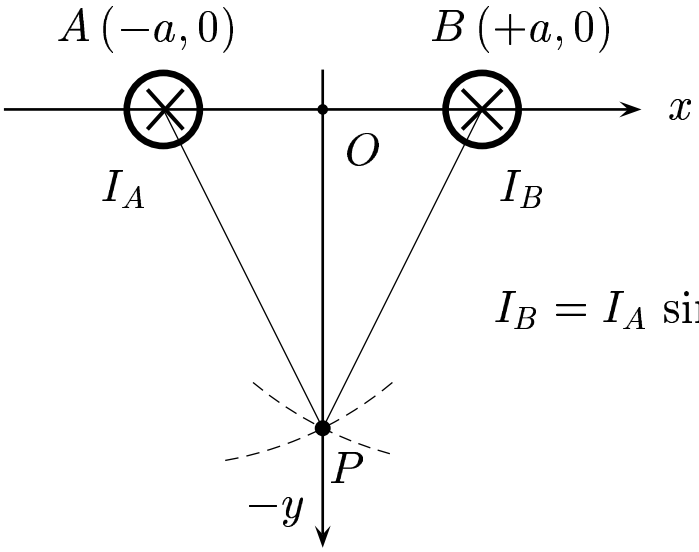
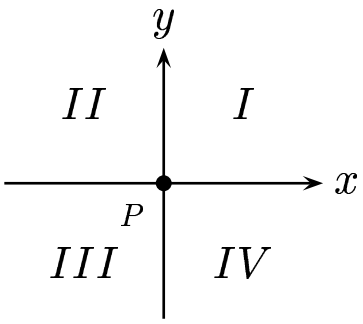
Given: Two parallel wires with currents I_A and I_B enter into the page, where $I_B = I_A \sin 30^\circ$. The separation between them is $2\,a$.



$I_B = I_A \sin 30^\circ$



The direction of the magnetic field $\vec{B}$ at $P\ (0, -2\,a)$ is

A) in quadrant I.

B) in quadrant II.

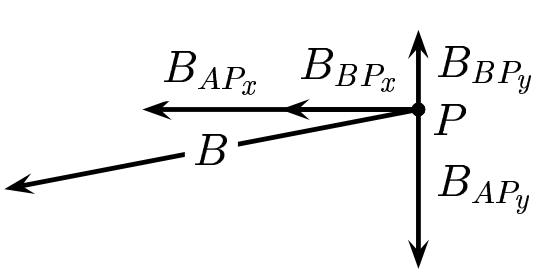
C) in quadrant III.

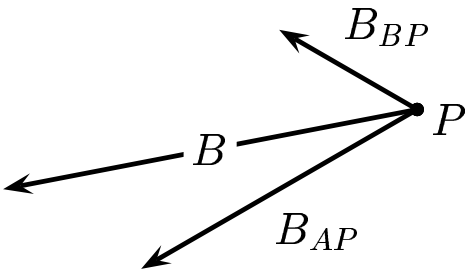
D) in quadrant IV .

$I_A = 2\,I_B$,

since

$\sin 30^\circ = \dfrac{1}{2}$.





By the RH-rule for a long wire, $\vec{B}$ at point P due to current I_A is tangential to the arc with the center at $A\,(-a, 0)$ and radius $\overline{AP}$, pointing left-downward; $\vec{B}$ at point P due to current I_B is tangential to the arc with center at $B\,(+a, 0)$ and radius $\overline{BP}$, pointing left-upward. These two magnetic fields have horizontal components in the negative x direction.

Since $I_A = 2\,I_B$, the magnitudes of the vertical components are related such that $\|\vec{B}_{AP_y}\| = 2\,\|\vec{B}_{BP_y}\|$. *Note:* $\vec{B}_{AP_y}$ points downward (in the negative y direction) so the resultant y components is downward.

So the net $\vec{B}$ at P is directed in quadrant III .

Answer **C**.

30.03-01˙Magnetic˙Field˙due˙to˙Two˙Parallel˙Lines 2004-10-20