

2. [5 points] Let

$$Q(r) = 1 + r^{\ln(r)}.$$

Use the limit definition of the derivative to write an explicit expression for $Q'(5)$. *Your answer should not involve the letter Q . Do not attempt to evaluate or simplify the limit.* Please write your final answer in the answer box provided below.

Answer: $Q'(5) =$

3. [11 points] Inga, a beekeeper, sets up a new hive on April 1. At two later times, she estimates the hive's population. These estimates are shown in the table below.

weeks after April 1	2	5
population of the hive, in thousands	7.7	10.9

- a. [2 points] Find a formula for a linear function $L(t)$ modeling the hive's population, in thousands, t weeks after April 1.

Answer: $L(t) =$ _____

- b. [4 points] Find a formula for an exponential function $E(t)$ modeling the the hive's population, in thousands, t weeks after April 1.

Answer: $E(t) =$ _____

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Inga is now studying the populations of two other hives. She determines that the population, in thousands, t weeks after April 1 of her hive of Carniolan bees can be modeled by

$$C(t) = 9e^{0.14t},$$

while the population, in thousands, of her hive of Starline bees can be modeled by

$$S(t) = 17(1.05)^t.$$

- c. [1 point] By what percent is the hive of Carniolan bees growing each week?

Answer: _____ %

- d. [4 points] At what time t will the populations of these two hives be equal? Give your answer in **exact form**, and show every step of your algebraic work.

Answer: _____