

Question 8 (12 marks)

Park-o-Rama is a multi-storey 24-hour parking garage. On a day in 2024, t hours after midnight, the rate at which vehicles:

- enter Park-o-Rama can be modelled by the function $E(t)$
- leave Park-o-Rama can be modelled by the function $L(t)$.

Both $E(t)$ and $L(t)$ are measured in vehicles per hour for $0 \leq t \leq 24$, and Park-o-Rama contains no vehicles when $t = 0$.

Graphs of $y = E(t)$ and $y = L(t)$ are shown in Figure 6.



Source: adapted from © s99 | iStock.com

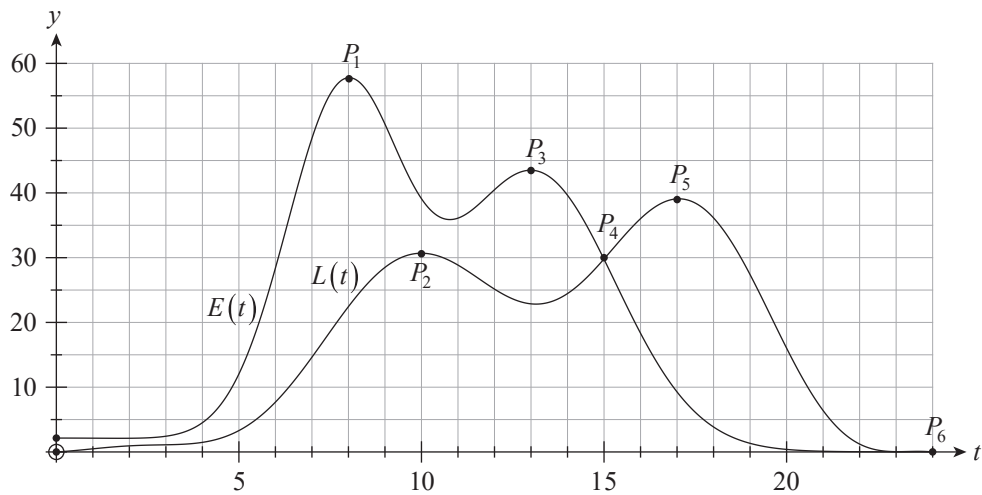


Figure 6

The t -coordinates of the labelled points and the values of various integral expressions are shown in Table 2. Assume that P_1 , P_2 , P_3 , and P_5 are stationary points.

Table 2

Point P_i	P_1	P_2	P_3	P_4	P_5	P_6
t_i , the t -coordinate of P_i	8	10	13	15	17	24
$\int_0^{t_i} E(t) \mathrm{d} t$	130	230	347	429	462	471
$\int_0^{t_i} L(t) \mathrm{d} t$	40	96	177	227	298	406

(a) (i) It is known that $E(9) = 50.6$. State the meaning of this result in the context of the problem.

(2 marks)

(ii) Use the information given on page 4 to determine:

(1) how many hours after midnight vehicles were *leaving* Park-o-Rama at the maximum rate.

(1 mark)

(2) how many vehicles *entered* Park-o-Rama during the 24-hour period.

(1 mark)

(3) how many vehicles *left* Park-o-Rama during the final 7 hours of the day.

(1 mark)

(iii) The maximum number of vehicles in Park-o-Rama was 202. How many hours after midnight did this occur?

(1 mark)

