Ampere's law

The magnetic field at a point due to an axially symmetric current distribution can be given by using Ampere's law.

According to this law the line integral (Product of field and length in same direction) of the magnetic field is equal to the current within the loop. Mathematically this can be written as

$$\oint \vec{B}.\overrightarrow{dl} = \mu_0 I$$

here $\vec{B} \bullet d\vec{l}$ gives the product of the length element dl (circumference) of the loop and the component of the magnetic field along the loop.

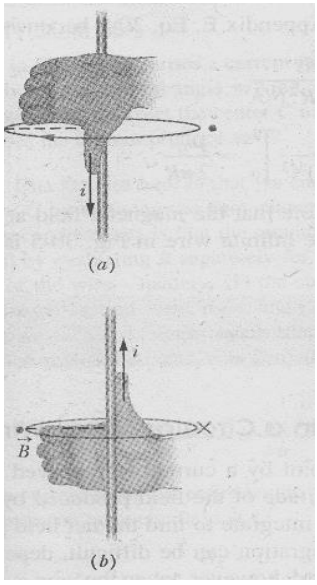
If the current is distribution is circularly uniform, the circular loop for which the magnetic field at all points equal in magnitude and parallel to it then $\oint \vec{B}.\overrightarrow{dl}$ is given by B*2πR where R is the radius of the loop.

Right hand rule

The magnetic field due to a long straight wire is haveng circular lines(flux) and the direction of the field at a point (along the flux) is given by right hand rule.

According to this rule if we emagine to hold the wire with our right hand in such a way that thumb is showing the direction of current in the wire, then the direction of megnetic feld at a point is given by the direction of curled fingures.

Right-hand rule: Grasp the element in your right hand with your extended thumb pointing in the direction of the current. Your fingers will then naturally curl around in the direction of the magnetic field lines due to that element.



In case a) the current is downward so the thumb of right hand should point downward then the fingures points clockwise direction (as seen from top). Hence the magnetic field at a point is in clockwise direction (from top) of the tangent on the circular field line at that point.

Similarly the in case b) the current is upward and keeping the thumb upward the direction of the magnetic field lines will be anticlockwise from the top. Hence the magnetic field at a point is in anticlockwise direction (from top) of the tangent on the circular field line at that point.