There have been times with our robots where we have needed to have a component "hover" at a particular height while driving over the mats. We tried using standoffs but found they created too much drag while moving forward or pivoting. We tried using wheels from the tank tread kit which worked when driving forward and backward, but they created the same drag when turning or pivoting. We had to overcome the issues we faced by doing our best to stabilize the hovering component to reduce any bounce created while competing.

While working in our robot lab (the garage of one of our coaches), we used shop stools which utilized castors to easily move around the garage in all directions. This got us thinking that a simple very small "castor" would achieve what we needed to fix our issue of drag while keeping our component at a consistent height over the mats. Utilizing the different size standoffs available to attach to the top of the castor would allow for different hovering heights to be achieved.

We used the following version of Autodesk Inventor:

Autodesk Inventor Professional 2017 64-Bit Edition
Build: 142, Release: 2017 RTM – Date: Wed 02/24/2016

Autodesk Inventor allowed us to easily sketch and test our designs. We learned that having the wheel in the correct horizontal position in relation to the vertical pin was critical when needing the castor to pivot when the direction of the robot changed. Allowing us to change the sketch which, in turn, changed the 3D model made the changes to the design easy and efficient.

Our biggest obstacle was educating ourselves on the software itself. Our understanding is that Inventor is used for engineering very precise parts in companies and various industries. It has a lot to offer, most of which we only got to see with the icons and menu options. Once we mastered the features we needed to complete the basic tasks for our part, the easier it got. We were fortunate to have a coach that was familiar with 3D modeling from his past and he helped us understand the different types of constraints and how they work and the transition from a sketch to a 3D model. We also watched a lot of YouTube videos and Inventor tutorials to understand how the different constraints work and which ones we needed to use for different aspects of our design. It made us think in three dimensions which stretched our minds a little bit, but slowly began to make sense. We used this challenge to teach ourselves the software. We then used the software to build our actual robots used in competition. There is much more to learn as Inventor has an incredible number of features that we have not even touched yet. One feature we definitely want to learn more about are iMates. We can see how they could be very helpful but did not have the time to figure them out. We also learned that keeping an organized Browser menu is critical when there are a lot of parts to keep track of (naming conventions seem to help quite a bit).

As I am sure with most, if not all, competitors, we continually questioned our robot and whether we could build a better, more efficient one. We struggled with the type of "lift" we wanted to use, especially with the need to place cones on the stationary goals. We needed to make sure we achieved enough height to not only place a single cone on the approximately 24-inch goal, but to stack additional cones on top. After we had already built one of our robots (we ended up building a total of three), we decided to test whether a scissor lift would be better. Inventor allowed us to test how high we could get our lift to go without having to build an actual scissor lift. Using the CAD parts supplied on the vexrobotics.com site, we built a test scissor lift solely for the purpose of testing the height we could achieve. We then began using Inventor to test other components of our designs. In short, our third robot ended up using components we first tested in Inventor.

We had never used a 3D printer before and ended up using Sculpteo to build our part. Our Vex castor is made up of five different parts (plus a standoff) which "snap" together. We had to try two times to get the variances close enough for the snapping to work. Once it did, we were excited to see the part come together and actually work.
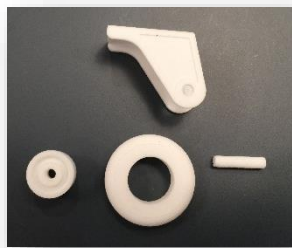

First Attempt
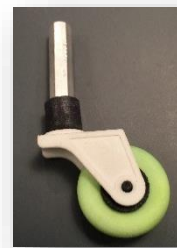
Final Attempt

The process for sending the .stl files to Sculpteo was very easy and we were very happy with the results.
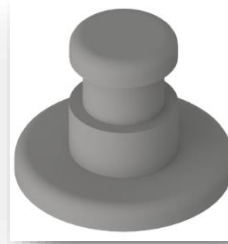
We both go to a STEM school and hope to end up with a career in a technological industry. Until we decided to take on this challenge, we did not know anything about 3D modeling software and what it could do. Seeing our design go all the way from a sketch (on paper) to the same sketch in Inventor, all the way to an actual part was very exciting.
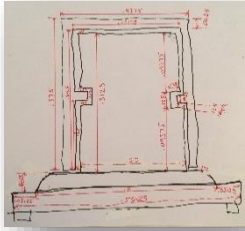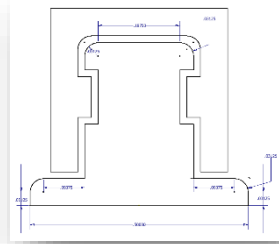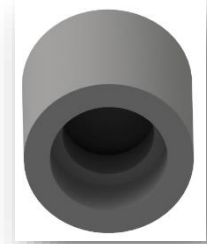
| Sketch Paper | Inventor Sketch | Inventor Revolve | Inventor Revolve |

We cannot imagine a technological industry where using some aspect of 3D modeling software would not help our ultimate careers in some way.