Instructions: Write your name at the top. You have ten minutes to complete the following two questions. Show your work as clearly as possible. No calculators, books, or notes are allowed.

1. Luke and his sister are trapped in a large rectangular garbage compactor, which is 30 feet high, 50 feet long, and 20 feet wide. The 50-foot long walls start to move towards each other at a rate of 2 feet per minute. How quickly is the volume of the garbage compactor decreasing?

Let \( x = x(t) \) denote the distance by the 50 ft walls. The volume of the garbage compactor is given by

\[
V = U(t) = 50 \cdot 30 \cdot x.
\]

So \( \frac{dV}{dt} = 1500 \frac{dx}{dt} \)

\[
= 1500 \cdot (-2) = -3000.
\]

So the volume is decreasing by 3,000 cubic feet each minute.

2. A 10 foot ladder is leaning against a wall. The top of the ladder begins to slip down the wall at a constant rate of 1 inch per minute. How quickly is the base of the ladder moving away from the wall when the top of the ladder is 6 feet up the wall?

We need to find \( \frac{dx}{dt} \) when \( y = 6 \).

Since \( x^2 + y^2 = 10^2 = 100 \),

\[
2x \frac{dx}{dt} + 2y \frac{dy}{dt} = 0
\]

and since \( \frac{dy}{dt} = -1 \), we have

\[
2x \frac{dx}{dt} = 2y
\]

\[
\frac{dx}{dt} = \frac{y}{x}
\]

So when \( y = 6 \), \( x = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8 \) ft

and \( \frac{dx}{dt} = \frac{6}{8} = \frac{3}{4} \) inches per minute.