9. [7 points] After the first ever picture of a black hole was released by Event Horizon Telescope (EHT), the public awaits an image of Sgr A*, the black hole at the Galactic Center. Let t be the amount of time, in years, between now and when the EHT releases such an image. The probability density function for t is given by

$$q(t) = \begin{cases} 0 & \text{for } t < 0 \\ 1/2^n & \text{for } n < t \le n+1, \text{ for each positive integer } n. \end{cases}$$

Part of the graph of $q(t)$ is given below.
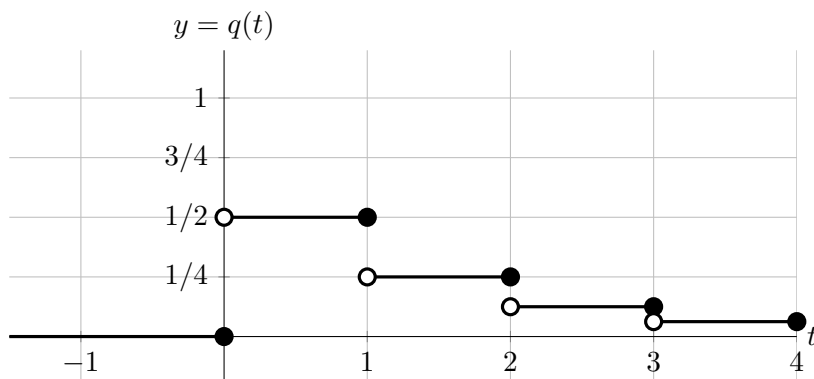
a. [4 points] Let $Q(t)$ be the cumulative distribution function for t. Carefully sketch the graph of $Q(t)$ on the domain $-1 \le t \le 3$.
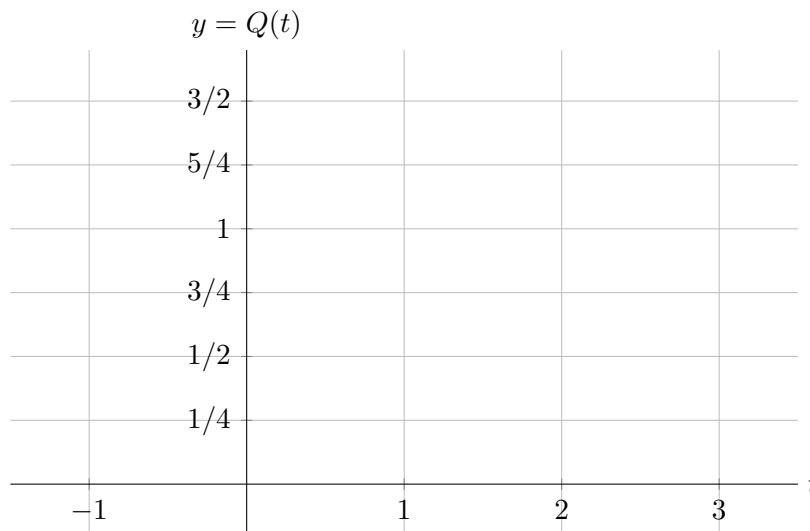
b. [3 points] Let P_n be the probability that EHT releases an image of Sgr A* within n years, and p_n be the probability that release time is in the nth year.
For each part below, circle "True" if the statement **must be** true and circle "False" otherwise. No justification is necessary.

The sequence p_n converges. $\boxed{\text{True}}$ False

The sequence P_n converges to 0. $\boxed{\text{True}}$ False

The series $\displaystyle\sum_{n=1}^{\infty} p_n$ converges. $\boxed{\text{True}}$ False