9. [10 points] Annie Ant finished building her anthill, and it immediately started eroding because of the weather. Every day, her anthill loses 1.5% of its volume. Let $v(d)$ be the volume, in cm^3, of Annie's anthill d days after she finished building it. Assume that her anthill was 1200 cm^3 when she finished building it.

a. [2 points] Based on the description above, answer each of the following questions. In each case, *circle the one best answer.* Note: You do NOT need to explain your reasoning.

Solution: According to the description, the volume of the anthill changes at a constant percent rate per unit time, so $v(d)$ is an exponential function. Since the anthill is losing volume, $v(d)$ is a decreasing function. (The volume of the anthill is decaying exponentially.)

(i) What kind of function is $v(d)$?

○ linear ○ quadratic ○ $\boxed{\text{exponential}}$ ○ NONE OF THESE

(ii) Which of the following accurately describes $v(d)$?

○ $v(d)$ is an increasing function. ○ $\boxed{v(d) \text{ is a decreasing function.}}$

○ NEITHER OF THESE

b. [3 points] Find a formula for $v(d)$ in terms of d.

Solution: The initial value is 1200. Because the anthill loses 1.5% of its volume every day, the decay factor of this exponential function is $1 - 0.015 = 0.985$. So a formula for the exponential function $v(d)$ is

$$v(d) = 1200(0.985)^d$$

Answer: $v(d) =$ $1200(0.985)^d$

c. [3 points] Give a practical interpretation of the expression $v^{-1}(50)$ in the context of this problem. *Use a complete sentence and include units. Note that you do not need to evaluate* $v^{-1}(50)$.

Solution: After the anthill is finished being built, it takes $v^{-1}(50)$ days for the volume of the anthill to be 50 cm^3.

d. [2 points] Solve for a in the equation $v^{-1}(a) = 10$. *Either give your answer in exact form or rounded to the nearest* 0.01.

Solution: If $v^{-1}(a) = 10$, then $v(10) = a$. Therefore

$$a = v(10) = 1200(0.985)^{10} \approx 1031.67653071.$$

Answer: $a = 1200(0.985)^{10}$ **or** $a \approx 1031.68$