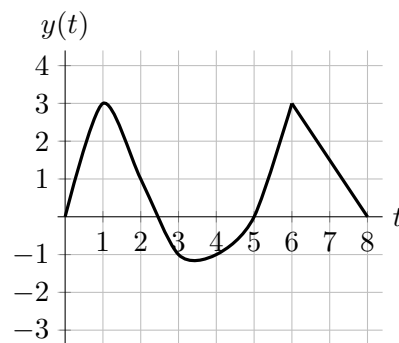
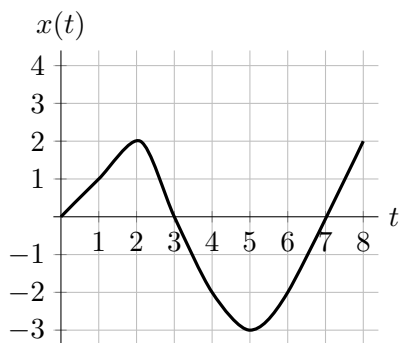


1. [8 points] Once again, Giuseppe Li has a nightmare. This time he is roaming the plains in a covered wagon. His stepfather, Gerd Hömf, plotted the  $x$ - and  $y$ -coordinates of Giuseppe's dream wagon measured in astral miles as a function of dream days  $t$ . The positive  $y$ -direction is north, and the positive  $x$ -direction is east.



- a. [2 points] At what time(s)  $t$  was Giuseppe's wagon moving directly north? Directly south? If there are no such times, write "NONE".

**Answer:** Directly north at  $t = \underline{\hspace{2cm} 5 \hspace{2cm}}$

**Answer:** Directly south at  $t = \underline{\hspace{2cm} 2 \hspace{2cm}}$

- b. [2 points] How far, in astral miles, from where it began was Giuseppe's wagon after 8 dream days?

**Answer:** 2 astral miles

- c. [2 points] What was Giuseppe's approximate speed, in astral miles per dream days, at time  $t = 7$ ?

*Solution:* speed at  $t = 7$  is given by

$$\sqrt{x'(7)^2 + y'(7)^2} = \sqrt{2^2 + (-1.5)^2} = \frac{5}{2}$$

**Answer:** 2.5 astral miles per dream day.

- d. [2 points] Approximate the total distance, in astral miles, that Giuseppe's wagon traveled during the first 2 dream days.

*Solution:* On the first day Giuseppe travels from  $(0,0)$  to  $(1,3)$  and on the second day from  $(1,3)$  to  $(2,1)$  along an approximately straight path each day. Hence the total distance is approximately

$$\sqrt{(1-0)^2 + (3-0)^2} + \sqrt{(2-1)^2 + (1-3)^2} = \sqrt{10} + \sqrt{5} \approx 5.398.$$

**Answer:**  $\sqrt{10} + \sqrt{5} \approx 5.398$  astral miles.