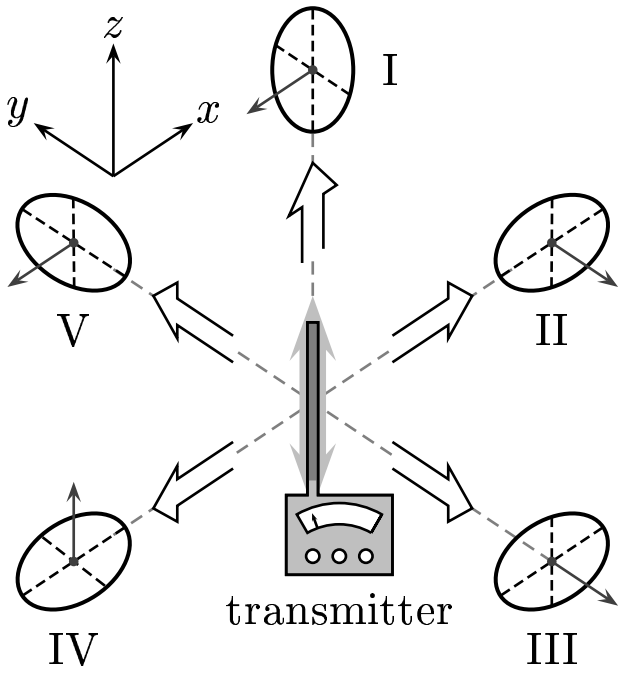
A radio transmitter drives an oscillating current back and forth along the z axis in the aerial antenna wire as shown below.

Five circular receiving antennas are positioned with their centers at equal distances d from the center of the transmitter as follows



I. Positioned at d, in the $+\hat{k}$ direction, facing along $\hat{x}$.

II. Positioned at d, in the $+\hat{\imath}$ direction, facing along $\hat{y}$.

III. Positioned at d, in the $-\hat{\jmath}$ direction, facing along $\hat{y}$.

IV. Positioned at d, in the $-\hat{\imath}$ direction, facing along $\hat{z}$.

V. Positioned at d, in the $+\hat{\jmath}$ direction, facing along $\hat{x}$.

The strongest signal is received by antennas

A) II B) I C) — III

D) II and V E) I, II, III, and V

Circular antennas, unlike linear antennas, detect the magnetic fiels B of the EM wave. The changing magnetic flux through the loop induces an *emf* in the coil by Faraday induction. There will be no magnetic flux (and thus no changing magnetic flux) through the loop, unless the magnetic field vector is perpendicular to the face of the loop as the EM wave passes the loop.

Antenna I receives no singnal because no EM wave propagates toward it from the antenna. However, EM waves propagate to the other 4 antennas.

At antenna II, the B-vector is along y, perpendicular to the face of this loop, thus a signal is receives.

At antenna III, the B-vector is along x, and thus lies in the face of this loop and receives no B field and no signal.

At antenna IV, the B-vector is along y, and thus lies in the face of this loop and receives no B field and no signal.

At antenna V, the B-vector is along x, perpendicular to the face of this loop, so it receives a signal for the same reason as antenna II.

Answer **D**.