MATH 125
FALL 2020 NAME:
EXAM 3

1. [10 pts.] Find the domain of $h(x) = \log_7\left(\dfrac{2x+3}{x-1}\right)$.

2. [10 pts. each] Let $f(x) = 1 - 6\log_4(3-x)$.
   (a) Find f^{-1}.
   (b) Find the domain and range of both f and f^{-1}.

3. [10 pts.] Write as a single logarithm with coefficient 1:

$$3\log_b(2x+4) - 2\log_b(1-2x) - \log_b(2x).$$

4. [10 pts.] If $f(x) = \log_a x$, show that $-f(x) = \log_{1/a} x$.

5. [10 pts. each] Solve each equation in exact form.
   (a) $\ln(x+1) - \ln x = 2$
   (b) $\log_2 x - 2\log_2 5 = \log_2(x+1) - 2\log_2 10$
   (c) $(\log_3 x)^2 - 5(\log_3 x) = 6$
   (d) $9^x - 3^{x+1} + 1 = 0$
   (e) $\log_2(3x+2) - \log_4 x = 3$

6. The population of a midwestern city follows the exponential law.
   (a) [5 pts.] If N is the city's population and t is the time in years, express N as a function of t.
   (b) [10 pts.] If the population decreased from 900,000 to 800,000 from 2004 to 2008, what was the population in 2012?

7. [15 pts.] A kettle full of water is brought to a boil in a room with temperature 22 °C. After 30 minutes the temperature of the water has decreased from 100 °C to 80 °C. Find the temperature after another 30 minutes, using Newton's Law of Cooling.

8. [10 pts.] Convert 107.329° to degree-minute-second format, rounding to the nearest second. Show work.

9. [10 pts.] The terminal side of the angle θ contains the point $(-1, -2)$. Find the exact value of each of the six trigonometric functions of θ.

10. [10 pts.] Given that $\sin\theta = \frac{\sqrt{3}}{2}$ and $\cos\theta = \frac{1}{2}$, find the exact values of the remaining trigonometric functions of θ.

11. [10 pts.] Given that $\cot\theta = \frac{4}{3}$ and $\cos\theta < 0$, find the exact values of all trigonometric functions of θ.