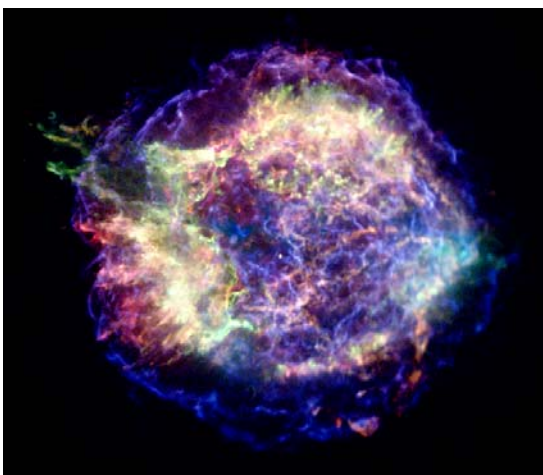


The Quadratic Formula and the Discriminant



The expanding supernova shell Cass-A as seen by the Chandra X-ray Observatory (Courtesy: NASA/Chandra)

When a star explodes as a supernova, a shock wave travels from the center of the explosion into interstellar space. As the shell of debris expands, it compresses the interstellar gas surrounding it to a higher density. The amount of compression can be modeled by the formula:

$$Y(x) = 0.67x^2 + 6x - 2.66$$

where x is the ratio of the gas density ahead of the shock front to the density behind the shock front.

Problem 1 – Use the Quadratic Formula to find the two roots for $y(x)$.

Problem 2 – What is the vertex location for $y(x)$?

Problem 3 - What is the graph for $y(x)$?

Problem 4 – Only choices for x that are positive-definite over the set of Real numbers are permitted solutions for $y(x)$. What root for $y(x)$ is a permitted solution for $y(x)$?

Problem 5 – The value for x that satisfies $y(x)=0$ gives the ratio of the gas density behind the shock wave, to the density of the undisturbed interstellar medium. By what factor was the interstellar medium compressed as it passed through the shock wave?