

3. [12 points] In parts of Antarctica, snowfall accumulates each year and is eventually compacted into ice. A research team is drilling down into this ice to collect a sample, called an ice core, of snowfall from past years.

- Let  $D(t)$  be the depth below the surface, in feet, that the drill has reached  $t$  minutes after it begins drilling the ice core.
- Let  $A(p)$  be the age, in years, of the ice at a depth of  $p$  feet below the surface.

The functions  $D(t)$  and  $A(p)$  are invertible and differentiable. Use a complete sentence to write a practical interpretation for the equations in **a.–c.**

a. [3 points]  $D^{-1}(A^{-1}(110)) = 35$

*Solution:* The drill reaches ice that is 110 years old 35 minutes after it begins drilling the ice core.

b. [3 points]  $A'(185) = 12$

*Solution:* The ice 186 feet below the surface is approximately 12 years older than the ice 185 feet below the surface.

c. [3 points]  $\int_{60}^{120} D'(t) dt = 172$

*Solution:* Two hours after it begins drilling the ice core, the drill is 172 feet deeper than it was after only one hour of drilling.

- d. [3 points] Write an expression involving an integral that represents the average age of the ice in the first 300 feet below the surface.

*Solution:*  $\frac{1}{300} \int_0^{300} A(p) dp$