

## Quiz 5

The following information may or may not be of use:

$$\text{Electron current: } i = nA\bar{v}$$

$$\text{Conventional current: } I = |q| i$$

$$\text{Bio-Savart: } \Delta\vec{B} = \frac{\mu_0}{4\pi} \frac{I\Delta\vec{l} \times \hat{r}}{r^2}$$

$$\text{Straight Wire: } |\vec{B}| = \frac{\mu_0}{4\pi} \frac{LI}{r\sqrt{r^2 + (L/2)^2}}$$

$$\text{Very long straight wire: } |\vec{B}| \approx \frac{\mu_0}{4\pi} \frac{2I}{r}$$

$$\text{Center of loop of current: } |\vec{B}| = \frac{\mu_0}{4\pi} \frac{2\pi R^2 I}{(z^2 + R^2)^{3/2}}$$

A very long wire carrying a current  $I$  is kinked in the middle so that it forms a small loop of radius  $R$ . What is the magnetic field (both magnitude and direction) at the center of the loop? Express your answer in terms of  $\mu_0$ ,  $I$ , and  $R$ . Use a coordinate system where  $+x$  points to the right ( $\rightarrow$ ) and  $+y$  points up ( $\uparrow$ ).

