scribes simultaneously the convergence of the $\pi_n(x, y)$ and the $\rho_n(x, y)$. Let $\sigma_m(x, y)$ be the linear combination of the first m of the functions

$$1,\ r\cos\theta,\ r\sin\theta,\ r^2\cos 2\theta,\ r^2\sin 2\theta,\ \ldots$$

which satisfies at the origin the first m of the conditions

$$\sigma_m = u,\ \frac{\partial\sigma_m}{\partial x} = \frac{\partial u}{\partial x},\ \frac{\partial\sigma_m}{\partial y} = \frac{\partial u}{\partial y},\ \frac{\partial^2\sigma_m}{\partial x^2} = \frac{\partial^2 u}{\partial x^2},\ \frac{\partial^2\sigma_m}{\partial x\partial y} = \frac{\partial^2 u}{\partial x\partial y},$$
$$\frac{\partial^3\sigma_m}{\partial x^3} = \frac{\partial^3 u}{\partial x^3},\ \frac{\partial^3\sigma_m}{\partial x^2\partial y} = \frac{\partial^3 u}{\partial x^2\partial y},\ \frac{\partial^4\sigma_m}{\partial x^4} = \frac{\partial^4 u}{\partial x^4},\ \ldots$$

Then $\sigma_m(x, y)$ is uniquely determined and is the polynomial $\pi_n(x, y)$ if $m = 2n + 1$ and is the polynomial $\rho_n(x, y)$ if $m = 2n + 2$. The sequence $\sigma_m(x, y)$ approaches $u(x, y)$ uniformly in any closed region interior to C_R, and if $u(x, y)$ has a singularity on C_R, the sequence $\sigma_m(x, y)$ converges uniformly in no region containing in its interior a point of C_R.

[1] Walsh, *Bull. Amer. Math. Soc.*, **33**, 591–598 (1927).
[2] *Theory of Approximation*, p. 121 (New York, 1930).
[3] *Trans. Amer. Math. Soc.*, **33**, 370–388, §9 (1931).
[4] *Theorie und Praxis der Reihen*, 126–142 (Leipzig, 1904).
[5] *Göttinger Nachrichten*, 319–331 (1918).

PARTIAL DIFFERENTIATION IN THE LARGE

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Two classical problems which to the best of our knowledge have never been solved are the following:

Problem 1.—Let $f(x, y)$ be a function of class C' on an open point set H. Let the partial derivative $f_{xy}\ \left(\frac{\partial}{\partial y}f_x\right)$ exist and have finite values on H. Then what can be said about the existence and values in the large of $f_{yx}\ \left(\frac{\partial}{\partial x}f_y\right)$?

Problem 2.—Let $f(x, y)$ be of class C' on an open set H and let all four second order partial derivatives

$$f_{xx},\ f_{xy},\ f_{yx},\ f_{yy}$$

exist at each point of H.

What is the measure of the point set on which

$$f_{xy} = f_{yx}.$$

Problems of this type can be multiplied indefinitely, and a general theory of partial differentiation in the large to cover all such problems is desirable. We have started to construct such a theory. Among the various theorems which we have proved are three which we announce in this note as follows.

THEOREM 1. *Let $f(x, y)$ be of class C' on an open point set H. Let the four second partial derivatives*

$$f_{xx} \quad f_{xy} \quad f_{yx} \quad f_{yy}$$

exist everywhere on H. Then $f_{xy} = f_{yx}$ almost everywhere on H.

THEOREM 2. *Let $f(x, y)$ be of class C' on an open point set H. Let f_{xy} exist everywhere on H. Then there exists a point set W of positive measure on which f_{yx} exists and equals f_{xy}.*

THEOREM 3. *Let $f(x, y)$ be of class C' on the open point set H. At each point P of H let at least one of the two partial derivatives f_{xy}, f_{yx} exist. Then there exists a set W of positive measure on which both f_{xy} and f_{yx} exist and are equal.**

* For certain theorems on second order partial derivatives the reader is referred to the following articles:

Hobson, "Theory of Functions of a Real Variable," Cambridge, pp. 425, 426, 428 (1927).

Carathéodory, "Vorlesungen über reelle Funktionen," Berlin, 650 (1927).

EOCENE LAND MAMMALS ON THE PACIFIC COAST

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The Sespe formation comprises a series of sandstones, shales and conglomerate, several thousand feet in thickness, and receives its name from the type locality of its occurrence on Sespe Creek north of the Santa Clara Valley, Ventura County, California. Originally described by Watts,[1] this formation has been recognized as furnishing an important stratigraphic record of the early Tertiary in the southern coast ranges with a position between marine sediments of Eocene age and marine sediments of Miocene age. At a number of localities in southern California deposits having the stratigraphic position and lithologic characteristics of the Sespe