

1. 10 pts. each Let

$$f(x) = \frac{6x - 3}{2x + 1}.$$

- (a) Prove or disprove that f is one-to-one.
(b) If f is one-to-one, find a formula for the inverse.
2. 5 pts. Given the relation $x = y^2 - 2y$, find an equation for the inverse relation.
3. 10 pts. Graph the piecewise-defined function

$$g(x) = \begin{cases} 4, & x \leq -3 \\ x^2 - 6, & -3 < x < 0 \\ e^x, & x \geq 0. \end{cases}$$

4. 10 pts. Convert $\ln W^5 = t$ to an exponential equation, and convert $10^{0.3010} = 2$ to a logarithmic equation.
5. 5 pts. Give the domain of the function $f(x) = \log_4 x^2$.
6. 10 pts. Express

$$\log_a \sqrt{\frac{x^6}{p^5 q^8}}$$

in terms of sums and differences of $\log_a x$, $\log_a p$, and $\log_a q$.

7. 5 pts. Simplify $\log_b \sqrt[3]{b}$.
8. 10 pts. each Solve each equation algebraically.
- (a) $27 = 3^{5x} \cdot 9^{x^2}$
(b) $e^x + e^{-x} = 5$
(c) $\log_2(10 + 3x) = 5$
(d) $\log_4(x + 3) + \log_4(x - 3) = 2$
(e) $\ln \sqrt[4]{x} = \sqrt{\ln x}$

9. 15 pts. In 2006 archaeologists unearthed the first tomb since King Tut's tomb was found in 1922. The tomb harbored five wooden sarcophagi containing mummies. The mummies had lost about 33.3% of their carbon-14. How old were the mummies at the time they were discovered? The half-life of carbon-14 is 5750 years.
10. 10 pts. Algebraically solve the system
- $$\begin{cases} x + 2y = 2 \\ 4x + 4y = 5 \end{cases}$$
11. 15 pts. Algebraically solve the system
- $$\begin{cases} x + 2y - z = 4 \\ 4x - 3y + z = 8 \\ 5x - y = 12 \end{cases}$$
12. 15 pts. The owner of The Daily Grind coffee shop mixes French roast coffee worth \$12.00 per pound with Colombian coffee worth \$9.50 per pound in order to get 20 pounds of a mixture worth \$10.50 per pound. Determine algebraically how much of each type of coffee was used.