4. The speed of sound, \( v(T) \) (in miles per hour), at an ambient temperature, \( T \) (in degrees Fahrenheit), 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?