Question:

Consider the line integral defined by

$J = \int_c G \bullet dr$, with $G = ye^{xy}\grave{a}_x + (xe^{xy} + 1)\grave{a}_y$, and the curve C extending from $x = 1$ to $x = 6$, along $y = x^3$

(i) Evaluate the integral explicitly
(ii) By taking the curl of G, show that it is a conservative vector
(iii) Integrate G in order to determine the corresponding potential function Φ, such that
(iv)

$$G_x = \partial\Phi/\partial x, \text{ and } G_y = \partial\Phi/\partial y$$

(v) Verify the result of your integration by evaluating Φ at the end points of C.

Attempt so far:

Integrating $ye^{xy}\grave{a}_x$ with respect to x = $ye^{xy}dx$
Integrating $(xe^{xy} + 1)\grave{a}_{y\ x}$ with respect to y= $(xe^{xy} + 1)dy$
$dx = du$
$dy = 3u^2du$

Substituting
Integral $ye^{u4}du + 3u^3e^{u4}du + 3u^2du$

No further clue.