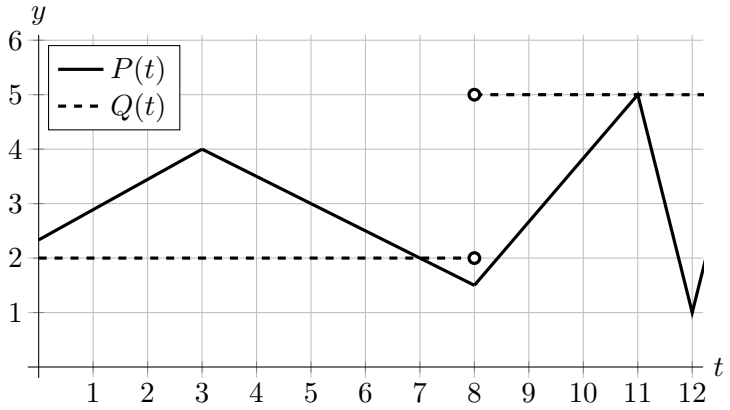
6. [11 points] After selling *Lambda Inc.*, the team is doing a volunteer data analysis of a pond near Ann Arbor, in which the amount of water changes over time due to various factors such as streams, rain, and evaporation. Considering all such factors combined, let $P(t)$ be the rate of water entering the pond, and let $Q(t)$ be the rate of water leaving the pond, both measured in thousands of tons per hour, t hours after noon on a particular day. (That is, $t = 0$ is noon, $t = 1$ is 1 pm, etc.). The graphs of $P(t)$ and $Q(t)$ are given below.



a. [2 points] At which of the following times t is the amount of water in the pond decreasing? Circle all correct answers.

$t = 2$ $t = 4$ $t = 9$ $t = 11.5$ NONE OF THESE

b. [2 points] At what time(s) t for $0 \le t \le 12$ is the amount of water in the pond changing the fastest?

Answer: $t =$ 12

c. [2 points] At what time(s) t for $0 \le t \le 12$ does the pond have the greatest amount of water?

Answer: $t =$ 7

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

d. [2 points] Write a single expression for the total amount of water that enters the pond from 5 pm to 7 pm.

Answer: $\int_5^7 P(t)\,dt$

e. [3 points] Write a single equation representing the following statement:

The total change in the amount of water in the pond from noon to midnight is zero.

Answer: $\int_0^{12} P(t)-Q(t)\,dt = 0$ **or** $\int_0^{12} P(t)\,dt = \int_0^{12} Q(t)\,dt$