- Use the line tool and the Regions menu to make four measurements of the SNR diameter in different orientations, as in Task 2 of the activity. Provide a table of your four measurements, and an estimate of the uncertainty on each measurement.
  (*Hint*: the uncertainty can be estimated by examining how much longer or shorter you could make the line length without it looking obviously too long or short compared to the X-ray bright region. The size of the uncertainty will be the same, or similar, for your four measurements.)
  (**6 marks**)

- b.Calculate the mean (average) angular diameter of the remnant in units of arcseconds, and then calculate the diameter of the SNR in units of **parsec**.
  (**4 marks**)

- c.The **supernova** that produced this remnant is thought to have exploded in ~406 AD, while the Chandra X-ray observation you have used was made in 2006. The age of the supernova at the time of observation was therefore 1600 years.
  Calculate the speed of expansion of the remnant in units of km s^{-1}, assuming it has expanded at a constant speed throughout its lifetime. Is the remnant expanding faster or slower than the Tycho SNR that you studied in the activity?
  Based on the four diameter measurements you made in part a. of this question, and their uncertainties, comment on whether the SNR appears to have been expanding evenly in all directions.
  (**7 marks**)

- d.As mentioned in the activity, in reality the expansion speed of a SNR is not usually constant. For most of their lives their radius expands in proportion to age to the power of 0.4:

  where and are the radius of the SNR at ages and , respectively.
  Using this relationship and your measured size from the year 2006, reported in part b. of this question, estimate the **angular size** the remnant would have had in the year 1952.
  It was in 1952 that **radio** astronomers Jennison and Das Gupta first measured the size of an **extended** radio source, Cygnus A. The instrument they used – an interferometer – had a **spatial resolution** of 2 arcminutes. Based on the size you have calculated for this image, would the radio astronomers have been able to resolve the SNR in

1952 (assuming it was sufficiently bright)?
(**7 marks**)