Mathematics > Classical Analysis and ODEs

Illumination by Tangent Lines

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Let f be a differentiable function on the real line, and let P\inG_{f}^{C}= all points not on the graph of f. We say that the illumination index of P, denoted by I_{f}(P), is k if there are k distinct tangents to the graph of f which pass through P. In section 2 we prove results about the illumination index of f with f'' (x)\geq 0 on \Re. In particular, suppose that y=L_1(x) and y=L_2(x) are distinct oblique asymptotes of f and let P=(s,t)\in G_{f}^{C}. If max(L_1(s),L_2(s))<t<f(s), then I_{f}(P)=2. If L_1(s)\not= L_2(s) and min(L_1(s),L_1(s))<t\leqmax(L_1(s),L_2(s)), then I_{f}(P)=1.
Finally, if t_\leqmin(L_1(s),L_2(s)), then I_{f}(P)=0. We also show that any point below the graph of a convex rational function or exponential polynomial must have illumination index equal to 2. In section 3 we also prove results about the illumination index of polynomials.

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