

9. (a) The Biot-Savart law may be written as

$$\vec{B}(\mathbf{r}) = \frac{\mu_0}{4\pi} \int \frac{I d\vec{s}_2 \times \hat{r}_{12}}{r_{12}^2}$$

Define the variables $\vec{B}(\mathbf{r})$, I , $d\vec{s}_2$ and \hat{r}_{12} used in this expression.

[4]

(b) Find the magnetic field at the point P in Figure 3, if a current of 8 A flows in the infinitely long wire. The radius R of the semicircle is 1.2 cm.

[8]

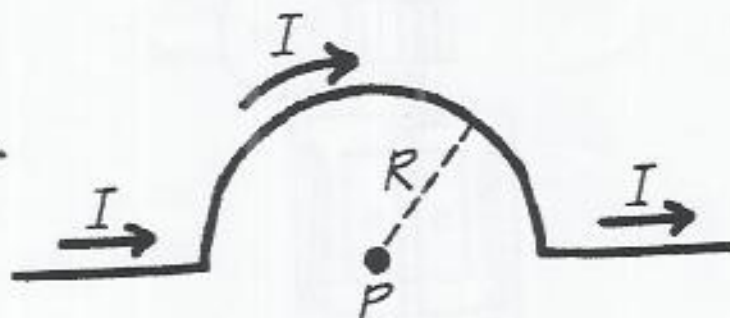


Figure 3

(c) An infinitely long wire is bent into an "L" shape and placed so that a current I flows along the y -axis towards the origin, then out from the origin along the x -axis, as shown in Figure 4.

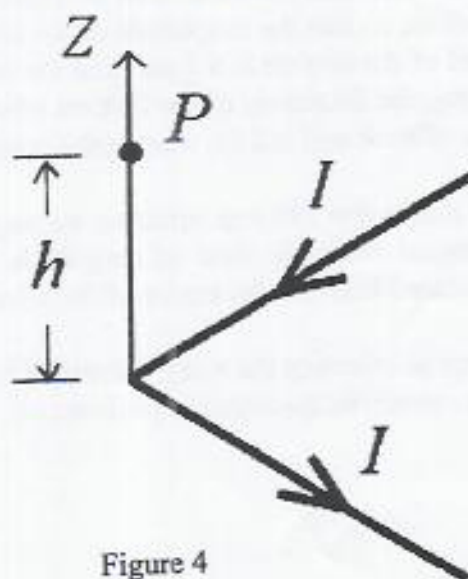


Figure 4

Calculate the magnetic field at the point P on the z -axis at a height h above the origin, and state its direction. (Ampère's law can be applied: the field of a semi-infinite wire is equal to half the field generated by the same current in an infinite wire).

[8]