Mathematical Literacy Exam - Sample Question:

When a drug is taken into the bloodstream, the body works to remove it. Suppose the body removes 20% of a certain drug every 4 hours. The body needs at least 100 mg of this drug to be effective, but more than 1000 mg of the drug is dangerous. A doctor wants to prescribe an amount of the drug to be taken at regular intervals. How much of the drug should be taken? How often should it be taken?

Response by Student #1.

100 mg every 4 hours.

Response #1 would not be judged passing, even if the dosage were appropriate (which it is not). The response shows no communication of understanding of the problem and gives no indication of the use of a mathematical solution strategy. This response is a guess with no validation.

Response by Student #2.

\[
\begin{array}{c|c|c}
20\% & 5\% & \\
4\ hrs & 1\ hr & \\
\hline
20 & 80 & 4\ hrs \\
\hline
50 & 60 & 8\ hrs \\
\hline
100 & 40 & 12\ hrs \\
\hline
50\ mg & 40 & 16\ hrs \\
\hline
50\ mg & 20 & 20\ hrs \\
\hline
\end{array}
\]

Response #2 would not be judged passing. It does show some calculations and it correctly reduces the amount of drug in the bloodstream by 20% in the first 4 hours. However, the solution fails to apply the 20% reduction to the remaining 80 mg of the drug in the second 4 hours. Applying the reduction of 20 mg at each successive step is not an appropriate solution strategy. Furthermore, there is always less than 100 mg in the bloodstream, so the drug is never effective. Finally, there is no explanation of how this dosage was derived from these calculations.
Response by Student #3.

1  
2  \[ 200 - 20\% = 160 + 200 = 360 \text{ mg} \]
3  \[ 360 - 20\% = 288 + 200 = 488 \text{ mg} \]
4  \[ 488 - 20\% = 390.4 + 200 = 590.4 \text{ mg} \]
5  \[ 590 - 20\% = 472.32 + 200 = 672.32 \text{ mg} \]
6  \[ 672.32 - 20\% = 537.856 + 200 = 737.856 \text{ mg} \]
7  \[ 737.856 - 20\% = 590.2848 + 200 = 790.2848 \text{ mg} \]
8  \[ 790.2848 - 20\% = 632.22789 + 200 = 832.22789 \text{ mg} \]
9  \[ 832.22789 - 20\% = 665.782272 + 200 = 865.782272 \text{ mg} \]
10 \[ 865.782272 - 20\% = 692.6256 + 200 = 892.6256 \text{ mg} \]

The patient should take 200 mg every 4 hours. The amount of the drug should be greater than 100 mg to kill whatever virus is infecting the body. You can stay at this rate for at least 10 intervals according to my analysis, and it looks like you could take even more doses.

Response #3 presents an appropriate strategy with correct use of mathematical procedures (adding the dosage to the bloodstream and reducing the amount of drug by 20% in each interval). However, the steps string along several operations on each line, and thus show incorrect usage of the equal sign (=). Finally, to be considered passing, this response would need to include an explanation of what these numbers mean and how they are interpreted in the solution of the problem.