[89r]

[Signature written sideways at the top of this page — belongs at end of letter so transcribed there]

Ockham
Wed$^{\text{dy}}$ 3$^{\text{d}}$ Feb$^{\text{y}}$

Dear M$^{\text{r}}$ De Morgan. I have a question to put respecting a <u>condition</u> in the establishment of the conclusion $\frac{\varphi(a+h)}{\psi(a+h)} = \frac{\varphi^{(n+1)}(a+\theta h)}{\psi^{(n+1)}(a+\theta h)}$ in page 69 of the Differential Calculus. _ I have written down, & enclose, my notions on the steps of the reasoning used to establish that [89v] conclusion. So that you may judge if I take in the objects & methods of it.

The point I do not understand, is why the distinction is made, (& evidently considered so important a one), of "ψx "being a function which has "the property of <u>always</u> "<u>increasing or always decreasing</u>, "<u>from $x = a$ to $x = a + h$</u>, "in other respects fulfilling the "conditions of continuity in "the same manner as φx". [90r] For this, see page 68, lines 9, 10, 11, 12 from the top ; _ page 68, line 12 from the bottom ;
page 69, lines 7, 8 from the bottom ; &c
I see perfectly that this condition must exist, & that without it we could not secure the denominators

(alluded to in page 68, line
13 from the bottom), being
all of one sign. —
But what I do not
understand, is [something crossed out] why the
condition is not made
[90v] for $\varphi\ x$ also. It appears
to me to be equally requisite
for this latter ; because if
we do not suppose it,
how can we secure the
numerators $\varphi(x + k\Delta x)-$
$-\varphi(x + \overline{k-1}\Delta x)$ being all
of one sign ; & unless they
are all of one sign, we
cannot be sure that they
will [something crossed out] when added,
so destroy one another as to
give us $\varphi(a + h) - \varphi a$; –
an expression essential to
obtain. ____ I think I have
explained my difficulty, &

[something missing here?]

[the following written vertically on 89r]

believe me
Yours most truly
A. A. Lovelace