3. [10 points] Annie Ant and Greta Grasshopper are having a debate about how to spend their time during October. Annie says that she will spend a total of 12 hours each day gathering food and building her anthill. Let \( B \) be the number of cm\(^3\) of anthill that Annie builds in October, and let \( D = g(B) \) be the number of grams of food that she gathers in October.

Annie knows that \( g \) is a linear function. She is also able to determine that if she builds 500 cm\(^3\) of her anthill in October, then she will gather a total of 1500 grams of food but that if she builds only 150 cm\(^3\) of her anthill, then she will gather a total of 2300 grams of food in October.

**a. [4 points]** Find a formula for \( g(B) \).

**Solution:** Since \( g \) is linear, we first find its constant average rate of change. We have \( g(500) = 1500 \) and \( g(150) = 2300 \), so the constant average rate of change (slope) of \( g \) is

\[
\frac{g(500) - g(150)}{500 - 150} = \frac{1500 - 2300}{350} = \frac{-800}{350} = \frac{-16}{7}.
\]

Using point-slope form, we find \( g(B) - 1500 = \frac{-16}{7}(B - 500) \) so

\[
g(B) = 1500 - \frac{16}{7}(B - 500) = \frac{18500}{7} - \frac{16}{7}B.
\]

**Answer:** \( g(B) = \frac{18500}{7} - \frac{16}{7}B \)

**b. [6 points]** Find and interpret the slope and horizontal intercept of the graph of \( D = g(B) \) in the context of this problem. *For each interpretation, remember to use a complete sentence and include units.*

**Answers**

Slope = \( \frac{-16}{7} \) grams of food per cm\(^3\) of anthill

**Interpretation of slope:** In October, for every 7 cm\(^3\) of her anthill that Annie builds, she gathers 16 fewer grams of food.

**Solution:** The horizontal intercept occurs when \( g(B) = 0 \). Solving for \( B \), we have

\[
\frac{18500}{7} - \frac{16}{7}B = 0 \quad \text{so} \quad \frac{16}{7}B = \frac{18500}{7} \quad \text{and} \quad B = \frac{18500}{16} = \frac{4625}{4} = 1156.25.
\]

Horizontal intercept = \( \frac{18500}{16} = \frac{4625}{4} = 1156.25 \) cm\(^3\) of anthill

**Interpretation of horizontal intercept:** In October, if Annie builds 1156.25 cm\(^3\) of her anthill, she will gather no food.