MAT123 Quiz 8

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Name: Solutions
Student ID:

For each of the questions below, show ALL of your work, and ALL the steps required to reach the final answer. There will not be full credit for incomplete solutions. Calculators are not permitted. Please give exact values (do not use decimals).

1. Simplify as much as possible. \( \log \left[ \frac{10x^2 \sqrt{1-x}}{7(x+1)^2} \right] \)

\[
= \log 10 + 2 \log x + \frac{1}{3} \log (1-x) - \log 7 - 2 \log (x+1)
\]

2. A spider has 8mg of radioactive material in its venom at 8am. The radioactive material decomposes with a half life of 3 hours. If it bites a victim while it has more than 2mg of radioactive material in its venom, the victim will begin to develop spider-like characteristics. What is the latest time of day that Peter Parker's class could have visited the science exhibit that houses this spider?

\[
\frac{A}{A_0} = e^{-rt}
\]

\[
\frac{A}{A_0} = e^{-r \cdot \frac{1}{2} t}
\]

\[
r = \frac{\ln \left( \frac{1}{2} \right)}{3}
\]

\[
A_0 = 8 \text{mg}
\]

\[
A = 8 e^{\left( \ln \left( \frac{1}{2} \right) \right) \frac{1}{3} t} = 8 e^{\frac{\ln \left( \frac{1}{2} \right)}{3} t} = 8 e^{\ln \left( \frac{1}{2} \right) t / 3}
\]

\[
\frac{\ln \left( \frac{1}{2} \right)}{\ln \left( \frac{1}{2} \right)} = \frac{1}{3}
\]

\[
t = 3 \cdot 2 \cdot \frac{\ln \left( \frac{1}{2} \right)}{\ln \left( \frac{1}{2} \right)} = 6 \text{ hrs}
\]

i.e. 2pm