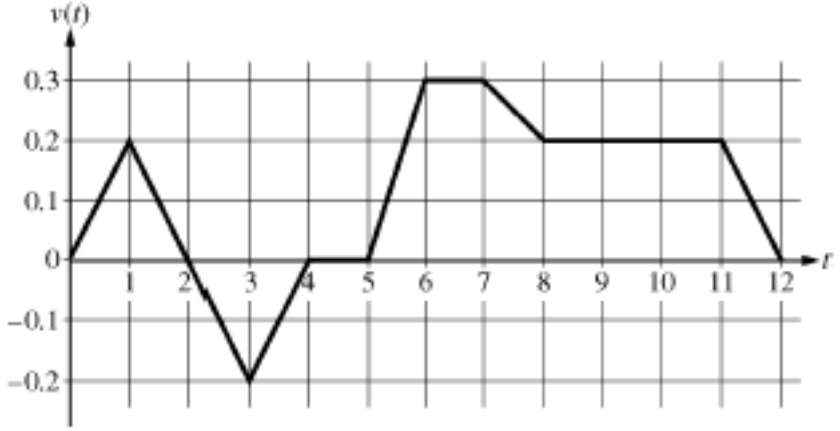

Julia rides her bike in a straight line from point A to point B, starting at point A at time t during the interval in minutes [0, 12]. Her velocity v(t), in miles per minute, is given by the function whose graph is shown above.

a. Find Julia's acceleration at time t = 7.5 minutes. Indicate units of measure.

b. Using correct units, explain the meaning of $\int_0^{12} |v(t)|\,dt$ in terms of Julia's drive. Find the value of $\int_0^{12} |v(t)|\,dt$.

c. Soon after starting, Julia decides to go back to point A. At what time does she turn around? Give a reason for your answer.

d. Lisa also rides her bike in a straight line from point C to point B in 12 minutes. His velocity w(t) is given by $w(t) = \frac{\pi}{15}\sin\left(\frac{\pi}{12}t\right)$, where w(t) is in miles per minute for t in minutes on [0, 12]. Which is closer to B, A or C? Show the work that leads to your answer.

People enter the auditorium at the rate given by $R(t) = 1380t^2 - 675t^3$ people per hour during the time [0, 2]. No one is in the auditorium at time t = 0, when the doors open. The doors close at time t = 2.

a. How many people are in the auditorium when the doors close?

b. At what time is the rate of entry at a maximum. Justify your answer.

c. The sum of all the hours that each person spends between their entry and the doors closing is w(t). The derivative of w is given by $w'(t) = (2 - t)R(t)$. Find $w(2) - w(1)$, the total time for those who enter the auditorium after time t = 1.

d. Find the average amount of time each person spends after entry until the doors close. Use the model for total wait time for part (c).