 and the single-season Major League record for home runs with 73 (set in 2001), and is also the all-time career leader in both walks (2,558) and intentional walks (688). Bonds is a member of the so-called "300-300 Club"; he is one of only six players in the history have hit 300 homers and stolen 300 bases in a single season. Barry is the only player to hit 400 homers and steal 400 bases and likewise hit 500 homers and steal 500 bases. He hit many milestone home runs; #500, #600, #660 to tie his godfather Willie Mays, #700, #715 to . He smashed #756 against the Washington Nationals August 7, 2007. He blasted his 762nd home run at Coors Field on September 5, 2007.

We are going to analyze home run #756. Because of its historic implications, there were many high-speed cameras recording the event. These cameras, combined with computers, tracked the position, speed, and acceleration of the ball with great precision. The ball left the bat at a speed of 112.5 mi/h at an angle of 27 degrees. The ball would have traversed a total horizontal distance of 442 feet before returning to home-plate level had it not hit the fans in the stadium first. The maximum height of the trajectory is about 92 ft.

Show the equations you use to solve the problem, solve for the unknown, and then plug in the given values, and finally box or highlight your answers otherwise no credit will be awarded. Use the tangent method to construct the angle for your graph. Solve both graphically and analytically. If done carefully, your graphical solution should agree within 5% of your analytical one. Remember,  $g = 32 \text{ ft/s}^2$ . Assume the effects of air friction are negligible. Find the following:

- 1) First, convert 112.4 mi/h to ft/s. Remember  $1 \text{ mi/h} = 1.47 \text{ ft/s}$ .
- 2) Sketch a diagram of the velocity vector and its horizontal and vertical components. Use the scale  $1 \text{ cm} = 10 \text{ ft/s}$
- 3) Determine the ball's initial horizontal velocity (that is, the horizontal component of the ball as it leaves the bat).
- 4) Determine the ball's initial vertical velocity (that is, the vertical component of the ball).
- 5) How long does it take for the ball to reach its maximum height ( $t_{\text{top}}$ )?
- 6) How long does it take the ball to land (that is, the hang time . . . remember, hang time =  $2t_{\text{top}}$ )?
- 7) How high does the ball go?
- 8) How far does the ball land from home plate?
- 9) What does your answer to #8 say about our assumption that the effects of air friction are negligible?
- 10) What famous landmark is located directly beyond the Port Walk?