2) (5 pts) ANL (Algorithm Analysis)

An algorithm to find a particular value takes O(log(n)) time where n is the total number of values. On a data set of $n = 2^{30}$ it took 1.2 seconds to find the desired value. How many **milliseconds** will it take to find a value in a data set with $n = 2^{20}$? (Note: for ease of computation, you may use a logarithm with base 2.)

The runtime is in seconds can be expressed as $c\log_2(n)$ where c is some constant. We can find the c by plugging in $n = 2^{30}$ with the answer as 1.2 seconds. We find that

$$1.2s = c\log_2(2^{30})$$
$$1.2s = c\log_2(2^{30})$$
$$1.2s = 30c$$
$$\frac{1.2s}{30} = c$$

To solve for the question we plug 2^{20} for n.

$$answer = \frac{1.2s}{30}\log_2(2^{20})$$
$$= \frac{1.2s}{30} \times 20$$
$$= \frac{2\ (1.2s)}{3}$$
$$= .8s$$

Convert to milliseconds

$$\boldsymbol{\underline{answer = 800ms}}$$

Grading:
Find c, 2 pts.
Plugging in 2^{20}, 2 pts.
Correct answer by converting, 1 pts.