1. There is no snow on Janet's driveway when snow begins to fall at midnight. From midnight to 9 A.M., snow accumulates on the driveway at a rate modeled by $f(t) = 7te^{\cos t}$ cubic feet per hour, where t is measured in hours since midnight. Janet starts removing snow at 6 A.M.($t = 6$). The rate $g(t)$, in cubic feet per hour, at which Janet removes snow from the driveway at time t hours after midnight is modeled by

$$g(t) = \begin{cases} 0 & \text{for } 0 \le t < 6 \\ 125 & \text{for } 6 \le t < 7 \\ 108 & \text{for } 7 \le t \le 9 \end{cases}$$

a) How many cubic feet of snow have accumulated on the driveway by 6 A.M.?

b) Find the rate of change of the volume of snow on the driveway at 8 A.M.?

c) Let $h(t)$ represent the total amount of snow, in cubic feet, that Janet has removed from the driveway at time t hours after midnight. Express h as a piecewise-defined function with domain $0 \le t \le 9$.

d) How many cubic feet of snow are on the driveway at 9 A.M.?

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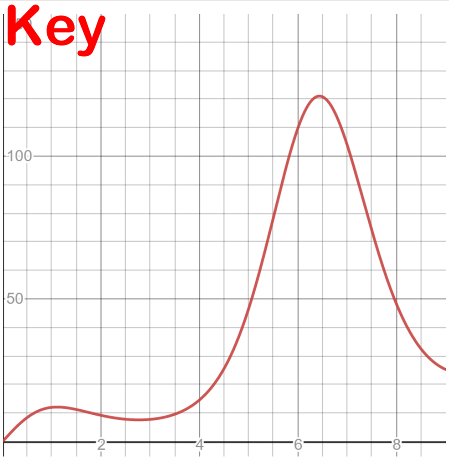

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a) $\int_0^6 f(t)dt$

$= 142.274688881$

b) $f(8) - 108$

$= -59.5829677928$

c) $h(t) = \begin{cases} 0 & \text{for } 0 <= t < 6 \\ 125(7-t) & \text{for } 6 <= t < 7 \\ 125 + 108(9-t) & \text{for } 7 <= t < 9 \end{cases}$

d) $\int_0^9 f(t)dt - 125 - 216$

$= 26.3346063652$

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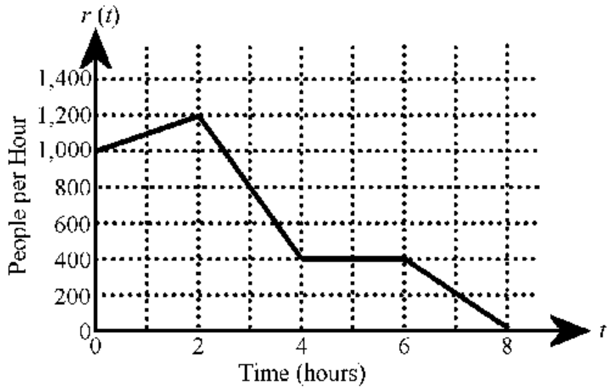

3. There are 700 people in line for a popular amusement park ride when the ride begins operation in the morning. Once it begins operation, the ride accepts passengers until the park closes 8 hours later. While there is a line, people move onto the ride at a rate of 800 people per hour. The graph above shows the rate, $r(t)$, at which people arrive at the ride throughout the day. Time t is measured in hours from the time the ride begins operation.

a) How many people arrive at the ride between $t = 0$ and $t = 3$? Show the computations that lead to your answer.

b) Is the number of people waiting in line to get on the ride increasing or decreasing between $t = 2$ and $t = 3$? Justify your answer.

c) At what time t is the line for the ride the longest? How many people are in line at that time? Justify your answer.

d) Write, but do not solve, an equation involving an integral expression of r whose solution gives the earliest time t at which there is no longer a line for the ride.

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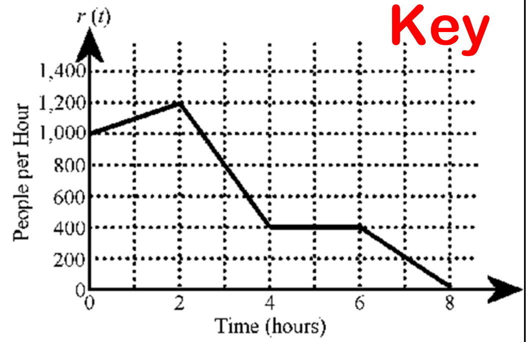
a) $2(1100)+1(1000)$

$= 3200$



b) increasing, because r(t) always exceeds 800 during this time interval

c) at 3 hours, because prior to 3 hours more people arrive than are being serviced each hour (line lengthens), while after 3 hours less people arrive than are being serviced each hour (line shortens).

d) $700 + \int_0^t r(t)\,dt - 800t = 0$

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