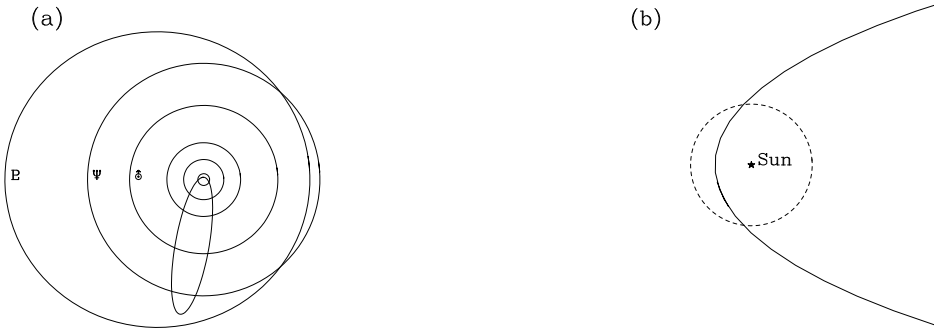

Figure 2.2: *The path of Comet Halley.* **(a)** *Comet Halley and the orbits of the planets from Mars to Pluto.* **(b)** *Comet Halley near the Sun and the Earth's orbit (dashed circle).*

Table 2.1: Data on Comet Halley

Period	76 years
Semimajor axis	18AU
Eccentricity	0.98
Perihelion distance	0.6AU
Date of perihelion	1986 Feb 7
Inclination of orbit to ecliptic	162°

The Films

Two films of Comet Halley are provided; the data about the films is given in Table 2.2. The globular cluster M75 (NGC6809), a small fairly loose cluster of magnitude 7.6 can be seen on the films. It is at position (125,065) on J10822T.

Table 2.2: Data on Comet Halley films

	J10822T	J10831T
Exposure date	9 March 1986	10 March 1986
Exposure time	8 minutes	10 minutes
Coordinates of comet	$20^h10^m.2(303°), -19°51'$	$20^h8^m.1(302°), -20°20'$
Coordinates of Sun	$23^h19^m.3(350°), -4°23'$	$23^h22^m.9(351°), -3°59'$
Distance of comet from Sun **(R)**	0.84AU	0.85AU
Plate centre	$19^h59^m - 20°$	$19^h57^m - 20°25'$

EXERCISE I. To show that the comet's tail points away from the Sun.

A comet consists of a nucleus only a few kilometres across surrounded by a coma (or head). When far from the Sun the comet is a tenuous structure of dust and frozen gases, aptly described as a "dirty snowball". On coming near to the Sun the ices evaporate and the gases and dust are released to form the coma and tail(s).

There are two types of tail which are distinguished by their appearance and by their spectra. Type I is a straight tail, composed of ions (electrically charged particles) of various molecules and radicals and shows knots, waves and twists. This tail is blown from the comet by the solar wind which is a stream of plasma (a hot ionised gas) emanating from the Sun. The Type II tail (or tails) are broad, spread out like a fan and are caused by the pressure of the Sun's radiation pushing small dust grains away from the Comet. A cloud of dust grains of various sizes spreads out into a fan in which the small grains travel fastest and straightest. See figure 2.3 below for examples.

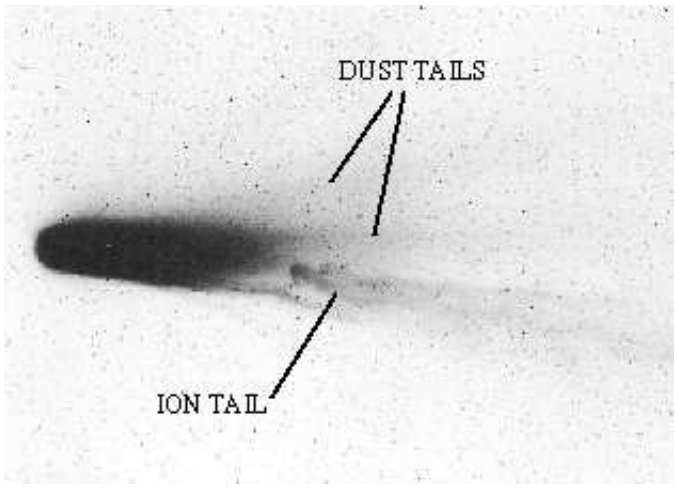

Figure 2.3: *An image of the comet showing the ion and dust tails.*

Using the data in Table 2.2 (for either film) plot the positions of the Sun and Comet on Fig 2.4. Measure the separation and use the declination (vertical) axis to convert to degrees (θ). *(θ will be required for later exercises.)*

On the chosen film measure the angle (ψ) between the direction of the ion tail and the E-W direction and plot this at the position of the comet on Fig 2.4. It should be seen that this tail points away from the Sun. By measuring the angle between the dust tails and the E-W direction it can also be seen that these tails do not point exactly in the anti-solar direction.

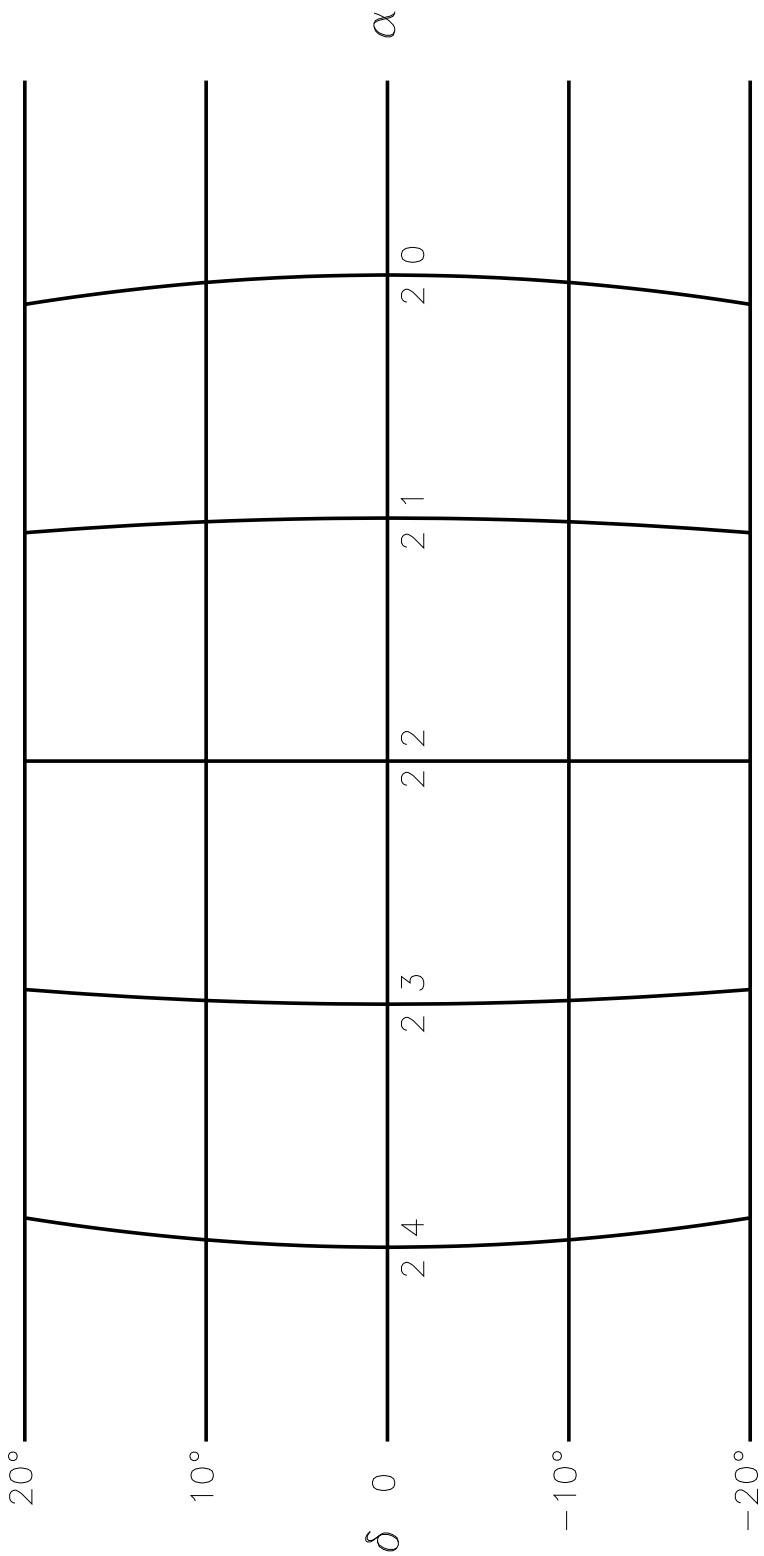

Figure 2.4: *This is a flat map of the part of the sky containing Comet Halley and the Sun at the time the films were exposed.*