MATH 125
SPRING 2020
EXAM 3

NAME:

1. $\boxed{\text{15 pts.}}$ Find the domain, range, and horizontal asymptote of $f(x) = 6 - 2^{x+3}$.

2. $\boxed{\text{10 pts.}}$ Solve for x, showing all work as usual: $9^{2x} \cdot 27^{x^2} = 3^{-1}$.

3. $\boxed{\text{10 pts.}}$ Find the domain of the function

$$H(x) = 32 + 4\log_7\left(4 - \frac{x}{3}\right).$$

4. $\boxed{\text{10 pts.}}$ Find f^{-1}, the inverse of the function $f(x) = \frac{1}{2}\log(2x) - 9$.

5. $\boxed{\text{10 pts.}}$ Showing work (as ever), find the exact solution to $e^{-2x+3} = 12$.

6. $\boxed{\text{10 pts.}}$ Write the expression as a sum and/or difference of logarithms, expressing powers as factors:

$$\ln\left[\frac{(x-4)^2}{x^2-1}\right]^{2/3}, \quad x > 4.$$

7. $\boxed{\text{10 pts.}}$ Express y as a function of x, eliminating all logarithms (C is a positive constant):

$$\ln y = 2\ln x - \ln(x+1) + \ln C.$$

8. $\boxed{\text{10 pts. each}}$ Solve each equation in exact form. The Change-of-Base Formula may be necessary.
   (a) $\log_5(x+3) = 1 - \log_5(x-1)$
   (b) $0.3^{1+x} = 1.7^{2x-1}$
   (c) $\log_2(x+1) - \log_4 x = 1$

9. The population of a midwestern city follows the exponential law.
   (a) $\boxed{\text{5 pts.}}$ If N is the city's population and t is the time in years, express N as a function of t.
   (b) $\boxed{\text{10 pts.}}$ If the population decreased from 900,000 to 800,000 from 2005 to 2007, what was the population in 2009?

10. $\boxed{\text{15 pts.}}$ A kettle full of water is brought to a boil in a room with temperature 20 °C. After 15 minutes the temperature of the water has decreased from 100 °C to 75 °C. Find the temperature after another 10 minutes, using Newton's Law of Cooling.

11. $\boxed{\text{10 pts.}}$ Convert 127.117° to degree-minute-second format, rounding to the nearest second. Show work.

12. $\boxed{\text{10 pts.}}$ The terminal side of the angle θ contains the point $(-0.3, 0.4)$. Find the exact value of each of the six trigonometric functions of θ.

13. $\boxed{\text{10 pts.}}$ Given that $\sin\theta = -1/\sqrt{5}$ and $\cos\theta = -2/\sqrt{5}$, find the exact values of the remaining trigonometric functions of θ.

14. $\boxed{\text{10 pts.}}$ Given that $\csc\theta = 3$ and $\cot\theta < 0$, find the exact values of all trigonometric functions of θ.