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A THEOREM ON MONOTONICITY AND A SOLUTION TO A PROBLEM OF ZAHORSKI

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In the body of his study of derivatives [5], Zahorski posed two problems. The second of these problems is the following:

ZAHORSKI'S PROBLEM II. Let f be a finite real valued function defined on an interval I_0 and satisfying the following conditions:

(1) f is a Darboux function,

(2) f is in the first class of Baire,

(3) f possesses an approximate derivative f'_{ap}, finite or infinite, except perhaps on a denumerable set,

(4) $f'_{ap} \geq 0$ almost everywhere.

Is it necessarily true that f is continuous and nondecreasing on I_0?

Zahorski notes that Tolstoff [3] proved that if conditions (1) and (2) are replaced by the more stringent condition that f be approximately continuous, while conditions (3) and (4) remain the same, then f must be continuous and nondecreasing. Furthermore, a slight modification of an example found in [4] shows that condition (2) in the statement of Zahorski's problem cannot be weakened to the requirement that f be in the second class of Baire.

After stating Problem II, Zahorski proceeded to prove that if the approximate derivative in conditions (3) and (4) is replaced by the ordinary derivative, then f must be continuous and nondecreasing. (In this case condition (2) is an automatic consequence of condition (3).)

It is clear that an affirmative answer to Zahorski's Problem II represents a generalization of both Tolstoff's Theorem and Zahorski's