MATH 120
FALL 2022
EXAM 4

NAME:

1. [10 pts. each] Find the domain of each in interval notation.
   (a) $f(x) = \ln(4 - 6x)$
   (b) $f(x) = \log_9\left(\dfrac{x+3}{8-x}\right)$

2. [10 pts.] Condense the logarithmic expression, writing a single logarithm with coefficient 1 and simplifying where possible:

$$\log x + \log(x^2 - 1) - \log 7 - \log(x + 1)$$

3. [10 pts.] Given $\alpha = \log_b 2$ and $\beta = \log_b 5$, express $\log_b \sqrt[3]{25/16}$ in terms of α and β.

4. [10 pts. each] Solve each equation exactly. No rounded decimal answers!
   (a) $8^{1-x} = 4^{x+2}$
   (b) $2^{2x} + 2^x - 12 = 0$
   (c) $\log_3(x + 6) - 1 = -\log_3(x + 4)$
   (d) $2|\ln x| - 8 = 0$

5. [15 pts.] The half-life of thorium-229 is 7340 years. How long will it take for a sample of this isotope to decay to 1% of its original amount?

6. [10 pts.] The growth model $A(t) = 4.8e^{0.0082t}$ describes New Zealand's population, in millions, t years after 2020. What is New Zealand's growth rate? In what year will New Zealand's population double, according to the model?

7. [10 pts.] Solve the system by the substitution or addition method:

$$\begin{cases} 2x - 7y = 2 \\ 3x + y = -20 \end{cases}$$

8. [15 pts.] The sum of three times a first number and twice a second number is 8. If the second number is subtracted from twice the first number, the result is 3. Set up a system of equations and solve to find the numbers.

9. [10 pts.] Solve the system:

$$\begin{cases} 2x + y = 2 \\ x + y - z = 4 \\ 3x + 2y + z = 0 \end{cases}$$