2. [9 points] Consider the function $g(t)$, whose graph is shown below, which satisfies

$$0 < g(t) \leq \frac{1}{\sqrt{1 + t^p}} \quad \text{for } t > 1.$$

a. [4 points] Find a formula for the antiderivative $f(t)$ of $g(t)$ satisfying $f(1) = 2$.

b. [2 points] For which values of $t \geq 0$ is $f(t)$ increasing?

c. [2 points] For which values of $t \geq 0$ is $f(t)$ concave up?

d. [1 point] For which values of $p$ is the limit $\lim_{t \to \infty} f(t)$ guaranteed to exist?