As students walk into the classroom instead of a bellringer I will have this picture placed on the screen to make students wonder how could this relate to math?

In teaching equations of a parabola, students' favorite question is "why do I need to know this?" and "When will I ever use this in real life?". I have decided to take a different route into teaching equations of parabolas. I am going to show a video of a space shuttle launch and return to earth. Then I am going to pose this question to the class: What shape is the path of a space shuttle leaving earth landing on the moon and coming back to earth? Then we will have a class discussion about that and what it would look like. Yes, I understand that these are rotating objects that they may have to orbit around the earth and moon before landing. In a perfect unreal world, we say that the space ship takes off goes around the moon and returns to earth. That pattern would be a parabola. Here is an engagement article on the way that shuttles launch and can be used to grab students' attention and answer their questions that are not as math-related Math and Science @ Work- Student Edition.

Next as a class, students could discuss how to make a parabola out of this information leading we could set up our coordinate plane to monitor distance as y and time as the x coordinate. Then track how space shuttles distance and time. I know this wouldn't be consistent but I would find data and limit their data to data points that gradually increase then decrease. They could use that graph to visually see a parabola and be able to find a pattern in the data points to fit a parabola and create the equation. Students could use the desmos calculator and test different equations to place on top of there graph they created. Moon Exploration, this would be one form of formative assessment to see if students can use a set of data and make a graph, then use the parabola equations to make a parabola of best fit for their space ships trip. Here is the site to gather data about different shuttles and have students work out the trajectory of different missions Real-Time Space Shuttle in Google Earth (Beta Version).

The second form of formative assessment will come as an exit slip in which students will have a question in which they have to match 4 graphs of parabolas and 4 equations. Then they will be given a survey about the learning targets.

Parabola Exit Slip

The standards that will be addressed are

Science:

HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Math:

KY.HS.G.20.a Derive the equation of a parabola given a focus and directrix.

KY.HS.F.1.e Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions) Compare linear functions: graphs and equations (A1-S.15).

If students complete the two formative assessments to mastery then they will be given a summative quiz [Parabolas Quiz](#) in which they are given a set of data, have to graph it, and then find the equation the parabola on their own. If students on average perform non-mastery then we will go back as a class to discuss the project together and address any misconception that was shown in students' work. Since this is real-time data there will be no negative numbers, that will have to be addressed in another lesson. If students are still struggling we will go to pre-made graphs with pictures of parabolas and have students find the focus and directrix of each and then use that to fill in a pre-laid out the equation with step by step blanks on how to solve.