

9. [9 points] A new computer antivirus is available to be downloaded on March 19 at the university's ITS website. The antivirus is only available for students. Let $T(s)$ be the time (in days after March 19) it takes for s students to download the antivirus to their personal computers. The function $T(s)$ is given by

$$T(s) = 20 \log \left(\frac{s}{2} + 1 \right).$$

- a. [3 points] List the transformations required to obtain the graph of $T(s)$ from the graph of the function $f(s) = \log(s)$. Make sure to be precise when you describe each transformation and indicate the order in which they need to be applied.

Solution:

1. Vertical Stretch by 20.
2. Horizontal Shift to the left by 1.
3. Horizontal Stretch by 2.

- b. [2 points] How many days after March 19 are required for a thousand students to download the antivirus to their personal computers? Your answer needs to be exact or rounded up to the nearest .01.

Solution:

$$T(1000) = 20 \log \left(\frac{1000}{2} + 1 \right) = 20 \log (501) \text{ days after March 19.}$$

- c. [4 points] How many students have downloaded the antivirus seven days after March 19? Your answer must be found algebraically and written in exact form.

Solution:

$$\begin{aligned} 20 \log \left(\frac{s}{2} + 1 \right) &= 7. \\ \log \left(\frac{s}{2} + 1 \right) &= \frac{7}{20} \\ \frac{s}{2} + 1 &= 10^{\frac{7}{20}} \\ \frac{s}{2} &= 10^{\frac{7}{20}} - 1 \\ s &= 2(10^{\frac{7}{20}} - 1). \end{aligned}$$