Goal: A long wire carrying a current I folds back with a semicircular bend of radius b as in Fig. Q6-38. Determine the magnetic flux density $\mathbf{B}$ at the center point P of the bend.

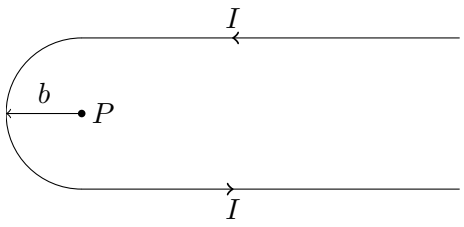

Fig. Q6-38

Steps:

1. Determine the contribution of B due to the two straight wires. Hint: exploit symmetry
   Solution:
   $$\mathbf{B} = \frac{\mu_o I}{2\pi b}\mathbf{a}_z$$

2. Determine the contribution of $\mathbf{B}$ due to the semi-circle.
   Solution:
   $$\mathbf{B} = \frac{\mu_o I}{4b}\mathbf{a}_z$$

3. Determine the total $\mathbf{B}$ field at point P.
   Solution:
   $$\mathbf{B} = \frac{\mu_o I}{2b}\left(\frac{1}{\pi} + \frac{1}{2}\right)\mathbf{a}_z$$

Answer:

$$\mathbf{B} = \frac{\mu_o I}{2b}\left(\frac{1}{\pi} + \frac{1}{2}\right)\mathbf{a}_z$$