

CONCEPT: MAGNETIC FIELD PRODUCED BY STRAIGHT CURRENTS

• Remember: Moving Charges PRODUCE A NEW FIELD → $B =$ _____

• Currents are just charges moving in a wire. So currents ALSO produce new Magnetic Fields:

- MAGNITUDE → _____ (for very long wire) - Remember $\mu_0 = 4\pi \cdot 10^{-7} \text{ N/A}^2$
- DIRECTION → RIGHT HAND RULE: GRAB wire, with THUMB in direction of _____.
- TWO Fields at same location: Same Direction → _____ Opposite → _____

EXAMPLE 1: What is the direction of the magnetic field produced by a current on a very long wire if the current is oriented:

(a) up

(b) left

(c) into the page

EXAMPLE 2: The two wires shown below are 4 m away from the other. What is the magnitude and direction of the magnetic field that is produced at a point in the center of the two wires?

$i = 3 \text{ A}$

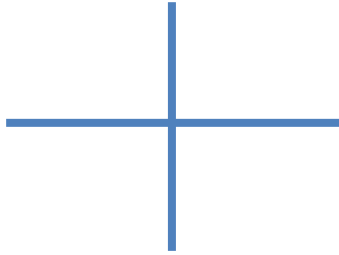


$i = 5 \text{ A}$



EXAMPLE: FIND MAGNETIC FIELD DUE TO TWO PERPENDICULAR CURRENTS

The very two long, perpendicular wires below intersect at (0, 0). The vertical wire carries $2\ \mu\text{A}$ up, while the horizontal wire carries $3\ \mu\text{A}$ to the left. What is the net magnetic field at point P located at (-4, -9) cm?



EXAMPLE: FIND ZERO MAGNETIC FIELD

Two long, horizontal wires are 6 m away from each other. The bottom and top wires carry currents of 4 A and 5 A, respectively, both to the right. How far from the bottom wire is the NET magnetic field due to these currents zero?