Summary: Given a proper edge $k$-coloring $\phi$ and a vertex $v \in V(G)$, let $C_\phi(v)$ denote the set of colors used on edges incident to $v$ with respect to $\phi$. The adjacent vertex distinguishing index of $G$, denoted by $\chi'_a(G)$, is the least value of $k$ such that $G$ has a proper edge $k$-coloring which satisfies $C_\phi(u) \neq C_\phi(v)$ for any pair of adjacent vertices $u$ and $v$. In this paper, we show that if $G$ is a connected planar graph with maximum degree $\Delta \geq 12$ and without 3-cycles, then $\Delta \leq \chi'_a(G) \leq \Delta + 1$, and $\chi'_a(G) = \Delta + 1$ if and only if $G$ contains two adjacent vertices of maximum degree. This extends a result by K. Edwards et al. [Graphs Comb. 22, No. 3, 341–350 (2006; Zbl 1107.05032)], which says that if $G$ is a connected bipartite planar graph with $\Delta \geq 12$ then $\chi'_a(G) \leq \Delta + 1$.

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