

**2018 AP<sup>®</sup> CALCULUS AB FREE-RESPONSE QUESTIONS****Version # 14****CALCULUS AB****SECTION II, Part A****Time—30 minutes****Number of questions—2****A GRAPHING CALCULATOR IS REQUIRED FOR THESE QUESTIONS.**

1. People enter a line for an escalator at a rate modeled by the function  $r$  given by

$$r(t) = \begin{cases} 49\left(\frac{t}{100}\right)^3\left(1 - \frac{t}{363}\right)^1 & \text{for } 0 \leq t \leq 300 \\ 0 & \text{for } t > 300, \end{cases}$$

where  $r(t)$  is measured in people per second and  $t$  is measured in seconds. As people get on the escalator, they exit the line at a constant rate of 0.2 person per second. There are 2 people in line at time  $t = 0$ .

- (a) How many people enter the line for the escalator during the time interval  $0 \leq t \leq 300$  ?
- (b) During the time interval  $0 \leq t \leq 300$ , there are always people in line for the escalator. How many people are in line at time  $t = 300$  ?
- (c) For  $t > 300$ , what is the first time  $t$  that there are no people in line for the escalator?
- (d) For  $0 \leq t \leq 300$ , at what time  $t$  is the number of people in line a minimum? To the nearest whole number, find the number of people in line at this time. Justify your answer.
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