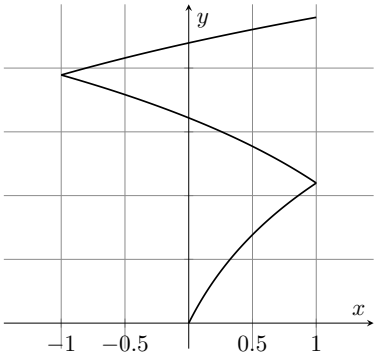
4. [6 points]

a. [3 points] Bertie the beetle enters a different bug race. This race lasts for a thrilling 10 seconds. His position t seconds into his race is given by $(x(t), y(t))$ where

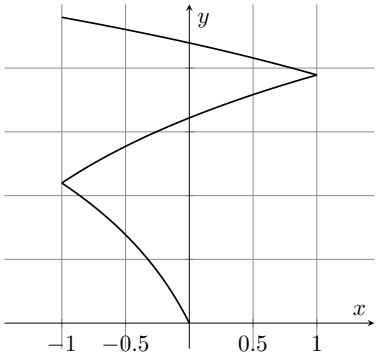
$$x(t) = \begin{cases} \frac{1}{2}t, & 0 \le t < 2, \\ \frac{1}{2}(4-t), & 2 \le t < 6, \\ \frac{1}{2}(t-8), & 6 \le t < 10, \end{cases}$$

and where $y(t) = \ln(t+1)$. Which of the following graphs best represents the path he follows? Circle the **one** best answer.

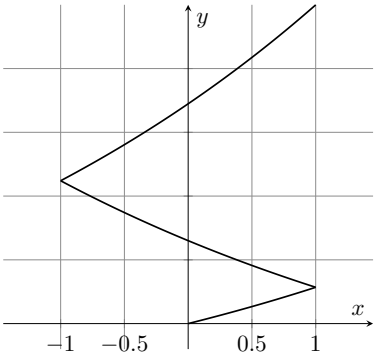
(**A**)



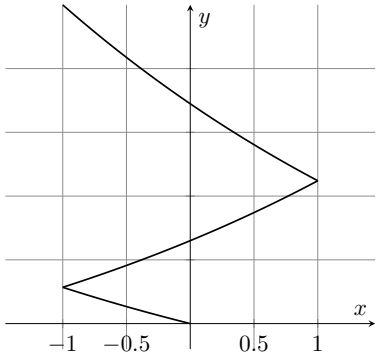
(**B**)



(**C**)



(**D**)



b. [3 points] Carlos the centipede is training for a bug race by running in circular laps. On his first lap, Carlos' position t seconds after he began his lap is given by the parametric equations $x = f(t)$ and $y = g(t)$. For the second lap, his position t seconds after the lap begins is given by the parametric equations $x = f(2t)$ and $y = g(2t)$.
How is Carlos' path in the second lap different from the first? Circle the **one** best answer from the options below.

(I) Carlos follows a path which has the same shape as the one for the first lap, but which has half the diameter.

(II) Carlos follows a path which has the same shape as the one for the first lap, but which has twice the diameter.

(III) Carlos follows the same path as before but travels at half the speed.

(IV) Carlos follows the same path as before but travels at twice the speed.