1. Problem 29-49. (**+10 pts**)

   I. +3 pts - correct expression for the magnetic field generated by one semicircle at the center of the semicircle (P).

   $$B(P) = \left(\frac{1}{2}\right)\frac{\mu_0 I}{2R} \quad \text{(factor of } \frac{1}{2} \text{ due to semicircle)}$$

   II. +4 pts - correct directions for the magnetic field due to the top wire and the bottom wire - Biot-Savart.

      i. +2 pts - B due to the smaller radius wire is directed into the page.

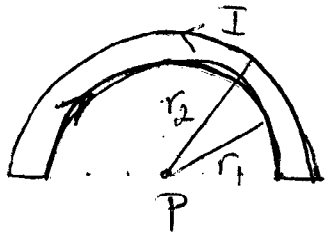
      ii. +2 pts - B due to the larger radius wire is directed out of the page.

   III. +2 pts - correctly subtracting out the magnitude of the magnetic field at the center of the semi-circles.

   IV. +1 pt - correct answer.

   $$\vec{\mathbf{B}}(P) = 2.8 \times 10^{-5}\, T \quad \text{(into the page)}$$

29-49



$r_1 = 5\text{ cm} = 5\times10^{-2}\text{ m}$

$r_2 = 8\text{ cm} = 8\times10^{-2}\text{ m}$

$I = 12\text{ A}$.

We obtained $B(P)$ for a full circle carrying current from class

$$B(P) = \frac{\mu_0 I}{2R}$$ if we only have $\frac{1}{2}$ a circle

then $$B(P) = \frac{1}{2}\frac{\mu_0 I}{2R} = \frac{\mu_0 I}{4R}$$

We need to superpose the magnetic fields due to both semicircles.

Inner semicircle produces $B_{r_1}(P)$ into page

Outer semicircle produces $B_{r_2}(P)$ out of page.

$|B_{r_1}(P)| > |B_{r_2}(P)|$

$$B_T(P) = B_{r_1}(P) - B_{r_2}(P) = \frac{\mu_0 I}{4}\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$$

$\vec{B}_T(P) = 2{,}8\times10^{-5}\text{ T}$ into the page.