1. [10 pts. each] Define the function $\Omega(x) = \dfrac{8}{3 - \sqrt{x}}$.

    (a) Show that Ω is one-to-one.

    (b) Find Ω^{-1}.

    (c) Find the domain and range of Ω and Ω^{-1}.

2. [10 pts.] Solve for x, showing all work: $4^x \cdot 2^{x^2} = 16^2$.

3. [10 pts. each] Define the function $\Psi(x) = \ln(2x - 4) + 6$.

    (a) Find Ψ^{-1}.

    (b) Find the domain and range of Ψ and Ψ^{-1}.

4. [10 pts. each] Solve each equation in exact form. The Change-of-Base Formula may be necessary.

    (a) $\log_6(x + 3) + \log_6(x + 4) = 1$

    (b) $e^{-2x+3} = 12$

    (c) $2^{2x} + 2^{x+2} - 12 = 0$

    (d) $\log_9(7x - 5) = \log_3(x + 1)$

5. 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 2005 to 2007, what was the population in 2009?

6. [15 pts.] A kettle full of water is brought to a boil in a room with temperature $20\,°\text{C}$. After 15 minutes the temperature of the water has decreased from $100\,°\text{C}$ to $75\,°\text{C}$. Find the temperature after another 10 minutes, using Newton's Law of Cooling.

7. [10 pts.] Convert $87.461°$ to degree-minute-second format, rounding to the nearest second. Show work.

8. [10 pts.] The terminal side of the angle θ contains the point $(-2, 5)$. Find the exact value of each of the six trigonometric functions of θ.