I have been tasked in finding the statistical throwing speed of Jameis Winston, in comparison to the throwing speed of an established NFL quarterback. My findings were in depth and found that Jameis may need more time to develop his arm, therefore, should stay at Florida State one more year before entering the draft. I say this because when comparing Ben Roethlisberger to Jameis Winston, there is a noticeable margin between the speed and acceleration of an elite college player, and an elite NFL quarterback. The solitary statistics and the average statistics both show that Jameis needs time to develop his arm if he wants to compete at the most elite level in the world.

First, when watching Jameis Winston in his National Championship game, there were four passes that stood out. These were during the final quarter, Florida State was down a touchdown, so Jameis had to really show his skill at the quarterback position. The first pass was thrown 11 yards, from the 26 yard line to the 15 yard line. Using the conversion factor of 1 yard equals .9144 meters, we find that this was a 10.06 meter pass. This pass also took .64 seconds to complete, giving it an average velocity of 10.06. This was found by dividing the distance in meters by the time it took to get to the receiver in seconds. Then, using that velocity, I found the acceleration of the ball to be 12.28 m/s^2. This was found using the velocity as a function of position equation: $V^2=V_0^2+2a\Delta x$. Finally using the final velocity, acceleration, and time, I was able to calculate the velocity of the ball as it left Jameis' hand to be 2.2 meters per second. This was calculated using the equation $V=V_0+at$. The next pass was calculated using the same procedure with variables of 8.23m pass completed in 1.01 seconds. The final velocity was found to be 8.15 m/s, the acceleration to be 4.04 m/s^2 and the initial velocity to be 4.07m/s. The third pass followed the same mathematical procedure using the variables of a 9.14 meter pass, completed in .93 seconds. This yielded a final velocity of 9.83 meters per second, an acceleration of 5.29 m/s^2, and an initial velocity of 4.91 meters per second. The final pass that I noted during the BCS national championship followed the same mathematical procedure as the last three passes, using the variables of 9.14 meter pass completed in .66 seconds. This yielded a final velocity of 13.85 meters per second, an acceleration of 10.49 m/s^2 and an initial velocity of 6.93 meters per second. I then

calculated what on average an NFL team can expect from Jameis Winston if they drafted him. I did this by averaging all of his final/initial velocities and then averaging his accelerations. On average he initially throws at 4.53 meters per second. He averages a final velocity of 11.89 m/s and an average of 8.025 m/s^2 acceleration.

When examining a notable game that Ben Roethlisberger played in Green Bay in 2009 where he reached 503 passing yards, we can see that Jameis is not very comparable to an elite play extending quarterback that Jameis claims he is. . The first pass was thrown 57 yards, from the own 33 yard line to the opposing 10 yard line. Using the conversion factor of 1 yard equals .9144 meters, we find that this was a 52.1 meter pass. This pass also took 2.86 seconds to complete, giving it an average velocity of 18.21 m/s. This was found by dividing the distance in meters by the time it took to get to the receiver in seconds. Then, using that velocity, I found the acceleration of the ball to be 3.18 m/s^2. This was found using the velocity as a function of position equation: $V^2=V_0^2+2a\Delta x$. Finally using the final velocity, acceleration, and time, I was able to calculate the velocity of the ball as it left Ben's hand to be 9.11 meters per second. This was calculated using the equation $V=V_0+at$. The next pass was from the own 18 yard line to the own 37 yard line, giving a distance of 17.37 meters. This pass took .915 seconds to complete, this pass, giving a final velocity of 19.09 meters per second. Then using the same mathematical process as before, I was able to calculate the acceleration to be 10.49 m/s^s and the initial velocity to be 9.49 meters per second. The third notable pass in this game, Ben passed from the Steelers own 44 yard line to the opposing team's 30 yard line. This pass when converted to meters is 23.77m and it took 1.41 seconds to complete. This yields a velocity of 16m/s and an acceleration of 5.98 m/s^2. Using the information calculated thus far, this third pass had an initial velocity of 7.57 meters per second. Finally, the last notable pass from this game Ben passed from his own 22 yard line to the Steeler 33 yard line. This was a 17 yard pass that when converted to meters, is 15.54m and was completed in 1.43 seconds. The velocity of this pass was 10.87 meters per second, and the acceleration was 3.8 m/s^2. The initial velocity for this pass was 5.4m/s. Again, I averaged each of the three pieces of information to see what the

Steelers can expect from Ben Roethlisberger on any given pass. The averages of velocity, acceleration, and initial velocity are the following respectively: 15.61m/s,5.86m/s^2, 7.89m/s.

If looking at the averages, it is notable that Jameis cannot throw the ball quite nearly as hard as an elite quarterback like Ben Roethlisberger. The average initial velocity of the ball when leaving Jameis' hand was 4.53 meters per second, whereas Ben was able to get the ball quickly away from behind the line of scrimmage with an initial velocity of 7.89 m/s. The reason Jameis' average acceleration is so high, was his initial and final velocities were so different, there needed to be a higher rate of change to make up the difference between the two. Ben was already throwing at a high rate of speed, and thus given the ball can only have a certain max velocity due to air resistance, velocity, and human limitations, it reached the max speed quicker. That is the reason Jameis was able to win one of three categories between initial, final velocities and acceleration. The final velocities showed that Jameis cannot throw a football nearly as hard as an elite quarterback like Ben, with a difference of 3.72 m/s between Ben's average final velocity and Jameis' average final velocity. In conclusion, I would not draft Jameis this year since he cannot perform at the level that would be seen in quarterbacks in the National Football League.

Work Sample Evaluation

Subject Area: Physics
Task Title: NFL Ready
Student Work Sample Title: Untitled

The document was scored using the *CCR Task Bank Rubric*. The final scores are indicated in the following chart.

Scoring Criteria	Insufficient Evidence	Developing	Progressing	Accomplished	Exceeds
Research and Investigation		**X**			
Ideas and Content		**X**			
Reading and Analysis			**X**		
Communication				**X**	
Organization				**X**	
Accuracy		**X**			

Annotations: The following evidence from the work sample and the reviewer's comments support the scores above. Page and line numbers refer to the original work sample.

Scoring Criteria	Page #	Line #	Commentary about the work sample
Research and Investigation: *Locating resources independently and/or identifying information within provided texts*	1	8	The student used data from the National Championship game, however it was not cited in the work sample.
	2	5	While the student analyzed a Green Bay Packers game, it was not cited.
Ideas and Content: *Presenting a thesis and understanding concepts*	1	1	The student clearly summarizes the task.
	1	2	The conclusions of the thesis were stated at the start of the paper.
	3	3	The student's original statement is well supported.
	1	11	The author did not notice that both x- and y- components of displacement must be taken into account.
	1	15	The physical premise upon which the arguments are made is faulty. The assumption has to be made that the initial and final heights of the ball are the same, therefore the equation that author used makes no sense in this context.
	2	3	The ball while in projectile motion is governed by gravitational acceleration ONLY. The author stated the acceleration is some other value.
Reading and Analysis: *Evaluating sources and selecting evidence to support the central idea*	3	3	The work sample presents connections between the sources of data for the two players
			The work sample does not discuss any limitations of the data.
			Calculations are made with too many significant figures.
Communication: *Using subject-appropriate language and considering audience*			This work integrates physics with the task of describing football statistics. The equations used are clearly laid out and each analysis is presented clearly.
Organization: *Structuring main ideas and supporting information*			The paper is organized with a thesis paragraph, two paragraphs of supporting data, followed by a concluding paragraph.
			Though data could have been more easily conveyed in a table, the work sample was easy to read with all information being supported.
Accuracy: *Attending to detail, grammar, spelling, conventions, citations, and formatting*			No Works Cited list was included.
	2	12	The work sample contained small errors in the format of equations (capital versus lower case lettering).
	2	7	This sentence has a small punctuation error.
			Overall there are very few errors in the paper grammatically.