10/6

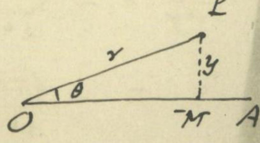
London,
Saturday, 4 o'c.

Φ,

I wrote to you today from Coopers Hill about Clerk Maxwell's investig.n of density near an edge (Vol. I, p 236). Since I came to town, I have thought of a method of getting out his result, but it is clear that there must be some point of view of his that I am ignorant of, inasmuch as he writes down the total electrif.n on a $\parallel^m$ at once, while I deduce it as an integral result from the density at each point.

My work stands thus:

Let OA be drawn in plane of plate & in a plane through P $\perp^r$ to plate.



Since the plate is infinite, we may consider only *curves* in the plane POA.

Sir William Thomson on his receipt of my Statics.

You never wrote in reply to my last, but I suppose you have been busy with Exam.ns Look at this month's Educational Times (in M & X H's) at Carey Foster's solution of the question on Dynamo-Machines. Ask Townsend if Macmillan has sent him a copy of Statics. I told him to do so.

I have bought a quadrant electrom.r for light exp.ts; but the air is so damp, that I have not been able to give it a high charge yet.

The theory of conjugate functions is nice, and *hard*. I shall work somewhat at it. Did Burnside get Statics from Macmillan?

Write appreciatingly, adequately, and promptly.

— M.

Now in my other letter I have shown you that

$$V = C - 4\pi\sigma_0 \frac{r^n}{a^{n-1}} \sin n\theta$$ is a possible potential at P. Hence the equipotential curves are $r^n \sin n\theta = h^n$. The function of flow when V was $C - 4\pi\sigma_0 y$ was simply x, the transformed value of which is ($\because x = ae^{\rho}\cos\theta$)

$$ae^{n\rho}\cos n\theta, \text{ or } \frac{r^n}{a^{n-1}}\cos n\theta,$$

so that the curves of flow are

$$r^n \cos n\theta = h'^n.$$

Now to find the density at each point of the line OA, which is one of the Equipotential Curves (got by taking $h=0$) we observe that the line of flow at each point of it is $\parallel^l$. to axis of y, so that

$$-\frac{1}{4\pi}\frac{dV}{dy}$$

will be the density at each point of OA.

But $$\frac{dV}{dy} = -\frac{4\pi\sigma_0}{a^{n-1}}\left(n\sin n\theta . r^{n-1}\frac{dr}{dy} + n r^n \cos n\theta\frac{d\theta}{dy}\right)$$

$$= -\frac{4\pi\sigma_0}{a^{n-1}} n r^n \frac{d\theta}{dy}$$ at a point on OA

$$= -\frac{4\pi\sigma_0}{a^{n-1}} n x^{n-1}$$ ($\because r = x$ for a point on OA)

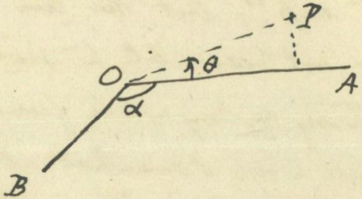
Hence $$\sigma = \frac{n x^{n-1}}{a^{n-1}}\sigma_0,$$

which is the law of density wh. he deduces from $\frac{dE}{dr}$:

We must be looking at the matter from opposite ends, but I don't see how he at once writes down

$$E = \sigma_0\frac{r^n}{a^{n-1}} \left[\text{or rather } \sigma_0\frac{x^n}{a^{n-1}}\right].$$

It is not quite clear how he passes from the infinite perfect plate to one with an edge at O; but granting the passage, the conducting surface will be BOA, and



V must of course be the same (C) at all p^{ts}. on OB as at points on OA, so that we ought to take, as he says, $n = \frac{\pi}{2\pi - \alpha}$.

This theory of conjugate f^{ns}. has given me a good deal of trouble. Can you throw any light on it? Especially, say how the contemplation of an edge (a discontinuous plate) is logically contained in the theory of transformation.

I had an appreciatory letter from