1. [11 points] Mad scientist Kiki LeBlanc is continuing her experiments with size-change technology. She is trying out her technology on ants. Below is a table showing some data for w, the weight of an ant in grams, ℓ, the length of an ant in cm, and t, the strength of an ant in marches (a unit of strength). Suppose t is a function of w.

w	0.1	0.25	1	2	2.5
ℓ	0.05	0.10	0.15	0.2	0.25
t	5	4	3	4	5

a. [3 points] Circle all statements that could be true given the information in the table. Any unclear answers will be marked incorrect.

- ℓ could be a function of t.
- t could be a function of ℓ.
- w could be a *linear* function of ℓ.
- ℓ could be a function of w.

b. [3 points] If the function f relates t and w, i.e. $t = f(w)$, could f be only concave up, only concave down, or is it not possible for f to be either only concave up or only concave down? Give a brief justification.

Solution: f could be only concave up because the average rates of change between consecutive values in the table are increasing.

c. [3 points] Find the average rate of change of t between $w = 0.25$ and $w = 2.5$. Leave your answer in exact form, and don't forget to include units.

The average rate of change of t between $w = 0.25$ and $w = 2.5$ is $\frac{1}{2.25}$ marches/gram .

d. [2 points] Give a practical interpretation of the rate of change you found in part (c).

Solution: Our answer from (c) means that, on average, between weights of 0.25g and 2.5g, ants gain $\frac{1}{2.25}$ of strength for each increase in weight of 1g.