1. [10 points] The dogs Elvis and Judy are playing with their owner.

At time $t = 0$ seconds, Elvis starts to run in a straight line away from his owner. After running 110 feet, Elvis turns around and runs back to his owner along the same straight line. Some values of the differentiable function $E(t)$, which gives Elvis's distance from his owner, in feet, at time t seconds, are recorded in the table below. Assume that Elvis's velocity is positive when he is moving away from his owner.

t	2	5	7	10	12	15	17	18
$E(t)$	33	78	98	98	74	44	34	10

a. [2 points] What was Elvis's average velocity between times $t = 12$ and $t = 17$? Include units.

b. [2 points] Estimate Elvis's instantaneous velocity at $t = 5$. Include units.

c. [2 points] For which of the following time interval(s) must $E'(t) = 0$ for some value of t in that time interval? Give your answer as a list of <u>one or more</u> of these intervals, or write NONE.

$(2, 5)$ $\qquad\qquad$ $(6, 9)$ $\qquad\qquad$ $(7, 10)$ $\qquad\qquad$ $(15, 17)$

Judy is also running along a straight line, sometimes away from and sometimes back toward her owner. The function $J(t)$ gives Judy's distance from her owner, in feet, at time t seconds. Some values of $J'(t)$, the **derivative** of $J(t)$, are given in the table below. Assume that $J'(t)$ is continuous, decreasing on the interval $(4, 11)$, and increasing on the interval $(11, 22)$.

t	4	7	8	11	15	17	20	22
$J'(t)$	10	2	0	-12	-3	0	1	9

d. [2 points] On which of the following time interval(s) is Judy running away from her owner? Give your answer as a list of <u>one or more</u> of these intervals, or write NONE.

$(4, 7)$ $\qquad\qquad$ $(8, 11)$ $\qquad\qquad$ $(11, 15)$ $\qquad\qquad$ $(20, 22)$

e. [2 points] At which of the following times is Judy's speed the greatest? Write the <u>one</u> correct answer.

$t = 4$ $\qquad\qquad$ $t = 11$ $\qquad\qquad$ $t = 17$ $\qquad\qquad$ $t = 20$