1 Rocket Speed at Maximum Momentum

The rocket starts at rest with initial mass m_0 in outer space (no gravity). The rocket propels its self by expelling mass at a constant rate of $-\dot{m} = \alpha$ and with a relative exhaust speed of u. What is the speed of the rocket when it has its maximum momentum, v', as a function of m_0, u, and α?

Hint: You do not need to solve any differential equations. You can do this by manipulating the free space rocket equation $m\,\dot{v} = -u\,\dot{m}$.