Conservation of ME vs Primitive Kinematics

For calculating:

E.g., The speed of a falling object at a specified height \( y \), after starting at rest at height \( H \).

(A) \( \text{Cons of (ME)} = (PE)_f + (KE) = \text{constant} = ME_0 = mgH \)
\[ mg \frac{y}{2} + \frac{1}{2} mv^2 = mgH \implies v^2 = 2g(H-y) \]
\[ v = \sqrt{2g(H-y)} \]

(B) We can also calculate \( v(y) \) from kinematics of constant acceleration:

(i) \( y(t) = y_0 + v_0t + \frac{1}{2} at^2 = H + 0 - \frac{gt^2}{2} \) (adopting upward as +y-axis)

(ii) \( v(t) = \dot{y}_0 + at = -gt \)

& calculate \( v(y) \) by eliminating \( t \) from these two equations:

From (ii) \( t = -\frac{v_1}{g} \) & insert into (i):

attempt: \( y(y) = H - \frac{v^2}{2g} \left( \frac{g(H-y)}{2g} \right)^2 = H - \frac{v^2}{2g} = y \)

so that \( H-y = \frac{v^2}{2g} \implies \sqrt{2g(H-y)} \neq v \)

... same answer as Cons of ME yields above.

As, of course, it had to be, since \( N\&T \) determines both.