Creating the SR-71 Blackbird Elliotte Lee Jun Beom

Introduction to the design:

The SR-71, or the Strategic Reconnaissance Aircraft, dubbed blackbird, is one of the fastest manned aircraft in the world. Developed from the times of the cold war, the SR-71 flies at a cruise speed of mach 3.2, or 3400km/h. If a hostile missile was detected, its basic evasive action was to accelerate and outrun the missile.

Because of its highly-developed reconnaissance capability, the design of the aircraft is sleek, and highly aerodynamic. Huge number of curvatures, such as the curvature of the head and chines, the curvature of the wings and the engines, as well as the rudders and its approximate size, make it a very challenging design to make.

Functions that I have employed:

Functions on the head of the aircraft:

I have employed various cubic functions, quadratic functions and exponential functions to create the curvatures on the surface of the SR-71. If you observe closely, you will be able to see that the chines and the head of the aircraft was made using 2 different cubic functions, and a quadratic function. I have cut out single pieces (using the domain and range controller) in the cubic and quadratic curves to correctly fit the head line to line. The top part of the aircraft head is made up of 2 differently cut cubic functions. Their equations were $y=-(0.1x-3.5)^3+10$ and $y=-(0.075x)^3+17.3$. Creating the head was the most challenging part in designing the aircraft- it required longer time to think. I have discovered that when moving the cubic function across the x-directions, the 'k' value in the brackets would be cubed and it will also affect the entire curvature of the cubic function. The 'y' values at the end of the equations affect their y-intercepts, and the value of 'a' affects their curvature (although 'k' in the brackets affects them as well).

Functions on the wings of the aircraft:

The wings are made up of both quadratic and negative exponential functions. The right wing (the foremost wing to the viewer) is made up of a negative exponential function which its equation is $y=-1.1^{-x}+6.5$. I have experimented on creating different exponential functions, and because I needed to do a reflection of a positive exponential, I have turned them negative.
I have also used a quadratic function in the other wing- the equation is $y=0.015x^2+16.5$. As the wings were slightly curved, I had to decrease the value of 'a' to decimal places- so that it would fit and would not look out of place. Calculating the appropriate decimal places were challenging- because slight changes could result in a totally different curve.

Functions on the main body of the aircraft:

The tip of the wings as well as the body was created mostly using linear equations, and I had to adjust their positions in the y directions and the x direction. (If possible, you can view the equations of the design clicking each of their curves and lines.) I have discovered that, in linear equations, if I alter the value of the y intercept, it would also affect their position of x-intercepts. I have used this to a clever advantage in designing the two rudders, and the engine exhausts.

Functions on the engines of the aircraft:

The chines of a plane are smooth curvatures along the sides of the engines and the heads of a plane which creates aerodynamic lift. In the SR-71, the chines are located on the heads, and on the sides of the circular engines. You may notice, that next to the foremost engine, there is a quadratic curve representing the curvature of the chine. This quadratic equation is $y=(0.09x+2.3)^2-11$, which creates a smooth and a slender curve. The '-11' represents the y value of the vertex.

The oval shapes representing the air inlet of the engine was made by these two equations: $30(x+13)^2+2(y-24.5)^2=7.5^2$ and $30(x+15)^2+2(y+4.2)^2=7.5^2$. The values of k in the x brackets indicate its position in the x direction, while the values of k in y brackets indicate their position in the y direction. (Note that the + and - signs reverse)
The value at the end represents their radius, or r^2.

Using these steps, by altering the value of the vertex points, y-intercepts, x intercepts, and the values of ‘a’ and ‘k’, and using a variety of functions, I have successfully made the SR-71’s challenging and complex design.