**5.** [9 points] The ExpressTram in the Detroit Metro Airport travels along a straight line through McNamara Terminal between the North and South Stations, with the Terminal Station in between. North and South Station are 600 meters north and 600 meters south, respectively, of the centrally located Terminal Station.

Suppose $g(t)$ is the position of the tram, in meters north of Terminal Station, t seconds after it leaves Terminal Station at 1pm on a certain day. A portion of the graph of $g(t)$ is given below.
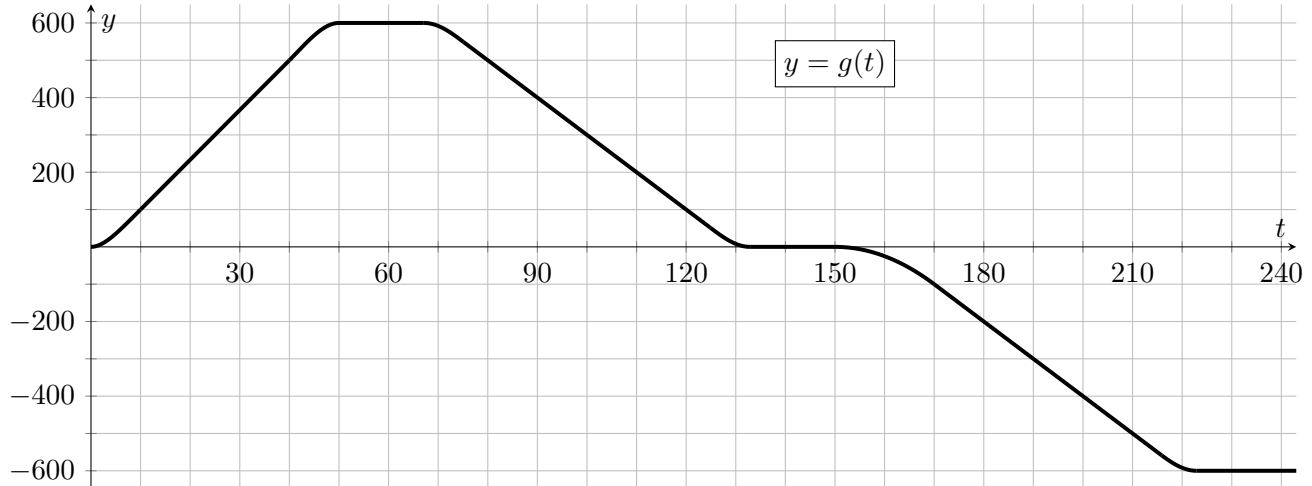
a. [2 points] What is the total distance the tram traveled between 1:00pm and 1:02pm?

> *Solution:* In the first 2 minutes ($= 120$ seconds) after 1pm, the tram travels 600 meters north, pauses for a bit, and then travels 500 meters south, for a total of 1100 meters.

       Answer: 1100 **meters**   .

b. [2 points] It appears that the tram traveled at two different top speeds, depending on whether it was heading northward or southward. In which direction did it travel *faster*? Circle NORTH or SOUTH below. Then find the fastest speed at which the tram traveled, in meters per second.

> *Solution:* The tram's speed going north is the slope of the linear segment from $t = 10$ to $t = 40$, which is $\frac{40}{3}$ m/s. The tram's speed going south is the absolute value of the slope of the linear segment from $t = 80$ to $t = 120$, which is 10 m/s.

 NORTH   SOUTH   **Answer:** $40/3$ meters per second

c. [2 points] What was the average velocity of the tram over the time interval $10 \le t \le 210$? Remember that the velocity is positive when the tram is traveling north.

> *Solution:* $\frac{g(210)-g(10)}{210-10} = \frac{-500-100}{200} = \frac{-600}{200} = -3$ meters per second.

       Answer: -3 meters per second

d. [1 point] At which times in the interval $10 \le t \le 210$ was the tram's instantaneous velocity the *same* as its average velocity between $t = 10$ and $t = 210$? *Circle the one best answer.*

   $t = 10$ $t = 49$ $t = 93$ $\boxed{t = 156}$ $t = 200$

e. [2 points] You are trying to get to Gate A64, which is 500 meters north of Terminal Station. Unfortunately, you just miss the ExpressTram at 1pm, so you start walking from Terminal Station towards your gate just as the tram departs. Assuming you walk at 3 meters per second, how far away from Gate A64 are you when the tram passes you again on its return trip?

> *Solution:* The tram passes you again at the point where the graph of $g(t)$ meets the line of slope 3 through the origin, which is at $(100, 300)$. So at that moment you are 300 meters north of Terminal Station, and 200 meters south of Gate A64.

     Answer: 200   meters away from Gate A64