Magnetic Field due to Current in a Pipe

A uniform current density *J* flows along a thick-walled copper pipe with inner radius *a* and outer radius *b*. What is the formula for the magnetic field at radius *r* (for **any** *r*)?

$r < a$ ➔ $i_{enc} = 0$ ➔ $B = 0$

$r > b$ ➔ $i_{enc} = J\pi(b^2 - a^2)$

$$B = \frac{\mu_0}{2\pi r} J\pi(b^2 - a^2)$$

$a < r < b$ ➔

$$J = \frac{i_{enc}}{\pi(r^2 - a^2)}$$

$$B2\pi r = \mu_0 i_{enc} = \mu_0 J\pi(r^2 - a^2)$$

$$B = \mu_0 J \frac{(r^2 - a^2)}{2r}$$

J