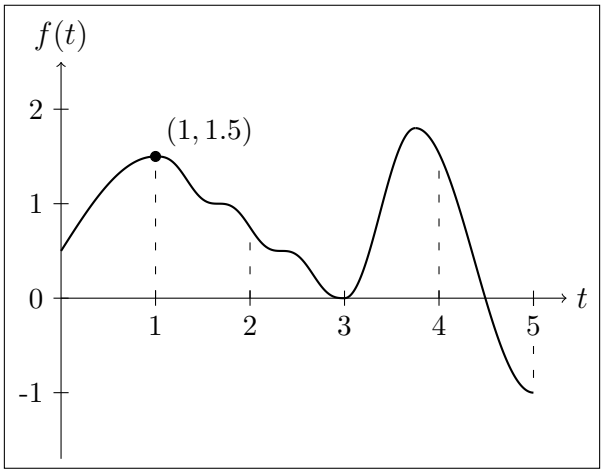
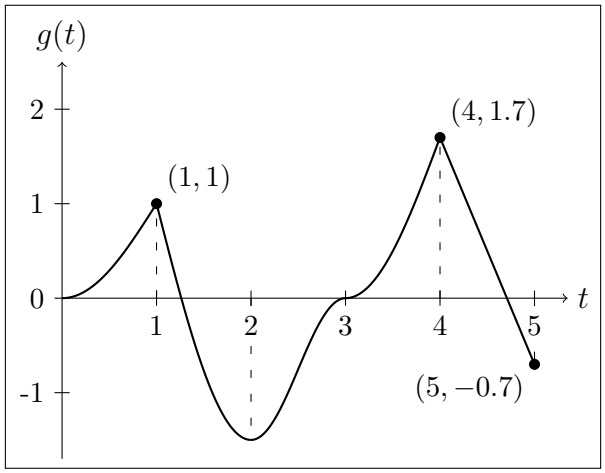
10. [14 points] Fearing that she is losing authority over her robot ward, Dr. Durant has installed a tracking chip in Steph's mainframe. The chip gives Steph's location separately in x- and y-coordinates, where the units of the axes are miles, Dr. Durant's office corresponds to the origin $(x, y) = (0, 0)$, the positive y-axis points north, and the positive x-axis points east. On night 1, Dr. Durant noticed unusual levels of activity; t hours after midnight, Steph began moving according to the parametric equations

$$x = f(t) \qquad\qquad y = g(t),$$

where $f(t)$ and $g(t)$ are plotted below for $0 \le t \le 5$.





a. [2 points] When was Steph farthest north and south on night 1? Write your answers in the blanks provided. You do **not** need to show your work.

North: _____ **a.m.** **South:** _____ **a.m.**

b. [3 points] What was Steph's speed at $t = 4.9$ on night 1? You may use the fact that $f'(4.9) = -1$. Include units.

c. [2 points] What direction was Steph moving at $t = 2$ on night 1? Circle only one answer.

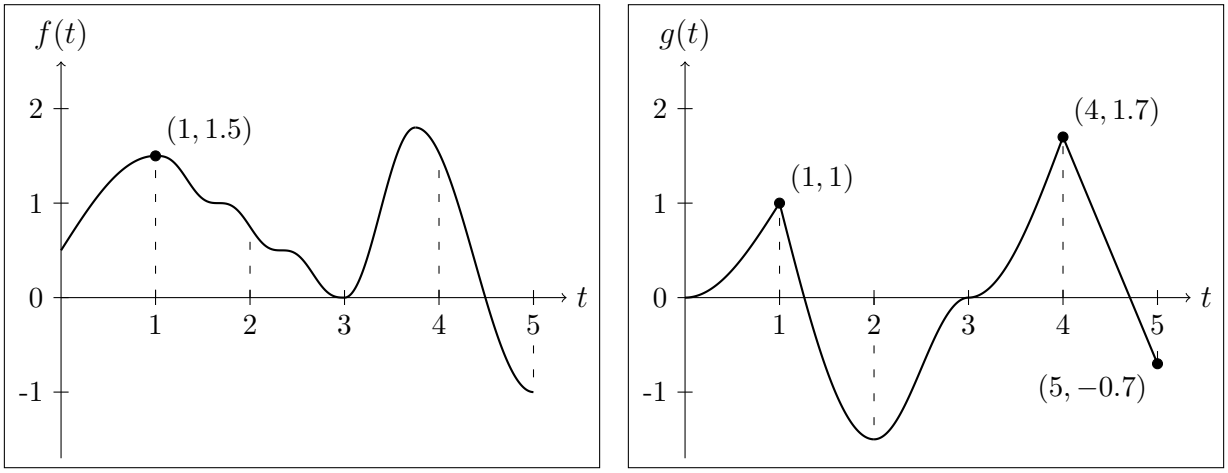
NORTH AND EAST **EAST ONLY** **SOUTH AND EAST**

NORTH AND WEST **WEST ONLY** **SOUTH AND WEST**

10 (continued). Recall that on night 1, Steph's position was given by the parametric equations

$$x = f(t) \qquad\qquad y = g(t),$$

where $f(t)$ and $g(t)$ are plotted below for $0 \le t \le 5$. As before, Dr. Durant's office is at the origin $(x, y) = (0, 0)$, the positive y-axis points north, and the positive x-axis points east.



d. [3 points] How far away was Steph from Dr. Durant's office at $t = 1$ on night 1?

On night 2, Steph's movements were even stranger, following the parametric equations

$$x = \int_0^t f(s)\,ds \qquad\qquad y = \int_0^t g(s)\,ds.$$

e. [2 points] What direction was Steph moving at $t = 2$ on night 2? Circle only one answer.

NORTH AND EAST	**EAST ONLY**	**SOUTH AND EAST**
NORTH AND WEST	**WEST ONLY**	**SOUTH AND WEST**

f. [2 points] Did Steph come to a stop between midnight and 5 a.m. on night 2? If so, at what time(s) did she come to a stop?