8. [12 points] The velocity of an object, with air resistance, may in some circumstances be given as

$$v(t) = \sqrt{\frac{g}{k}}\left(\frac{e^{2mt}}{e^{2mt}+1} - \frac{1}{e^{2mt}+1}\right),$$

where g is the acceleration due to gravity, k is a constant representing air resistance, and $m = \sqrt{gk}$.

(a) [2 points of 12] Write an expression for the distance D that the object falls in the first t_0 seconds.

(b) [5 points of 12] Find the distance D *(note that half of this calculation is significantly harder than the rest; do not waste too much time on it if you get stuck).*

(c) [5 points of 12] Suppose $\sqrt{g/k} = 10$ and $m = 1$. Note that in this case $v(3) = 9.95 \approx 10$. Use a geometric argument to show that the distance traveled between $t = 0$ and $t = 3$, $D(3)$, satisfies the inequality $15 < D(3) < 30$.