J Griffin 10/29/07 (b)

Conservation of ME vs Primative Kinematics

for calculating,

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

(A) Cons of (ME) = (PE)$_G$ + (KE) = constant = $ME_0 = mgH$.

$\cancel{m}gy + \frac{1}{2}\cancel{m}v^2 = \cancel{m}gH$ yields $v^2 = 2g(H-y)$

$v = \sqrt{2g(H-y)}$

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

(i) $y(t) = y_0 + \cancel{v_0 t}_0 + \frac{1}{2}at^2 = H + 0 - \frac{gt^2}{2}$ (adopting upward as $+y$ axis)

(ii) $v(t) = \cancel{v_0}_0 + at = -gt$

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

From (ii) $t = -v(t)/g$ & insert into (i):

at time, t, $y(t) = H - \frac{g}{2}\frac{[v(t)^2]}{g^2} = H - \frac{v^2}{2g} = y$

So that $H - y = v^2/2g \Rightarrow \sqrt{2g(H-y)} = \sqrt{v^2} = v$

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

As, of course, it had to be, since NII determines both.