The unusual band structure of graphene, with unique linear dispersions, has led to the discoveries of a variety of surprising phenomena, primarily in DC transport, in the last several years. Here we report that graphene’s AC or infrared properties are also highly unusual. Specifically, we have observed electron cyclotron resonance in \( p \)-type graphene – a non-intuitive phenomenon that is possible only via graphene’s unique Landau-level structure. Using ultrahigh magnetic fields up to 170 T, we performed cyclotron resonance (CR) measurements in large-area graphene grown via chemical vapor deposition (CVD) at room temperature. Polarization and wavelength dependence using a tunable CO\(_2\) laser determined the carrier type of doping and the value of the Fermi energy. Polarization-dependent magneto-transmission measurements through the use of circularly-polarized light revealed a strong unintentional \( p \)-type doping of CVD graphene with a small CR feature at 10 T and a larger CR feature at 65 T that corresponds to the \( n = 0 \) to \( n = -1 \) and \( n = -1 \) to \( n = -2 \) Landau level (LL) transitions, respectively. Furthermore, wavelength-dependent measurements determined the Fermi energy to be -250 meV. After annealing the graphene samples in vacuum to remove physisorbed molecules, we demonstrate that the Fermi energy can be shifted closer to the Dirac point (-34 meV), resulting in the simultaneous appearance of electron and hole CR in the magnetic quantum limit, i.e., the \( n = 0 \) to \( \pm 1 \) transitions, with similar intensities.