**5.** [12 points] The Queen of Hearts has welcomed the Cheshire Kid into a poker game at her saloon. Unfortunately, since he joined the games, her luck has been nearly as bad as his. Suppose $W(t)$ gives the rate at which the Queen's saloon generates profits, and $L(t)$ the rate at which the Queen loses money at poker, both in thousands of dollars per week, t days after the Cheshire Kid joined her poker games. Assume that during these two weeks, profits from the saloon and gains/losses from poker are the only factors affecting the Queen's wealth. $W(t)$ is the dashed graph and $L(t)$ the solid graph in the figure below.
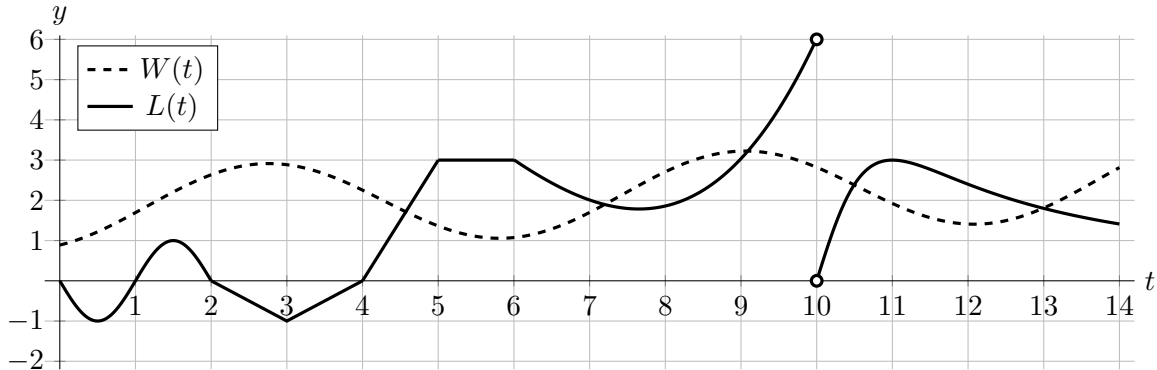
a. [2 points] Circle all times t when the Queen was "up" in poker games she played with the Kid, meaning that in the time interval $[0, t]$ she had won more money than she had lost.

| $t = 1$ | $t = 4$ | $t = 6$ | $t = 11$ | NONE OF THESE |

b. [2 points] Circle all time intervals when the Queen's wealth was increasing.

| $(3, 4)$ | $(6, 7)$ | $(8, 9)$ | $(11, 12)$ | NONE OF THESE |

c. [2 points] Circle the time at which the Queen's wealth was changing the fastest.

| $t = 3$ | $t = 6$ | $t = 10$ | $t = 14$ | NONE OF THESE |

d. [2 points] Circle the number that gives the best approximation of the total amount of money the Queen *lost* from playing poker between $t = 0$ and $t = 6$.

| $-\$5{,}500$ | $-\$3{,}500$ | $-\$500$ | $\$500$ | $\$3{,}500$ | $\$5{,}500$ |

In parts **d.** and **e.** below, give your answers in terms of $W(t)$, $L(t)$, their derivatives, and/or definite integrals. Do not attempt to numerically evaluate any expressions in your answers.

e. [2 points] Write a single expression for the net change (in dollars) in the Queen's wealth from $t = 0$ to $t = 14$.

Answer: $\dfrac{1000}{7} \displaystyle\int_0^{14} \big(W(t) - L(t)\big)\, dt$

f. [2 points] Write a single expression for the average rate at which the Queen *lost* money playing poker over the two weeks. *Include units.*

Answer: $\dfrac{1}{14} \displaystyle\int_0^{14} L(t)\, dt$ **thousands of dollars per week**