4. The speed of sound, $v(T)$ (in miles per hour), at an ambient temperature, T (in degrees Farenheit), is given by:

$$v(T) = 740 + 0.4T.$$

Objects which travel faster than the speed of sound create *sonic booms*. However, the ambient temperature T in the Troposphere also decreases with height h (in miles) from Earth's surface according to the equation

$$T(h) = -26h + T_0,$$

where T_0 is the temperature at the surface.

(a) (3 points) Find a formula which will give the speed of sound S as a function of height h, assuming the surface temperature is $68°$F.

(b) (4 points) Find $S'(1)$ and interpret the meaning of $S'(1)$ in the context of this problem.

(c) (3 points) While on a flight from Ann Arbor to Chicago on a beautiful $68°$ day, the pilot's instruments measure the outside temperature to be $0°$. What is the plane's altitude, and how fast would the pilot need to fly at this altitude to create a sonic boom?