

6. Particle  $P$  moves along the  $x$ -axis such that, for time  $t > 0$ , its position is given by  $x_P(t) = 6 - 4e^{-t}$ .

Particle  $Q$  moves along the  $y$ -axis such that, for time  $t > 0$ , its velocity is given by  $v_Q(t) = \frac{1}{t^2}$ . At time  $t = 1$ , the position of particle  $Q$  is  $y_Q(1) = 2$ .

- (a) Find  $v_P(t)$ , the velocity of particle  $P$  at time  $t$ .
- (b) Find  $a_Q(t)$ , the acceleration of particle  $Q$  at time  $t$ . Find all times  $t$ , for  $t > 0$ , when the speed of particle  $Q$  is decreasing. Justify your answer.
- (c) Find  $y_Q(t)$ , the position of particle  $Q$  at time  $t$ .
- (d) As  $t \rightarrow \infty$ , which particle will eventually be farther from the origin? Give a reason for your answer.

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**Write your responses to this question only on the designated pages in the separate Free Response booklet. Write your solution to each part in the space provided for that part.**

**STOP**

**END OF EXAM**